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Quality of chest compressions by Down syndrome people: A pilot trial☆

Antonio Rodríguez-Núñez[a,b,c,d,*], Alexandra Regueiro-García[a], Cristina Jorge-Soto[b], Janali Cañas-González[e], Pilar Leboráns-Iglesias[a,f], Oswaldo García-Crespo[g], Roberto Barcala-Furelos[b,e]

[a] Pediatric Area, Pediatric Emergency and Critical Care Division, Hospital Clínico Universitario de Santiago de Compostela, Santiago de Compostela, Spain
[b] School of Nursing, University of Santiago de Compostela, Santiago de Compostela, Spain
[c] Institute of Investigation of Santiago (IDIS), Santiago de Compostela, Spain
[d] Research Network on Maternal and Child Health and Development II (Red SAMID II), Spanish Health Institute Carlos III, Madrid, Spain
[e] Education and Sports Sciences University School, University of Vigo, Pontevedra, Spain
[f] Down Compostela Foundation, Santiago de Compostela, Spain
[g] Social Sciences and Communiation School, University of Vigo, Pontevedra, Spain

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ABSTRACT

Introduction: Immediate bystander cardiopulmonary resuscitation (CPR) is essential for survival after out-of-hospital cardiac arrest. Down syndrome (DS) citizens have improved their active engagement in society. The objective of this pilot trial was to investigate if they are able to perform quality chest compression-only CPR after a brief training.

Methods: Nineteen DS young people (15–30 year old) and 20 University level subjects (18–29 year old) were trained by means of a short video and a brief hands-on session on manikins, to perform chest compression-only CPR. All participants were naïve in CPR. Chest compression (CC) quality (percentage of correct CC, CC rate and depth and chest complete release) was measured during a 2 min test. CPR quality goal was according to 2010 European Resuscitation Council guidelines.

Results: DS people had similar weight, lower height and a higher BMI than controls. They were able to deliver chest compression-only CPR but with higher mean CC rate (140 ± 30 vs 123 ± 12 CC/min, $p = 0.03$), less mean CC depth (35.4 ± 10.3 vs 47.2 ± 9.6 mm, $p = 0.03$) and lower % of full correct CC (13 ± 18 vs 39 ± 37, $p = 0.02$) than controls. Differences were maintained when first and second minute of test were compared.

Conclusions: After a short instruction based on a brief video and hands-on session DS people were able to deliver CC but with poor quality.

1. Introduction

In case of cardiac arrest, immediate initiation of cardiopulmonary resuscitation (CPR) by bystanders improves survival.[1,2] However, the number of laypeople who deliver first aid after witnessing an accident remains to be poor.[3] Everyone should be informed and trained to detect a cardiac arrest victim and to immediately start good quality CPR as an essential link of the chain of survival.[4]

In recent years, many institutions have targeted efforts at training laypeople in compression-only CPR skills and have designed CPR training programs and resources to be applied in schools as well as in other settings.[5–7] Brief videos have been used to train laypeople on the provision of compression-only CPR.[5]

Down syndrome (DS) is the most common genetic cause of intellectual disability. As a result of improvement in medicine, technology, and education, the life expectancy and quality of individuals with DS is nearly comparable to the general population in developed countries. Due to health and social policy strategies as well as multifaceted efforts DS citizens have increased their active

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* Corresponding author at: Unidad de Cuidados Intensivos Pediátricos, Hospital Clínico Universitario de Santiago de Compostela, A Choupana s/n, 15706 Santiago de Compostela, Spain.
E-mail address: Antonio.Rodriguez.Nunez@sergas.es (A. Rodríguez-Núñez).

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presence in the society and try to gain integration. Offering DS individuals the same learning and training options as laypersons may be a good way of improving their self-steam and active role in society.[8]

Due to the fact that we were not aware of prior experiences about CPR training of DS people we designed the "Yes, we also can!" pilot trial. We hypothesized that DS young persons were capable of learning and performing quality chest compressions (CC) similarly to laypeople. The aim of this study was to assess the ability of young people with DS to perform good quality compression-only CPR in a manikin after a brief training supported by a brief funny video in comparison with university students. Primary endpoint was CC depth, CC rate and composite CC quality.

2. Material and methods

2.1. Study design and selection of participants

This study was designed as a prospective investigation and it was conducted in April 2014 in Galicia, Spain. The study sample was divided into two groups: experimental (DS) and control.

DS subjects: The participants were recruited at the Down Compostela Foundation. This is a not-for-profit organization where DS and other disabled people go for training and education to live independently. Currently, a total of 68 DS persons aged from newborn to adulthood use the facility. All DS persons older than 15 years were invited to participate in the study.

Inclusion criteria were: age from 15 to 30 years, mild or moderate intellectual disability (estimated by the Foundation's psychology team),[9] ability to understand the objective and methods of the study and signed informed consent (by the subject and a parent). Exclusion criteria: any physical disability that limits chest compressions. Of possible 20 candidates, one was excluded due to lack of cooperation during the learning/training process and the study was performed with the 19 remaining.

Controls: University students of the Social Sciences and Communication School at the University of Vigo (Spain), without physical or psychological disability, aged between 18 and 29 years were invited to participate in the trial by means of posters at the School entrance hall and cafeteria. Of a total of 220 potential participants, the first 20 who accepted and signed the informed consent were recruited. Three of them did not come to the test, resulting in a final inclusion of 17 participants.

None of the participants had received CPR training before the study. Participation was voluntary and no personal incentive for participation was given.

2.2. Curriculum content

In designing the training program we took into consideration the characteristics of the experimental group, who usually have some difficulties to maintain their attention span during instruction.[10] We decided to use a short (3 min, 20 s) video that tells a story of a boy who suffers a sudden collapse while playing indoor football and is resuscitated by his coach; at the end of the video, an "expert" summarizes the essentials of bystander CPR. The video is available on the web: https://www.youtube.com/watch?v=ZQdwoRf-TLg.

The video was intended for a younger audience or people with learning difficulties as it is narrative with some comic elements.

Each group was split in two subgroups that viewed the video in separate rooms. After viewing the video, the instructor performed a real time chest compressions-only basic life support (BLS) sequence on a manikin (*Resusci Anne*, Laerdal, Norway) and was open to questions from participants for 15 min. After that, participants trained the CC hands-only sequence on manikins (*Resusci Anne* and *Mini Anne Plus*, Laerdal, Norway) (one manikin for each two of them) with a 5/1 participant/instructor rate, during 45 min. Feedback was provided to subjects by the instructor in order to achieve the goal of 2010 European Resuscitation Council adult BLS guidelines.[4] The four instructors and the course director (all co-authors of the study) were certified in basic and advanced life support and had a substantial experience as CPR instructors in courses for laypeople, lifeguards and health professionals.

2.3. Measurements

We documented age, gender, body weight, height and body mass index (BMI) of participants and previous BLS training.

CPR quality was assessed through the *Laerdal Resusci Anne* manikin connected to a *Laerdal PC SkillReporting* Software, version 2.4, which measures hands position, chest compression rate in CC per minute, depth in mm, detects leaning and hands-off time. It gives results for the individual CC quality components as well as a composite result of the combination of all of them that indicates full correct CC. Goals were set according to the 2010 quality standards established by the European Resuscitation Council: 2010: depth of 50–60 mm and rate of 100–120 compressions per minute.[4] Complete release was defined as a leaning force between compressions of <0.5 kg.

During the challenge tests, participants were asked to deliver 2 min of continuous CC. Tests were done between half and one hour after the training. Subjects were tested individually; they were alone and without feedback or external references. CPR quality recorded variables were: total number of CC, CC rate (CC/min), CC depth in mm, and percentage of fully correct CC, correct CC rhythm, and chest complete release. Applied work was calculated as: CC rate × CC depth.[11] Analysis of the test total time (2 min) and an analysis segregated by time (first minute and second minute) were done.

2.4. Statistics

Categorical data are described by absolute numbers and percentages. Continuous data were described by average and standard deviation (SD). All p values are two-sided and $p < 0.05$ was considered to be statistically significant. The homogeneity between groups was assessed by Kolmogorov–Smirnov test. The equality of variances was determined using Levene's test. Correlations between continuous data were assessed using Student's t-test. SPSS Statistics 20.0 Software was used for statistical analysis.

2.5. Ethics

Participation was voluntary and no personal incentive for participation was given. Data were treated anonymously. The study respected the Helsinki Declaration and was approved by the local institutional review board (Research Ethics Committee of the School of Education and Sports Sciences, University of Vigo). Verbal and signed informed consent was obtained by the participants (in control group) and by participants and parents or guardians (in DS group).

3. Results

DS individuals had lower height and slightly higher BMI than controls (Table 1).

CC quality results are shown in Table 2. CC rate, percentage of shallow CC, and percentage of CC without complete release were significantly higher in DS subjects than in controls. Mean CC depth, percentage of CC delivered at recommended rate, and the percentage of the composite variable "full correct CC" were significantly lower in the experimental group than in controls. The applied work