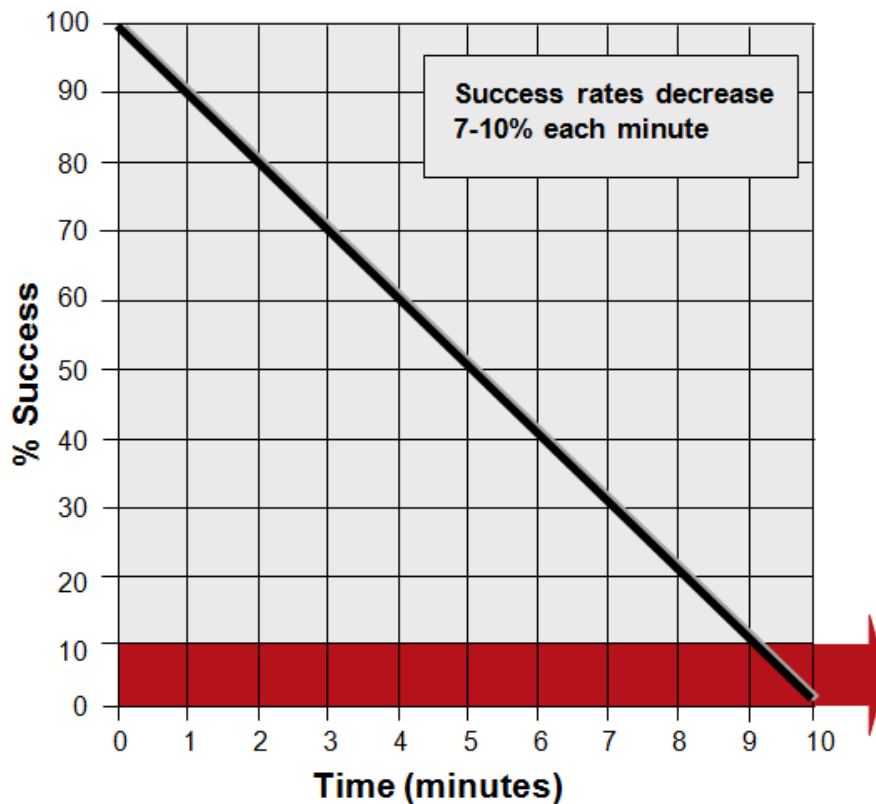


## When Is It Time to Replace Your AED?

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### Introduction

An automated external defibrillator (AED) is one of the most important safety tools in any facility. In a cardiac emergency, it could help save a life. Although not everyone can be saved from sudden cardiac arrest, studies show that early defibrillation can dramatically improve survival rates.



**Figure 1: Cummins, R.O. 1989. From concept to standard-of-care? Review of the clinical experience with automated external defibrillators. *Annals of Emergency Medicine* 18: 1269-75.**

As equipment matures and technology advances, it is important to evaluate the age and capabilities of your AEDs to determine if it is time for a replacement.

## **Recommended Criteria to Determine AED Replacement**

### Age of Device

There are currently two sources that regularly review depreciation of medical supplies. The American Hospital Association's 2004 Estimated Useful Lives of Depreciable Hospital Assets lists the life expectancy of a defibrillator at five years. The Department of the Army Technical Bulletin (TB MED 7) lists life expectancy of a defibrillator at eight years.

Manufacturers also determine to discontinue products when parts may become obsolete and are no longer available for service and repairs. In addition, if your warranty is expired, it can become cost-prohibitive to service or upgrade the unit. Check with your manufacturer for any take-back or trade-in discounts that can help offset the cost of replacement.

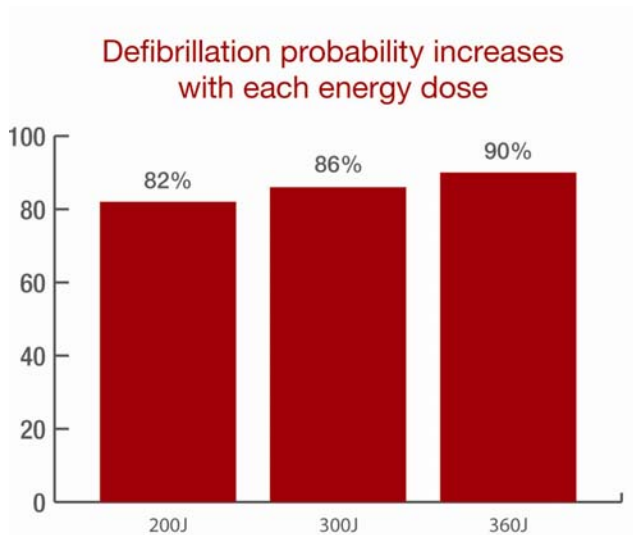
When you decide it's time to replace your AEDs, ask about the warranty period of your new devices. Physio-Control, for example, offers an eight-year warranty on the LIFEPAK CR<sup>®</sup> Plus AED – the longest warranty on the market today.

### Technology Improvements

**Biphasic waveforms.** Gentle, yet effective, biphasic waveforms are now the standard of care. It has been proven that biphasic waveforms are more effective than monophasic waveforms in converting chaotic heart rhythms to an organized heart rhythm. Because of the effectiveness of biphasic waveforms, defibrillators with monophasic waveforms are no longer manufactured. If you bought your unit before 2004, it is possible that it is a monophasic defibrillator.

**Escalating energy.** The ability to escalate energy to 360J can improve shock success when lower energy shocks fail<sup>1</sup>. This gives those difficult-to-defibrillate patients a better chance of survival. Currently, Physio-Control is the only manufacturer that escalates energy to 360J, an energy level used by many paramedics and physicians.

Further support for increasing energy up to 360J comes from a recent analysis of the behavior of biphasic shocks from a large set of out-of-hospital cardiac arrest data<sup>2</sup>. The study showed defibrillation probability increased in parallel with each higher energy dose (82% at 200J, 86% at 300J, 90% at 360J) in patients who received shocks at each of the three energy levels. In addition, clinical studies of both Atrial Fibrillation<sup>3</sup> and Ventricular Fibrillation<sup>1</sup> show no evidence of cardiac damage with escalating energy to 360 joules.



**Figure 2. For patients in VF, defibrillation probably increases with each energy dose. Walker, et. al, *Resuscitation* 2009; 80: 773-777.**

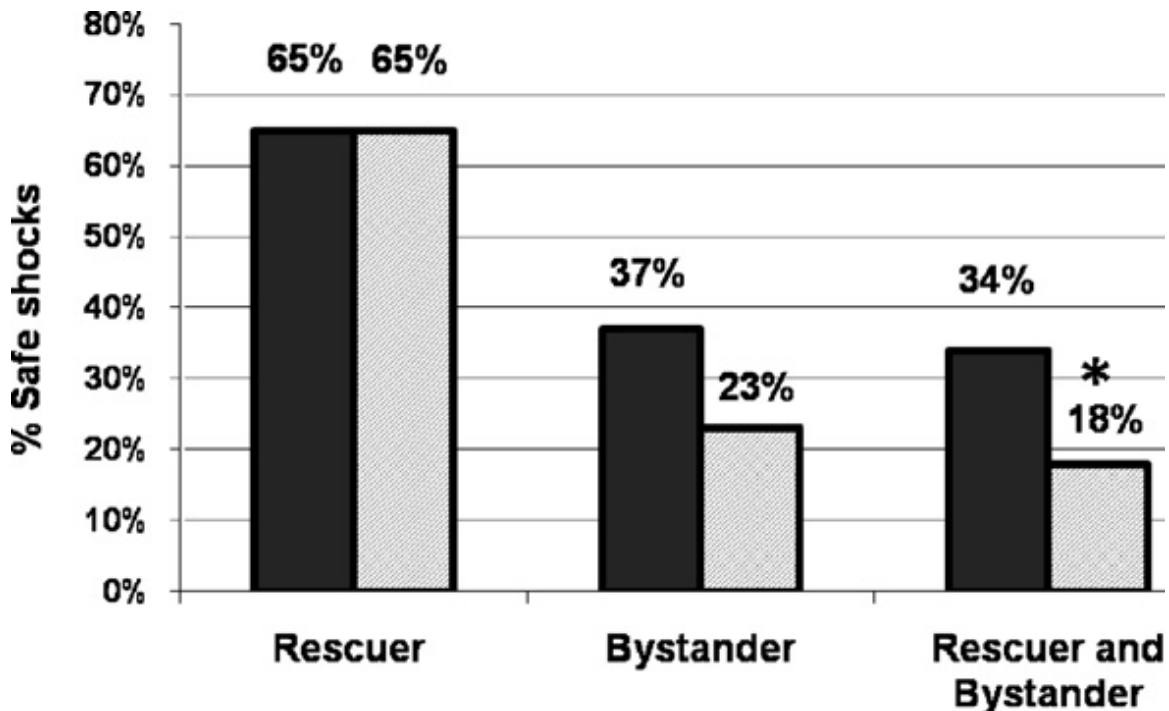
A defibrillator purchase is an investment that lasts years. Choosing an AED with full energy provides the flexibility to deliver the dose your patient needs as guidelines and protocols may evolve to reflect new understanding and research.

**Battery improvements.** Battery technology has improved significantly in recent years. Older units often require large, bulky batteries that are expensive to replace. Batteries in current AEDs are typically small and lightweight, carry a higher capacity, and are less expensive on a per year basis.

### **Usability Improvements**

**Fully automatic shock.** While all AEDs are designed to be user-friendly, fully automatic AEDs make it even easier for a responder to help a victim of sudden cardiac arrest. A fully automatic AED is designed to give a shock automatically, if needed, without the user having to push a button to deliver that shock. The device communicates clear, calm, step-by-step instructions that let responders know when a victim is about to be shocked. Fully automatic models are designed to help responders who may hesitate to push the shock button.

Two studies compared the behavior of untrained rescuers using a fully automatic or semi-automatic external defibrillator in a simulated cardiac arrest scenario. The first study found there was no difference in rescuer safety between a fully automatic and a semi-automatic device<sup>4</sup>. The other study demonstrated use of the fully automatic device resulted in fewer errors during shock delivery, and reduced the time interval from the first shock to the third shock.<sup>5</sup>



**Figure 3. Percentage of safe shocks. Black: FAED; Gray: SAED (\* $p < 0.05$ )**

**Clear voice prompts and step-by-step instructions.** Continual improvements in the quality and clarity of voice prompts and instructions are helping to better guide responders in deploying the AED device and delivering CPR appropriately.

For example, both the 2005 and 2010 AHA Guidelines state that after delivering defibrillation therapy, “the AED should instruct the rescuer to resume CPR immediately, beginning with chest compressions”. After the 2005 Guidelines were published, Physio-Control updated its LIFEPAK CR Plus AED device prompt to “Provide chest compressions and rescue breaths” to better align with the guidelines.

Visual indicators and voice prompt updates have also been added to help instruct the responder in placing the electrode pads appropriately. The simple, step-by-step instructions are continually reviewed and updated based on user feedback and new AHA Guidelines. If you purchased your AED prior to 2005, you can improve responders’ ability to deliver lifesaving intervention by updating your AEDs to take advantage of the most advanced prompts and instructions.

**Ease of maintenance.** To increase readiness assurance, today’s AEDs have indicators that notify you when the electrode pads are past the Use By date and when the battery requires replacement. Additionally, Physio-Control devices offer a synchronized replacement schedule for pads and batteries, minimizing the maintenance burden and helping to ensure your units will always be supplied and ready for use.

### **Compatibility**

Coordination with your EMS agency is key to a successful AED program at your facility. Inquire about the brand of devices your local EMS teams use. Aligning your program with your local EMS helps to streamline the transition of a patient from your facility to the ambulance to the hospital.

## References

1. Stiell IG, Walker RG, Nesbitt LP, et al. Biphasic trial: A randomized comparison of fixed lower versus escalating higher energy levels for defibrillation in out-of-hospital cardiac arrest. *Circulation*. 2007; 115:1511-1517.
2. Walker RB, et al. Defibrillation probability and impedance change between shocks during resuscitation from out-of-hospital cardiac arrest. *Resuscitation* 2009; 80:773-777.
3. Neal S, et al. Comparison of the efficacy and safety of two biphasic defibrillator waveforms for the conversion of atrial fibrillation to sinus rhythm. *Am J Cardiol* 2003; 92(7):810-14.
4. Hosmansa, T., Maquoia, I, Vogelsb, C, et al. Manikin and simulation study: Safety of fully automatic external defibrillation by untrained lay rescuers in the presence of a bystander. *Resuscitation*. 2008; 77:216-219.
5. Monsieursa, KG, Vogelsb, C, Bossaertc, LL, et al. A study comparing the usability of fully automatic versus semi-automatic defibrillation by untrained nursing students. *Resuscitation*. 2005; 64:41-47.

**Note:** AED users should be trained in CPR and use of an AED. Some AEDs are prescription devices. Please consult your physician.