Resuscitation 108 (2016) 1–7

Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Simulation and education

Teaching school children basic life support improves teaching and basic life support skills of medical students: A randomised, controlled trial☆

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ARTICLE INFO

Article history:
Received 29 May 2016
Received in revised form 18 July 2016
Accepted 4 August 2016

Keywords:
BLS-training
Cardiopulmonary resuscitation
Kids save lives
Teaching
Pupils
School children

ABSTRACT

Background: The "kids save lives" joint-statement highlights the effectiveness of training all school children worldwide in cardiopulmonary resuscitation (CPR) to improve survival after cardiac arrest. The personnel requirement to implement this statement is high. Until now, no randomised controlled trial investigated if medical students benefit from their engagement in the BLS-education of school children regarding their later roles as physicians. The objective of the present study is to evaluate if medical students improve their teaching behaviour and CPR-skills by teaching school children in basic life support.
Methods: The study is a randomised, single blind, controlled trial carried out with medical students during their final year. In total, 80 participants were allocated alternately to either the intervention or the control group. The intervention group participated in a CPR-instructor-course consisting of a 4 h-preparatory seminar and a teaching-session in BLS for school children. The primary endpoints were effectiveness of teaching in an objective teaching examination and pass-rates in a simulated BLS-scenario.
Results: The 28 students who completed the CPR-instructor-course had significantly higher scores for effective teaching in five of eight dimensions and passed the BLS-assessment significantly more often than the 25 students of the control group (Odds Ratio (OR): 10.0; 95%-CI: 1.9–54.0; p = 0.007).
Conclusions: Active teaching of BLS improves teaching behaviour and resuscitation skills of students. Teaching school children in BLS may prepare medical students for their future role as a clinical teacher and support the implementation of the "kids save lives" statement on training all school children worldwide in BLS at the same time.

Introduction

Ischemic heart disease is the leading cause of death in the world. According to international consensus, the most important determinant to survive a sudden cardiac arrest is the presence of a trained lay rescuer who is ready, willing, and able to act.[1–3] However, in many countries the rate of lay rescuers in the population is low.[4]

Based on low bystander resuscitation (CPR) rates in general and the advantages of coupling CPR-education with school-education the European Patient Safety Foundation (EUPSF), the European Resuscitation Council (ERC), the International Liaison Committee on Resuscitation (ILCOR) and the World Federation of Societies of Anesthesiologists (WFSA) released the "kids save lives" statement on training school-children in CPR world-wide.[5]

This statement is based on the proven positive impact of training on bystander-CPR-rates[6,7,4] and increased survival of out-of-hospital cardiac arrest after the mandatory introduction of CPR-training for school children in Sweden and Denmark.[8,9] The statement aims to introduce CPR-training in the curriculum for all school children world-wide and was endorsed by the World Health Organization in January 2015.[5] However the training of school children by professionals is expensive and time-consuming.

Therefore, several studies investigated the effectiveness of medical students and peers as trainers, because of the greater availability and higher cost-effectiveness of these trainers. The medical students and peers seem to be as effective as physicians in

☆ A Spanish translated version of the abstract of this article appears as Appendix in the final online version at http://dx.doi.org/10.1016/j.resuscitation.2016.08.020.

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http://dx.doi.org/10.1016/j.resuscitation.2016.08.020
0300-9572/

teaching basic life support (BLS) to school children.[10,11] Additionally, the students themselves benefit from their participation as an instructor as theoretical background and practical skills, which have to be explained and shown to another person are usually better understood and memorised.[12] Accordingly, acting as teachers improved medical students' knowledge about CPR and their practical skills compared to students of a control group in a previous study.[13] Until now, no study investigated if students also improve their teaching-skills, when getting involved in teaching BLS to school children. This is a highly relevant question as students should be prepared for their later teaching tasks. In their later role as Physicians, medical students are required to teach colleagues and medical students, as well as other health professionals. By discussing diagnoses and care plans, they also teach patients which has a positive effect on health outcomes.[14,15] Because of the outcome-relevant influence of teaching-skills, the teacher role of the physician is implied in the communicator and scholar roles of the CanMEDS Physician Competency Framework.[16] Formal preparation is essential to enable physicians to be more effective teachers.[17–19] There are several reasons why formal preparation for students' role as a teacher should already be part of the medical curriculum. For example, residents often feel unprepared for teaching responsibilities.[20] Gathering residents for a teaching skills program requires considerable resources and can compete against patient care and on-call responsibilities.[21] Early involvement in teaching improves long-term motivation to teach and understanding the principles of teaching and learning supports medical students to become more effective communicators and learners.[15]

We evaluated in this proof-of-concept-study if involving medical students in public health education, i.e. BLS-training of school children, is effective to improve both, teaching behaviour and BLS-skills.

Methods

Trial design and participants

We conducted a randomised controlled trial between July and November 2015 at the Medical School of Hamburg University. Medical students in their final year were informed orally and in writing about the study. They were asked to contact the trial-manager when willing to participate. Exclusion criteria were mental, physical or psychical reasons making CPR and teaching impossible.

Randomisation

All volunteers were alternately allocated to the control or intervention group: first volunteer to the intervention group second volunteer to the control-group, third volunteer to the intervention group and so on.

Intervention

The intervention consisted of a CPR-instructor course including a preparatory seminar and BLS-teaching-session at a school. Medical students of the intervention group received the intervention before the assessment. In the control group the assessment of CPR- and teaching-skills was performed first and the intervention followed afterwards.

The students were grouped into 4–10 students according to the numbers of instructors needed for one school. The two parts of the intervention and the assessment were scheduled for every group within three weeks in different order according to intervention or control arm.

The 4-h-preperatorial seminar was provided by two anaesthesiologists and consisted of five parts: Part one was an outline of the importance of bystander-CPR and theoretical revision of BLS-guidelines provided by an anaesthesiologist. Part two consisted of a practical training of BLS-skills including chest compression, giving rescue breaths and AED use. Feedback about the CPR-performance was given immediately and metrics of the feedback-system (Resusci Anne QCPR® plus Wireless SkillReporter™, Laerdal™) were analysed. During the third part, the students defined learning goals for the BLS-teaching-session at the school. The fourth part consisted of three brief simulated teaching-scenarios demonstrating different aspects of effective or ineffective teaching performed by the seminar-leaders following a predefined script. The students were asked to analyse aspects promoting and distracting effective learning and the answers were grouped into the four dimensions: structure, interaction, relationship and presentation style. The last part was a simulation of a BLS-teaching-session at the school giving the medical students the opportunity to train by the concept of the four-step-approach.[22]

The BLS-teaching-session at the school consisted of a 45-min theoretical lecture held by the two anaesthesiologists and a 45-min practical BLS-training provided by the medical students. Respectively, two students instructed one class (7th or 8th grade) consisting of 22–28 school children in BLS following the four-step-approach. During the last step of the four-step-approach every instructor trained half of the class using a mannequin (MiniAnne®, Laerdal™).

Outcome measures

The two primary endpoints were measured in an objective structured assessment with three stations. We used two teaching-stations to assess effectiveness of teaching in a real teaching situation based on observed behaviour. At the third station, pass-rates in a simulated BLS-scenario were used to measure BLS-skills. The medical students of the intervention and control group rotated between the three stations every 10 min. At the two teaching-stations the medical students had to explain the use of a stiff neck and mask ventilation to high school students. All medical students were informed two days prior to the assessment that they would have to teach high school students at two stations (use the stiff neck and mask ventilation) and that they would have to perform BLS at a third station. The teaching-stations were independently evaluated by one physician or medical student who has not been involved in the study previously and two to seven high school students. The assessors were blinded in respect to group allocation and trained to use the standardized checklist. All assessors used a 5-point-Likert-scale to rate 10 items of the modified Stanford Faculty Development Program's (SFDP's) clinical teaching framework (Table 1). The scale was modified by excluding items not applicable to such a teaching session first and then reduced to the items of every domain with the highest impact on good teaching.[23]

The third station consisted of a simulated resuscitation-situation where BLS-skills and automated external defibrillator-use were evaluated. The skills were rated by a blinded assessor using a structured assessment-checklist with 15 items and supported by a feedback-device included in a high-fidelity mannequin (Resusci Anne QCPR® plus Wireless SkillReporter™, Laerdal™). Eight items of the checklist were relevant for passing the exam. The BLS-examination was "passed", when all eight items of the structured assessment checklist were rated as "yes" (Table 2). Metrics of the CPR-feedback-device evaluated compression-depth, compression-frequency, effectivity of ventilation, and no-flow-time.

Secondary outcomes were mean scores in the four dimensions relevant for effective teaching according to the modified *Stanford*