EUROPEAN RESUSCITATION COUNCIL

Simulation and education

e-Learning in advanced life support – An evaluation by the Resuscitation Council (UK)☆

C.J. Thorne [a,b,∗], A.S. Lockey [b,c], I. Bullock [b,d], S. Hampshire [b], S. Begum-Ali [b], G.D. Perkins [a,b,e], on behalf of the Advanced Life Support Subcommittee of the Resuscitation Council (UK)

[a] Department of Critical Care Medicine, Heart of England NHS Foundation Trust, Birmingham B9 5SS, UK
[b] Resuscitation Council (UK), Tavistock House North, Tavistock Square, London WC1H 9HR, UK
[c] Calderdale & Huddersfield NHS Foundation Trust, Halifax HX3 0PW, UK
[d] Royal College of Physicians, London NW1 4LE, UK
[e] University of Warwick, Warwick Medical School, Warwick CV4 7AL, UK

ABSTRACT

Aim: To descriptively analyse the outcomes following the national roll out of an e-Learning advanced life support course (e-ALS) compared to a conventional 2-day ALS course (c-ALS).

Method: Between 1st January 2013 and 30th June 2014, 27,170 candidates attended one of the 1350 Resuscitation Council (UK) ALS courses across the UK. 18,952 candidates were enrolled on a c-ALS course and 8218 on an e-ALS course. Candidates participating in the e-ALS course completed 6–8 h of online e-Learning prior to attending the 1 day modified face-to-face course. Candidates participating in the c-ALS course undertook the Resuscitation Council (UK) 2-day face-to-face course. All candidates were assessed by a pre- and post-course MCQ and a practical cardiac arrest simulation (CAS-test). Demographic data were collected in addition to assessment outcomes.

Results: Candidates on the e-ALS course had higher scores on the pre-course MCQ (83.7%, SD 7.3) compared to those on the c-ALS course (81.3%, SD 8.2, $P < 0.001$). Similarly, they had slightly higher scores on the post-course MCQ (e-ALS 87.9%, SD 6.4 vs. c-ALS 87.4%, SD 6.5; $P < 0.001$). The first attempt CAS-test pass rate on the e-ALS course was higher than the pass rate on the c-ALS course (84.6% vs. 83.6%; $P = 0.035$). The overall pass rate was 96.6% on both the e-ALS and c-ALS courses ($P = 0.776$).

Conclusion: The e-ALS course demonstrates equivalence to traditional face-to-face learning in equipping candidates with ALS skills when compared to the c-ALS course. Value is added when considering benefits such as increased candidate autonomy, cost-effectiveness, decreased instructor burden and improved standardisation of course material. Further dissemination of the e-ALS course should be encouraged.

1. Introduction

Advanced life support (ALS) courses, which include hands-on practice and simulation, are widely used in healthcare training to equip candidates with the knowledge, attitudes and technical and non-technical skills to effectively manage patients in cardiac arrest. Such courses are consistently well received by learners and have been shown in some settings to improve patient outcomes from cardiac arrest.[1–3] In the United Kingdom (UK), competency in ALS is a core requirement for healthcare professionals working in front-line acute care specialties. The Resuscitation Council (UK) introduced its first ALS course in 1992,[4] and since then there have been increasing numbers of candidates undertaking ALS courses nationwide. During 2013 alone, 19,082 candidates participated in an ALS course.[4,5]

In recent years there has been a global change in medical education, with academic institutes pioneering e-Learning as an alternative to more traditional delivery methods. The reasons for this shift are multi-factorial but include rapid medical advancements resulting in decreased time for academics to deliver formal teaching, the increasing accessibility of online material via the internet and making education more learner-centred rather than instructor-centred.[6] Several randomised controlled trials (RCTs)

have demonstrated that e-Learning is superior to more traditional methods in higher education and corporate environments.[7,8] In the medical field, e-Learning courses are becoming exponentially more popular in both undergraduate and post-graduate education as candidates seek greater accessibility to pre-requisite material and a more personalised learning schedule. A large meta-analysis found that internet-based learning had comparable outcomes to conventional learning methods.[9] E-Learning has been shown to be effective in areas as diverse as reproductive health training,[10] ultrasound skills,[11] haematological disorders[12] and the management of epistaxis.[13]

The ability to deliver ALS course content by e-Learning was evaluated in a large, multi-centre, non-inferiority randomised controlled trial. The trial established equivalence in outcome when comparing learning methods (by finding no difference in overall pass rates) and was significantly cheaper to deliver.[14] Following the results of this trial the Resuscitation Council (UK) rolled out a national e-Learning ALS course (e-ALS). The course required an update in learning materials (to reflect emerging evidence) but remains conceptually the same as the course tested in the randomised controlled trial. The methods of candidate assessment remained identical.

The aim of this study is to descriptively analyse the outcomes following the national roll out of an e-Learning ALS course.

2. Methods

2.1. Setting and participants

Potential ALS candidates were invited to participate in ALS courses through one of the 181 national training centres. Course centres were able to select the balance of e-ALS and c-ALS courses that they offered. Participants were free to register for either course at any of the course centres, thus candidate choice was based on availability of ALS courses in the local area.

Each candidate was required to register on the Resuscitation Council (UK) learning management system (LMS) prior to attending the course. They also received the ALS course manual a minimum of 4 weeks before the course date. Those undertaking the e-ALS were asked to complete the electronic learning modules. Progress on the e-Learning content was monitored by the course centres and this information was available to the faculty at the start of the course. Candidates were free to choose to personalise their learning experience – undertaking as little or as much of the e-Learning preparation as they felt necessary.

2.2. c-ALS and e-ALS courses

The Resuscitation Council (UK) 2-day c-ALS course involves participation in three e-Learning modules plus face-to-face lectures, small group sessions and practical cardiac arrest simulation teaching (CAS-teach).

The e-ALS course comprises 6–8 h of e-Learning content which replaces a number of the face-to-face lectures that are present on the c-ALS course. The candidates then attend a 1-day face-to-face course, which has fewer lectures and consequently a proportionately greater amount of time devoted to small group teaching and simulation training (CAS-teach).

Prior to attending the face-to-face element of each course, participants undertook a pre-course MCQ, although the score did not contribute towards the final assessment. Candidates subsequently completed their respective e-ALS or c-ALS course. They then undertook a compulsory post-course MCQ and were assessed by means of a practical cardiac arrest management simulation test (CAS-test) where they assumed the role of team leader. In order to successfully become ALS providers it is compulsory for candidates

to pass both the post-course MCQ and the CAS-test. Candidates were permitted two attempts at the MCQ and three attempts at the CAS-test. Both sets of MCQs consisted of 30 stem questions, selected from a question bank, with each having four true/false answers, thus the total number of items to answer was 120. The pass mark was 75%. The CAS-test simulations have been previously validated[15,16] and assess candidates' abilities in airway management, patient assessment, defibrillation and basic life support. Raw scores and pass/fail data were collected for both of these aspects of assessment.

Routinely collected demographic data were collected for each participant during online registration on the LMS. Data were then transferred to Microsoft Excel (*Microsoft Corporation, Redmond, USA*) and subject to statistical analysis using SPSS 22 (*IBM, Armonk, USA*). Descriptive statistics were extracted. Independent t-tests were utilised to determine differences between continuous variables, and the chi-squared test for the dichotomous variables. P-values of <0.05 were considered statistically significant.

3. Results

There were 1350 ALS courses carried out between 1st January 2013 and 30th June 2014. Nine hundred c-ALS courses were run by 181 ALS centres across the UK. The remaining 450 e-ALS courses were facilitated by 94 centres.

3.1. Demographics

A total of 18,952 (69.8%) candidates participated in a c-ALS course. The remaining 8218 (30.2%) candidates undertook an e-ALS course. Mean age on the e-ALS course was 32.0 years (SD 8.2) and on the c-ALS course 32.8 years (SD 8.7). Table 1 demonstrates participant demographics with regards to professional background and previous ALS/ILS experience (immediate life support). Candidates on both courses were highly comparable, in spite of statistically significant differences between the proportions on each course, which was mostly attributable due to the very large sample size in this study. On the c-ALS course 57 candidates started but did not complete the course and on the e-ALS course the corresponding number was 15. The remainder of missing data resulted from incomplete data entry by candidates or local course organisers on the LMS.

3.2. Candidate pass/failure rates

3.2.1. Multiple choice questions

Candidate pass/failure results are portrayed below in Table 2. The proportion of candidates completing the pre-course MCQ was 97.6% for the c-ALS course and 99.1% for the e-ALS course. The mean score of 83.7% (SD 7.3) on the e-ALS course was significantly higher than the mean score of 81.3% (SD 8.2) on the c-ALS course (average difference 2.4%, 95% CI 2.2–2.6%, $P < 0.001$).

The mean post-course MCQ score was slightly higher on the e-ALS course at 87.9% (SD 6.4), compared to 87.4% (SD 6.5) on the c-ALS course. The mean difference of 0.6% (95% CI 0.4–0.7%) was small, but statistically significant ($P < 0.001$). The corresponding pass rates for the post-course MCQ first attempt were therefore higher on the e-ALS course (97.5%) compared with the c-ALS course (96.7%).

3.2.2. CAS-test assessments

The first attempt CAS-test pass rate of 84.6% (95% CI 83.8–85.4%) on the e-ALS course was significantly higher than the pass rate of 83.6% (95% CI 83.1–84.1%) on the c-ALS course (Chi-square 4.44, $P = 0.035$). There were no difference in pass rates between the two courses in terms of 'Airway Management' (Chi-square 0.06, $P = 0.807$) or the 'Initial Assessment and Resuscitation' workshop (Chi-square 0.411, $P = 0.522$).