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An evaluation of the Acute Critical Events Simulation (ACES) course for family medicine residents

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Introduction: A 2-year residency must prepare family physicians to provide a broad range of services. In many settings, especially rural and remote practices, family physicians provide emergency and inpatient care and thus encounter critically ill patients. Evidence of the importance of early recognition and aggressive intervention in critical illness is growing. However, opportunities to safely practise critical care skills during residencies are limited.
Methods: The 2-day Acute Critical Events Simulation (ACES) course was offered to all family medicine residents at the University of Ottawa in 2009. The course included lectures, case discussions, hands-on task training and a half-day of high-fidelity simulation. Its aims were to enhance the abilities of residents in family medicine to recognize signs of critical illness, to teach competencies in the early resuscitation and care of such patients, and to increase residents' confidence to include inpatient and emergency care in their practices, or to practise in a rural or remote setting. A postcourse questionnaire, which included Likert-scale and open-ended questions, was distributed to all participants.
Results: Thirty-seven participants completed the survey. The ACES course was exceptionally well-received by participants, who reported increases in confidence and perceived competence, as well as intentions to change practice. The course appeared to increase participants' confidence to work in rural or remote areas and include inpatient or emergency medicine services in their practices.
Conclusion: The ACES course achieved its aims, and participants reported positive outcomes. This highly interactive, simulation-based program may help prepare residents for work in rural or remote communities with critically ill patients.

Introduction : Une résidence de deux ans doit préparer les médecins de famille à fournir un large éventail de services. Dans de nombreux contextes, en particulier dans les régions rurales et éloignées, les médecins de famille fournissent des soins d'urgence et des soins aux patients hospitalisés. Ils sont donc en contact avec des patients gravement malades. L'importance du dépistage précoce et du recours à des interventions énergiques en cas de maladies graves est de plus en plus évidente. Or, les possibilités de pratiquer en toute sécurité des techniques de soins critiques en résidence sont limitées.
Méthodes : On a offert à tous les résidents en médecine familiale à l'Université d'Ottawa en 2009 un cours de deux jours sur la simulation d'événements critiques en phase aiguë. Il comprenait une partie magistrale, des discussions de cas, une formation pratique et une demi-journée de simulation de haute fidélité. Les objectifs étaient de renforcer les capacités des résidents en médecine familiale à reconnaître les signes d'une maladie grave, de leur enseigner des compétences en réanimation précoce et prise en charge de ces patients, et d'accroître leur confiance en eux pour qu'ils puissent inclure dans leur pratique les soins aux patients hospitalisés et les soins d'urgence, en milieu rural ou éloigné. On a distribué un questionnaire à tous les participants après le cours. Il comportait des questions ouvertes et des questions cotées selon l'échelle de Likert.

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Résultats : Trente-sept participants ont répondu au sondage. Le cours a été exceptionnellement bien accueilli par les participants, qui ont déclaré se sentir plus sûrs d'eux et plus compétents, et avoir l'intention de modifier leur pratique. Le cours semble avoir rendu les participants plus confiants pour le travail en région rurale ou éloignée et disposés à inclure des services de soins aux patients hospitalisés ou des services d'urgence dans leurs pratiques.
Conclusion : Le cours a atteint ses objectifs et, selon les participants, a donné des résultats positifs. Ce programme par simulation et très interactif peut aider à préparer les résidents à traiter des patients gravement malades dans les collectivités rurales ou éloignées.

INTRODUCTION

There exists a knowledge gap in most acute care settings. Typically, residents and family physicians are called on to provide initial assessment and management of critically ill patients, especially in rural or remote clinical settings.[1] In an effort to better equip residents, the Department of Family Medicine at the University of Ottawa partnered with CRI [Canadian Resuscitation Institute] Critical Care Education Network (now a unit of the Office of Professional Affairs, The Royal College of Physicians and Surgeons of Canada) to deliver the Acute Critical Events Simulation (ACES) course. The course was designed to teach the basic competencies required to deal with critically ill patients in any setting. The course meets an important recommendation of a 2003 discussion paper by The College of Family Physicians of Canada (CFPC)[2] that states the following:

> The CFPC's accreditation standards should require all family medicine programs to provide family medicine residents with the opportunity to acquire the acute care skills needed for both rural and urban inpatient hospital care.

The discussion paper also suggests that the reluctance of family physicians to practise inpatient medicine may be owing to "a lack of self confidence in their professional abilities."

The goals of the course were to provide residents with the knowledge and skills to recognize the early signs and symptoms of critical illness; the competence necessary to deliver appropriate care in the early hours of critical illness, making optimal use of whatever resources may be available in their practice setting; and confidence in their ability to care for critically ill patients by meeting the above objectives. This, in turn, may have secondary benefits, such as improved recruitment, retention and overall professional satisfaction.

METHODS

Program

To the best of our knowledge, this is the only simulation-based course in Canada delivered to family medicine residents to be mandated by their department. Before delivery of the course, a brief focus group was held with representative residents in family medicine. Perceived needs with respect to education in critical care were discussed. Based on the results of the focus group and direction from M.K., an active educator in family medicine who works both with urban inpatients and in remote communities, the ACES course was modified in content and context to optimize relevance to residents in family medicine.

Four 2-day ACES courses, with up to 16 participants each, were delivered to residents during April and May 2009. CRI Critical Care Education Network assumed responsibility for course coordination, logistics and delivery. The department assisted the process by facilitating communication with the residents and arranging for time off from clinical placements.

The learning outcomes of the ACES course are to enable participants to understand the principles of effective crisis resource management, including leadership, communication, situational awareness, problem-solving and use of resources; recognize a critically ill patient by performing an initial assessment, initiate effective life-saving strategies for management and establish priorities for management in a patient with conflicting medical conditions; and assess and manage airway compromise, respiratory failure and shock.

Each course included the following modules:

- introduction to crisis resource management (lecture with video-based discussions);
- airway, breathing and circulation modules (all include a lecture, case discussions and hands-on training with equipment and manikins);

- neurologic and dysrhythmia modules (shorter modules including a lecture and case discussions);
- simulation (small-group sessions — maximum 4 participants — for 3.5 hours in team simulations with a computer-controlled lifelike manikin, dynamic vital signs monitor and real medical equipment, with video-based debriefing and feedback after each scenario).[3]

Participants received the course textbook in advance. The lecture on crisis resource management was the first module delivered. Participants were divided into streams and completed the other modules in variable order.

Instructors of these courses included 1 family physician, 5 critical care specialists and 3 critical care fellows. Teaching assistance was provided by critical care nurses and respiratory therapists from The Ottawa Hospital. The nurses were actors in the simulation scenarios, and the respiratory therapists helped to teach set-up of ventilators and troubleshooting.

Evaluation

These courses represent the first delivery of ACES to residents in family medicine. Postcourse questionnaires were distributed to all participants. Residents who did not attend both days of the course were excluded from the study. Questionnaires were delivered electronically, and 3 reminders were sent after the course. The survey included both Likert-scale (5-point) and open-ended questions.

We used quantitative methods to analyze the Likert-scale data, treating the responses as scale data. Means and 95% confidence intervals were reported. Intergroup comparisons of Likert-scale data were done using independent-sample t tests and one-way analysis of variance, with significance set at $p < 0.05$. Comparisons of categorical data were performed using χ^2 tests, again with significance set at $p < 0.05$. For comparisons of groups based on anticipated practice location, participants were classified as having a preference for "tertiary/suburban," "rural/remote" or "both." Statistics were calculated using SPSS version 15.

Qualitative data were reviewed and coded by one of us (T.G.W.) using a thematic analysis, in which themes were progressively defined and modified (with data recategorized as necessary) as information was analyzed.

Table 1. Demographics of respondents and their anticipated practices (n = 37)

Survey question	Response	% of respondents
Sex*	Male	22
	Female	76
	No response	3
Anticipated practice setting(s)†	Tertiary or large urban	35
	Small urban or suburban	62
	Rural	70
	Remote	24
Intent to include in practice†	Inpatient care	51
	Emergency care	70
	Neither	16

*Total does not equal 100% because of rounding.
†Participants were permitted to select more than 1 response.

RESULTS

The ACES courses were delivered to 49 second-year residents in family medicine. Responses to questionnaires were received from 37 participants, resulting in a response rate of 76%. Table 1 summarizes respondents' sex, anticipated practice location(s) and intent to include inpatient or emergency work in their practices. In this cohort, men were more likely to practise in tertiary or suburban settings, and women were more likely to practise in rural or remote settings (Table 2; $p = 0.006$). However, there was no association between sex and the choice to include inpatient or emergency care in one's practice.

The postcourse questionnaires contained 4 items addressing the level of complexity of the course (Fig. 1), 12 items related to the curriculum, content and outcomes of the course (Fig. 2), and 14 items related to the teaching and learning methods used (Fig. 3).

All course modules (including simulation) were rated as appropriate or close to it, with airway and circulation rated as slightly too basic.

With respect to course content and outcomes, all participants agreed (78% strongly so) that the course was relevant to their anticipated job-related needs. Sixty-one percent disagreed with the statement, "There were not enough opportunities for me to solve patient cases." Participants intending to

Table 2. Association between respondents' sex and anticipated practice setting (n = 36*)

	No. of respondents	
Practice setting	Male	Female
Tertiary or suburban	6	5
Rural or remote	2	13
Both	0	10

*One respondent did not indicate their sex.

work in tertiary or suburban centres were less likely to disagree. Seventy-nine percent agreed (41% strongly so) their technical skills improved because of the course. All participants agreed (68% strongly so) the course increased their confidence to manage the treatment of critically ill patients. Participants believed their competence improved with respect to breathing problems (97%), circulation (95%) and airway problems (92%). Female participants were more likely to strongly agree that their competence in airway and breathing problems had improved. Ninety percent indicated they planned to change practice because of the course. Finally, 97% agreed (83% strongly so) they would recommend this course to their colleagues and future residents in family medicine.

With respect to educational methods, 70% found the book to be useful preparation for the course; participants who intended to practise in rural or remote areas and who intended to include emergency or inpatient care in their practices were more likely to agree. All respondents agreed the slides were clear and easy to follow and the presentations enhanced their learning. All respondents agreed the case studies were a useful learning tool, and 76% indicated there was enough time for discussion and feedback. Those who intended to practise in rural or remote areas were more likely to strongly agree. Eighty-six percent agreed the use of the technical skills models improved their abilities. Ninety-two percent agreed there was enough time with the models; those who intended to include emergency or inpatient care in their practices were more likely to agree. Eighty-nine percent indicated the simulator recreated life-like crises, and 94% agreed the simulations reinforced the concepts taught in the course modules. Ninety-seven percent felt they gained skills in crisis resource management from the simulator, and 97% agreed they received useful feedback after the simulations. Only 6% found the simulations too stressful, and 95% indicated the simulations increased their confidence to manage critical situations.

Participants were asked 5 open-ended questions. Four questions were for purposes of quality improvement, addressing content or materials that could be altered or added. Eighteen respondents indicated they would like more simulations. The only prevalent theme for content to remove was, "nothing."

One question investigated whether the course had an impact on participants' confidence and attitudes toward rural practice. Nineteen respondents (51%) commented that the course increased their confidence to care for critically ill patients; 8 (22%) indicated it increased their confidence to work in a rural location; and 4 (11%) indicated it increased their comfort to include inpatient or emergency care in their practices. For example, one respondent wrote that the course "greatly increased my confidence to work in rural or remote areas with fewer resources." Another indicated, "Yes, I do feel more confident to work in emergency because I feel that in worst-case scenarios I have some tools at my disposal." Only 5 respondents (14%) indicated the course had little impact on their confidence or attitude; 4 of these respondents stated it was because they already worked or planned to work in rural areas or in the emergency department.

DISCUSSION

Skills in resuscitation are an important component of medical practice in rural and remote areas, where family physicians are responsible for the recognition and initial stabilization of critically ill patients.[4] Previous studies of training in advanced cardiac life support (ACLS) in rural communities have demonstrated improvements in patient care and outcomes.[5,6] Complementary to ACLS, the ACES

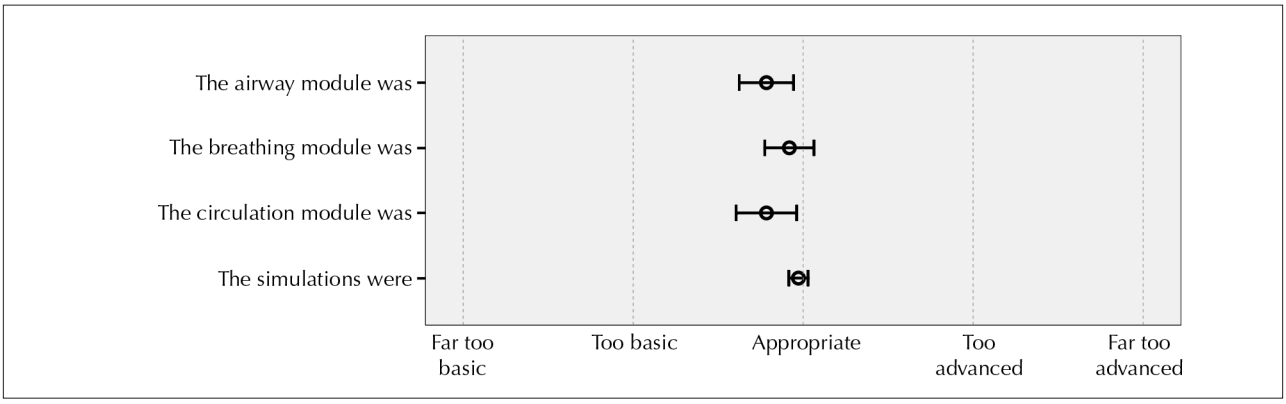


Fig. 1. Mean responses regarding participants' perceptions of the level of complexity of the course. Error bars represent the 95% confidence interval.

course aims to enable practitioners to provide resuscitation for the undifferentiated pre-arrest critically ill patient. This questionnaire-based ACES evaluation targeted levels 1 (satisfaction) and 3 (competence, confidence, intent to change practice) of Kirkpatrick and Kirkpatrick's model of program evaluation,[7] with information based on participant perceptions. The 76% response rate is acceptable for analysis.

Overall, the ACES course was very well-received by the participants. Likert-scale scores were exceptionally positive, which suggests the course is particularly appreciated by family physicians at this stage of their training. All respondents agreed the course was relevant to their anticipated job-related needs, and 97% would recommend the course to future residents.

Among course participants, some intended to practise in a rural or remote setting (largest group), some in a tertiary or suburban setting and some in both. Interestingly, female participants were more inclined to practise in rural or remote settings, although the current trend appears to be that about equal numbers of men and women enter rural practice.[8]

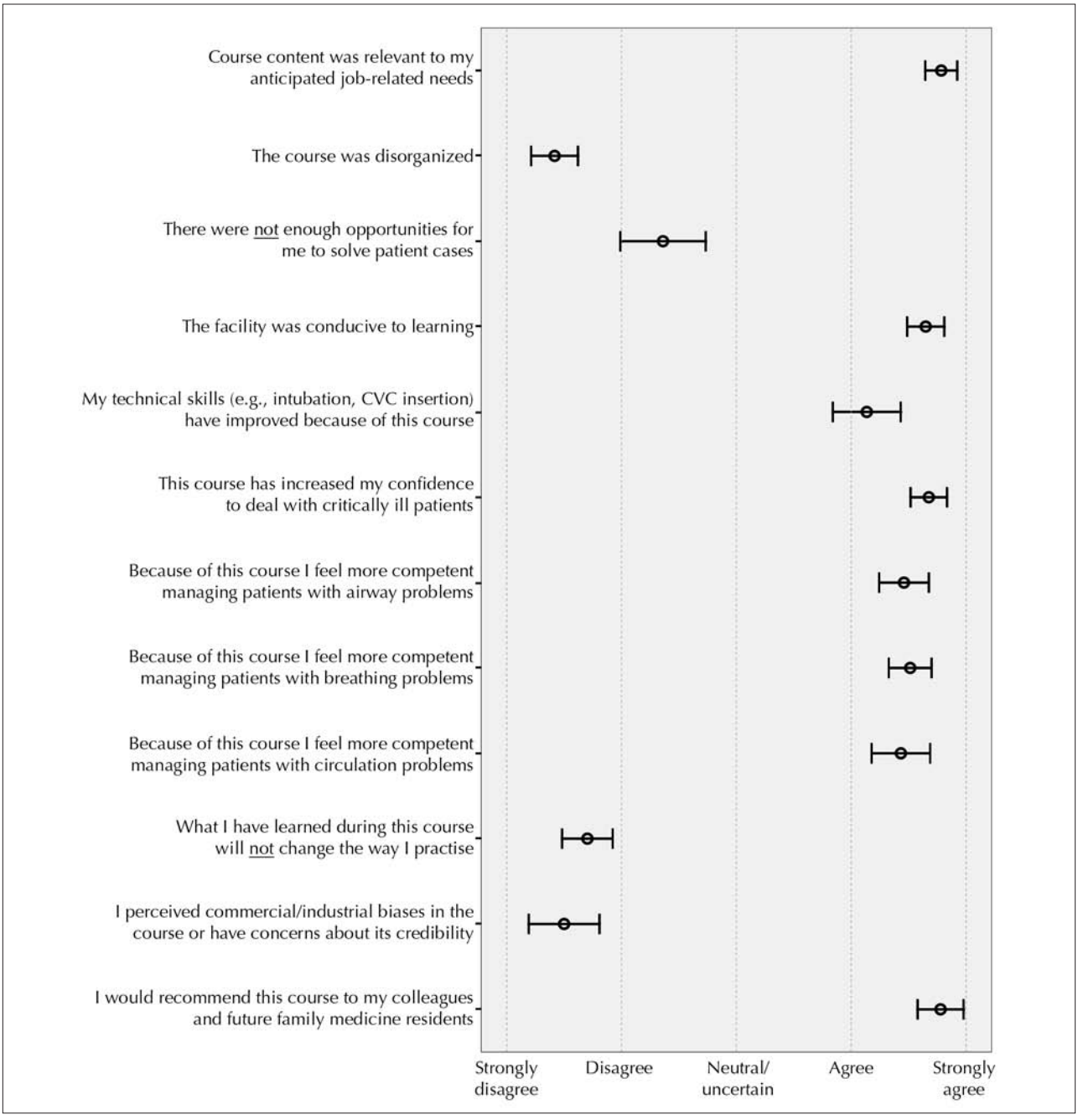


Fig. 2. Mean responses to Likert-scale items related to curriculum, content and outcomes. Error bars represent the 95% confidence intervals. CVC = central venous catheter.

The level of difficulty of the modules was considered appropriate by the vast majority of participants. Some found the airway and circulation modules too basic. These modules may benefit from addition of more advanced material. The relevance, organization, format and impartiality of the course were all rated favourably.

Responses to items addressing outcomes of the course were tremendously encouraging. Seventy-nine percent of respondents felt their technical skills had improved because of the course. A range of 92% to 97% believed their competence in airway, breathing and circulation management had improved. All respondents agreed their confidence had improved, and 90% indicated they would change some aspect of their practices. These findings are particularly encouraging, because intention to change practice has been shown to predict actual changes in behaviour.[9,10]

With respect to course content, the only significant theme that emerged regarding what should be removed from the course was "nothing," indicating all current course content should remain. If there were room to add content, a few themes were



Fig. 3. Mean responses to Likert-scale items related to teaching and learning methods used in the course. Error bars represent the 95% confidence intervals. ACES = Acute Critical Events Simulation.

prevalent: more on medications (which could be accomplished with a pocket reference card), pediatrics and mechanical ventilation. However, none of these recommendations were given by more than 14% of respondents.

A prevalent comment for course improvement was to offer more simulations. Although possible, increasing the number of scenarios for each participant would have a substantial impact on the course's length and cost, given the logistics, equipment requirements, personnel and cost involved in running simulations.

The course was designed such that the modules are not a prerequisite to the simulations; feedback focuses on crisis resource management more than medical decisions specific to the cases. Although skills in crisis resource management are generic,[11] problem-solving skills are not,[12] so it may be beneficial to offer the simulation module last, as some respondents suggested. However, the course and simulations were rated favourably even by those who entered the simulation sessions before completing all other modules.

Participants were asked explicitly about the impact of the course on their confidence. Encouragingly, 84% of respondents indicated their confidence had increased, either with respect to critically ill patients generally, rural practice or inclusion of emergency or inpatient care in their practices. This sentiment was echoed in responses to the open-ended question about confidence. It was a primary goal of this program to augment trainees' confidence to practise in a rural or remote setting including emergency or inpatient care. Results from the questionnaire suggest this goal was achieved.

Limitations

The results of this evaluation are limited by the method, data source and sample size. A questionnaire was used to collect data from as many participants as possible, although the depth of qualitative information to be gained was limited. Furthermore, results pertaining to competence and intent to change are based on respondents' self-perceptions, not testing or performance observation. The small sample size reflects the cohort to whom this course was delivered and limits the generalizability of results. Finally, women outnumbered men in this sample; it is not clear if and how this may have affected findings. Although this study was an encouraging first step in evaluating the course, further research is required to determine whether competence is objectively increased or changes in practice are indeed implemented.

CONCLUSION

The ACES course was adapted for and delivered to second-year residents in family medicine at the University of Ottawa to enhance their competence in identifying and resuscitating critically ill patients, and to increase their confidence to work in rural or remote areas and to include inpatient or emergency care in their practices. The course was rated as relevant by all participants, who indicated perceived increases in competence, increased confidence and intentions to change aspects of their practices.

Competing interests: Timothy Willett is a full-time employee of the Royal College of Physicians and Surgeons of Canada, which offers the course, and Pierre Cardinal is a paid consultant to the college. None declared by Michael Kirlew and Philip Karas.

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