

Surviving Sudden Cardiac Arrest: Improving the Odds with Automated External Defibrillators

Synopsis

The Grand Jury investigated the need for Automated External Defibrillators (AEDs) in Santa Cruz County, how they are currently being deployed, and what policies are in place for their use in saving the lives of sudden cardiac arrest (SCA) victims.

An estimated 325,000 lives are lost each year in the United States due to sudden cardiac arrest.¹ From October 2004 through September 2006, 484 people were victims of sudden cardiac arrest in Santa Cruz County alone.² With the recent advances in technology, the modern AED units are simple and relatively low cost. Many lives could be saved if they were made available and used within the first few minutes after the onset of sudden cardiac arrest. Although fire and ambulance services in the county are well equipped and have an excellent reputation for effective medical response, their ability to reach a patient who is suffering from sudden cardiac arrest in time is highly problematic. The solution lies with AEDs being more widely distributed at key sites throughout the county.

In providing what is fast becoming a “standard of care,” the county must keep up to date with technology, national trends and the legal liability associated with failure to be proactive. The county should re-examine its policy and its requirements for the placement of AEDs as recommended in this report.

Definitions

AED

Automated External Defibrillator — a computerized medical device that automates the process of administering an electrical shock to the heart to restore its natural rhythm.

Advanced Life Support (ALS)

Medical care provided by emergency medical technicians trained to assess a patient's condition, administer drugs, defibrillate and provide advanced airway management prior to transportation to the hospital.

AMR

American Medical Response — a private ambulance service that coordinates with emergency services agencies in the county for first responder Advanced Life Support service. AMR is the sole provider of medical transport in the county.

Basic Life Support (BLS)

Basic Life Support consists of a number of life-saving techniques focused on the ‘ABCs’ of pre-hospital emergency care: Airway, Breathing and Circulation. BLS generally does

¹ Sudden Cardiac Arrest Association, <http://www.early-defib.org/learn.asp>

² Santa Cruz County Cardiac Arrest Audit 2004-2006, May 2007, p. 2 (hereafter referred to as “SCA Audit.”).

not include the use of drugs or invasive skills, but with advances in AEDs may now include defibrillation.

CPR

Cardio-Pulmonary Resuscitation.

EMSIA

Emergency Medical Services Integration Authority — a combination of county fire districts and departments that work together with American Medical Response to provide Advanced Life Support medical services in Santa Cruz County.

Net Com

Santa Cruz Consolidated Emergency Communications Center — the county’s primary response and dispatch center for 911 calls.

PAD

Public Access Defibrillator — an AED that is available in public and/or private places where large numbers of people gather or people who are at high risk for heart attacks live.

Standard of Care

The level of service that the average, prudent provider in a given community would practice.

VF/VT

Ventricular Fibrillation/Ventricular Tachycardia — chaotic heart rhythms that can be restored to a natural spontaneous rhythm through defibrillation.

Background

Heart disease is a serious public health issue. In the United States, at least 61 million people have cardiovascular disease, resulting in an estimated 1 million deaths per year. About one-third of these deaths, 300,000 to 400,000, are due to sudden cardiac arrest, the sudden and unexpected loss of heart function.³

Most often, sudden cardiac arrest is due to chaotic beating of the large chambers of the heart, called ventricular fibrillation. Typically, its victims have no warning and quickly collapse and lose consciousness. The only treatment that can save their lives is the quick use of a defibrillator, a medical device that administers an electrical shock to the heart to restore its synchronous pumping rhythm. Defibrillators work by giving the heart a controlled electric shock that has the chance to resynchronize the contraction of the heart muscle and restore its normal rhythm.

The overall survival rate for out-of-hospital cardiac arrest is 6.4 percent nationally and 6 percent in Santa Cruz County.⁴ Immediate treatment with defibrillation can improve the odds of survival significantly — resulting in greater than 90 percent survival. Every

³ American Heart Association, <http://www.americanheart.org/presenter.jhtml?identifier=4478>

⁴ SCA Audit, p. 4.

minute of delay decreases the survival rates by 10 percent; after 10 minutes without defibrillation, it is highly unlikely that a sudden cardiac arrest victim will survive.

Defibrillators are available in two forms, manual and automated. Only trained medical professionals are qualified to use manual defibrillators. Manual defibrillators require interpretation of the patient's condition and an understanding of the capabilities of the defibrillator to deliver an effective and safe shock.

Recently, as a result of technological advances and the development of special computer applications, a new kind of defibrillator has become available. Today's AED uses embedded computer chips and sophisticated programming to analyze heart rhythms quickly and accurately and determine if a shock should be given. It will only deliver a shock if the readings indicate that one is necessary. This automation makes it possible for non-medically trained individuals to deliver the same life-saving treatment as medical professionals without risking an accidental or inappropriate shock. Most modern AEDs are equipped with synthesized voice instructions telling the user how to proceed in the case of a cardiac emergency. This new equipment is very easy to use. In fact, in one study, untrained sixth graders took only 30 seconds longer than trained emergency service technicians to prepare a patient for a shock.⁵

Another advantage of modern automated defibrillators is the fact that, like most electronic equipment, they have become more affordable and available to the general public. In the past, their cost put them out of the reach of most people, but today they can be purchased through retail and online outlets for prices ranging from about \$1,000 to \$2,000.

The American Heart Association has recognized four critical factors associated with improved survival rates from sudden cardiac arrest in communities. More people survive when this sequence of events, called the Chain of Survival, happens as quickly as possible. These four steps are:

1. Early Access — recognizing that a cardiovascular emergency exists and immediately notifying the Emergency Medical Services (EMS) system, usually by calling 911.
2. Early CPR — starting CPR immediately after cardiac arrest to circulate blood to vital organs buys time for the victim until defibrillation can be administered.
3. Early Defibrillation — defibrillation of the victim as soon as equipment arrives.
4. Early Advanced Care — trained health care providers arriving quickly to administer advanced lifesaving interventions.

Establishing a viable chain of survival in a community requires an integrated plan that relies on the cooperation of local government agencies and ordinary citizens to know what to do and be prepared to take action when an emergency occurs.

⁵ Gundry, W., Comess, K., DeRook, F., and Jorgenson, D. AEDs user-friendly — even for children, October 17, 1999. http://www.eurekalert.org/pub_releases/1999-10/AHA-Auef-171099.php

Findings

Status of Emergency Services in Santa Cruz County

1. The 911 system for most of Santa Cruz County is administered through the Santa Cruz Consolidated Emergency Communications Center, commonly called Net Com. Additional public safety answering points for the 911 system are in Scotts Valley and at the University of California's Santa Cruz campus.
2. Net Com is an up-to-date, modern facility. Dispatchers have access to computer-aided dispatch systems that allow them to rapidly send police, fire, and medical assistance when needed. For medical calls involving a person not breathing, such as sudden cardiac arrest, Net Com was able to dispatch Emergency Medical Service units within 60 seconds 92 percent of the time in 2006.
3. The Emergency Medical Services Integration Authority (EMSIA) — consisting of the Aptos/La Selva Fire District, Central Fire District, Scotts Valley Fire District, City of Watsonville Fire Department, and City of Santa Cruz Fire Department — provides first responder Advanced Life Support (ALS) medical services to the urban areas of the county.
4. The remainder of the county receives first responder Basic Life Support medical services from a variety of smaller fire departments and the California Department of Forestry.
5. American Medical Response (AMR), a private ambulance service, coordinates with the EMSIA agencies for first responder ALS service and through its contract with the County of Santa Cruz is the sole provider of medical transport in the county.
6. EMSIA fire agencies are able to provide a paramedic to a medical emergency within eight minutes of dispatch 90 percent of the time in urban areas.
7. AMR is able to provide an ambulance to a medical emergency within 12 minutes of dispatch 90 percent of the time.
8. A fire department paramedic is the first one to arrive at a medical emergency about 60 percent of the time.
9. The expectations of service are carefully listed in the emergency services' contracts issued by the county to American Medical Response. AMR coordinates its services with the EMSIA to ensure the best possible service to the citizens of Santa Cruz County.

AED Distribution and Training

10. Manual defibrillators, such as those carried by fire department and AMR paramedics, are expensive and complex and require significant training and experience to be effective. Conversely, automated external defibrillators (AEDs) are reasonably priced and simple to operate by anyone with a minimum of training.

11. Santa Cruz County does not have a comprehensive policy regarding the distribution and installation of AEDs in public locations.
12. AEDs are carried in police patrol cars in Scotts Valley. No other law enforcement agencies in the county require AEDs in their vehicles.
13. The locations of AEDs in the county are not available to Net Com dispatchers.
14. When AEDs are deployed in public buildings, they are often not visible and therefore not accessible when needed.
15. CPR classes, including training in the use of AEDs, are available through a variety of sources in the county.

Need for AEDs

16. While immediate CPR can buy valuable time for a sudden cardiac arrest victim, defibrillation is the only treatment that can save the victim's life by restoring the heart's spontaneous rhythm.
17. People of any age may suffer sudden cardiac arrest and die suddenly.
18. Sudden cardiac arrest is different from a heart attack although coronary artery disease may reduce heart circulation and eventually result in SCA.
19. Often the first sign that a person is vulnerable to ventricular fibrillation is an attack that results in sudden cardiac arrest and death.
20. In Santa Cruz County, approximately 250 people per year are victims of out-of-hospital sudden cardiac arrest. From October 2004 through September 2006, more than half of these victims (51 percent) were not candidates for resuscitation, mostly because too much time had elapsed before emergency medical services could be activated.⁶
21. Some common causes for sudden cardiac arrest include asphyxia due to drowning or other oxygen deprivation, congenital heart conditions, sudden blows to the chest, electrocution, and coronary artery disease.
22. The worst combination for cardiac arrest survival is if patients collapse without witnesses, and when discovered, receive no bystander CPR while emergency services personnel are en route. In a two-year period in Santa Cruz County, only two of 215 patients in this situation had their hearts begin to beat again, and neither survived. When sudden cardiac arrest was witnessed and immediate CPR was administered, nearly a quarter of the victims regained pulses and 10 percent survived. The survival rate jumped to 19 percent when EMS professionals witnessed cardiac arrest and could begin treatment immediately. There were 16 EMS-witnessed cases in the two-year period, and three of those were found to be

⁶ SCA Audit, p. 6.

- in ventricular fibrillation (as opposed to those with no electrical activity or pulse). All three were successfully resuscitated with defibrillation only.⁷
23. Some experts believe that a connection may exist between the use of ‘Tasers’ by law enforcement and sudden cardiac arrest in some individuals.
 24. To improve the survival rate of victims of out-of-hospital cardiac arrest in Santa Cruz County, the Emergency Medical Services Integration Authority recommends “promulgating citizen CPR programs, Public Access Defibrillator (PAD) programs, and continued rapid EMS response using all the latest AHA (American Heart Association) recommendations for CPR, defibrillation, and advanced life support care.”⁸

Laws related to AEDs

25. Effective July 1, 2007, the State of California will require all health clubs to be equipped with AEDs on site and establish a program of training, maintenance, and record keeping.
26. Good Samaritan laws protect most citizens from liability if they take action in a medical emergency, which includes using an AED. Conversely, lawsuits have been filed against organizations such as amusement parks and airline companies for not having AEDs readily available.
27. AEDs are now required at FAA governed airports and on all commercial airliners.
28. The Federal Cardiac Survival Act of 2000 (Public Law 106-505) directed the Health and Human Services Department to establish guidelines for evaluating and installing AEDs in federal buildings.

Conclusions:

1. In Santa Cruz County, the American Heart Association’s recommended ‘Chain of Survival’ for victims of sudden cardiac arrest is incomplete. Specifically, the availability of early CPR and early defibrillation is lacking.
2. Although Net Com and the Emergency Medical Services Integration Authority cooperate to ensure advanced life support (ALS) services are sent to medical emergencies as quickly as possible, even the most rapid dispatch and transit times by Net Com and ALS providers will rarely get a defibrillator to the victim within the three- to five-minute window recommended by the American Heart Association for best survival, especially in outlying areas of the county.
3. Modern AEDs are simple to use and can improve the chances of surviving sudden cardiac arrest if they are deployed in the community and if there is a base

⁷ SCA Audit, p. 6.

⁸ SCA Audit, p. 9.

- population of trained citizens able to step in when a medical emergency requiring the use of an AED occurs.
4. When AEDs are deployed in the community, they need to be made visible and readily accessible to the public so they can be used immediately.
 5. Net Com staff could improve response time in cases of sudden cardiac arrest if they knew the locations of nearby AEDs.
 6. Deaths due to sudden cardiac arrest can be reduced through a combined program of public education in CPR and effective public access defibrillator (PAD) implementation.
 7. The availability of an AED is becoming the expected 'standard of care' in many situations.
 8. The availability of AEDs in county buildings — and their deployment in sudden cardiac arrest incidents — may protect the county from possible litigation and financial liability.
 9. Providers of AEDs may be protected from liability if they comply with simple regulations regarding training, maintenance, record keeping, and medical oversight.

Recommendations

1. The Santa Cruz County Health Services Agency should establish a public education program to enhance the community's knowledge and awareness of CPR and the use of AEDs as a life-saving measure.
2. The locations of AEDs in the county should be entered in Net Com's Computer-Assisted Dispatch system.
3. Santa Cruz County should require AEDs in county buildings with more than 100 employees or daily visitors and in county detention facilities, including Juvenile Hall.
4. Santa Cruz County should encourage the use of AEDs in the following public locales and private settings:
 - Public schools
 - Public swimming pools
 - Public libraries
 - Large concerts and other public events
 - Public golf courses
 - Churches with a capacity of 100 or more
 - Private schools
 - Private recreation clubs

- Medium to large hotels and motels
 - Shopping centers
 - Medical and dental offices
 - Private golf courses
 - Senior citizen centers and care facilities
5. The county and each city should equip law enforcement vehicles with AEDs.
 6. The county should establish a mechanism to ensure that once AEDs are deployed by public agencies, those responsible meet the requirements needed to shield the county from liability by providing training, maintenance, record keeping and medical oversight.
 7. The county should establish a reporting and inspection mechanism to ensure that AEDs deployed in the community are identified by Net Com and thereby viable in case of an emergency.
 8. The county should develop a strategy for implementing a meaningful public access defibrillator program that meets the criteria of the American Heart Association and American Red Cross recommendations.
 9. The county should explore funding opportunities to pay for an expanded public access defibrillator program from both public and private sources, possibly enlisting the aid of community service organizations.

Commendation

Santa Cruz County's emergency services teams and organizations for providing the most efficient and responsive services possible under current conditions.

Responses Required

Entity	Findings	Recommendations	Respond Within
Santa Cruz County Consolidated Emergency Communications Center	1, 2, 13	2	90 days October 1, 2007
Santa Cruz County Health Services Agency	11	1, 3, 4, 6-9,	90 days October 1, 2007
Santa Cruz County Board of Supervisors		1, 3, 4, 6, 8, 9	60 days September 1, 2007
Santa Cruz County Emergency Medical Services Integration Authority	1-10, 16-24		90 days October 1, 2007
Santa Cruz County Sheriff	12	5	60 days September 1, 2007
City of Santa Cruz Police Department	12	5	90 days October 1, 2007
City of Scotts Valley Police Department	12	5	90 days October 1, 2007
City of Capitola Police Department	12	5	90 days October 1, 2007
City of Watsonville Police Department	12	5	90 days October 1, 2007

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