



# Crisis Leadership Education for Critical Care Fellows

## A Longitudinal Curriculum Using Simulation

Trevor C. Steinbach<sup>1</sup>, Rosemary Adamson<sup>1,2</sup>, David J. Carlbom<sup>1</sup>, Nicholas J. Johnson<sup>1,3</sup>, Patricia A. Kritek<sup>1\*</sup>, Jonathan M. Keller<sup>1</sup>, Jennifer Clark<sup>4</sup>, and Başak Çoruh<sup>1</sup>

<sup>1</sup>Division of Pulmonary, Critical Care and Sleep Medicine, Department of Medicine and <sup>3</sup>Department of Emergency Medicine, University of Washington, Seattle, Washington; <sup>2</sup>Veterans Affairs Puget Sound Healthcare System, Seattle, Washington; and <sup>4</sup>Department of Respiratory Therapy, Harborview Medical Center, Seattle, Washington

### ABSTRACT

**Background:** Leadership and teamwork are critical to the performance of a multidisciplinary team responding to emergencies in the intensive care unit; yet, these skills are variably taught to pulmonary and critical care trainees. Currently, there is no standardized leadership curriculum in critical care training.

**Objective:** We developed a longitudinal crisis leadership curriculum for first-year pulmonary and critical care fellows using high-fidelity simulation as a medium to practice and solidify skills. The goal was to improve leadership skills and trainee confidence when leading a team during life-threatening emergencies.

**Methods:** Guided by a needs assessment of current and recently graduated fellows, we developed a leadership curriculum from a review of the available literature and local expert opinion. Four sessions were conducted over the academic years of 2016 to 2017 and 2017 to 2018, each including small-group teaching on effective leadership behaviors, followed by simulation with postsession leadership debriefing to review performance. Fellows were surveyed regarding their experiences with the curriculum.

**Results:** Over two academic years, 100% of targeted fellows ( $N=13$ ) completed every session. Participants reported improved understanding of key elements of effective leadership, greater confidence in leading a multidisciplinary team, and increased preparedness to lead during a crisis. Simulation with debriefing was viewed as an effective medium for learning leadership skills, and fellows provided positive feedback regarding the experience.

**Conclusion:** Implementation of a longitudinal crisis leadership curriculum within the first year of pulmonary and critical care fellowship was feasible and highly valued by learners. More research is needed to determine effective methods for teaching and assessing leadership skills.

#### Keywords:

leadership; education; simulation; teamwork

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Correspondence and requests for reprints should be addressed to Başak Çoruh, M.D., Division of Pulmonary, Critical Care and Sleep Medicine, Department of Medicine, University of Washington, 1959 N.E. Pacific Street, Box 356522, Seattle, WA 98195. E-mail: bcoruh@uw.edu.

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Critically ill patients carry a high risk of sudden, unexpected deterioration. Adding to the complexity of caring for these patients is the need to act swiftly, coordinating the actions of multiple team members. The importance of this skill is highlighted by the fact that leading a multidisciplinary critical care team has been identified as a core entrustable professional activity for pulmonary and critical care medicine (PCCM) trainees (1).

Leadership and interdisciplinary teamwork, key factors for successful clinical performance (2–4), are nontechnical skills that can be taught to trainees effectively using simulation for assessment (5, 6). One example, Crisis Resource Management (7), results in improved team performance in simulated emergencies (8–11). Even when provided solely to dedicated leaders, Crisis Resource Management training has been shown to increase the performance of the entire team (12). Despite the impact on leadership and team performance, this type of training has only been implemented to a limited degree across medical disciplines (13).

Published reports of leadership education often lack a standardized curriculum, and formats for implementation of leadership education are highly variable (14). Of 52 studies identified in a systematic review of leadership training in health care, only 10% focused their intervention specifically on the leader, with the remainder providing leadership education as a component of broader teamwork training. Furthermore, leadership training in critical care is rare, with the majority occurring in the fields of surgery,

anesthesiology, and trauma surgery (14). An additional challenge for educators is the lack of a uniform, validated assessment tool to measure the impact of curricular developments in leadership education (15).

In an effort to address the need for leadership training for critical care physicians, we developed a longitudinal curriculum on crisis leadership for critical care fellows using the Kern six-step approach (16). The goal was to improve fellows' leadership skills during crises in the ICU as well as fellows' confidence and readiness to lead a multidisciplinary team when managing life-threatening emergencies. Specifically, our objectives in implementing this curriculum were to 1) highlight the impact of leadership on team function, 2) provide a framework for leadership during a crisis, and 3) outline techniques for improving leadership skills. This curriculum was reported previously in the form of an abstract (17).

## METHODS

### Targeted Needs Assessment

To inform content development for simulation scenarios, we electronically surveyed current fellows and recent graduates of the PCCM, internal medicine critical care medicine (IMCCM), and anesthesiology critical care medicine (ACCM) programs at the University of Washington. Respondents were asked to identify technical and nontechnical skills they had learned during their fellowships, as well as skills needing additional development. Questions allowed selection from a prespecified list as well as free-text responses.

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This article has an online supplement, which is accessible from this issue's table of contents at [www.atsjournals.org](http://www.atsjournals.org).

**Leadership Framework Development**

A review of the available literature was conducted to identify skills and behaviors linked to effective leadership during emergencies. The majority of the literature described specific behavioral and interpersonal traits leading to successful leadership in trauma, emergency medicine, and surgical settings (18–24). The course faculty included individuals with substantial leadership experience within our healthcare system and school of medicine, who collectively identified key leadership skills for inclusion in the framework.

The Crisis Leadership Framework was generated on the basis of themes extracted from the literature and expert review. Once constructed, the framework was graphically represented as depicted in Figure 1. Essential skills were organized into three core categories: information, communication, and behaviors. Within

each category, learners were encouraged to consider patient, self, team, and environment (24).

**Development of Simulation Scenarios**

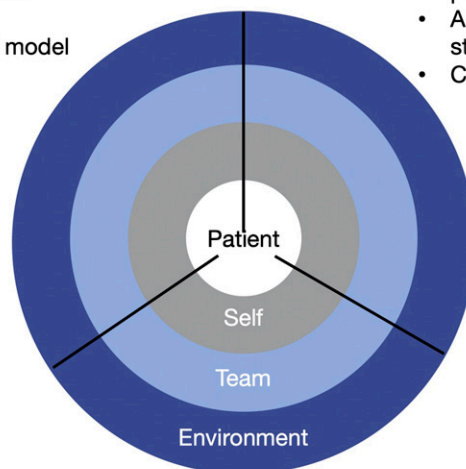
To practice leadership skills and approximate the clinical environment, simulation was selected as the format for this curriculum. Based on the needs assessment, four categories of emergencies were prioritized: airway emergencies, neurologic emergencies, mechanical ventilator emergencies, and cardiac arrest resuscitation. A total of 10 simulation scenarios were developed within these categories. For example, airway emergencies included simulations of angioedema, endotracheal tube dislodgement, and endotracheal tube occlusion. Examples of these simulation scenarios, including learning objectives, have been published previously (25, 26) and are also included in the online supplement.

**INFORMATION**

- Think out loud
- Provide frequent updates
- Define team goals
- Nurture shared mental model

**BEHAVIORS**

- Delegate tasks and procedures
- Anticipate and verbalize next steps
- Coordinate team tasks



**COMMUNICATION**

- Facilitate conflict resolution
- Use closed-loop communication
- Elicit team concerns and preferences

**Figure 1.** The Crisis Leadership Framework was created to represent core leadership skills based on themes extracted from the literature.

Each of the simulation scenarios was used once per academic year and not repeated.

In addition to the clinical challenge presented in the simulation session, several scenarios were designed to create team discord that could only be resolved through effective leadership behaviors. These engineered conflicts were introduced in response to feedback from participants, who identified this as an additional source of anxiety in emergencies.

### Curriculum Implementation

The curriculum was implemented in 2016–2017 for first-year pulmonary and critical care fellows at the University of Washington, and each session was held during protected education time for PCCM fellows. Fellows from IMCCM and ACCM programs were invited to attend as able, depending on clinical obligations, but their participation could not be guaranteed, owing to lack of shared protected time. Sessions were 4 hours in duration and held on a quarterly basis over the course of the academic year. Each session began with 1 hour of leadership content. Topics included an introduction to the Crisis Leadership Framework, leadership during crises, leadership beyond the ICU, and a final session to allow reflection on personal leadership challenges. Successful elements of leading a clinical debrief were discussed in several of the sessions (27).

After each education session on leadership, fellows participated in two or three 15-minute simulations involving an interdisciplinary team. For each scenario, one fellow was designated as a lead fellow and a second fellow (support fellow) assisted with necessary procedures such as bedside ultrasound or endotracheal intubation. Embedded participants, including nurses, respiratory therapists,

residents, and consultants, were incorporated to replicate a typical multidisciplinary ICU team. To enhance the realism of the scenario, these roles were all played by participants in their usual roles (i.e., the nurse role was played by a critical care nurse), with the exception of an embedded faculty observer who participated in the simulation as a member of the team (typically the intern) to relay key information to the participants.

Each simulation was observed via live video feed in an adjacent room by fellows and course faculty not directly participating in the case. After the simulation, the lead fellow was instructed to conduct a debrief with the team while remaining “in character” to review the events from the scenario. At the conclusion of the scenario, the participating fellows, together with the embedded team members, joined their peers who had observed the simulation to debrief the case and discuss leadership observations. This discussion was facilitated by a faculty member, who then provided a review of the salient clinical management in the scenario.

Simulation sessions were conducted in a simulation center designed to mimic the ICU environment, with the patient represented by a high-fidelity mannequin (SimMan 3G; Laerdal Medical). Scenarios requiring mechanical ventilation used the ASL 5000 lung simulator (IngMar Medical), which was connected to the ventilator at the mannequin’s bedside.

### Assessment

Participating fellows completed surveys after the first and last sessions of the year regarding their subjective

experiences with the leadership curriculum. Survey questions explored changes in self-perceived preparedness to lead during a crisis and negotiate conflicts among healthcare professionals, comfort with the clinical content areas covered by the simulations, comfort leading a team debrief, and the utility of the leadership framework. The survey responses used a 4-point scale with answer options including strongly agree, somewhat agree, do not agree, and not applicable. In addition to the rating scale, comments were invited. The participating 2017–2018 fellows were also asked to share the practice from this curriculum that they planned to implement in their future practice. This study was deemed exempt from the need for review by the University of Washington Institutional Review Board.

## RESULTS

### Surveys

Seven PCCM fellows in 2016–2017 and six PCCM fellows in 2017–2018 participated in all sessions of the curriculum (100% for both years). Fellows from IMCCM and ACCM participated in sessions as able during both academic years, but their attendance was not individually tracked. All participating fellows were invited to complete surveys, and results were pooled together. We received six evaluations in 2016–2017 and five evaluations in 2017–2018; survey results are presented in Figure 2.

After completion of the first session in both the 2016 and 2017 academic years, all fellows believed that they better understood the key concepts of effective leadership, with 45% and 57% indicating strong agreement, respectively. This improved further after completion of

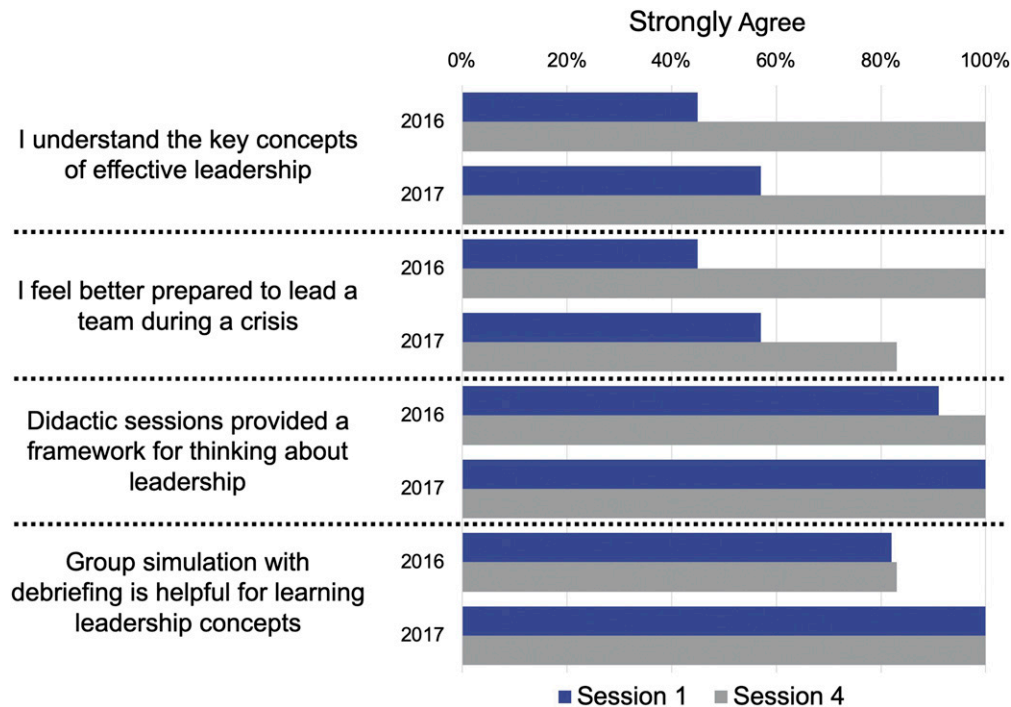


Figure 2. Survey results with percentage of respondents strongly agreeing with each statement by year and session.

the fourth and final session, with 100% of participants in both cohorts specifying strong agreement. Participants also confirmed that they felt better prepared to lead a team during a crisis after completion of the curriculum, with 100% and 83% indicating strong agreement after session 4 in 2016 and 2017, respectively. All fellows strongly agreed that the didactic sessions provided a framework for thinking about leadership during a crisis and that group simulation with debriefing was a helpful format for learning these concepts. These views were consistent in both years from sessions 1–4.

**Narrative Feedback**

Participants had an overwhelmingly positive response to the leadership curriculum and simulation experiences. Although a formal qualitative analysis on narrative feedback from participating fellows was not performed, a number of themes emerged from the comments (Table 1). Several participants commented

on the value of navigating simulated conflict or challenging team dynamics. Others commented on the utility of debriefing about leadership after each simulation and discussing challenges experienced in the case. The 2017–2018 fellow participants were also asked to reflect on how they would change their practice as a result of participating in this curriculum. Two participants shared a plan to be better active listeners, and others commented on remaining calm as a leader, using the language of collaboration in stressful situations, and employing more closed-loop communication.

**DISCUSSION**

Implementation of a longitudinal crisis leadership curriculum for first-year critical care fellows proved feasible and was well received by trainees. Fellows found the curriculum helpful in providing a framework for thinking about leadership and reported feeling better prepared to

**Table 1. Narrative feedback from participants organized into identified themes**

**General comments**

- “The simulation leadership curriculum provides instruction on rare events in the hospital, and I think provides appropriate stress to allow the fellow to try to exhibit leadership under duress.”
- “This is a GREAT sequence of learning experiences—truly the highest quality of anything I have experienced in medical school or residency.”
- “Overall excellent curriculum! I really enjoyed working with the teams. I appreciated having our own nurses, RTs, med students available to help.”
- “I don’t know if I have changed my leadership practice; however, I am more aware of it.”

**Comments about team dynamics and conflict**

- “The most useful scenarios were those with interpersonal conflict in addition to acute medical issues. It was very helpful to work through these scenarios with both medical reasoning and the added layer of conflict resolution.”
- “The conflict resolution scenarios were the best because that is what I struggle the most with in real life.”
- “The confrontational attending and nurse simulations in the context of codes were more memorable and helpful to me. They were charged situations that were realistic and generated the emotional responses that complicate these scenarios in real life.”
- “I would like more scenarios where there is discord within the team, or potentially where there is discord with the family members.”

**Comments about postsimulation debrief**

- “I enjoy the post-sim debriefing a lot—the opportunity to hear from others and what they observed.”
- “I think more constructive criticism [during the debrief] is helpful—it won’t hurt my feelings, but it is helpful.”
- “I am one of those people who struggles with ‘simulation’ in terms of engagement emotionally with the task; however, the discussions at the end were great! They act to bring us together as a group, great to hear other people’s thoughts/strategies.”

*Definition of abbreviation:* RTs = respiratory therapists.



lead a team during crises. Scenarios that simulated interpersonal conflict were particularly helpful to participants, as was the use of group debriefing to discuss these challenges with peers and faculty.

Between the first and second years, we implemented iterative improvements to the curriculum based on feedback from participating fellows. These included creation of new simulation scenarios, incorporation of challenging team dynamics, and having fellows volunteer to be leaders for each scenario rather than making assignments. These small improvements proved easy to implement and enhanced learner satisfaction.

The primary strength of this curriculum lies in the use of simulation as a format for skill development; this is superior to simple lecture-based training (8) and best approximates clinical environments (28). The longitudinal design of this curriculum may also mitigate the loss in beneficial effects of multidisciplinary simulation training observed after only a single session (29).

Our curriculum also has several limitations. There is currently no standardized approach to leadership education in graduate medical education (14), and existing curricula lack any grounding in an established conceptual framework (30). Because of the relatively small size of each fellowship class, the number of participants has been limited. Of particular note for others considering a similar curricular intervention, the lack of an established assessment tool (15) to measure changes in leadership performance represented a significant challenge. As a result, outcomes demonstrating a change in leadership skills or clinical impact from this curriculum are lacking, consistent with

other leadership education initiatives (14, 30). Assessment of our curriculum using more robust outcomes is limited by considerable logistical challenges. Because of the relatively short and infrequent nature of sessions, it was not possible to observe individual participants repeatedly over time to assess changes in leadership performance. In addition, our survey results were pooled to include invited participants from IMCCM and ACCM; thus, it is impossible to analyze our results in the context of how frequently a participant was able to attend. Finally, it is not possible to determine whether the observed improvement in self-reported preparedness to lead a team during a crisis was due to this curriculum or to completion of 1 year of critical care training.

## Conclusions

Team leadership is an essential skill for pulmonary and critical care trainees; yet, there are limited leadership curricula targeting these learners. We developed a longitudinal crisis leadership curriculum for critical care fellows and used simulation as a means to practice leadership skills. Although limited by the lack of an established assessment tool for leadership in medicine, the curriculum was rated highly by participants and improved learners' self-perceived leadership skills and confidence when leading a clinical crisis. More research is needed to determine effective educational approaches for leadership skill training, which will require the development of a comprehensive assessment tool for leadership skills in critical care. Next steps include determining feasible ways to follow

learners' skill improvement over successive sessions; assessing higher-level outcomes such as objective skill acquisition or behavior change; and developing formal content on conflict resolution, given participants' desire to learn this skill. Finally, further

study is needed to confirm that improvements in leadership skills translate to improved patient outcomes.

**Author disclosures** are available with the text of this article at [www.atsjournals.org](http://www.atsjournals.org).

## REFERENCES

1. Fessler HE, Addrizzo-Harris D, Beck JM, Buckley JD, Pastores SM, Piquette CA, *et al*. Entrustable professional activities and curricular milestones for fellowship training in pulmonary and critical care medicine: report of a multisociety working group. *Chest* 2014;146:813–834.
2. Ford K, Menchine M, Burner E, Arora S, Inaba K, Demetriades D, *et al*. Leadership and teamwork in trauma and resuscitation. *West J Emerg Med* 2016;17:549–556.
3. Hunziker S, Johansson AC, Tschan F, Semmer NK, Rock L, Howell MD, *et al*. Teamwork and leadership in cardiopulmonary resuscitation. *J Am Coll Cardiol* 2011;57:2381–2388.
4. Schmutz J, Manser T. Do team processes really have an effect on clinical performance? A systematic literature review. *Br J Anaesth* 2013;110:529–544.
5. Gregg SC, Heffernan DS, Connolly MD, Stephen AH, Leuckel SN, Harrington DT, *et al*. Teaching leadership in trauma resuscitation: immediate feedback from a real-time, competency-based evaluation tool shows long-term improvement in resident performance. *J Trauma Acute Care Surg* 2016; 81:729–734.
6. Hunziker S, Bühlmann C, Tschan F, Balestra G, Legeret C, Schumacher C, *et al*. Brief leadership instructions improve cardiopulmonary resuscitation in a high-fidelity simulation: a randomized controlled trial. *Crit Care Med* 2010;38:1086–1091.
7. Petrosniak A, Hicks CM. Beyond crisis resource management: new frontiers in human factors training for acute care medicine. *Curr Opin Anaesthesiol* 2013;26:699–706.
8. Burden AR, Pukenas EW, Deal ER, Coursin DB, Dodson GM, Staman GW, *et al*. Using simulation education with deliberate practice to teach leadership and resource management skills to senior resident code leaders. *J Grad Med Educ* 2014;6:463–469.
9. Fernandez Castela E, Russo SG, Cremer S, Strack M, Kaminski L, Eich C, *et al*. Positive impact of crisis resource management training on no-flow time and team member verbalisations during simulated cardiopulmonary resuscitation: a randomised controlled trial. *Resuscitation* 2011;82: 1338–1343.
10. Blackwood J, Duff JP, Nettel-Aguirre A, Djogovic D, Joynt C. Does teaching crisis resource management skills improve resuscitation performance in pediatric residents? *Pediatr Crit Care Med* 2014;15:e168–e174.
11. Fung L, Boet S, Bould MD, Qosa H, Perrier L, Tricco A, *et al*. Impact of crisis resource management simulation-based training for interprofessional and interdisciplinary teams: a systematic review. *J Interprof Care* 2015;29:433–444.
12. Fernandez Castela E, Boos M, Ringer C, Eich C, Russo SG. Effect of CRM team leader training on team performance and leadership behavior in simulated cardiac arrest scenarios: a prospective, randomized, controlled study. *BMC Med Educ* 2015;15:116.



13. Boet S, Reeves S, Bould MD. Call for an internationally recognized interprofessional simulation-based disease/injury independent, crisis resource management training certification. *Resuscitation* 2015; 92:e7.
14. Rosenman ED, Shandro JR, Ilgen JS, Harper AL, Fernandez R. Leadership training in health care action teams: a systematic review. *Acad Med* 2014;89:1295–1306.
15. Rosenman ED, Ilgen JS, Shandro JR, Harper AL, Fernandez R. A systematic review of tools used to assess team leadership in health care action teams. *Acad Med* 2015;90:1408–1422.
16. Kern DE. Curriculum development for medical education: a six-step approach. Baltimore: Johns Hopkins University Press; 1998.
17. Steinbach TC, Adamson R, Carlbom DJ, Johnson NJ, Kritek PA, Çoruh B. Leadership education for critical care fellows using simulation [abstract]. *Am J Respir Crit Care Med* 2017;195:A7299.
18. Rosenman ED, Branzetti JB, Fernandez R. Assessing team leadership in emergency medicine: the milestones and beyond. *J Grad Med Educ* 2016;8:332–340.
19. Flin R, Maran N. Basic concepts for crew resource management and non-technical skills. *Best Pract Res Clin Anaesthesiol* 2015;29:27–39.
20. Leenstra NF, Jung OC, Johnson A, Wendt KW, Tulleken JE. Taxonomy of trauma leadership skills: a framework for leadership training and assessment. *Acad Med* 2016;91:272–281.
21. Reader TW, Flin R, Cuthbertson BH. Team leadership in the intensive care unit: the perspective of specialists. *Crit Care Med* 2011;39:1683–1691.
22. Agency for Healthcare Research and Quality. TeamSTEPPS 2.0 pocket guide. Rockville, MD: U.S. Department of Health and Human Services; 2013 [accessed 2017 Mar 1]. Available from: <https://www.ahrq.gov/sites/default/files/wysiwyg/professionals/education/curriculum-tools/teamstepps/instructor/essentials/pocketguide.pdf>.
23. Sundar E, Sundar S, Pawlowski J, Blum R, Feinstein D, Pratt S. Crew resource management and team training. *Anesthesiol Clin* 2007;25:283–300.
24. Reid C. Making things happen. Resuscitation Medicine Education. 2013 [accessed 2018 Oct 31]. Available from: <http://resus.me/smacc-2013/smacc2013-making-things-happen/>.
25. Keller JM, Steinbach TC, Adamson R, Carlbom DJ, Johnson NJ, Clark J, et al. ICU emergencies simulation curriculum for critical care fellows: the difficult airway. *MedEdPORTAL* 2018;14:10744.
26. Keller JM, Steinbach TC, Adamson R, Carlbom DJ, Johnson NJ, Clark J, et al. ICU emergencies simulation curriculum for critical care fellows: neurologic emergencies. *MedEdPORTAL* 2019;15:10813.
27. Gardner R. Introduction to debriefing. *Semin Perinatol* 2013;37:166–174.
28. Boet S, Bould MD, Fung L, Qosa H, Perrier L, Tavares W, et al. Transfer of learning and patient outcome in simulated crisis resource management: a systematic review. *Can J Anaesth* 2014;61:571–582.
29. van de Ven J, Fransen AF, Schuit E, van Runnard Heimel PJ, Mol BW, Oei SG. Does the effect of one-day simulation team training in obstetric emergencies decline within one year? A post-hoc analysis of a multicentre cluster randomised controlled trial. *Eur J Obstet Gynecol Reprod Biol* 2017;216:79–84.
30. Sultan N, Torti J, Haddara W, Inayat A, Inayat H, Lingard L. Leadership development in postgraduate medical education: a systematic review of the literature. *Acad Med* 2019;94:440–449.