PHILIPS

Ultrasound

EPIQ CVx

Designed for cardiologists.
Built for better care.

Evaluating the technical features and user experience of Philips EPIQ CVx

Background

Philips has introduced a dedicated cardiology ultrasound system: the Philips EPIQ CVx. The new system delivers the latest technology advancements and insights gained from both imaging cardiologists and sonographers.
The EPIQ CVx is designed around the needs of both diagnostic and interventional cardiologists working in adult and pediatric medicine.

To evaluate the functionality, performance and usability of its latest development, Philips engaged an independent usability engineering consultancy and interface design expert, Use-Lab GmbH from Steinfurt, Germany. Use-Lab was tasked with conducting a study to compare the new EPIQ CVx to the Philips iE33 ultrasound system.

Method

The study was performed by Use-Lab with the assistance of Philips employees at the 2017 EACVI EuroEcho-Imaging Congress held in Lisbon, Portugal.
In total, 42 experienced echo cardiographers, specializing in diagnostic and/or interven-tional cardiology, were surveyed. Each participant received a live demonstration of the iE33 and the EPIQ CVx. Subsequently, they were asked to indicate the extent to which they agreed with a number of pre-formulated statements ('claims') comparing the performance, usability and workflow of the two systems.

Results

The participants overwhelmingly felt, based on their average 18.5 years of experience, that the performance and usability of the Philips EPIQ CVx exceeded that of the Philips iE33 system. The individual claims are outlined on pages 8 and 9.

Overview

The EPIQ CVx is a dedicated cardiac ultrasound system that offers a wide range of 2D and 3D transthoracic and transesophageal echo imaging. It delivers exceptional image quality and significant advances seeking to address the strains on today's overburdened staff and healthcare systems.

To assess acceptance of the new EPIQ CVx cardiac ultrasound system, Philips enlisted the support of Use-Lab, from Steinfurt, Germany, an independent usability engineering consultancy and interface design agency. The evaluation, designed by Use-Lab, aimed to validate customer perception of the new EPIQ CVx relative to the well established Philips iE33.
This was done utilizing a claims-based investigation protocol.

The specific areas evaluated were:
- Ease of operation and workflow
- Improved image quality: sharper and clearer image
- Improved diagnostic confidence
- Increased lab throughput
- Simplification and efficiency of interventional procedures

The new EPIQ CVx includes all the features of the iE33 plus additional unique developments designed to meet the needs of today's diagnostic and interventional cardiologists.
The innovations presented to the study participants included:
- Configurable touchscreen user interface
- Dynamic HeartModel[A.I.] cardiac quantification
- PureWave pediatric S9-2 transducer
- Live 3D photorealistic rendering
- MultiVue MPR alignment
- AutoSTRAIN as a tested feature

Please refer to page 10 and 11 for feature descriptions.

Study methodology

1. Process and procedure

The validation study was designed to gather subjective input on a number of pre-defined claims relating to individual product features of the EPIQ CVx as well as to the system in its entirety. The study was jointly conducted by Use-Lab and Philips. Use-Lab was responsible for data capture, analysis and reporting while Philips recruited and scheduled respondents and introduced them to the EPIQ CVx system.

Philips and Use-Lab compiled a list of 33 statements ('claims') pertaining to the functionality, performance, and usability of EPIQ CVx. Questions were derived from these claims and presented in two questionnaires as statements or questions. Respondents were asked to indicate the extent to which they agreed with each statement using the five-point Likert scale – ranging from "I agree" to "I disagree", and sometimes, depending on the wording of the claim – 'very easy' to 'very difficult'.

In December 2017 at the EACVI EuroEcho-Imaging Congress in Lisbon, 42 current Philips iE33 users from 17 countries participated in the evaluation sessions.

Before the demonstrations and questioning began, respondents were welcomed and given a short overview of the procedure. They were then asked to complete consent and confidentiality paperwork and provide details of their clinical background. Based on the information they gave, and whether their interests lay mainly in diagnostic or interventional cardiology (or both), they were asked to complete the first of two questionnaires. The first questionnaire (tailored to the relevant professional profile) addressed general thoughts on working with ultrasound, including the iE33; and was filled out by imaging clinicians prior to seeing the EPIQ CVx. After completing this questionnaire, participants were given a brief refresher demonstration on the iE33 system with the aim of re-familiarizing them with key functions.

Subsequently, respondents were taken to another room containing the EPIQ CVx system. Here, a Philips trainer explained the system's features and demonstrated them on the system. Study participants were invited to try out the touchscreen themselves, by moving the virtual light source and 3D image of a photorealistic 3D rendering.

After the EPIQ CVx demonstration, participants were asked to complete a second questionnaire and rate their agreement with the defined claims using the aforementioned scale. If the respondent indicated they managed pediatric patients, they received an additional questionnaire pertaining to the use of ultrasound in pediatric cardiology.

A pre-defined, standardized script for both the iE33 refresher and the EPIQ CVx demonstration ensured a consistent baseline for all respondents, helping to maintain the reliability of the data. Throughout all live demonstrations and while participants filled out the questionnaires, Use-Lab team members oversaw the process and presentations to ensure consistency of message across all sessions as well as answer participants' queries and concerns.

2. Profile of respondents

All activities related to screening and recruiting respondents and scheduling sessions were performed by Philips. Philips recruited from its network of current ultrasound clients and at its official booth in the EuroEcho exhibition hall.

Everyone who took part was an experienced ultrasound user. Various subgroups were defined ahead of the study in order to tailor the sessions to the respondents' clinical interests. Participating clinicians were categorized as primarily diagnostic, primarily interventional, or both diagnostic and interventional. Furthermore, they were asked to indicate whether they also treated pediatric patients.

The overall profile of the participants – Respondent characteristics

Category	Characteristics	Number	
Sex	Female Male	17 25	
Years of experience	Median / range	18.5 years / 7 - 48 years	
Type of facility (multiple responses possible)	Type of facility / number of respondents	University Public Private	29 17 10
Countries represented		17	
Specialty (multiple responses possible)	Primary focus / number of respondents	Adult D&I Adult diagnostic Pediatric – D&I Sonographer *Additionally see pediatric patients*	30 3 8 2 5

Example of how a claim was formed
Claim 12 is evaluated based on two statements. 37 of 38 respondents agreed to the first statement; 37 of 38 agreed to the second statement. However, a total of 36 of 38 agreed to both statements, because two different respondents did not agree with statements 1 and 2. This leads to an overall agreement of 94% (36 of 38 respondents).

Question / statement	Total responses	1		2		3		4		5		Statement agreement (4&5)	
		n	%	n	%	n	%	n	%	n	%	n	%
I believe good alignment is essential to measuring valves for correct device sizing.	38	0	0%	0	0%	1	2%	3	7%	34	89%	37	97%
I believe the EPIQ MultiVue – live 3D cropping and MPR alignment tool could improve alignment accuracy for sizing the relevant device for the procedure.	38	0	0%	0	0%	1	2%	11	28%	26	68%	37	97%
Overall	38											36	94%

Data analysis

Use-Lab collected respondent data and responses in a confidential manner; responses were not linked to a respondent's name. During and following completion of the questionnaire, there was no verbal discussion with the respondent regarding the questionnaire or the responses. Use-Lab handled all finalized questionnaires and data, which was not shared with Philips until the final data was provided.

Post data collection, all gathered information was then analyzed. Due to the nature of the method used during this investigation, descriptive statistics were used to analyze the data. These data analyses provided a basis for a judgment about whether certain claims can be supported.

Many claims are supported by more than one question. To determine the percentage agreement with these claims, the percentage of respondents who agreed with every supporting question was calculated.

Key findings and highlights

Diagnostic confidence

- **78%** of clinicians[1] who saw the new EPIQ CVx perceived it as able to drive improved diagnostic confidence due to improved image quality, anatomical intelligence (Dynamic HeartModel[A.I.] – Innovations to HeartModel[A.I.]) and advanced visualization tools (e.g., TrueVue and the OLED monitor).
- **90%** of clinicians[1] who saw the new EPIQ CVx felt the new TrueVue 3D photorealistic rendering improved viewing of anatomical structures thus increasing clinical confidence.
- **89%** of clinicians[3] who saw the new EPIQ CVx perceived it as able to drive improved confidence during procedure guidance due to improved image quality, advanced workflow (MultiVue – Live 3D cropping and MPR alignment tool), and advanced visualization tools (e.g., TrueVue and the OLED monitor).

[1] Based on responses from 41 respondents
[2] Based on responses from 42 respondents
[3] Based on responses from 38 respondents
[4] Based on responses from 31 respondents

Usability and workflow

- **92%** of clinicians[2] who saw EPIQ CVx believed it would be easy to operate.
- **90%** of clinicians[2] think with the use of touchscreen, it's easy to move/rotate photorealistic TrueVue rendering and positioning light source.
- **85%** of clinicians[1] who saw EPIQ CVx thought the customization of the user interface would improve their on-cart scanning workflow.
- **100%** of clinicians[4] who saw the new EPIQ CVx believe the EPIQ CVx's AutoStrain software is easier to use than the iE33's strain package.
- **75%** of clinicians[1] who saw the new EPIQ CVx felt the EPIQ CVx monitor provided an enhanced user experience.
- **86%** of clinicians[3] who saw the new EPIQ CVx thought that the new cardiac user interface would help make ultrasound guided procedures more streamlined.

Overall claims

Result
92% of clinicians[1] who saw EPIQ CVx believed it would be easy to operate. [1] based on responses from 42 respondents
95% of clinicians[1] who saw the new EPIQ CVx believed it offered improved image quality: sharper and clearer images. [1] based on responses from 42 respondents
78% of clinicians[1] who saw the new EPIQ CVx perceived it as able to drive improved diagnostic confidence due to improved image quality, anatomical intelligence*, and advanced visualization tools** * Dynamic HeartModel[A.I.] – Innovations to HeartModel[A.I.] **e.g., TrueVue and the OLED monitor. [1] based on responses from 41 respondents

EPIQ CVx diagnostic pediatric feature claims

Result
The new pediatric PureWave transducer is designed to allow for scanning across a wider body habitus. 84% of clinicians[1] who see pediatric patients and saw the new EPIQ CVx, believe that this can lead to less switching of transducers during an exam resulting in faster scans. [1] based on responses from 13 respondents
92% of clinicians[1] who work with pediatric patients and saw the new EPIQ CVx thought the coronary submode on EPIQ CVx would enable them to evaluate coronary arteries and flow more quickly and more easily. [1] based on responses from 13 respondents
92% of clinicians[1] who see pediatric patients and saw the new EPIQ CVx thought they would be able to detect disease states such as Kawasakis, anomalous coronaries or coronary artery fistulas better with EPIQ CVx's coronary submode than with their current systems. [1] based on responses from 13 respondents
92% of clinicians[1] who see pediatric patients and saw the new EPIQ CVx thought the new PureWave S9-2 transducer would allow for superior imaging for 2D mode. [1] based on responses from 13 respondents

EPIQ CVx diagnostic feature claims

Result
TrueVue
90% of clinicians[1] think with the use of touch screen it's easy to move/rotate photorealistic TrueVue rendering and positioning light source. [1] based on responses from 42 respondents
90% of clinicians[1] who saw the new EPIQ CVx felt the new TrueVue 3D photorealistic rendering improved viewing of anatomical structures thus increasing clinical confidence. [1] based on responses from 42 respondents
User interface (UI)
85% of clinicians[1] who saw EPIQ CVx thought the customization of the UI would improve their on-cart scanning workflow. [1] based on responses from 41 respondents
OLED
75% of clinicians[1] who saw the new EPIQ CVx felt the EPIQ CVx monitor provided an enhanced user experience. [1] based on responses from 41 respondents
Dynamic HeartModel[A.I.]
97% of clinicians[1] who saw the new EPIQ CVx believed quicker left-heart quantification would result in increased lab throughput. [1] based on responses from 41 respondents
Coronary modes
92% of clinicians[1] who work with pediatric patients and saw the new EPIQ CVx thought the coronary submode on EPIQ CVx would enable them to evaluate coronary arteries and flow more quickly and more easily. [1] based on responses from 13 respondents
TOMTEC AutoSTRAIN
100% of clinicians[1] who saw the new EPIQ CVx believe the EPIQ CVx's AutoSTRAIN software is easier to use than the iE33's strain package. [1] based on responses from 31 respondents
100% of clinicians[1] who saw the new EPIQ CVx believe the EPIQ CVx's AutoSTRAIN software is easier to use than the iE33's strain package. [1] based on responses from 31 respondents
96% of clinicians[1] who saw the new EPIQ CVx believe EPIQ CVx's AutoSTRAIN software is faster than the iE33's strain package. [1] based on responses from 31 respondents
96% of clinicians[1] who saw the new EPIQ CVx believe EPIQ CVx's AutoSTRAIN software is easier to use and faster than the iE33's strain package. [1] based on responses from 31 respondents

EPIQ CVx interventional feature claims

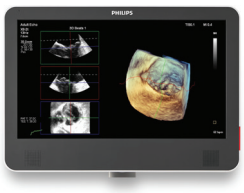
Result
83% of clinicians[1] who saw the new EPIQ CVx believed that EPIQ CVx would help to reduce the time needed for ultrasound guidance during Cardioband (Edwards) and tricuspid valve procedures. [1] based on responses from 30 respondents
80% of clinicians[1] who saw the new EPIQ CVx thought that using EPIQ CVx in combination with the new Live 3D TEE would help to increase the efficiency of ultrasound guided procedures. Where efficiency means quicker ultrasound guidance during procedures. [1] based on responses from 30 respondents
94% of clinicians[1] who saw the new EPIQ CVx thought that it would permit them to guide innovative procedures. [1] based on responses from 38 respondents
89% of clinicians[1] who saw the new EPIQ CVx perceived it as able to drive improved confidence during procedure guidance due to improved image quality, advanced workflow*, and advanced visualization tools** * X's MultiVue – Live 3D cropping and MPR alignment tool **e.g., TrueVue and the OLED monitor. [1] based on responses from 38 respondents
MultiVue
100% of clinicians[1] who saw the new EPIQ CVx believed that using the EPIQ CVx MultiVue alignment tool would simplify echo guidance for complex procedures. [1] based on responses from 38 respondents
84% of clinicians[1] who saw the new EPIQ CVx believed that the EPIQ MultiVue alignment tool would be easy to use. [1] based on responses from 38 respondents
94% of clinicians[1] who saw the new EPIQ CVx thought the EPIQ MultiVue alignment tool could help to reduce the risk of choosing an incorrectly sized device during interventional procedures. [1] based on responses from 38 respondents
TrueVue
90% of clinicians[1] think with the use of touch screen it's easy to move/rotate photorealistic TrueVue rendering and positioning light source. [1] based on responses from 42 respondents
90% of clinicians[1] who saw the new EPIQ CVx felt the new TrueVue 3D photorealistic rendering improved viewing of anatomical structures thus increasing clinical confidence. [1] based on responses from 42 respondents

Result
71% of clinicians[1] who saw the new EPIQ CVx believed that the new photorealistic TrueVue rendering can help to facilitate communication between the interventional cardiologist and the echocardiologist during complex ultrasound guided procedures. [1] based on responses from 38 respondents
84% of clinicians[1] who saw the new EPIQ CVx thought having the capability to move the light source inside photorealistic TrueVue rendering would make Live 3D images easier to understand during complex procedures. [1] based on responses from 38 respondents
User interface (UI)
85% of clinicians[1] who saw EPIQ CVx thought the customization of the UI would improve their on-cart scanning workflow. [1] based on responses from 41 respondents
86% of clinicians[1] who saw the new EPIQ CVx thought that the new cardiac user interface would help make ultrasound guided procedures more streamlined. [1] based on responses from 38 respondents
OLED
75% of clinicians[1] who saw the new EPIQ CVx felt the EPIQ CVx monitor provided an enhanced user experience. [1] based on responses from 41 respondents

Selected features

TrueVue – photorealistic rendering

For improved visualization of cardiac anatomy in transesophageal and transthoracic echo, Philips cardiology TrueVue, with its virtual light source makes it simpler to visualize the location of defects and comprehend depth within the structures. In interventional cardiology, TrueVue helps clinicians visualize the location of catheters and devices by providing images with improved tissue detail and depth perception. Since it offers a viewing context for the echo images, caregivers in the interventional suite can rely on support when communicating complicated echo images and enhance their procedural confidence.



MultiVue – live MPR alignment

During an interventional procedure, MultiVue on the Philips EPIQ CVx provides one-click alignment of the Live 3D volume and the MPR views as well as a way to crop the volume if required. This helps interventional cardiologists provide the right image at the right moment, or to make faster 3D measurements, for example for device sizing during mitral valve repair. It also provides a home position in live scanning to ensure that the clinician returns to the same orientation when back in Live 3D.

Dynamic HeartModel[A.I.] cardiac quantification

Philips Dynamic HeartModel[A.I.] is a 3D tool which provides robust, reproducible ejection fraction (EF) in seconds as part of a routine workflow. Dynamic HeartModel[A.I.] shows moving contours of the left ventricle (LV) and left atrium (LA) volumes. It also highlights newly automated measurements, including LV Mass and indices. Dynamic HeartModel[A.I.] now allows multi-beat analysis enabling quantification of patients who may be in arrhythmias.

AutoSTRAIN

AutoSTRAIN is the first TOMTEC application being integrated on EPIQ CVx. It's uniquely powered by advanced automation technologies: Automatic View Recognition which automatically recognizes and labels which view is the apical 4 chamber, 2 chamber and 3 chamber view and Automatic Contour Placement which automatically detects and places the left ventricle border. It delivers a one-button-push, robust and reproducible global longitudinal strain (GLS) measurement for everyday clinical use

Coronary sub-mode

The one-button coronary sub-mode, now on many cardiology transducers, helps clinicians who see pediatric patients detect disease states such as Kawasakis, anomalous coronaries and coronary artery fistulas.

S9-2 PureWave transducer

The next-generation pediatric 2D TTE PureWave S9-2 transducer allows you to visualize extraordinary levels of detail and contrast resolution with exceptional penetration at higher frequencies through ultra-wide bandwidth and next-generation single-crystal technologies that reinforces exceptional tissue information at greater depths with less noise. The S9-2 transducer comes with a one-button coronary sub-mode designed for easier and faster evaluation of the coronary artery.

OLED monitor
The 22-inch, 2nd generation OLED monitor on the Philips EPIQ CVx gives you an image 38% larger than traditional ultrasound images with no loss of resolution. As well as a 180° viewing angle, it also delivers a greater dynamic range, and a wider colour range over its predecessor. This enhances your view of side-by-side, colour compare, and all images.

User interface
The Philips EPIQ CVx has a user-configurable layout of the controls on the touch screen, allowing clinicians to position their most-used functions where they want them. The system has a tablet-like interface, which supports pinching, zooming and rotating even of 3D datasets. The new cardiac user interface is designed to dramatically decrease reach.

Conclusions

The Use-Lab analysis of the participant's responses to the new Philips EPIQ CVx showed a generally high level of agreement for the claims evaluation. Respondents predominantly experienced and expressed favorable impressions of the Philips EPIQ CVx cardiac ultrasound system, both as a whole and with regards to the individual features. This impression is reflected in the high overall levels of agreement with the claims.

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