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Simulation and education

Innovative cardiopulmonary resuscitation and automated external defibrillator programs in schools: Results from the Student Program for Olympic Resuscitation Training in Schools (SPORTS) study☆

Victoria L. Vetter[a,*], Danielle M. Haley[b,d], Noreen P. Dugan[b], V. Ramesh Iyer[a], Justine Shults[c]

[a] The Children's Hospital of Philadelphia, Perelman School of Medicine of the University of Pennsylvania, Department of Pediatrics, Division of Cardiology, 34th and Civic Center Blvd, Philadelphia, PA 19104, United States
[b] The Children's Hospital of Philadelphia, Department of Pediatrics, Cardiology Division, 34th and Civic Center Blvd, Philadelphia, PA 19104, United States
[c] The Children's Hospital of Philadelphia, Perelman School of Medicine of the University of Pennsylvania, Department of Biostatistics and Epidemiology, 635 Blockley Hall, 423 Guardian Drive, Philadelphia, PA 19104, United States

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ABSTRACT

Background: Bystander cardiopulmonary resuscitation (CPR) rates are low. Our study objective was to encourage Philadelphia high school students to develop CPR/AED (automated external defibrillator) training programs and to assess their efficacy. The focus was on developing innovative ways to learn the skills of CPR/AED use, increasing willingness to respond in an emergency, and retention of effective psychomotor resuscitation skills.

Methods and results: Health education classes in 15 Philadelphia School District high schools were selected, with one Control and one Study Class per school. Both completed CPR/AED pre- and post-tests to assess cognitive knowledge and psychomotor skills. After pre-tests, both were taught CPR skills and AED use by their health teacher. Study Classes developed innovative programs to learn, teach, and retain CPR/AED skills. The study culminated with Study Classes competing in multiple CPR/AED skills events at the CPR/AED Olympic event. Outcomes included post-tests, Mock Code, and presentation scores. All students' cognitive and psychomotor skills improved with standard classroom education ($p < 0.001$). Competition with other schools at the CPR/AED Olympics and the development of their own student-directed education programs resulted in remarkable retention of psychomotor skill scores in the Study Class (88%) vs the Control Class (79%) ($p < 0.001$). Olympic participants averaged 93.1% on the Mock Code with 10 of 12 schools ≥94%.

Conclusion: Students who developed creative and novel methods of teaching and learning resuscitation skills showed outstanding application of these skills in a Mock Code with remarkable psychomotor skill retention, potentially empowering a new generation of effectively trained CPR bystanders.

Introduction

Cardiac arrest is the third leading cause of death in the United States (US), responsible for over 395,000 out of hospital cardiac arrests (OHCA)/year.[1,2] Pediatric cardiac arrests comprise 2–3% of all cardiac arrests in the US.[2,3] The survival rate to hospital discharge for adults who experience an OHCA is 5.5–11%[2,4] and for children is 7.9%.[2] Bystander cardiopulmonary resuscitation (CPR) rates are low in most communities averaging 15–30% prior to emergency medical services (EMS) arrival.[5,6]

In recent years, additional attention has been focused on automated external defibrillator (AED) placement and education in schools.[7–10] The American Heart Association specifically recommends that AED training and skills practice should be included in school CPR training.[10] When resuscitation efforts occur, high rates of bystander CPR (up to 94%), shock with an AED (up to 83%) and survival to hospital discharge (up to 64–74%) have been reported in schools.[9]

Instruction in practical hands-on skills results in greater improvement in performance skills than theoretical knowledge

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* Corresponding author at: Cardiology Division, 8NW, The Children's Hospital of Philadelphia, 34th and Civic Center Blvd, Philadelphia, PA 19104, United States.
E-mail address: vetter@email.chop.edu (V.L. Vetter).
[d] Current affiliation: Nemours Children's Health System, United States.

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alone. In Norway, training 50,000 school children led to an increase in bystander CPR from 60% to 73%.[11] Students with training are more willing to perform CPR.[11] Currently, 31 states in the US mandate CPR education in the high school.[12]

In 2011–2012 Youth Heart Watch (YHW) at The Children's Hospital of Philadelphia (CHOP) initiated a research study of CPR/AED education in the Philadelphia School District (PSD), the Student Program for Olympic Resuscitation Training in Schools (SPORTS). Our research study focused on helping students within 15 Philadelphia high schools develop innovative ways to learn and retain lifesaving CPR and AED skills within their high school health class curriculum. Our rationale was that high school students thrive on competition and group activities. We hypothesized that empowered students who assumed leadership roles in developing the CPR/AED curriculum would enhance their own learning.

Methods

This study was an IRB approved (10-007748) prospective trial in a high school classroom using an intervention, only in the Study Class, to develop novel CPR and AED education programs. The Study Class presented their programs at a CPR/AED Olympic Day and competed against other Philadelphia High Schools.

Study setting

The School District of Philadelphia, by enrollment, is the eighth largest school district in the nation, serving a racially and ethnically diverse student population. As of December 6, 2012, African-Americans made up 54.5% of those enrolled; Asian/Pacific Islanders, 7.8%; Caucasian/Euro-Americans, 14.3%; Hispanics/Latinos/as, 18.6%; Native Americans, 0.2%; and Multiracial/Others, 4.6%. During the testing year, the PSD served an enrollment of 149,535 students.

Study population

Schools were selected on a first come first served basis from volunteers solicited by the PSD Physical and Health Education Department. Students became eligible when health teachers, who taught CPR/AED instruction, agreed to participate in our SPORTS study. Those eligible Health Class students assented to participate in an education, training, and assessment program and, only for the Study Class, the CPR/AED Olympics. Testing and enrollment began in February 2011 and was completed in May 2012 with retention testing. Standard CPR/AED education was provided in the Health Education (HE) curriculum as part of the regular HE class instruction. Of the 523 students in the original Control and Study Classes, 494 signed consents/assents (94.5%). Of those 494, 412 participated in both the pre- and post-testing (83%).

Detailed study methods and study flow

The study included 15 high schools in the PSD. From each school, two Health classes were selected, one Study Class and one Control Class. The study flow is shown in Fig. 1.

The Control Class received the usual Health Education class CPR program at their school, was tested in the same manner as the Study Class, but did not participate in the CPR/AED Olympics. The Study Class received the usual Health Education class instruction but were asked to develop innovative programs to teach other high school students the basics of CPR and AED use, and participated in the CPR/AED Olympics at the end of the school year. Students assented to participate in the study and their parents received an opt-out form if they did not want their child to participate in the study.

Students completed a pre-test to assess cognitive knowledge of CPR and AED skills and willingness to respond to a cardiac emergency (Supplements 1 and 2). Additionally, students' CPR and AED psychomotor and performance skills were assessed prior to their CPR and AED instruction (Supplements 3 and 4). The testing skills focused on (1) recognition of the need for CPR; (2) calling 911; (3) hand placement; (4) AED electrode pad placement; and (5) effectiveness of ventilations and compressions.

The psychomotor test assessed whether students opened the airway, performed adequate ventilations, had proper hand placement, continued to perform CPR until an AED was available, turned the AED on, had proper AED pad placement, and pressed the shock button when indicated. The performance test utilized the Skill-Reporter manikin to assess students' compression and ventilation adequacy. Willingness testing was assessed using 5 scenarios of performing CPR using mouth to mouth or hands only on a relative, child, an elderly person, or in the presence of blood or vomitus. A Likert scale was used with 1 indicating *Very Likely* to perform and 5 indicating *Very Unlikely*. After the completion of pre-tests, CPR

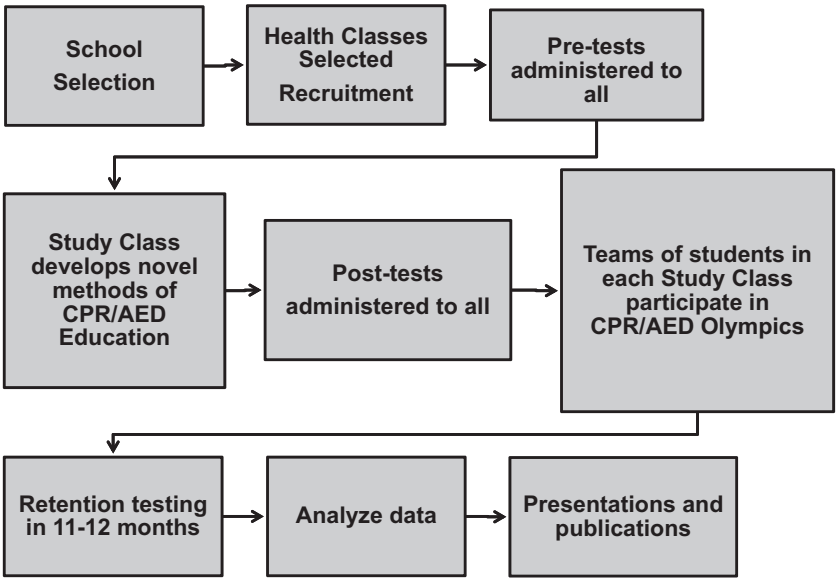

Fig. 1. SPORTS study methods and flow. Graphic description of study methods.