A usability study

Mac-Lab™ | CardioLab™
AltiX Edition

A usability study with experienced clinicians and technologists measured general usability and reactions to specific new characteristics of the hemodynamic and electrophysiology recording system from GE Healthcare.

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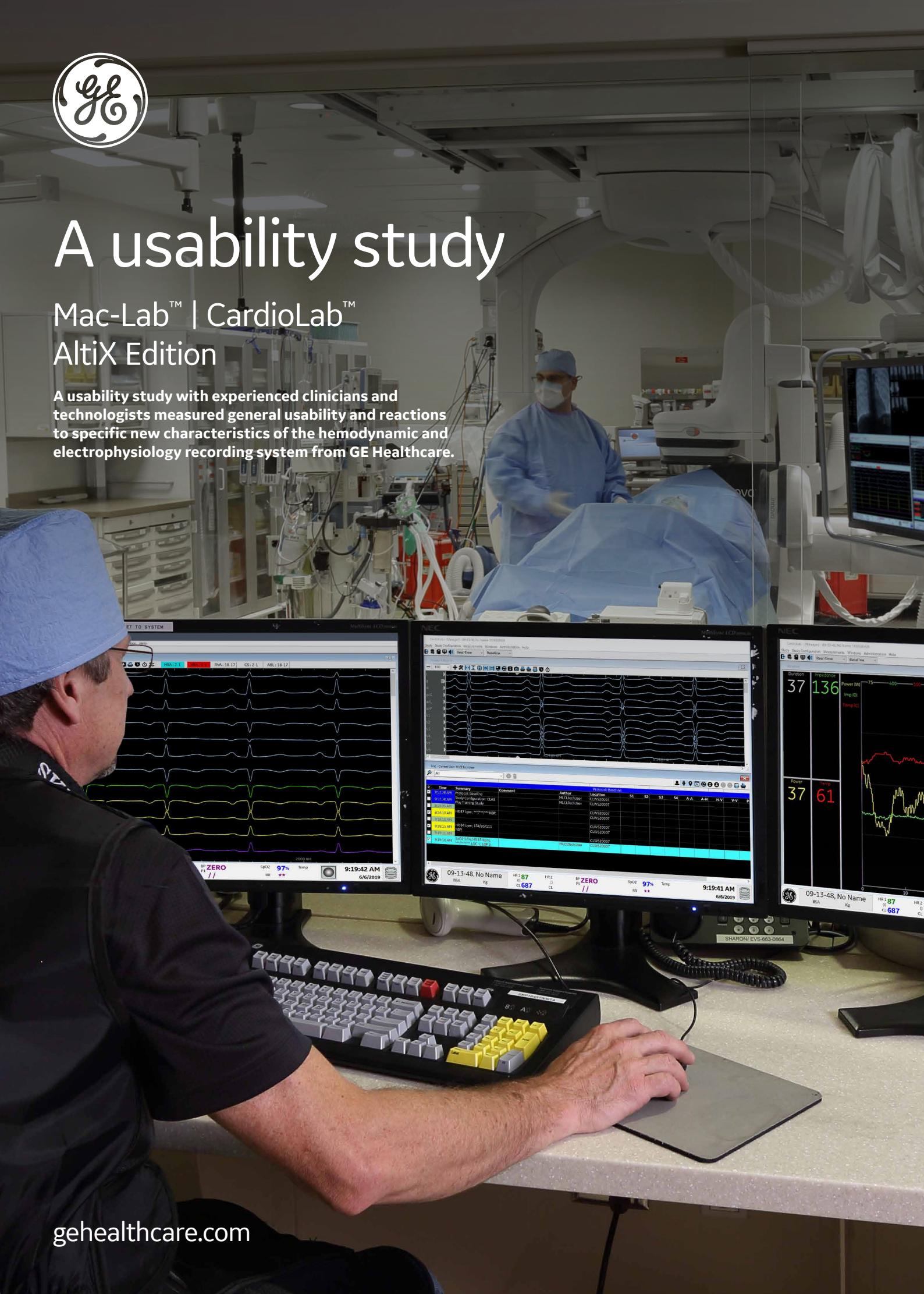
Introduction

Hospitals applying technology always aim to create an environment in which physicians can deliver excellent patient care with minimal administrative effort. This is especially important in the cath lab and EP lab.

Since cath lab and EP workflow is dynamic, premium patient care depends on an understanding of how the user interface can support cognitive workflow[1]. One way to further this understanding is through usability evaluations[1]. Usability is the extent to which a technology helps users achieve their goals in a safe, satisfying, effective and efficient manner within the constraints and complexities of their work environment[2].

The Mac-Lab/CardioLab AltiX Edition hemodynamic and intracardiac recording system (GE Healthcare) is designed to provide hospital clinicians with a safe, flexible, reliable, and secure solution.
It offers a single system that adapts to current workflows, enabling users to perform procedures efficiently and accurately.

Objective

To test the usability and user experience with new features of the Mac-Lab/CardioLab AltiX Edition system, GE Healthcare commissioned a study in which clinicians and technologists used the system and then reported on their experiences.

Participants

Nineteen participants were recruited. Twelve were Cardiovascular Technologists, four were cath lab nurses, two were EP Technologists, and one was an Interventional Electrophysiologist.

The participants had total cardiac cath and/or EP lab experience ranging from two to 40 years. All had experience with the Mac-Lab system (seven), the CardioLab system (four), or both (eight), ranging from three to 25 years.

Key Findings

GE Healthcare commissioned a usability study to test usability and user experiences with specific new features of the Mac-Lab/CardioLab AltiX Edition hemodynamic and intracardiac recording. During the study, clinicians and technologists used the system and then reported on their experiences. The key findings:

- 84% of participants found the system intuitive
- 95% found the system had an updated look and feel
- 89% found the system customizable to their workflow
- 81% believed the system would simplify workflow in the cath lab
- 86% believed the system would simplify workflow in electrophysiology

Methodology

The study was conducted at a GE Healthcare site in Wauwatosa, Wisconsin, USA, from March 11-15, 2019. The usability study was performed on the following features:

New iconography, font style and color palette.
Participants were asked to give their opinions of the new icons on the Navigator, Real-Time and Review windows, using their knowledge of the current MLCL system as a baseline. They were also asked for their opinions on the overall readability of the font.

Update to Level of Pain/Level of Consciousness workflow.
This feature adds the new Level of Pain metric to a Vitals event and allows users to configure the default scale of the Level of Consciousness/Level of Pain selections. Users were asked to remark on their ability to change the scale and what scale they would generate.

Macro color-coding.
This feature changes the color of a macro initiated by the user. The color change occurs only once and persists during the open study. Once the study has been closed, all macros that have changed color revert to the default color. Users were asked to initiate macros and tell whether they noticed the color change, what they thought it initially meant without prompting, and whether it was helpful.

Work stand ergonomics.
The mobile work stand has been redesigned to accommodate new hardware. To identify any ergonomic issues, it was tested using various physical movements.

Feedback during the test was taken using the Concurrent Think Aloud (CTA) and the Concurrent Probing (CP) usability methods. This was done to understand participants' thoughts as they interacted with the product. At the end of each session, each participant was given the GE Healthcare System Usability Score (SUS) survey, which measures the overall usefulness of a product (see next page). In addition, feedback on specific feature-based questions was obtained.
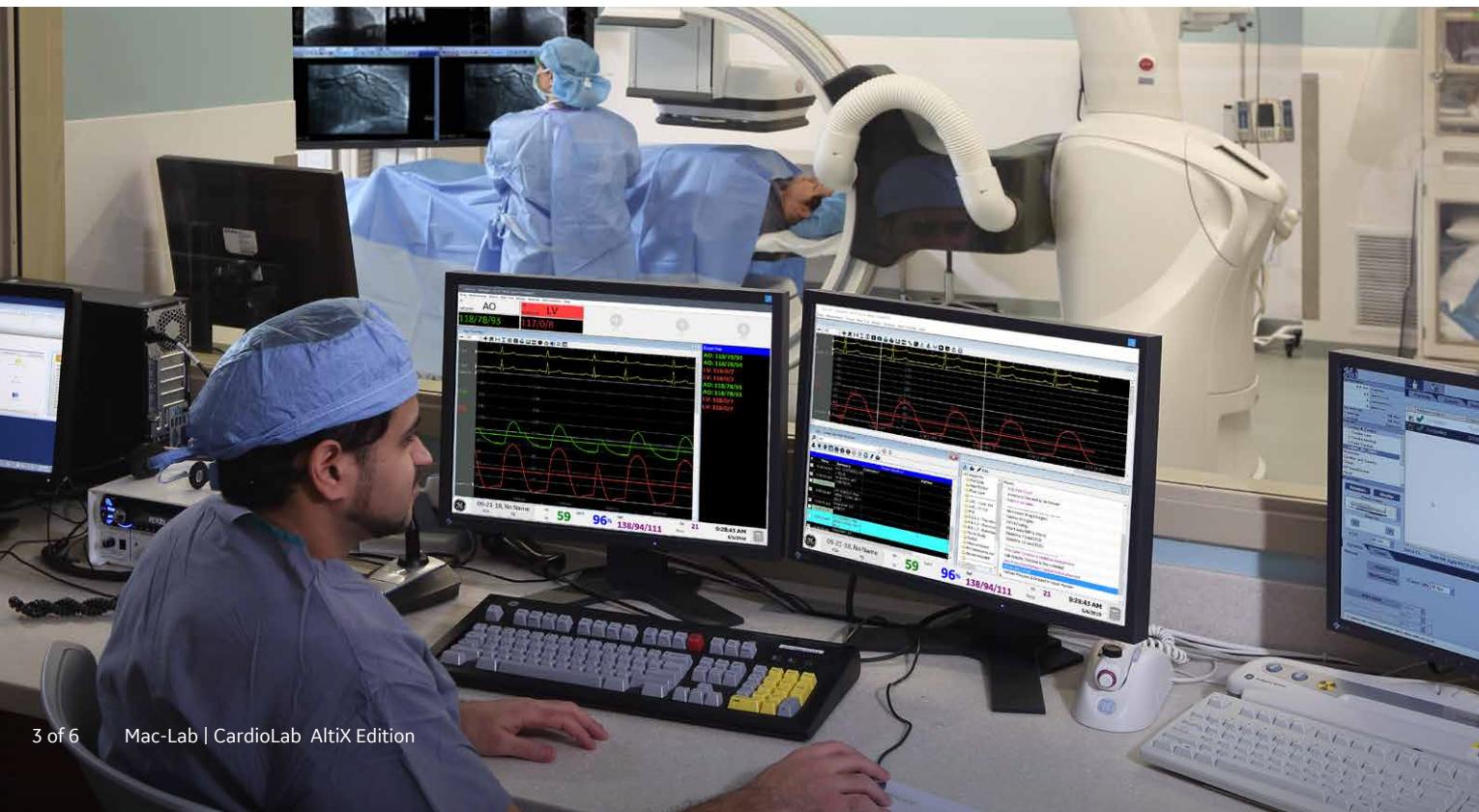
Results

Summative testing results

- New iconography, font style and color palette. Users said the new icons did not hinder or distract from workflow. They found the icons similar enough to the previous versions to be familiar, yet different enough to feel fresh and modern. All found the new font more readable.

- Update to Level of Pain/Level of Consciousness workflow. All participants agreed it was beneficial to be able to change the scale, especially the Level of Pain scale, since many situations require a variable scale (e.g., a simpler 0-5 scale).

- Macro color-coding. 18 participants saw the new macro color coding as major improvement because it told them which macros had been initiated. This reduced redundant actions and duplication of log events.

System usability scale (SUS) questionnaire responses

The SUS questionnaire is an industry-standard assessment tool created in 1986 and recommended by the U.S. Department of Health and Human Services as a reliable tool for measuring usability. Participants were asked to score a set of 10 standard items with one of five responses ranging from Strongly Agree (5) to Strongly Disagree (1).

The ten-item Likert-Scale produces a score between 0 and 100. Based on the SUS database of 500 studies, a score above 68 is considered above average and anything below 68 is below average[3]. Based on the ratings given to Mac-Lab/CardioLab AltiX Edition system, the SUS score was 87.4, which ranks above average (Figure 3).

Figure 3. Mac-Lab/CardioLab AltiX Edition overall SUS score
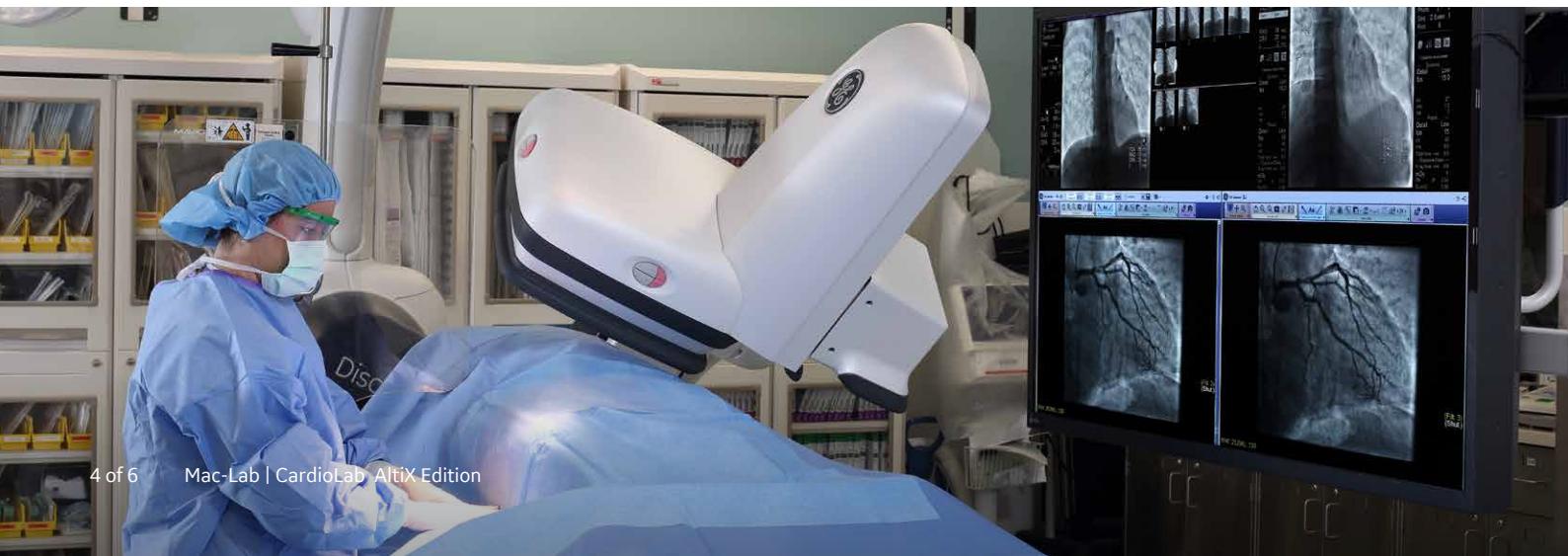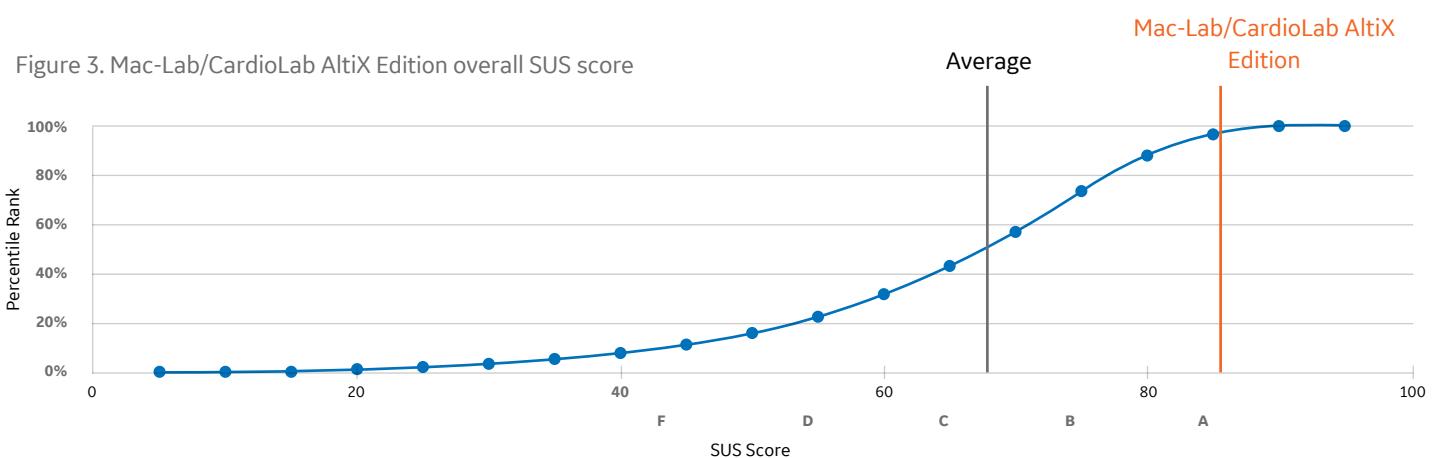
Results (continued)

Task/feature-specific questions.

1. I believe that this system is intuitive.
84% of the participants strongly agreed or agreed with this.

2. I believe that this system has an updated look and feel.
95% of the participants strongly agreed or agreed with this.
Participants noted the crispness/clarity, modern look, better readability, wider screen, updated but still familiar features, and macro colors. They mentioned that the system was brighter, clearer and sharper, and they found the updated icons easier to read. They also found the new digital waveforms much easier to read as there was less artifact in them.

3. I believe that this system is customizable to my workflow.
89% of the participants strongly agreed or agreed with this.

4. I believe that this system will simplify my workflow in the cath lab.
81% of the participants strongly agreed or agreed with this.
Participants mentioned that it was easy to work down the macro list with the change in color. They mentioned that it simplified the workflow as it saved time in figuring out what was done and where they were during the procedure.

5. I believe that this system will simplify my workflow in the EP.
86% of the participants strongly agreed or agreed with this.
Participants shared that the macros helped save time in understanding where they were is during the procedure, without having to look at the log to figure it out. They also found that the wider screens were easy to read and stated that the ability to customize the workflow would make the workflow easier. Additionally, they observed that customization would enable hospitals to set it up to make their workflow easier.

"I like the font. It is a bit easier on the eyes and easier to see. It looks pretty much the same as what it was before, which is good, because it's not too unfamiliar"
Cath Lab Nurse

"I really liked how when I clicked on something, it changed colors so I would remember I did that portion of the macro already."
Cardiovascular Tech

"I like the fact that (the macros) have the different colors on what you picked, because if we miss anything, it stands out."
Cardiovascular Tech

"I really like that (the log window) switches over to the different user names, and the user tracking of the authors of the log entries."
Cardiovascular Tech

"It would cut down on time. Any time you're spending just looking for certain things on the computer is just extra time you're adding on to the procedure."
Cardiovascular Tech

"Less noise on signal, more space/ more tracing"
Electrophysiologist

Conclusion

This study documents clinicians' experiences with and responses to GE Healthcare's Mac-Lab/CardioLab AltiX Edition.

The participants gave a SUS score of 87.4 which is well above the average. The iconography, font style and color palette were appreciated as it was updated but still familiar.

Users gave positive feedback on the new features of the product, giving favorable assessments of intuitiveness, the ability to customize, and the color-coded macros.

They noted that macros could reduce duplication of log events and thus simplify their workflow. Participants also found the signal quality sharper and clearer and shared that the monitor length placed more signal within view.

Sources:

1. Grabenbauer LA, Fruhling AL, Windle, JR (2014) Towards a Cardiology/EHR Interaction Workflow Usability Evaluation Method. 2014 47th Hawaii International Conference on System Science. Available at: https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=6758931

2. Ratwani RM, Benda NC, Hettinger AZ, Fairbanks RJ. Electronic Health Record Vendor Adherence to Usability Certification Requirements and Testing Standards (2015). JAMA. 314(10):1070–1071. Available at: https://jamanetwork.com/journals/jama/fullarticle/2434673

3. Usability.gov (2019) System Usability Scale (SUS). Available at: https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html

About GE Healthcare:

GE Healthcare is the $19.8 billion healthcare business of GE (NYSE: GE). As a leading provider of medical imaging, monitoring, biomanufacturing, and cell and gene therapy technologies, GE Healthcare enables precision health in diagnostics, therapeutics, and monitoring through intelligent devices, data analytics, applications, and services. With over 100 years of experience in the healthcare industry and more than 50,000 employees globally, the company helps improve outcomes more efficiently for patients, healthcare providers, researchers and life sciences companies around the world. Follow us on Facebook, LinkedIn, Twitter and The Pulse for latest news, or visit our website https://corporate.gehealthcare.com/ for more information.

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