LIFEPAK® CR Plus Defibrillator

Lifesaving Made Simple

SUMMARY The Medtronic CR Plus was found superior overall in **intuitiveness and ease of use** (also referred to as **usability**) compared to four competitors including Philips Heartstart FR2, MRL LifeQuest AED, Cardiac Science Powerheart AED and Zoll AED Plus. The usability or intuitiveness of operating an AED is critical because of infrequent use and many AED users are lay people performing a complex procedure to save a life under pressure. Every minute that defibrillation is delayed correlates with a 7-10 percent reduction in chance of success.

The aspects that make an AED highly usable hinges on providing the **right information at the right time**. Specifically, a good design provides only the appropriate information for users to **take the next action confidently and correctly**. A poorer design overloads users' thinking in many ways such as unfamiliar terminology, a mismatch between terminology in auditory and visual prompts or when a prompt is repeated, pictograms that are difficult to translate into a sequence of actions, or a treatment button that is difficult to find.

The Medtronic CR Plus was found superior overall in intuitiveness and ease of use because it has a **minimalist design** that provides effective support exactly when needed while avoiding user overload (too much information or too many choices at any point in time).

If you ever encounter someone in sudden cardiac arrest, you'll want to help. CPR is not enough—defibrillation is the only treatment for sudden cardiac arrest.

Medtronic, the world leader in medical technology, created the LIFEPAK CR Plus defibrillator specifically for the first person at the scene of a sudden cardiac arrest. Designed for the minimally trained and infrequent rescuer, it's easy to understand and use in a cardiac emergency, when every second counts. It's just plain simple.

METHOD Two highly experienced human factors engineers evaluated five AEDs to determine their usability. Human factors engineers are professionals trained in the principles and methodology of what makes a device intuitive for users of various backgrounds. The name of the profession derives from focusing on the **characteristics of the human, or human factor, in the two-way interaction that occurs when a person uses technology**.

In this study, two human factors engineers reviewed what users experience with each AED and identified usability strengths and weaknesses. This method is called an Expert Review. It draws on previous observation of hundreds of users, a deep understanding of principles underlying humans interacting with devices, and an equally deep understanding of human cognitive processes such as short-term memory.

PROCEDURE The study was comprised of three steps:

1. Identification of what makes an AED usable.

AED users are lay people working under time pressure and distraction to perform a complex procedure critical to saving someone's life. Therefore, the usability or intuitiveness of operating the device is critical to success. This is often referred to as a **good user experience**.

Due to the situation in which the device is used, a design that is highly usable will **inspire user confidence** and **minimize thinking**, also referred to as **cognitive load**. Specifically, a good design provides only the information needed for users to take the next action confidently and correctly, allowing users to progress step-by-step through the treatment episode. This is particularly important **during pad placement** when the majority of user errors occur.

In contrast, a poorer design overloads users' thinking, it creates too much cognitive load-by causing confusion and "extra" thinking. **This ultimately decreases users' accuracy and speed**. Causes include:

- Unfamiliar terminology,
- Mismatch between terminology in auditory and visual prompts or when a prompt is repeated,
- Pictograms that are difficult to translate into a sequence of actions,
- Too much information to wade through,
- Treatment button that is difficult to find.

Critical design aspects evaluated included:

• Whether the AED did all work possible for the user to **minimize opportunity for error** while **fostering a sense of control**. *E.g., Are all possible attachments already connected? Is there sufficient time to respond to the auditory instructions?*

• Clarity of design. This applies to instructions on all surfaces and modalities (screen, electrodes/pouches; pictorial, text; visual, auditory) and also to buttons and information on the screen. *E.g., Do the auditory instructions use common words users know? Are the pictograms (particularly on the electrodes/pouches) easy to understand and translate into action? Are buttons easily distinguished from informative graphics?*

• Minimalist design. This applies to instructions on all surfaces and in all modalities (screen, bags; pictorial, text; visual, auditory), and also to buttons and information on the screen. *E.g., Are there as few instructions as possible, did instructions use as few words as possible, in simple grammar, or simple visuals? Are there as few hard and soft buttons as possible? What about the level of information on the screen such as current date and time or elapsed time?*

• Instructions for only **one step at a time** so that user could **concentrate on only one goal at a time**. This applies to instructions on all surfaces and modalities (screen, bags; pictorial, text; visual, auditory). *E.g., Do the instructions present more than one step at a time causing more than one goal to think about? Is it clear which step was the current step? Is it clear on which steps to use the AED?*

• Consistency and coordination of all instructions and repetitions so that they **reinforce each other** rather than **appearing to contradict**. *E.g., Do repetitions of a single instruction use similar enough presentation (wording or pictogram) to seem like the same instruction, or does the repetition seem like a new instruction?*

• Adequately **addressing each step in the users' mind** regardless of the "objective size" of the step. *E.g., Does pad placement receive enough emphasis for users to understand its importance? Are the steps during pad placement small enough for users to perform this critical and difficult step correctly?*

• Provision of feedback about the current state of the device so that users **know that the right thing is happening**. *E.g., Can users tell when the device was monitoring, charging to shock, etc.*

2. Exploration of user experience in a wide variety of realistic scenarios.

Each AED was evaluated in typical training scenarios such as the victim being in ventricular fibrillation and responding to a single treatment shock, needing more than one treatment shock, etc. Also explored was a wide variety of circumstances users may introduce such the as spilling the contents of the carrying case, discarding the electrode pouch after opening, attaching electrodes before turning on the device, and not pushing the shock button when directed. These events are to be expected given the unusual and stressful nature of the situation.

Again, throughout all scenarios and circumstances, **the AEDs were evaluated for ease of use and understanding of the step-by-step experience**. Specifically, the step-by-step experience was evaluated with the above criteria as applied to typical users' demographics and psychographics, including their knowledge, attitudes, and cognitive strengths and limitations.

3. Summary evaluation of the user experience of each AED.

Based on the identified strengths and weaknesses of each AED, a summary evaluation was derived for each AED.

CONCLUSION The Medtronic CR Plus was found superior overall in **intuitiveness** and **ease of use**, the two key ingredients to **usability**. The CR Plus's superiority derives from providing only the right information at the right time **to move users successfully through the treatment episode**.

In addition, the CR Plus does so without weaknesses observed in other AEDs that can create high cognitive load by burdening users' thinking and ultimately **interfering with accurate and timely performance**. Examples of weaknesses include use of unfamiliar terminology, a mismatch between terminology in auditory and visual prompts or when a prompt is repeated, pictograms that are difficult to translate into a sequence of actions, or tones that evoke incorrect expectations.

In summary, the Medtronic CR Plus was found superior overall in usability because it has a minimalist design that provides well-targeted and effective cognitive support while avoiding user overload.