

cprMAX™ Technology

In recent years, the resuscitation community has focused its attention on the importance of CPR while a patient is in cardiac arrest. New international guidelines for resuscitation and emergency cardiac care have increased CPR time and eliminated stacked shock protocols.^{1,2} In addition, the medical community is requesting AEDs that provide more flexibility in integrating CPR and defibrillation, resulting in more time for CPR. cprMAX technology provides this flexibility.

TODAY'S CHALLENGE: **Grim Outlook for Many Cardiac Arrest Patients**

Despite the best efforts of emergency medical services (EMS) teams, average response times in the United States are longer than the recommended 5 minutes—often twice that long. In the interim, patients frequently receive no CPR or ineffective CPR. As their condition deteriorates, so does their chance for successful resuscitation.

CPR—particularly chest compressions—may be able to reverse some of the deterioration in patient condition and better prepare the heart for shock delivery.³

THE REQUEST: **Provide CPR Prior to First Shock Delivery**

Two key clinical studies have shown increased survival rates by providing CPR before the first shock is delivered in an EMS setting:

- Using historical controls, Cobb, et al, found survival rates increased from 17 percent to 27 percent in patients who received 90 seconds of CPR prior to the first shock—when EMS response time exceeded 4 minutes.⁴
- In a randomized controlled trial, Wik and colleagues found when response times were longer than 5 minutes, patients given three minutes of CPR prior to defibrillation had one-year survival rates of 20 percent, compared to 4 percent for patients who were defibrillated first.⁵

New resuscitation guidelines allow EMS systems to perform CPR prior to defibrillation when dispatch to EMS arrival time is greater than 5 minutes.^{1,2} In response to the evolving research, many EMS systems have already added periods of CPR before delivering shocks. But providing more CPR with today's AEDs requires EMS rescuers to work against the AED voice prompts or to delay attaching the AED to the patient.

cprMAX technology gives you the option to provide a specified CPR interval before delivering the first shock. It is highly flexible to accommodate your patient and CPR protocol requirements.

THE SOLUTION: **AEDs that Allow CPR Before First Shock**

cprMAX technology gives the option to provide a specified CPR interval before delivering the first shock. It is highly flexible, to accommodate patient and CPR protocol requirements. Care can be provided for patients in a way that complements how health care professionals work best.

Many EMS systems have already added periods of CPR before delivering shocks.

TODAY'S CHALLENGE: **Numerous Delays between CPR and Shocks**

The standard programming of AEDs create numerous interruptions between CPR and shocks. Because AED protocols assume that VF is persistent, devices are programmed to deliver a shock, check the patient to see if the shock worked, and repeat this process for up to three shocks before CPR resumes. This cycle of shocks is frequently referred to as 'stacked shocks.' It has been demonstrated, however, that in the vast majority of patients, VF can be terminated with a single Medtronic 200 J biphasic shock.⁶

The pulse check step also introduces delays to CPR time, despite the difficulty of locating a pulse and the fact that a pulse is almost never present immediately after a shock.

Two experimental studies that explore the impacts from gaps in CPR highlight these points:

- Berg, et al, discovered that in animals treated with an AED protocol, the average time between the first shock and first chest compressions was 46 seconds. No animal survived 24 hours. Animals treated with a manual defibrillator protocol received chest compressions in 22 seconds on average, with a 24-hour survival rate of 62 percent.⁷
- Yu, et al, explored the gap between the end of CPR and shock delivery. This animal study was specifically designed to measure the impact of gaps in CPR time on survival. Resuscitation success decreased as the gap between CPR and shock increased. In this model, no animal survived when the gap between CPR and shock extended to 20 seconds.⁸

THE REQUEST:

Limit Interruptions Between CPR and Shock

In response to this science, the new resuscitation guidelines limit the interruptions between CPR and shocks.^{1,2} New AED protocols eliminate stacked shocks and they allow AED providers to comply with these new guidelines.

THE SOLUTION:

AEDs Flexible Enough to Maximize CPR and Minimize Interruptions

cprMAX technology optimizes the interaction of defibrillation and CPR, with options to:

- Provide CPR while the AED is charging
- Prompt for CPR after each shock
- Eliminate pulse checks

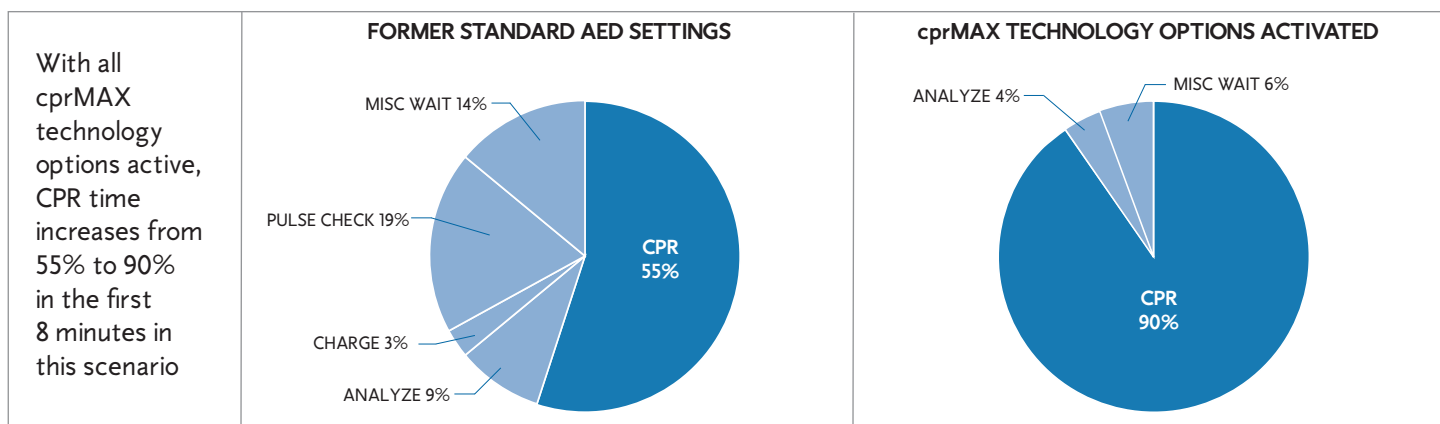
CONCLUSION:

In summary, the cprMAX technology enables an EMS medical director to tailor the AED protocol through the use of one or more options. These options provide:

- A CPR interval prior to the first shock (Initial CPR time),
- CPR during charging (Preshock CPR time),
- CPR after each shock (elimination of stacked shocks),
- Removal of the prompting for pulse checks.

In addition, each of the CPR intervals—except Preshock CPR time—can be up to 3 minutes.

The following chart shows the potential change in CPR that would be given using an AED with cprMAX technology compared to an AED with the former standard AED settings.



Assumptions: Patient is in VF and defibrillated with one shock. Patient refribrillates 30 seconds later. Each analysis takes 6 seconds. Each charge takes 8 seconds. Former standard AED settings: CPR intervals are one minute long. cprMAX technology options activated: Initial CPR time of two minutes, preshock CPR time is 15 seconds, all other CPR intervals are two minutes, stacked shocks eliminated, and AED does not prompt for pulse checks.

As new research increases understanding of key factors for patient survival, medical standards will continue to evolve. EMS rescuers need AEDs that can be adapted to reflect new evidence and updated guidelines. LIFEPAK® AEDs are designed to act like the defibrillators of today with the flexibility to be reprogrammed for the demands of tomorrow.

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Medtronic Emergency Response Systems, Redmond WA 98052 • For further information please call 1.800.442.1142 or visit medtronic-ers.com

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