Curso de emergência utilizando E-learning e simulação: visão do participante

E-Learning and Simulation on a Pré-Hospital Emergency Course: A Participant's Perspective

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RESUMO

O uso da simulação e da educação a distância tem aumentado consideravelmente na área da saúde, permitindo o desenvolvimento de competências de forma ética e segura. O objetivo deste artigo é descrever a concepção e a avaliação de um curso semipresencial de emergência pré-hospitalar para médicos e enfermeiros da Secretaria Municipal de Saúde de Belo Horizonte, Brasil. O curso a distância foi composto por 13 aulas, e a parte presencial por dez estações temáticas. Os participantes responderam a um questionário semiestruturado (escala de Likert) como forma de avaliar o curso. Participaram do curso 203 (63,6%) médicos e 116 (36,4%) enfermeiros. A maioria dos médicos (72,1%) tinha terminado seus estudos havia mais de cinco anos e tinha pouca prática (72,9%) em medidas de suporte avançado de vida. O curso a distância foi bem avaliado quanto a qualidade geral e dos vídeos, uso de imagens e animações, e usabilidade do sistema. A plataforma de ensino foi considerada amigável. A parte de simulação foi bem avaliada. O curso utilizou metodologia baseada em simulação e educação a distância, sendo bem avaliado. A plataforma de ensino foi classificada como boa e de fácil utilização.

ABSTRACT

The use of simulation and e-learning has increased considerably in healthcare related educational activities, enabling the acquisition of skills ethically and safely. The objective is to describe the design and evaluation of a semi-distance pre-hospital emergency course for physicians and nurses at the Public Health Department of Belo Horizonte City, Minas Gerais, Brazil. The course comprised 13 online lessons and ten stations, which used simulated scenarios. The participants answered a semi-structured questionnaire using the Likert scale to evaluate the course. Course participation included 203 (63.6%) physicians and 116 (36.4%) nurses; most physicians (72.1%) had finished their studies over five years prior to the study, and had little practice (72.9%) on advanced life support measures. The distance course was well evaluated in terms of general quality, video quality, use of images and animations and usability. The e-learning system was considered to be user friendly by doctors and nurses, and the practical activities were well rated. The course used methodology based on simulation and distance education, and received positive evaluations. The system was rated as good and easy to use.

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INTRODUCTION

Simulation teaching-learning process has been increasingly used in different scientific areas. Skills can be acquired and developed through basic or advanced simulations. In recent years the use of simulation as a teaching-learning methodology has greatly increased in the health education. One of the great advantages is that its use allows participants to learn how to deal with emergencies and get used to them without risk[1]. In addition, it provides a safe environment where "errors can be forgiven" facilitating the teaching and training of health professionals[2]. The challenge in medical education is to expose students to opportunities for errors, whilst developing safeguards that protect patients[3].

Clinical simulation is a powerful teaching tool that applies to all levels of medical education – undergraduate and postgraduate – enabling a multidisciplinary and multiprofessional approach, which contributes to proper patient care[4,5]. Simulation is widely used in the medical school curricula; however, further studies are still required in order to identify its benefits to the care of critically ill patients when compared with traditional educational methods[6]. Berkenstadt reports a better performance in emergency and intubation situations from medical students who participated in a pilot project for simulation teaching when compared to the control group[7].

At the same time, distance education has been incorporated as a routine for health professionals, providing training and updating in their workplace. E-learning can offer multiple benefits such as increased access and availability, and is becoming increasingly widespread in undergraduate and postgraduate programs[8].

The Health Technology Center (*Centro de Tecnologia em Saúde* – Cetes, in Portuguese), of the School of Medicine of the Federal University of Minas Gerais has developed distance courses in several health areas. Semi-distance education models were used for the emergency pre-hospital courses. The distant education part included 2D and 3D models, animation objects and educational videos, and the face-to-face part used a simulation teaching methodology.

The objective of this study is to describe the design and evaluation of pre-hospital emergency course that uses distance and simulation learning, developed by a public university for doctors and nurses of the public health care segment in the City of Belo Horizonte, state of Minas Gerais, Brazil.

METHODOLOGY

It is a cross-sectional descriptive study about the evaluation of the semi-distance pre-hospital emergency course. A brief, user-friendly questionnaire was developed to evaluate the course.

The course was designed in a partnership between professionals of the emergency sector of the Municipal Health Department of Belo Horizonte (*Secretaria Municipal de Saúde de Belo Horizonte*/SMSA-BH, in Portuguese), and teachers and health professionals (doctors and nurses) from the Federal University of Minas Gerais.

The case studies were developed after discussions and evaluations with the purpose of maintaining the same level of information available to the group.

The selected contents of the distance course were: basic life support, advanced life support, cardiopulmonary failure, shock, respiratory distress and failure, heart rhythm disorders, accidents by poisonous animals, metabolic and electrolyte disorders, poisoning and trauma. The Moodle platform was used with distance mentoring. The lessons included images with model, animation effects and videos. The course load was 50 online and 10 face-to-face class hours. The face-to-face segment included the use of mannequins and simulation equipment to create scenarios covering: basic life support to adults and use of automated external defibrillator, basic life support in children, cardiac arrest care with advanced life support, approach to respiratory failure and shock, first aid measures to trauma victims, neurological and metabolic disorders, different clinical cases, exogenous intoxication and accidents due to venomous animals. Each station included a summary of the cases to be developed by the instructors and a check list of skills and competencies for each participant individual assessment, as well as debriefing guidelines.

The criterion to select instructors was their educational and professional experience in the field of adult and pediatric emergency care.

The target audience included doctors and nurses of Emergency Care Units, Basic Health Units and Pre-hospital Emergency Medical Care Services (*Serviço de Atendimento Médico de Urgência*/Samu, in Portuguese). One month before the course, students received a textbook and a pocket-size booklet prepared by the course developers, which allowed them the opportunity to extend their knowledge and to have a quick reference when treating patients at the workplace.

After the course participants completed a questionnaire about their professional profile and evaluated the course using a Likert scale with five rankings, ranging from poor to excellent. In the questionnaire included the following items: organization, course load, theoretical and practical content, physical space, instructors, mannequins, course benefits and even items that characterized the student's profile such as profession and time of practice.

TABLE 1
Profile comparison between doctors and nurses (n = 319)

	Answers	Doctors n (%)	Nurses n (%)	Statistical Test	p
Length of time in the profession	< 5 years	77 (37.9)	73 (42.5)	$\chi^2=17.53$	<0.0001
	≥5 years	126 (72.1)	43 (57.5)		
Number of times the ALS* technique was used	0	57 (28.1)	17 (14.7)	$\chi^2=26.71$	<0.0001
	1 to 9 times	91 (44.8)	34 (29.3)		
	≥10 times	55 (27.1)	65 (56)		
Last ALS* course	Never	57 (28.1)	36 (31)	$\chi^2=4.06$	0.13
	<5 years	97 (47.83)	63 (54.3)		
	≥5 years	49 (24.1)	17 (14.7)		
Frequency of care to critical patients	Rarely	112 (55.2)	26 (22.4)	$\chi^2=30.95$	<0.0001
	Most of the time	91 (44.8)	90 (77.6)		
Previews participation in distance courses	No	10 (4.9)	1 (0.9)	$\chi^2= 4.27$	0.23
Course contribution to changes in healthcare practice	<50%	26 (12.8)	13 (11.2)		
	≥50%	60 (29.6)	40 (34.5)		
	All	107 (52.7)	62 (53.4)	$\chi^2=0.71$	0.40
	Small	13 (6.4)	4 (3.4)		
	Great	193 (95.1)	112 (96.6)		

*ALS: Advanced Life Support

TABLE 2
Doctor's and nurse's evaluation of the distance course

	Answers	Doctors n (%)	Nurses n (%)	Statistical Test	p
Overall course outline	Poor/Average	19 (9.4)	5 (4.3)	$\chi^2= 2.16$	0.14
	G/VG/E*	180 (88.7)	111 (95.7)		
Videos	Poor/Average	21 (10.3)	8 (6.9)	$\chi^2= 0.78$	0.38
	G/VG/E*	178 (87.7)	108 (93.1)		
2D and 3D Images	Poor/Average	18 (8.9)	5 (4.3)	$\chi^2=1.78$	0.18
	G/VG/E*	181 (89.2)	111 (95.7)		
Usability	Poor/Average	14 (6.9)	11 (9.5)	$\chi^2=0.37$	0.54
	G/VG/E*	185 (91.1)	103 (88.8)		

*G/VG/E: Good/Very Good/Excellent
** Non-respondents were excluded from the analysis (1.9%)

The data was systematized and analyzed by the SPSS program version 18.0. The responses were analyzed by Fisher's exact test and by comparing proportions, calculated by χ^2, considering $p < 0.05$ as statistically significant. This study was approved by the *Coep* (Research Ethics Committee) of the Federal University of Minas Gerais.

RESULTS

Nineteen courses were analyzed - both distance and face-to-face modules. Three hundred and nineteen professionals participated in the course: 63.6% (203) physicians and 36.4% (116) nurses. Table 1 shows the comparison between doctors' and nurses' profiles in relation to length of time in the profession, experience in the Advanced Life Support (ALS) technique, date of last ALS course taken, frequency of care to critically ill patients, percentage of study of the material provided by the distance course and overall course contribution to changes in health care practices.

The distance course was well evaluated as to its overall quality, video quality, included images and animations, and usability (Table 2). The e-learning system was considered user-friendly by both doctors and nurses.

The face-to-face modules were well rated. The simulation was conducted in small groups with an average of 16 profes-

	Answers	Doctors n (%)	Nurses n (%)	Statistical Test	p
TABLE 3 Doctor's and nurse's evaluation of the face-to-face segment of the course					
Course outline	Poor/Average G/VG/E*	2 (1) 201 (99)	2 (2) 114 (98)	Fisher	0.62
Instructors	Poor/Average G/VG/E*	3 (1.5) 200 (99)	2 (2) 114 (98.3)	Fisher	1.00
Overall course satisfaction	Poor/Average G/VG/E*	5 (2.5) 198 (97.5)	3 (2.6) 113 (97.4)	Fisher	1.00

G/VG/E: Good/Very Good/Excellent

sional per course, by developing five case-scenarios in the morning and five in the afternoon.

The course analysis evaluated the educational content used, the instructors' performance and overall course satisfaction (Table 3). Most participants considered the course load (98.5%) and physical space (90.5%) adequate. The majority of the respondents (92%) would recommend the course to others, and requested more courses using the same format.

DISCUSSION

The integration between the public health service and the public university contributes to the exchange of experiences between these sectors. The course demand emerged from the need to train professionals in psychomotor and technical skills to ensure the patient's welfare and reduce adverse events, providing continuing education.

By analyzing the profiles of professionals trained we can see that most doctors have more than five years of experience, while the group of nurses presented no statistically significant difference in this item. On the other hand, nurses reported having more contact with ill patients and performed advanced life support procedures more frequently than doctors. One possible explanation for this fact is that nurses often find themselves on the front line of health care services, being the first to be called for the evaluation of patients under critical conditions. The groups are more homogeneous regarding training in advanced life support procedures prior to the course, and the percentage of access to distance education lessons. Both groups reported that the course will contribute to changes in health care practices and it will improve patient care.

The development of nurses' skills in caring for critically ill patients – especially in cardiac arrest situations – is critical to patient's survival and sequelae reduction. Nori *et al.* (2012) studied the nurses' learning retention capacity in cardiopulmonary resuscitation techniques by using a questionnaire and checklist to assess their psychomotor skills before, immediately after, 10 weeks and 2 years after the course[9]. It was concluded that after two years there is loss of memory retention, requiring periodic training. Fisher *et al.* studied the out-of-hospital emergency physicians' ability to retain skills by using multiple choice questions. The participants were divided into two groups: one of them only took the advanced life support (ALS) course and other group had additional training after the ALS course. The study revealed that the second group had better results in the evaluation[10].

The organization of training courses in emergency situations involving simulation demand special attention to teamwork and careful preparation of cases/scenarios[11]. In the present study, after the distance course, participants were involved in 10 simulated scenarios to allow them to adequately train in conducting the procedures effectively. The great majority of the respondents (81.5%) reported that the course organization was excellent, reflecting a favorable perception of the course structure.

The course load was considered adequate by most participants and the content was well rated, demonstrating that the course content and syllabus were adequate to the needs of healthcare professionals.

Simulation is becoming increasingly recognized for training and assessment of emergency medicine[6,12,13,14]. Randomized studies are needed to evaluate the impact of simulated activities on undergraduate students' learning process and health professionals' continuing education development. Okuda *et al.* (2009) conducted a review of simulation and medical education and concluded that this teaching method has become common in medical courses and training for residents. More studies are needed to assess its impact on patient care[15].

Maximizing survival from cardiac arrest requires improvement in teaching of resuscitation skills. The 2010 protocols of American Heart Association (AHA) recommends training

in teamwork and leadership skills and the use of 2-year certification period for basic and advanced life support courses with periodic assessment of rescue knowledge and skills with reinforcement provided as needed[16]. Additional studies are needed to help provide evidence-based recommendations to assess the need for refresher training courses in order to maximize the maintenance of advanced life support skills[17].

It is necessary to use evidence-based instruction guidelines with appropriate application of learning theories in trainings. Failure to work as an effective team is commonly mentioned as a cause of errors and adverse events in emergency medicine[18]. Nowadays, it is also recommended the incorporation of debriefing tools into the 2011 Pediatric Advanced Life Support instructor's course materials in order to improve the acquisition of knowledge and skills[19].

The present course used the debriefing technique and emphasized the need for training and exercising teamwork and leadership skills as a way to increase the quality of care to the seriously ill patients, reducing mortality rates and sequelae.

In general, the present course was well evaluated and the system was rated good and easy to use. The teaching platform was considered user-friendly. E-learning has demonstrated to be a viable alternative to traditional resuscitation courses like ALS[20] and Pediatric Advanced Life Support[21]. A randomized controlled trial analyzed the effect of pre-course e-Learning prior to advanced life support training. The participants received a CD version of the Microsim® computer program and the standard support material for the ALS course, while the control group received only the standard course material. The simulation test did not present any difference between the two groups as to their psychomotor skills or performance[8].

Roe *et al.*, after analyzing the benefits and limitations, reported that distance education courses for training emergency skills should be linked with other educational methodologies[22]. One of the benefits mentioned is the easy access to training; however, group discussions and teacher feedback are also important tools for assimilation of knowledge, and should therefore be considered. Thomson *et al.* studied – by means of questionnaire administered before and after a course – the assimilation of knowledge on basic and advanced pediatric life support measures in semi-distance education courses, and concluded that the result was very favorable to the participants, especially regarding confidence, knowledge and ability to perform resuscitation[23]. To learn the new 2010 protocols, AHA instructors have been trained on certain steps of instructor courses and monitoring systems and have updated their scientific knowledge on resuscitation through e-learning[24]. AHA is investing in courses on line as tools to promote better access and reduce delay in certify providers and professionals.

Simulation is effective in enhancing the resuscitation performance. Nowadays, in situ simulation in limited resource settings identified latent threats to effective pediatric patient care and improved the emergency decision-making[27]. This learning methodology offers a good opportunity for training staff in their own environment and allows the professionals of the emergency department to recreate a more realistic work environment[28]. A multicenter randomized controlled trial demonstrated that in situ high-fidelity simulation training of a maternity's staff significantly improved overall team performance with reduction of hazardous events and improved the heart rate in neonatal resuscitation[26]. In Brazil there are few centers that use simulation in situ and this method is useful especially for teamwork training. Simulation will never totally replace learning in real situations involving patients; however, it can contribute to students' acquisition of all key competencies[25] and it is effective for the transmitting basic science and clinical knowledge, teaching procedural skills, teamwork, and communication for undergraduate and graduate medical students[15].

Cox *et al.* (2015) conducted a literature search using Medline database in order to identify studies that evaluated the impact of simulation training on patient outcomes. The papers were analyzed using the Kirkpatrick model of training evaluation adapted to medical education. Few papers reporting Kirkpatrick level 4 outcomes[29]. The authors concluded that further high-quality research is necessary.

Potential limitation of the present study is the fact that it was not possible to conduct an interventional and randomized study with a control group. Other point to be improved in future papers is following the Kirkpatrick's model[30] to evaluate training programs. It was not possible for us to complete all the steps, but in Brazil the simulation methods have been increasing lately and it is necessary to promote publications about this.

CONCLUSION

The course used an innovative learning structure in Brazil, mixing distance education and face-to-face activities in a simulation laboratory. The integration between university professors and health professionals while training for emergency care contributes to joint experience between the academic community and those who are involved in daily health care activities. Many teaching strategies can be used when training for emergency response services. Distance learning, simulation, teamwork and debriefing techniques are being increasingly

used. With increased physician knowledge and support and the advent of new learning technologies patients may soon have better assistance with reduced medical errors and higher survival rates. Further research is necessary to clarify the role of simulation and distance courses in the development of skills and competencies for health professionals.

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CONTRIBUIÇÃO DOS AUTORES

Todos os autores participaram de forma equivalente na organização dos cursos, elaboração do projeto e do artigo sob a coordenação da primeira autora. Todos revisaram a versão submetida e aprovaram.

CONFLITO DE INTERESSES

Os autores declaram não haver conflito de interesses.

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