# HOW TO CHOOSE THE AED FOR YOUR HOSPITAL

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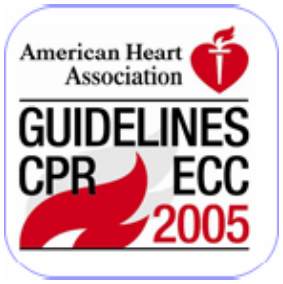
In the last issue of *Code Communications*, I concluded that many hospitals are not yet able to deliver defibrillation to patients located outside of critical care units within the American Heart Association (AHA) recommended 3-minute goal. The number of hospitals who have instituted a two-tiered system of defibrillation is increasing, but there are many institutions that need to change their practice and embrace the use of automated external defibrillators (AEDs). Survival of patients in ventricular fibrillation (VF) and pulseless ventricular tachycardia (VT) will not improve until Basic Life Support (BLS) trained first responders in areas outside of critical care are empowered to defibrillate prior to the arrival of the CPR team.

In this issue of *Code Communications* I will discuss how to choose an AED for your hospital. I will present an overview of the selection process and then describe key quality characteristics for consideration when selecting an AED.

## The Process for Choosing an AED

First, there must be a realization within the institution that change to two-tiered defibrillator technology is needed. With a two-tier model, manual defibrillators are utilized in critical care units and departments where staff are trained in Advanced Cardiac Life Support (ACLS) and arrhythmia recognition, and AEDs are operated by BLS-trained staff in other locations such as medical/surgical units, ambulatory care clinics, diagnostic/treatment areas, hallways, common areas such as information desks and the cafeteria, and outlying buildings.

What may be driving the change to two-tiered defibrillator therapy? It may be that the "life" of the current defibrillators is exceeded based on their capital depreciation. Perhaps the institution has embraced the concept of early defibrillation and strives for best practice. If their mean time to defibrillation is measured, they may find that it exceeds 3 minutes when delivered outside of critical care units. Defibrillator technology has improved during the last decade, with biphasic waveforms resulting in improved conversion of ventricular and supraventricular arrhythmias - and less skin burn. If practitioners have tried to implement the *2005 AHA Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care*,[1] they may realize that feedback on CPR technique, which is built into several AEDs, would be helpful. Or there may be a risk management concern with multiple models of defibrillators using a variety of accessories throughout the institution - and difficulty keeping staff competent in their use.




Key leadership persons need to be convinced that a change to two-tiered defibrillation therapy fits within the organization's goals and that they can support the implementation program over the next year. It is helpful to frame the discussion as an extension of existing emergency response procedures rather than as a new program. The rationale and impact of this major practice change will need to be discussed with clinical and administrative leadership groups. Discussion topics might include the scientific background, efficacy, AHA 2005 Guidelines, staff acceptance, safety, training, liability, cost, etc. Now that AEDs are available in the community at airports, health clubs, grocery stores, sports arenas, etc., we should be able to move beyond the conviction that defibrillators are only operated by critical care nurses and physicians.

It is important to point out that BLS competency programs already incorporate general AED training, and now it can be made specific to *one* AED. References 2 through 13 at the end of this newsletter may help in this discussion with leadership.

A decision-making group needs to oversee the process of changing to two-tiered defibrillator therapy. This group may be the Cardiopulmonary Resuscitation Committee, or a task force specifically selected for this purpose. Questions to consider when choosing group members include: Who are the leaders of resuscitation practice in your institution? Who will be affected by this change? Who sheperds product changes within the institution? Those persons who should be included in the decision-making group can be found in Table 1.

**Table 1. Persons to Include in the AED Decision-making Group**

- Cardiologist; an electrophysiologist is especially helpful
- Intensivist since half of all cardiopulmonary arrests occur in critical care units
- Critical care nurses
- Pediatric representative, either a pediatric clinical nurse specialist or attending
- General care unit nurses since placing AEDs on med/surg units will be new for them – both bedside provider and manager
- BLS-trained technical staff in diagnostic/treatment areas where AEDs will be placed – both provider and manager
- Cardiac clinical nurse specialist with expertise in this area
- House staff representative
- Biomedical engineering representative, perhaps the manager or the technologist responsible for defibrillators
- Administrator
- Purchasing agent
- Information technology representative since all AED vendors have data management programs
- Educator since initial and ongoing competency in use of the AED will be needed
- Other members of the CPR team who perform defibrillation

It is important that first responders who will newly use an AED be included in the decision-making group from the beginning so they can understand the change to two-tiered defibrillator therapy and help convince their peers that improved patient outcomes will result. Incorporation of defibrillation into their skill base will be frightening to general care nurses and technicians, who have only been responsible for a few minutes of CPR and then disappeared when the CPR team shows up. Consider where AEDs will be placed and who may be the greatest resistors to change in practice. For example, if it is predicted that security officers will carry an AED in their van, you may want to include a representative from this group since they do not think of themselves as providing "medical" care. Several authors writing about implementation of AEDs have mentioned that not including house staff in the decision-making group and in the AED training has lead to resistance, with remarks during codes such as "*Get that thing off and use the real defibrillator instead*."

Discuss whether AED placement and use will extend to areas where staff has no medical training. For example, are there distant sites where education, risk management or medical record departments are located? Purchase of AEDs for this type of location may be postponed until later, since it involves a mind shift for the employees and commitment to BLS training. At Dartmouth-Hitchcock Medical Center, I saw that the cardiac arrest of a Financial Services employee in an outlying building soon brought a request from them to the CPR committee for an AED. Check with your local Emergency Medical Services to learn how long it takes for an ambulance to reach a victim in your outlying buildings. The institution may want to offer the same hope of survival to *all* persons throughout the medical center - whether inpatient, outpatient, visitor or employee.

A champion should be chosen from the decision-making group who will guide the process from beginning to end. The champion should be passionate that this practice change is right for the institution and be given the time to make it happen. This will be the "go-to" person for planning, questions, and follow-up. It will be important to determine ahead of time how the decision of choosing an AED will be made. Will it be a consensus of the decision-making group, or does the final decision rest with a designated individual?

The decision-making group should convene and discuss how the AED will be used within the institution. Will the defibrillator be used strictly as an automated device by BLS-trained first responders? If so, the AED chosen needs to be extremely easy to operate with simple and thorough prompts. Then a manual defibrillator would be transported to the scene for subsequent use by the ACLS team. Or will the defibrillator be used initially as an automated device by first responders and then also as a manual unit by members of the resuscitation team? If the AED will be used during the whole resuscitation, it may be desirable that the AED selected contain ECG monitoring, manual override, and even synchronized cardioversion.

Does the institution desire their *manual* defibrillators to incorporate automatic advisory capacity and be available in some of the higher risk areas? I have found that BLS-trained staff are intimidated by these more complex defibrillators. Providing standalone AEDs is a simpler, less expensive option that will allow more defibrillators to be placed throughout the institution, even in non-traditional areas.

If the AED will be used for bedside monitoring of patients not in full arrest, then consider selecting an AED with 3-lead ECG monitoring capability. There are even a few AEDs that have a chart recorder. If the institution currently delivers manual defibrillation with paddles, consider switching these devices to hands-free defibrillation with disposable electrodes when the AED is introduced. It is helpful when the manual defibrillator and the automated defibrillator at an institution are from the same vendor, since electrodes may be shared, the data management program may be similar, and the sales rep is consistent. You may also want to determine what defibrillators are being used by the Emergency Medical Services in your region so that compatibility can be considered. Before proceeding further, the group should make sure that budgetary support is available for this change, and build this into the timeline.

Now you need to select the vendors who produce AEDs that meet your institutional needs. Using ECRI services is a good place to start. ECRI (formerly the Emergency Care Research Institute) is a nonprofit health services research agency and a Collaborating Center of the World Health Organization. It is designated as an Evidence-based Practice Center by the U. S. Agency for Healthcare Research and Quality. ECRI's mission is to improve the safety, quality, and cost-effectiveness of healthcare. Within their Healthcare Product Comparison System, they have technology overviews, the ability to create a customized comparison chart with side-by-side specifications, and links to supplier web sites and e-mail addresses. Laboratory, clinical and user evaluations of medical products are routinely published in their monthly *Health Devices*. AEDs were discussed in their June issues for 2003 and 2004. I found the section "AEDs in Your Facility, A Risk Management Perspective" in the June 2003 issue especially

helpful on this topic. The information from ECRI may help you narrow the field of AEDs that meet the needs of your institution. Their web site is http://www.ecri.org.


Companies who manufacture AEDs are found in the table below along with their respective products that are suggested for use in the hospital setting. AEDs targeted for public access use out of the hospital are not included.

**Table 2. Suppliers of AEDs**

**Burdick Inc, A Quinton Co**
http://www.burdick.com/products/relatedproducts/defibrillator.htm
- CardioVive AT
- CardioVive DM

**Cardiac Science Inc**
http://www.powerheart.com/products/
- Powerheart AED G3
- Powerheart AED G3 Pro

**Defibtech LLC**
http://www.defibtech.com/products/index.html
- LifeLine AED

**Medtronic Emergency Response Systems**
http://www.medtronic-ers.com/products/
- Lifepak CR Plus
- Lifepak 500

**Philips Medical Systems**
http://www.medical.philips.com/us/products/resuscitation/
- HeartStart FR2+
- HeartStart FRx

**Progetti srl**
http://www.progettimedical.com/defi.html
- PG DEF
- Rescue 2

**Schiller America Inc**
http://www.schiller.ch/navigation/powerslave,id,910,nodeid,910,_country,hq,_language,en.html
- FRED
- FRED easy

**Welch Allyn Inc**
http://www.welchallyn.com/medical/products/catalog/type.asp?ID=33392
- AED 20
- AED 10

**ZOLL Medical Corporation**
http://www.zoll.com/product_search.aspx?id=103
- AED Plus
- AED Pro

It is helpful to have a vendor fair in order to compare AEDs side by side. Staff who currently operates defibrillators and potential new users of an AED should be invited to the fair. Each vendor could be given a designated time(s) to present their AED(s) to a seated audience. In addition the representative would present their AED at a booth as reviewers stop by. Product literature and educational materials should be available.

It may be helpful to have targeted small group meetings to discuss specific aspects of the AEDs. For example, BioMed may want their own group discussion regarding set-up, maintenance and reliability. Educators will be interested in teaching methods and support. The electrophysiologist may desire a group to discuss the different biphasic waveforms, efficacy, and energy settings. Do not be surprised if this issue becomes contentious with heated debate about the importance of the waveform and maximum energy.

## Evaluating the Quality of AEDs

An evaluation form should be developed to obtain feedback from the reviewers during the vendor fair and additional small group discussions. Key AED quality characteristics should be evaluated from several aspects:

- Clinical
- Analysis algorithm, waveform, and energy delivery
- Technical
- Education
- Data management
- Cost

Each institution needs to decide what quality aspects are important for them to evaluate and incorporate these into their evaluation tool. Only select characteristics would be evaluated by each group. For example, potential new users may evaluate only the clinical characteristics. Those who will orient staff to the AED and track competence would evaluate education as well as clinical characteristics. The decision-making group will probably evaluate all characteristics. It may be helpful to *rank* the importance of the characteristics prior to summarizing scores from all the evaluations. The format for an evaluation tool may look something like this.

Any Hospital
**AED Evaluation**
November, 2006

Name: _____ Date: _____

Department: _____ Position: ☐ RN ☐ MD Other: _____

Please use numbers 1 through 5 to indicate whether you believe the quality characteristics are present for each AED.

Strongly agree = 1 Agree = 2 Disagree = 3 Strongly disagree = 4 Cannot assess/ = 5 Does not apply

| **Clinical Quality Characteristics** | **AED #1** | **AED #2** | **AED #3** |
|---|---|---|---|
| The AED is lightweight, compact and easy to carry. | | | |
| The AED provides clear indication of its readiness for use. | | | |
| All needed components are conveniently accessible within the carrying case. *etc* | | | |
| **My Choice** | **AED #1** | **AED #2** | **AED #3** |
| Place a checkmark in the box that corresponds with the AED that you believe is best for our institution. | | | |

In Table 3 is my list of quality characteristics that you may want to incorporate into an evaluation tool for the ideal AED.

**Table 3. Key Quality Characteristics of the Ideal AED**

**Clinical Quality Characteristics**

- The AED is lightweight, compact and easy to carry.
- The AED provides clear indication of its readiness for use.
- All the needed components are conveniently accessible within the carrying case.
- The AED is quick and easy to *set up* for use on a patient.
- The AED electrodes are pre connected to ease set up.
- The AED adapts easily for use with children.
- The diagrams for placement of the electrodes are helpful (both adult and children).
- The AED is compliant with 2005 American Heart Association Guidelines.
- Coaching is provided on CPR technique, i.e. rate, depth, and interruptions of compressions, timing of breaths.
- The voice prompts are helpful (appropriate, loud, clear).
- The text messages and/or graphic icons are helpful (appropriate, clear).
- The screen is easy to read in daylight and darkness.
- The screen displays a clear ECG.
- The AED is simple and intuitive to *operate*.
- The AED operates in a manner that promotes safety of care providers.
- The AED provides useful prompts of problems, e.g. poor electrode contact, disconnect, low battery.
- The AED can be set up to monitor the ECG in 3 leads.
- The AED manual override is easy to identify and operate.
- The AED is able to perform synchronized shock.
- A spare AED battery is easy to install.
- The wall mounting bracket provides easy access to the AED.

**Analysis Algorithm, Waveform and Energy Delivery Quality Characteristics**

- The first shock conversion rate for ventricular fibrillation/pulseless ventricular tachycardia and the average number of shocks for conversion is acceptable with this waveform.
- The scientific rationale for the energy output settings used by the vendor is acceptable.
- The AED automatically compensates for patient impedance when delivering the voltage.
- The voltage is easily attenuated when the device is used with children
- The charge time for the AED is within 10 seconds.
- The AED's algorithm ensures good sensitivity and specificity when analyzing rhythms in both adults and children.

## Analysis Algorithm, Waveform and Energy Delivery Quality Characteristics (continued)

- The AED's algorithm is accurate given pacemaker artifact and electrical artifact.
- The AED is able to analyze VF waveform frequency and advise whether shock or CPR is initially desirable.

## Technical Quality Characteristics

- The AED performs automatic self tests at an appropriate frequency for the internal circuitry, battery, pads, and discharge.
- The AED provides clear indication of its readiness/unreadiness to perform.
- AED maintenance to be performed by biomedical engineering is minimal.
- The warranty is competitive.
- The AED has a low problem/repair history.
- Programming the AED is easy and efficient.
- Drift of the AED clock is minimal.
- The time on the AED can be synchronized to a designated clock.
- The defibrillator, accessories, and battery are reliable.
- Current battery capacity is easy to identify.
- It is easy to see when the electrodes and battery are expired.
- The shelf life of the battery is acceptable.
- The environmental specifications for temperature, humidity, altitude, vibration, shock/drop abuse, water resistance, and electromagnetic interference are acceptable.
- The operating time is competitive (minutes of ECG monitoring, number of shocks over time).
- Heart rate and elapsed time are clearly visible on the screen.
- A chart recorder is available with the AED.
- Audio recording is available on the AED.
- The wall mounting cabinet for the AED provides good security for the device.
- The wall mounting option for the AED can be wired to a central operator.
- The vendor rep is approachable, knowledgeable, and available.
- The vendor provides onsite assessment for AED needs of the institution.
- The manufacturer has a history of producing good quality defibrillators.
- The company has a history of reliable and speedy customer service. There are no recent recalls or safety alerts that influence operation of the AED and its accessories.

## Education Quality Characteristics

- The AED training device and supplies are similar to the real AED.
- The real AED can be adapted for training.
- The training equipment and supplies are easy to use.
- The training materials are in a variety of formats, i.e. videos, DVDs, handouts, computerized learning programs.
- A training program is available which is interactive and tests competency.
- The training scenarios reflect current AHA standards.
- Competency skill checklists and written tests are available from the vendor.
- Templates for AED protocols in the hospital are available from the vendor.
- The company provides support for training.

## Data Management Quality Characteristics

- The software requirements for installing the vendor's data management program are available at my institution.
- The hard disk storage space needed for the data management program and its events is reasonable and manageable.
- Transferring data from the AED to the data management software program is easy and minimizes/eliminates down time of the defibrillator.
- Data entered into the software program for resuscitation is that required by AHA, National Registry of CPR, and the institution.
- The internal memory capacity for storage of resuscitation data is acceptable.
- The AED data management program is intuitive and easy to use.
- The data management program produces meaningful case reports that include ECG waveform, event log, case data, and CPR performance.
- The data management program produces meaningful aggregate reports.
- Expert technical support is available for use of the data management program.

## Cost

- The cost of the AED device is competitive.
- The cost of the electrodes (adult and pediatric), supply kit, and batteries are competitive.
- The AED electrodes interface well with the manual defibrillator from the same vendor.
- The AED electrodes are multifunctional, and support ECG monitoring, defibrillation and pacing.
- The shelf life of the electrodes is competitive.
- Rechargeable batteries are an option.

**Cost (continued)**

- The cost of the training device and training electrodes are competitive.
- The data management program is cost effective.
- The vendor offers a trade-in discount for defibrillators taken out of service.
- Upgrades are available for the AED and the data management program at a competitive cost.

## Conclusion

As you are deliberating about which AED to purchase, talk with other users of the various AEDs. The vendor representatives can provide you with contact names. I have found it helpful to keep for a short time within the institution those AEDs seriously being considered so they can be investigated further.

Once the AED is selected for the institution, work with the representative to make an assessment of target areas for AED placement, incorporating the 3-minute time goal. Use a stopwatch to calculate fast walking time so that an AED (or manual defibrillator) will be no further than one minute away. It should take no more than one minute to reach the AED, one minute to return to the victim, and one minute to operate the AED until a shock is delivered.

The rep will have valuable suggestions about how to implement the AED program and will provide educational support. Talk with others who have recently introduced this AED into their institution and learn what implementation methods worked best for them, and what stumbling blocks they encountered.

Moving into two-tiered defibrillator therapy is a culture shift for an institution, but if leadership is behind the change and you select a good quality AED that will meet the needs of your organization, then implementation flows smoothly. Don't forget to track patient survival from VF/pulseless VT resuscitations and compare the "*before AED*" to the "*after AED*" rate for return of spontaneous circulation and hospital discharge. You will see a significant improvement that can be proudly shared within your organization.

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