

Introduction

According to the American Heart Association (AHA), cardiac arrest is a leading cause of death in the United States (AHA, 2013). Approximately 360,000 victims of cardiac arrest are treated by emergency medical services (EMS) before they reach the hospital. Less than 10 percent of the victims survive. Although sudden cardiac arrests (SCA) occur more commonly in adults, an estimated 5,000 to 7,000 children (without symptoms) die suddenly in the United States each year, (sudden infantile death syndrome (SIDS) deaths are excluded from this estimate).¹ Research suggests that a majority of sudden cardiac deaths in children and adolescents are directly related to undetected cardiac anomalies.

In adults, ventricular fibrillation is the most common cause of sudden cardiac arrests. Ventricular fibrillation is an abnormal, chaotic heart rhythm that prevents the heart from pumping blood. The current treatment for SCA is the “chain of survival” which delineates the five links needed to increase the victim’s chance of survival. The AHA identifies the following five links in the chain of survival:

- Immediate recognition of cardiac arrest and activation of the emergency response team, i.e. calling 911 or EMS;
- Early cardiopulmonary resuscitation (CPR) with emphasis on chest compressions;
- Rapid defibrillation;
- Effective advanced life support; and
- Integrated post-cardiac arrest care.

Importance of Automated External Defibrillators (AED) in schools

Each school should have a current plan that includes procedures on how to manage sudden cardiac arrests in students and adults who work at and/or routinely visit schools for a variety of reasons including school-sponsored events. In 1990, the School Health Standards (Code of Maryland Regulation 13A.05.05.05-.15) were adopted and requires that “At least one adult in each school other than the designated school health services professional and the school health services aide shall be currently certified both in the First Aid Program of the American National Red Cross or its equivalent and in Adult and/or Pediatric Cardio-Pulmonary Resuscitation (CPR). Thus, one certified person should be available on-site during the regular school day and at all school-sponsored athletic events.”

All CPR/AED certified individuals are trained on when to activate the “chain of survival” which means that these trained individuals shall perform the actions or links that increase a victim’s chance of survival. Each year, all local school systems (LSS) in Maryland certify that their schools meet the School Health Standards that includes having a certified individual in each school to respond to sudden cardiac arrests.

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Additionally, each set of actions or links in the chain of survival must be performed as soon as possible to save an individual experiencing a SCA. If any link in the chain is weak, delayed, or missing the chance of survival is reduced. All public schools in Maryland have the first two links in place. The Annotated Code of Maryland, Education Article § 7-425 (Automated External Defibrillator Programs) mandates each local county board to develop and implement an AED program in all high schools and middle schools. The decision to implement an AED program in elementary schools at the local school system (LSS) level can best be made by assessing the school environment and the risk of SCA within the elementary school setting. The Maryland Institute for Emergency Management Services Systems (MIEMSS) is responsible for the coordination and training of all AED programs in Maryland per the Annotated Code of Maryland, Education Article § 13-517.

Market Value and Financial Analysis for AED in schools

AEDs are readily available from a number of manufacturers and the cost ranges from \$1,500 to \$3,000 each. Electrodes and batteries must be replaced periodically based on manufacturer's suggested shelf life. The pads must be replaced after each use and cost from \$50 to \$150. School systems that presently have AEDs in elementary schools identified parents and organizations as two funding sources that have donated AED equipment. The Automatic Defibrillation in Adam's Memory Act (Public Law 108-41, July 1, 2003) authorizes the federal government to establish an information clearinghouse that provides information to increase public access to defibrillation in schools. When established, the clearinghouse will serve as a good resource for schools interested in establishing AED programs. It is important to note that the law does not mandate AED programs in elementary schools. If AEDs are mandated in elementary schools, it would be prudent to set some parameters regarding the type of AED to be used, so that training is standard.

Technical Issues

The local school systems also addressed technical issues related to the AED Program in the school building. Maintenance of the AED equipment is important and identifying an individual within the school setting to be responsible for maintaining the AED is necessary. The designated person or persons in the school building will assure the AED device is ready to use when a rescue is required, and will replace supplies as needed. Additionally, MIEMSS requires equipment inspection to be conducted monthly and adherence to the manufacturer's recommended maintenance must also be followed.

Current Mandates for AED in Maryland Schools

The current mandate for AED Program in Maryland public schools requires LSS to develop and implement the program in high schools and middle schools. The mandate includes the provision for an individual to be trained in the operation and use of an AED to be present at all school-sponsored athletic events. The Maryland Public Access AED Regulations – Code of Maryland Regulations (COMAR) 30.06.01-05 under MIEMSS strongly encourages facilities with frequent visitors under the age of eight years old to include pediatric electrodes (chest pads) in their equipment kits along with adult electrodes. According to Lofti, et.al., the increasing availability and successful dissemination of AED into the public settings has led to advocacy for AED in

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every school which includes a U.S. Congressional bill promoting access to defibrillation on school grounds.² It is imperative that schools establish a "chain of survival" to be prepared for a sudden cardiac arrest. This begins with providing and maintaining CPR/AED training for identified staff.

Summary:

MSDE's Division of Student, Family, and School Support surveyed the local school systems school health services coordinators and directors of student services who provided information regarding the total of AEDs currently in elementary schools, the fiscal impact of having an AED available in all public elementary schools in Maryland, and the cost for the maintenance of AED in elementary schools.

Among the 24 LSS, one jurisdiction reported having AED in some elementary schools and four jurisdictions reported having no AED in the elementary school setting. Eighteen jurisdictions reported having an AED available in all elementary schools. In total, Maryland has 791 elementary schools. According to survey responses, 606 (81%) of elementary schools currently have AEDs. One LEA, Baltimore City Public School System (BCPSS), stated that they were unsure of the number of elementary schools with AEDs. BCPSS has 47 elementary schools. The percentage provided above is assuming that zero elementary schools in Baltimore City have AEDs.

All 24 LSS provided information regarding the fiscal impact of maintaining an AED in every public elementary school. The information provided from each LSS included the approximate cost of an AED, maintenance expenses, and replacement equipment expenses for expired parts such as batteries and pads. The prices of AEDs reported ranged from \$590.00 to \$4500.00. The average cost was approximately \$1700.00. The cost of maintenance and replacement equipment ranged from \$106.00 and \$325.00. The average maintenance and replacement cost was approximately \$240.00. The range in cost may be caused by the rise in price for new models versus the cost paid for older models. Also, the range may be based on prices negotiated for bulk purchases or prices negotiated to include cost of maintenance, training and/or installation. The results of this information are attached. See Appendix A for a Summary of the AED Program in Maryland public schools and the availability of AED in the elementary school setting.

References:

¹ Berger S, Dhala A. Griedberg DZ. Sudden cardiac death in infants, children and adolescents.³ Pediatric Clinics of North America, Vol. 467 (2), April 1999; p. 221.

²Lofti,K.; White, L.; Rea T.; Cobb, L.; Copass, M.; Yin, L.; Becker, L.; Eisenberg, M. Cardiac Arrests in Schools. Circulation. 2007; 116: 1374-1379.

Cave, D.M.; Aufderheide, T.P.; Beeson, J.; Ellison, A.; Gregory, A.; Hazinski, M.F.; Hiratzka, L.F.; Lurie, K.G.; Jorrison, L.J.; Mosesso, V.N.; Nadkarni, V.; Potts, J.; Sampson, R.A.; Sayre, M.; and Schexnayder, S.M. Importance and Implementation of Training Cardiopulmonary

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Resuscitation and Automated External Defibrillation in Schools – A Science Advisory From the American Heart Association. *Circulation*. 2011; 123:691-706. Downloaded from <http://circ.ahajournals.org>, August 4, 2015

Resources:

- School Health - <https://www.schoolhealth.com/aed-resources/>
- Sudden Cardiac Arrest Foundation - <http://www.sca-aware.org/schools/building-a-heart-safe-school>
- The Columbian, Priceless Precaution? AEDs in schools
<http://www.columbian.com/news/2012/apr/14/priceless-precaution-aeds-schools/>
- Cardiac Science – Defibrillators At Your School - <http://www.cardiacscience.com/wp-content/uploads/2013/08/57051.pdf>
- Maryland School Health Services Guidelines; Chain of Survival: Emergency Preparedness for Sudden Cardiac Arrest in Schools, October 2003 (Currently under review 2015).
- Manufacturers of approved AEDs can be found on the following Web sites:
<http://unix32.nysed.gov:9210/rscs/chaps/Health%20Services/AED-Manufacturers.doc>
- Information about potential funding sources is available from the National Center for Early Defibrillation at web site: http://www.early-defib.org/03_06_05.html
- Maryland Institute for Emergency Management Services Systems (MIEMSS)
- American Heart Association -
http://www.heart.org/HEARTORG/CPRAndECC/CorporateTraining/AEDResources/AED-Resources_UCM_001296_SubHomePage.jsp
- Accopora @ www.la12.org
- National Safety Council
- Code of Maryland Regulations, School Health Services Standards
- Annotated Code of Maryland
- Appendix A: Survey Responses from Local School Systems, Maryland, June/July 2015; Survey conducted by Alicia Mezu, Health Services Specialist, Maryland State Department of Education