BRIEF REPORT

Quasi-experimental study to assess schoolchildren's ability to use a semiautomatic external defibrillator 6 months after training

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Objective. To evaluate schoolchildren's ability to use a semiautomatic external defibrillator (SAED) in terms of how long they take to deliver a shock 6 months after they received training.

Methods. Uncontrolled, quasi-experimental study. Schoolchildren in grades 5 and 6 without prior knowledge of how to use a SAED were included. After the children answered a questionnaire about their knowledge, they were asked to position the SAED to treat a training mannequin. We measured the time it took them to switch on the device, place the electrode pads, and deliver the first shock (T0). The children were then individually given a simple explanation lasting approximately 60 seconds, after which we measured the time they took to place the SAED again and deliver a shock (T1). Each child's time was measured again 6 months later (T2).

Results. A total of 253 children aged between 10 and 13 years participated; 128 (50.6%) were girls. All the children were able to use the SAED without prior training, although we did not take into consideration mistakes they made in placing the pads at baseline (T0). The mean times were as follows: T0, 83 (SD 14) seconds; T1, 44 (SD 5) seconds; and T2, 45 (SD 7) seconds. The mean differences between times were as follows: T0–T1, 39 (SD 13) seconds ($P < .001$); T0–T2, 38 (SD 15) seconds ($P < .001$); and T1–T2, 1.4 (SD 7.5) seconds ($P = .010$).

Conclusions. Fifth- and sixth-grade primary school students are able to use a SAED without training. After the children received a brief explanation, they were able to deliver an effective shock without committing errors. The time until the first shock scarcely changed after 6 months had passed. We conclude that it would not be necessary to provide training for SAED use as often as is required for manual external chest compressions.

Keywords: Schoolchildren. Semiautomatic external defibrillator. Training.

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Estudio cuasiexperimental para evaluar la capacidad de los escolares para utilizar un desfibrilador externo semiautomático a los 6 meses tras un proceso formativo

Objetivo. Evaluar la capacidad por parte de los escolares para utilizar un desfibrilador externo semiautomático (DESA) y el tiempo de administración de una desfibrilación a los 6 meses tras un proceso formativo.

Métodos. Estudio cuasiexperimental sin grupo control. Se incluyeron niños del tercer ciclo de Educación Primaria sin conocimientos previos en el uso del DESA. Tras aplicar un cuestionario sobre conocimientos previos, se les pidió que usasen el DESA en un maniquí de entrenamiento, midiendo el tiempo que tardaban en encenderlo, colocar los parches y administrar la primera desfibrilación (T0). Se volvió a medir el tiempo tras una sencilla explicación de unos 60 segundos de manera individual (T1) y se repitió la medición de los tiempos pasados seis meses (T2).

Resultados. Se incluyeron 253 sujetos, de entre 10 y 13 años, de los cuales 128 (50,6%) fueron niñas. Un 100% de los niños fue capaz de usar el DESA sin formación previa aunque no se tuvieron en cuenta los errores en la colocación de parches en la toma inicial. Los tiempos medios fueron: T0 = 83 (DE 14) s; T1 = 44 (DE 5) s; T2 = 45 (DE 7) s. La diferencia de medias fue: T0-T1 = 39 (DE 13) s ($p < 0,001$), T0-T2 = 38 (DE 15) s ($p < 0,001$), T1-T2 = 1,4 (DE 7,5) s ($p = 0,010$).

Conclusiones. Los escolares del tercer ciclo de Educación Primaria son capaces de utilizar un DESA sin formación. Tras una pequeña explicación se reduce significativamente el tiempo en aplicar una descarga eficaz sin cometer errores. Este tiempo apenas aumenta pasados seis meses, por lo que no sería imprescindible realizar formación tan frecuentemente como en el caso de las compresiones torácicas externas.

Palabras clave: Escolares. Desfibrilador externo semiautomático (DESA). Formación.

Introduction

Out-of-hospital cardiac arrest (OHCA) is a serious problem in developed countries because of its high incidence and mortality[1]. In Spain, there are more than 24,500 cases of OHCA annually[2], of which 65% are due to ventricular fibrillation (VF)[3]. To improve the prognosis of OHCA, early initiation of basic life support (BLS) is

necessary, which includes immediate defibrillation. For every minute spent without initiating BLS manoeuvres, the chances of survival decrease by 10-12%[4].

Medical societies such as the American Heart Association (AHA) and the European Resuscitation Council (ERC), promote the teaching of BLS in compulsory education and, since pupils are motivated, they learn better and show willingness to perform it if necessary[5]. There are numerous experiences of schools teaching BLS using theoretical content, videos, and training with immediate feedback[6-8].

If children can learn to perform basic CPR from an early age[7,8]; then, they should also be taught the use of a semi-automated external defibrillators (SAED). The aim of the study was to evaluate the ability of pupils on the third cycle of primary school without experience to administer defibrillation with a SAED, and the time required to perform defibrillation before the training process, right after it and 6 months later.

Method

This was a quasi-experimental study with non-probability sampling. We included pupils aged between 10 and 13 years in their fifth and sixth year of primary school in Galicia 2013-2014. Inclusion criteria were: participant presence throughout the research process and consent of parents or guardians. The two public schools participating were C.E.I.P. Arealonga (Arousa, Pontevedra) and C.E.P. Salustiano King Eiras (Pobra do Caramiñal, A Coruña). We solicited the permission of the body responsible for the school and approval of the Committee for Bioethics at the University of Santiago de Compostela.

An ad hoc questionnaire was administered to collect socio-demographic data (age and gender) and previous knowledge of SAED. Later the students were given a SAED AED Trainer 2 by Laerdal and, using a stopwatch, we recorded the time they needed to defibrillate a Little Anne Laerdal mannequin, at three different time points: 1) Time 0 (T0): time in which the defibrillator was handed over explaining that they had to turn it on and use it on a mannequin, to assess the degree of baseline knowledge; 2) Time 1 (T1) time that the same procedure required after training of about 60 seconds individually following ERC criteria3 to evaluate the level of retained knowledge; and 3) Time 2 (T2): measured 6 months later, the time taken to perform the same procedure to assess long-term learning. The electric shock was deemed correct when electrode pads were placed without plastic covers on the chest of the dummy, according to ERC recommendations[3]. Time was counted from the delivery of SAED to the time the students pressed the shock button. The subjects were assessed individually.

The primary outcome variable was the time taken to deliver a shock. The variable was defined as "improvement effect" by absolute time difference between T1 and T0, and the variable "effect of forgetfulness" as the absolute difference between T1 and T2.

Quantitative variables are described as means and standard deviation (SD). To check whether the independent variables influenced the time spent on applying the shock, an analysis of variance for repeated measures was used, introducing as within-subject factor the time, and as covariates, age, gender and educational center. In addition, a multivariate linear regression analysis was used to relate the different independent variables with the dependent variables. IBM SPSS Statistics v. 20.0 was used.

Results

253 subjects from fifth (117) and sixth (136) year of primary education were included, mean age 10.9 (SD 0.74) years, of whom 128 were girls (50.6%). One hundred twenty subjects belonged to C.E.I.P. Arealonga and 130 to C.E.P. Salustiano King Eiras.

None of children had prior knowledge of SAED. The results in average time in seconds to deliver a shock with SAED were: T0 = 83 (SD 15) s; T1 = 44 (out of 5) s; T2 = 45 (SD 7) seconds.

Table 1 shows the results of univariate analysis of average time to defibrillation at different time points. In the within-subject test a statistically significant difference between the three measures of time ($p < 0.001$) was observed. A 47% reduction in average time to defibrillation after training ("improvement effect") was observed. The average time increased 1.4 seconds 6 months after training (3.2%) (“effect of forgetfulness"), yet this time (T2) was still lower than baseline (T0).

T1-T2 differences were significant for the whole sample ($p = 0.010$), but not for gender distribution. In the variable "improvement effect", gender factors ($p = 0.292$), age ($p = 0.330$) or center ($p = 0.599$) did not influence the results, whereas the only variable on which a decrease in time depended was T0 ($p < 0.001$). Regarding the variable "effect of forgetfulness" this was also influenced only by T0 ($p = 0.007$) and not by other factors: gender ($p = 0.688$), age ($p = 0.330$) and center ($p = 0.866$).

Discussion

The present study showed that the ability to use SAED by pupils aged 10 – 13 years with no prior knowledge of this procedure, after a brief explanation, was significantly better than its use without training. This response time hardly decreased after six months and was still significantly better than that with no prior knowledge. Therefore, retention of this ability was good. The young age of the participants does not limit learning this skill and, unlike cardiac massage[9], would not require reinforcement training within six months. Thus, in an emergency, if a primary education student is present and had a defibrillator before professional help reached the scene, he/she could contribute to achieving survival rates of up to 49-75%[10].

Table 1. Comparison by pairs of the variable time 0 (T0), time 1 (T1) and time 2 (T2)

Variable	Boys			Girls			Total		
Time (s)	DoM	Upper. Lower/limits. Inf.	p	DoM	Upper. Lower/limits. Inf.	p	DoM	Upper. Lower/limits. Inf	p
T0-T1	40*	37/43	< 0.001	38*	36/41	< 0.001	39*	37/41	< 0.001
T1-T2	–1.6	–3.4/0.2	< 0.001	–1.2	–2.3/0.2	0.127	–1.4*	–2.5/–0.3	0.010
T0-T2	38*	35/41	0.096	37*	34/40	< 0.001	38*	35/40	< 0.001

s: seconds; DoM: difference of means; p: significance; T0: time required to deliver a shock before training; T1: after training; T2: 6 months after training.

According to these results, defibrillators are easy to use, both by laypeople and hospital staff[3,11]. All pupils can deliver a shock if needed. Thus, claims by the Spanish Cardiopulmonary Resuscitation Council (CERCP) are supported, which argues for the liberalization of non-negligent SAED use by untrained non-medical personnel, with the intention of helping[11]. This also supports the idea of AHA[12] that the "widespread effectiveness and proven safety of SAEDs make it acceptable for non-professionals to handle the device effectively." Thus, SAED training should be implemented in schools.

As limitations of this study we have to take into consideration that the selection of the sample was not random and that it was performed in a simulated situation (role play) adapted to the age of the participants and therefore it is unknown how children would react to a real emergency. In addition, the safety of SAED use was not evaluated (defibrillation errors) nor the risk when several witnesses work together. However, it can be concluded that SAED is an easy device to use, since children between the ages of 10 and 13 are capable of performing defibrillation without prior training in an average time of 83 seconds. In addition, with minimal training, time was reduced by 47%, and after six months, the acquired skills remained without frequent periodic boosters, only increasing by an average of 1.4 seconds. For all the above, this study reinforces the population strategy of public access to defibrillators. Training is simple and should be implemented in the school curriculum.

Conflict of interest

The authors declare no conflict of interest in relation to this article.

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