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A video-based training to effectively teach CPR with long-term retention: the ScuolaSalvaVita.it ("SchoolSavesLives.it") project

Martina Paglino[1,2] · Enrico Contri[1,2,8] · Marta Baggiani[1,3] · Michela Tonani[1,4] · Giulia Costantini[1,5] · Maria Concetta Bonomo[1,2] · Enrico Baldi[1,6,7]

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Abstract

Enhancing CPR knowledge in schools is the key to improving bystander CPR rate and survival after an out-of-hospital cardiac arrest, but the best method to do so in a whole area is unknown. We wanted to assess if a province-based project, which involves the Secondary Schools of a whole Province, is effective in teaching schoolchildren CPR, and how well the skills are retained. We trained 100 teachers from the 21 Secondary Schools of the Province of Pavia with a BLS/AED course and we supplied each school with 10 low-budget manikins and four educational videos. These videos, about 2 min each, consist of a motivational part, an instructive part, a demonstrative part and a practice-while-watching part. We explained to the teachers how to use manikins and videos in a 2-h course. We carried out both a theoretical and a practical test in 21 classes, randomly selected between the classes trained by the teachers, 3 months and 6 months after the training. In the first 5 months of the project, 5146 schoolchildren aged 14–19, in the 21 Secondary Schools of our Province, were trained by their teachers. We tested 304 students 3 months after the course and 318 students 6 months after the course, with good results both in theoretical and practical skills. Our study demonstrates that the ScuolaSalvaVita project is able to effectively teach CPR through teachers using a video-based training in the Secondary Schools of a whole Province obtaining good long-term memory of CPR skills.

Keywords Training · Schools · Cardiopulmonary resuscitation · Schoolchildren · Cardiac arrest

Introduction

Sudden cardiac arrest is one of the most significant issues in global healthcare. In Europe and the US, at least 700,000 people die each year, 2000 everyday, following sudden cardiac death [1, 2]. Immediate initiation of Cardiopulmonary resuscitation (CPR) by lay bystanders improves the survival after out-of-hospital cardiac arrest (OHCA); thus, lay resuscitation can fill the time gap between collapse and the arrival of the EMS [3, 4]. However, bystander CPR is delivered only in 30–40% of OHCA, and increasing this rate will be able to save many lives every year [5]. While educating the lay public in CPR is clearly the most important way to increase survival, it is difficult to reach the entire population with the required training. On the other hand, many studies have demonstrated that schoolchildren are able to learn how to save a life after a cardiac arrest [6] and that they do this better than adults and in less learning time [7]. The American Heart Association advocates compulsory resuscitation training in American schools [8], and both European and American countries in which resuscitation has been integrated into

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✉ Enrico Baldi
enrico.baldi88@gmail.com

1 Pavia nel Cuore, IRC-Comunità Training Center, 27100 Pavia, Italy

2 School of Anesthesia and Intensive Care, University of Pavia, 27100 Pavia, Italy

3 University of Piemonte Orientale, 18100 Novara, Italy

4 Emergency Medicine Department, Ospedale Maggiore di Lodi, 26900 Lodi, Italy

5 School of Surgery, University of Pavia, 27100 Pavia, Italy

6 Robbio nel Cuore, IRC-Comunità Training Center, 27038 Robbio, Italy

7 School of Cardiovascular Disease, Department of Molecular Medicine, University of Pavia, 27100 Pavia, Italy

8 AREU - Azienda Regionale Emergenza Urgenza - AAT Pavia, Department of Intensive Care Medicine, Fondazione IRCCS Policlinico San Matteo Hospital, Pavia, Italy

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educational programs in schools report significantly higher resuscitation rates [9]. The existing teaching staff appears sufficient to teach CPR to schoolchildren, and children retain resuscitation skills many years after the end of school [10, 11], although the best method for efficient long-term skill memory in a whole area with a great number of schoolchildren is unknown. For the reasons explained above, in 2015, the European Resuscitation Council (ERC) promoted a statement that received the endorsement of the World Health Organization: to promote resuscitation education in schoolchildren from the age of 12 years old for 2 h per year in all the European countries [12]. As pointed out by ERC, teaching CPR to schoolchildren is extremely important not only because they learn how to save a life from cardiac arrest, but also because they spread their knowledge to their families at home. Moreover, this training also has a social benefit: it forms enthusiastic and positive young people who learn that they can help others [13]. The aim of our study is to verify if a video-based teaching project, which involved the Secondary Schools of a whole Province, could teach CPR to a vast number of schoolchildren, and to evaluate both the theoretical and practical knowledge retained after 3 and 6 months.

Methods

Study design

We designed the project ScuolaSalvaVita to spread CPR education in all the Secondary Schools of the Province of Pavia, in northern Italy, which consists of about 550,000 inhabitants. The project is designed so that the teachers themselves are able to teach their schoolchildren how to save a person suffering from cardiac arrest. We provided a kit of 10 manikins (Laerdal MiniAnne Plus, Laerdal Medical Inc., AS, Norway) to each school and created 4 educational videos, lasting 2 min each: the first video is a motivational video that explains why it is important to learn CPR, the second one explains the Basic Life Support (BLS) sequence, the third one demonstrates how to carry on a resuscitation, and the last one is a practice while-watching video, with background music at 110 bpm, since it has been shown that music enhances the efficacy of training [14]. We also created a website where the teachers were able to find the videos and report how many schoolchildren have been taught in every session. Each class, which consisted of 20–30 students, age 14–19, is taught by one teacher at a time, in a 1-h lesson, using videos and manikins. The students of each class saw the first 3 videos all together. They were then divided into smaller groups, up to 10 students each (one student for each manikin), and each group performed 2 min of chest compressions during the fourth video for a total of 4 times, with rest between each performance while the other groups were carrying out their performance.

Teachers had been previously taught a Basic Life Support and Defibrillation (BLSD) course lasting five hours, provided with a certificated instructor, and with an additional 2-h lesson aimed specifically at why “Kids save lives” is important, and how to use manikins and videos in their CPR lessons. After that, teachers could start training their students.

We carried out a test in 21 classes randomly selected between the classes that had been trained by the teachers, one for each school involved in the project, either 3 months or 6 months after the training. The classes tested at 3 months were excluded from the random selection at 6 months, in order to avoid that the test at 3 months could influence the test at 6 months. The test consisted in a theoretical questionnaire, made up of 6 questions on CPR and 4 questions regarding students’ feelings about the project (Supplementary File), and in a practical test of 1 min of compression-only CPR on a Laerdal Resusci Anne Wireless SkillReporter manikin (Laerdal Medical Inc., AS, Norway), connected to a Personal Computer with the Resusci Anne Wireless SkillReporter Software ver. 1.1.0.20 (Laerdal Medical Inc., AS, Norway). We chose the duration of 1-min to minimize the deterioration of chest compression quality due to fatigue, according to the results from Nishiyama et al. [15]. At the end of the test, we evaluated the number of correct answers for the theoretical questionnaire and compression depth, compression rate, chest recoil and correct hand position for the practical test.

Statistical analysis

All data were entered in anonymous form into a database (Microsoft Excel 2010) and then analyzed with MedCalc Ver. 12.5.0.0 Windows version (MedCalc software bvba). The main descriptive statistics as mean and standard deviation or median and interquartile range will be used to describe all the variables collected during the study.

Results

In the first 5 months of the project (February 2017–June 2017), 5146 schoolchildren were trained by their teachers in the 21 Secondary Schools of the Province of Pavia, accounting for about 28% of students enrolled in the Secondary Schools in our Province. We tested 304 students 3 months after the course (group 3 M) and 318 students 6 months after the course (group 6 M). All the students were age 14–19, without any exclusion needed. The anthropometric characteristics of two groups are presented in Table 1.

Table 1 Anthropometric characteristics of the two groups

	Group 3 M ($n=304$)	Group 6 M ($n=318$)
Sex (females, %)	61.5	49.7
Height (cm)	168.9 (95% CI 167.8–170)	170.9 (95% CI 169.9–171.9)
Age (years)	17 (95% CI 16.9–17.2)	16.6 (95% CI 16.4–16.7)
Weight (kg)	60.5 (95% CI 59.1–61.8)	61.8 (95% CI 60.5–63.1)

Test after 3 months

Regarding theoretical knowledge, 98% of the students knew when to perform CPR and 91.9% when to call EMS, while 78.8% knew how to evaluate if a person was in cardiac arrest. BLS sequence was correctly known by 97.3%, the correct chest compression rate by 89.6% and the correct chest compression depth by 72.3%. Notably 96.5% affirmed that they would perform CPR in case of cardiac arrest and 98.5% of the students thought that this type of training is useful. 93.8% liked the training activity and 92.7% were in favor of repeating the same activity every year during schooling.

Regarding practical skills, the median compression depth was 45 mm (95% CI 43–47), the median compression rate was 117/min (95% CI 115–120), the median of correctly released compressions was 90% (95% CI 83.1–95) and the median of correct hand position was 100% (95% CI 100–100).

Test after 6 months

About theoretical skill, 98% and 96.5% of the students knew when to perform CPR and when to call EMS, respectively, whilst 73.8% were able to recognize if a person was in cardiac arrest. 95.7% knew the correct BLS sequence, 86.7% the correct compression rate and 74% the correct compression depth. CPR would be carried out by 94.5% of the students in case of a real cardiac arrest and 98% considered the training useful. 93.3% of the students affirmed that they liked the training activity and 88.8% would repeat it every year.

Concerning practical test, the median compression depth was 45 mm (95% CI 44–47), the median compression rate was 119/min (95% CI 116–122), the median of correctly released compressions was 90% (95% CI 85.3–93) and the median of correct hand position was 100% (95% CI 100–100).

Discussion

Educating schoolchildren in CPR is associated with an increase in laypeople CPR rate and in survival after OHCA [9, 13, 16]. For these reasons, ERC has recommended, with a position statement [17], that schoolchildren should be trained in CPR in all the European countries. To date, educating schoolchildren in CPR is mandated by law only in only a few countries [18, 19]. In Denmark, it was also demonstrated that the law is not enough, considering that 8 years after mandating legislation, CPR education in schoolchildren has not been implemented in many schools in Denmark [20]. Factors associated with the absence of CPR training in schools include the fact that it was not known by teachers that other schools were conducting training, the lack of a CPR training coordinator at the school, the lack of feeling competent at training students in CPR and the absence of an easy access to good training material [21, 22]. Furthermore, the best method to teach CPR with good long-term skill memory in a whole area with a vast number of schoolchildren is unknown.

The aim of our study is to verify if the ScuolaSalvaVita project could involve all the Secondary Schools of our Province in teaching a great number of schoolchildren CPR, and also to test the students' knowledge after the training. We provided a kit of low-budget manikins to all the Schools, identified a project coordinator in each school, and created 4 educational videos to support teachers in their CPR training.

We demonstrate that after the first 5 months of the project, ScuolaSalvaVita is able to involve the Secondary Schools of a whole Province, training more than a quarter of all students enrolled in a secondary school. Notably, both the theoretical and practical knowledge of the students trained during the project were efficient, both 3 months and 6 months after the training. Moreover, practical skills seem to be similar to that of an adult class after a CPR/AED course lasting 5 h in another of our group's study [23], and this reinforces our previous demonstration that the students are able to learn CPR in less time than adults [7]. Regarding students' satisfaction after the course, almost all the students liked the activity and thought that this type of training is useful, they were also in favour of repeating the same activity every year, resulting in a total of about 95% of students affirming that they would perform CPR in case of real cardiac arrest. It is important to highlight that it is not an expensive project, as the costs are only the initial costs of purchasing manikins, training teachers and making the videos, while all the rest of the training is provided by teachers in the curricular hours.

In summary, we demonstrate that our video-based teaching project is able to involve the Secondary Schools of a whole Province, teaching a great number of schoolchildren CPR through their teachers with both good theoretical and practical knowledge retained. We believe that our study and our project can be useful to other organizations and realities that wish to implement schoolchildren CPR training.

Limitations

The principal limitation of our study is that we did not test all the students trained. Nevertheless, our study is the one with the highest number of schoolchildren tested with a practical test carried out to date.

In addition, we did not establish a comparison group in order to compare our video-based method with other well-validated CPR education delivery models. The reason is that the purpose of our study was to verify the effectiveness and sustainability of a project that consists in a video-based CPR teaching in schools by teachers on a provincial basis, and so we chose as outcome the memory of both theoretical CPR knowledge and practical skills at 3 and 6 months.

A third limitation of our study is that the students' CPR practical skills were tested on a manikin different from the manikin on which the training was conducted. However, considering that the training manikin was less realistic than the testing manikin, the practical skills reached by the students should only be underestimated.

Another limitation of our study is that the student's willingness to perform CPR in case of a real cardiac arrest was acquired only by questionnaire. Nonetheless, we can confirm that a student saved his father performing CPR after having participated in our project.

Moreover, in the questionnaire we did not inquire if the students had previously attended a CPR course, seeing as there were no CPR training projects in the schools in our Province, so we can assume that our population is naïve in CPR training. Nevertheless, we cannot exclude that a few students had prior CPR training. However, considering that they are at most a small minority in the population of 5146 students that we trained, we can reasonably assume that the statistics were not affected significantly.

Conclusion

We demonstrated that the ScuolaSalvaVita project is able to effectively teach CPR by teachers with video-based training in the Secondary Schools of a whole Province with a good retentiveness of both theoretical and practical skills after three and 6 months.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Statement of human and animal rights The study is considered exempt from an ethical evaluation because, accordance with Italian law, the study did not include the use of drugs or medical devices, and it was not directly related to health and illness of the participants.

Informed consent Formal consent is not required for this type of study and no personal data were collected.

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