The Power of Ultrasound + Artificial Intelligence

GE HealthCare

AI-driven ultrasound is solving challenges and supporting clinicians

Advancements in artificial intelligence (AI) in ultrasound are helping clinicians make more informed decisions faster and manage increased demand.

It's as if clinicians have a new teammate.

This is critical during a time when staffing shortages are the norm and many experienced clinicians are leaving the profession.

One survey of radiology technologists[i] indicates that heavy work load and burn out are key factors driving the departures.

Currently
10%
of sonographers in the US plan to leave the industry entirely[ii]

By 2030,
it is anticipated that there will be a shortfall of 10 million healthcare workers globally[iii]

81%
of health systems surveyed in the US reported radiology technologist shortages[i]

GE HealthCare: At the forefront of AI

For more than 25 years, GE HealthCare has been defining the ultrasound category.

Today, the company is ***redefining*** this category by pairing its expertise in ultrasound with groundbreaking AI capabilities.

GE HealthCare launched its first AI-powered tools more than five years ago, and today AI is a mainstay in many of its ultrasound products.

The company, as of October 2022, had more than 40 AI-enabled device authorizations across all modalities in the US, more than any other healthcare manufacturer.[iv]

Existing and emerging AI tools support not only clinical decision-making but also clinician well-being.

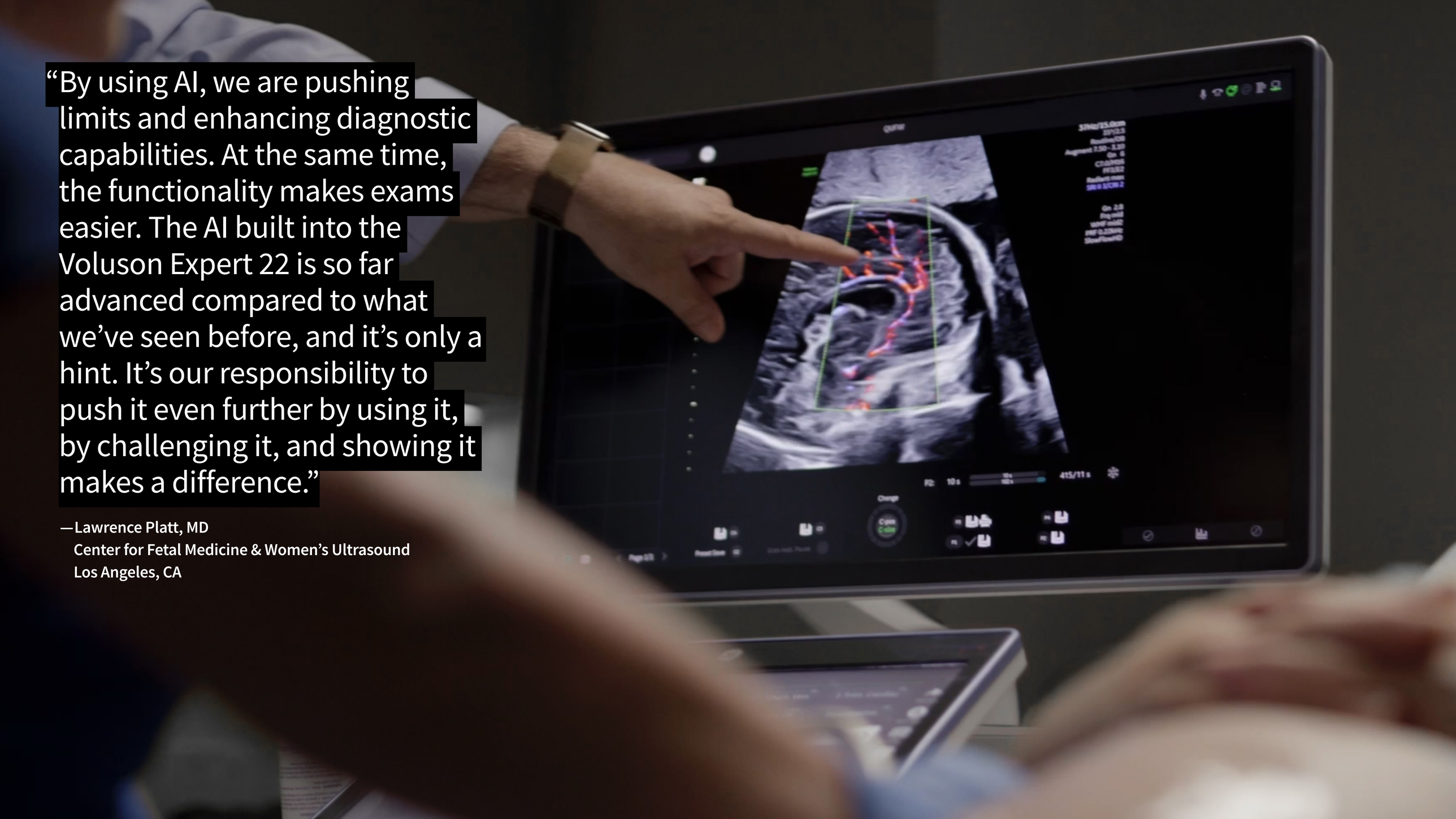
Improved workflows are driving efficiency, allowing clinicians to focus more on patient care. In addition, fewer repetitive clicks and manual manipulations aim to reduce operator musculoskeletal stress.

AI-powered ultrasound: Making an impact here and now

While some of what AI can do in combination with GE HealthCare ultrasound technology may seem futuristic, the fact is that clinicians are using AI-powered ultrasound systems now.

Advancements in AI-enabled ultrasound are helping reinvent care and unlock clinical challenges.

Every day, AI-powered ultrasound is supporting faster, more informed diagnoses, improved workflows, and a better experience for staff and patients, and is driving positive outcomes.



“By using AI, we are pushing limits and enhancing diagnostic capabilities. At the same time, the functionality makes exams easier. The AI built into the Voluson Expert 22 is so far advanced compared to what we’ve seen before, and it’s only a hint. It’s our responsibility to push it even further by using it, by challenging it, and showing it makes a difference.”

—Lawrence Platt, MD
Center for Fetal Medicine & Women’s Ultrasound
Los Angeles, CA

Some of the tasks that are now powered by GE HealthCare ultrasound with AI include[vi]:

GUIDANCE: AI-guidance that helps assist users with scanning.

STANDARDIZING

SonoLyst*, a suite of AI tools offered on the Voluson™ Expert 22 and Voluson SWIFT women's health ultrasound devices, **standardizes obstetrical exams**, improving consistency and saving time by identifying fetal anatomy seen on standard 2nd trimester views and further adding annotations and measurements, improving efficiency by 65%.[vi]

LABELING

Whizz Label on Versana Premier™ and Versana Balance™ ultrasounds **automatically labels liver, gallbladder, and right kidney** on ultrasound images during abdomen scans of the RUQ (right upper quadrant), helping to save time and enhance workflow productivity for users across experience levels.

MEASURING

On Vivid™ cardiovascular ultrasound, Easy AFI LV **ascertains measurement of the left ventricle** to measure strain in 15 seconds on average, and Easy Auto EF allows users to measure ejection fraction in just one click.[vii]

DETECTING

cNerve in the Venue™ family of point of care ultrasound devices helps anesthesiologists and other clinicians in 99% of cases **detect and track nerves** during scouting in nerve block procedures.[ix]

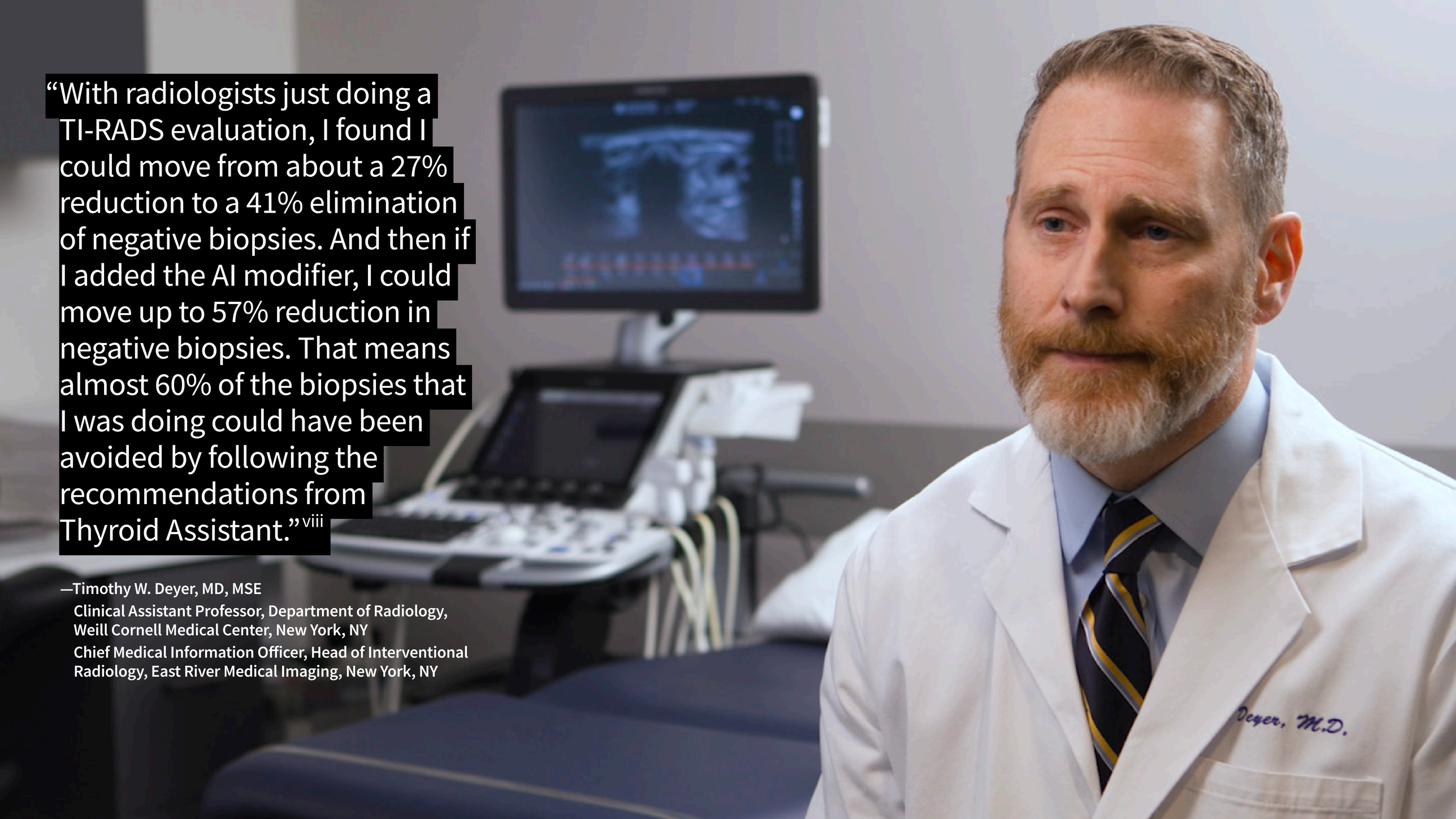
POPULATING

In near-real time, LOGIQ's™ Thyroid Assistant, powered by Koios DS™, **automatically populates all TI-RADS™ descriptors** and generates an AI-based thyroid cancer risk assessment using machine learning and proprietary algorithms, leading to a 57% reduction in benign biopsies.[viii]

*SonoLyst incorporates the AI technology of Intelligent Ultrasound.

ASSESSING

Breast Assistant, powered by Koios DS on the LOGIQ E10 and Invenia™ ABUS 2.0 ultrasound systems **automatically provides a quantitative breast malignancy risk assessment** aligned to a BI-RADS ATLAS® category in as little as two seconds.



"With radiologists just doing a TI-RADS evaluation, I found I could move from about a 27% reduction to a 41% elimination of negative biopsies. And then if I added the AI modifier, I could move up to 57% reduction in negative biopsies. That means almost 60% of the biopsies that I was doing could have been avoided by following the recommendations from Thyroid Assistant."[viii]

—Timothy W. Deyer, MD, MSE
Clinical Assistant Professor, Department of Radiology, Weill Cornell Medical Center, New York, NY
Chief Medical Information Officer, Head of Interventional Radiology, East River Medical Imaging, New York, NY

Ultrasound + AI has the power to help us know more and do more

Healthcare professionals are using the marriage of ultrasound and AI in three primary ways:

1

Guided ultrasound

2

Workflow productivity

3

Clinical decision support

1

Guided ultrasound

Its recent acquisition of Caption Health, a leader in AI for healthcare, signifies GE HealthCare's commitment to the **promise of using AI in guided ultrasound.**

AI is helping users, from the most experienced to newer healthcare professionals, acquire quality diagnostic images.

This broadens the set of professionals who can get consistently good images.

Caption Health's AI applications enable reliable, consistent ultrasound examinations to help the clinician deliver **more precise diagnoses with improved treatment decision-support**, and ultimately improved patient outcomes. The acquisition aims to help expand affordable access to ultrasound imaging to novice users and is aligned with a broader shift to precision care globally.

2

Workflow productivity

With increased demand for imaging services showing no sign of slowing down and a continued tight labor market, healthcare organizations continue to look for ways to ensure that time is spent on the highest-value tasks.

AI is a critical tool when it comes to saving time and clicks during scans. This not only increases productivity but also provides a better patient experience as well as easing the wear and tear on clinicians by reducing clicks and automating certain repetitive tasks.

87%
reduction in exam time

GE HealthCare's SonoPelvicFloor AI-powered tool on the Voluson Expert and Voluson SWIFT ultrasound devices removes the complexity from assessing pelvic floor anatomy by **guiding the user through the exam, automating plane alignment and measurements,** so exam time is reduced by 87% over manual exams.[x]

38%
reduction in radiologist reading time

Another time-saving advancement is QVCAD™ on Invenia ABUS 2.0. Invenia ABUS 2.0 is the first FDA-approved ultrasound supplemental screening technology specifically **designed for detecting cancer in dense breast tissue**. Adding QVCAD can reduce radiologist reading time for ABUS by 33%.[xi]

2

Reducing keystrokes and clicks are another key part of driving efficiency.

For clinicians and their health systems, reducing repetitive movements such as clicks and keystrokes can have a big impact.

90% of clinical sonographers experienced symptoms of work-related musculoskeletal disorders[xiii]

These injuries and related missed work time lead to up to **$120+ billion yearly** in direct and indirect costs for employers[xiv]

2-4
fewer manual steps

Whizz Label on Versana Premier and Versana Balance **automatically labels key organs** in scans of the right upper quadrant of the abdomen, removing 2-4 manual steps in the exam.

50%
reduction in keystrokes

Similarly, on LOGIQ E10 Series, Auto Doppler Assistant can **reduce keystrokes** by more than 50%.[xii]

3

Clinical decision support

The power of more knowledge to inform diagnosis and treatment is paramount, and adding AI to ultrasound exponentially adds to the clinician's knowledge.

Comparing over

400K

images

Tools such as Breast Assistant powered by Koios on GE HealthCare's general imaging ultrasound LOGIQ platform and Invenia ABUS 2.0 help physicians **confidently assess the malignancy of breast lesions** knowing that AI has compared their patient's lesion to more than 400,000 other images.

69%

reduction in benign biopsies

This diagnostic clarity can both help physicians **detect disease earlier and avoid unnecessary procedures** and treatments on non-malignant lesions. One study using Breast Assistant found a cancer identification rate of nearly 100%, with a 69% reduction in benign biopsies.[xv]

Addressing inter-operator and inter-reader variability

Ultrasound is especially vulnerable to operator dependence leading to variability between exams.[xvi]

In addition to inter-operator variability, there are also challenges with inter-reader variability. For example, when evaluating a thyroid nodule to determine if a biopsy is needed, radiologists with comparable training and experience **disagree with each other 25% of the time** making their diagnosis. In fact, when presented the same case only a month later, physicians disagree with themselves; **changing their initial diagnosis nearly 20% of the time**.[xvii]

41%

reduction in inter-reader variablility

Thyroid Assistant helps reduce inter-reader variability by 41%.[xvii]

AI-powered tools can help, not only with this inter-reader variability but also with inter-operator variability.

100%
reproducibility

AI Auto Measure – Spectrum Recognition on Vivid Ultra Edition semi-automatically detects appropriate measurement of spectral Doppler images, enabling the system to fast-forward the path from scanning to measurements with 98% accuracy and 100% reproducibility.[xviii]

1
click

Easy Auto AFI, automated one-click LV strain analysis, delivers AI-based global and segmental strain measurements that require no manual interaction apart from initiating the tool and approving the results.

Summary

In hospitals and clinics around the world, AI is elevating the power of many GE HealthCare ultrasound devices

Clinicians benefit with faster, more accurate results, increased diagnostic confidence, fewer musculoskeletal work-related injuries, and more efficient workflows.

Patients benefit from shorter exam times, fewer unnecessary procedures, and earlier diagnoses.

But this is only the beginning.

GE HealthCare envisions a future where data is connected, patients benefit from precision medicine, and artificial intelligence supports clinicians as it touches and improves every aspect of healthcare.

The future is one where healthcare has no limits.

A closer look

AI-driven innovations on GE HealthCare ultrasound devices

Today's reality:

90%
of sonographers experience work-related musculoskeletal disorders

$120+ billion
yearly in direct and indirect costs for employers due to injuries, staffing shortage, and increased demand

Experienced clinicians
leaving the profession

Inspired by these challenges, GE HealthCare is designing three primary types of AI solutions:

1. Guided Ultrasound
2. Workflow Productivity
3. Clinical Decision Support

Guided Ultrasound	
Caption Health for Guided Ultrasound	
Caption Health	Caption Health's AI applications for guided ultrasound help enable reliable, consistent ultrasound examinations to deliver more precise diagnoses, improved treatment decision-making, and ultimately improved patient outcomes

Technology	AI Tool	Workflow Productivity	Clinical Decision Support
Voluson Women's Healthcare Ultrasound			
Voluson Expert 22 Voluson SWIFT	***fetal*HS**	A step-by-step guidance that helps identify fetal situs and normal fetal heart anatomy using the 4-Chamber Heart, 3-Vessel View/3-Vessels and Trachea View, and Cardiac Axis. By acquiring a series of cine loops, views are automatically identified using AI and cardiac axis is calculated. *fetal*HS offers users a time-saving of 48% with the introduction of automated view detection and automated cardiac axis measurements.[xix]	
Voluson Expert 22 Voluson E10 Voluson S10 Expert Voluson S10 Voluson SWIFT Voluson S8 Touch	**SonoCNS**	SonoCNS helps properly align and display recommended views and measurements of the fetal brain. Reduces exam time by 81%[vi] (57% for Voluson SWIFT). Applying SonoCNS reduces the analysis time of datasets by 81.3%.[xix] SonoCNS performance has been improved, with time to access planes reduced by 16% and calculating measurements reduced by 29%, making the tool faster and more efficient.*[xx] *As compared to Voluson E10 BT19 version.	
Voluson Expert 22 Voluson SWIFT	**SonoLyst**	**SonoLystIR** Simply scan, then freeze, and SonoLystIR (Image Recognition) does the rest. SonoLystIR identifies the anatomy visualized, checks it off the list, and can initiate annotations or measurements. Confirm, and data is entered into the Scan Assistant checklist and report. Automatically identifies fetal anatomy on standard 2nd trimester views. By further adding annotations and measurements, SonoLyst improves your efficiency by 65%.[vi]	**SonoLystX** SonoLystX, your virtual, on-board ultrasound expert uses AI to compare the image or view acquired to standard criteria accepted by experts to ensure it meets the accepted clinical standards. Ideal for teaching and training, progress can be monitored for quality assurance to ensure the highest quality imaging standards and consistency.

Technology	AI Tool	Workflow Productivity	Clinical Decision Support
Voluson Expert 22 Voluson SWIFT	**SonoPelvicFloor**	Using a guided workflow and AI, SonoPelvicFloor removes the complexity of assessing pelvic floor anatomy. By guiding you through the exam, and automating plane alignment and measurements, you can reduce exam time by 87% over manual examinations.[x]	
LOGIQ General Imaging Ultrasound			
LOGIQ E10/E10s	**Anatomical Assistant**	Enables the ultrasound machine to be aware of *what* is being scanned in order to provide anatomical-based assistance to the user.	
LOGIQ E10/10s	**Auto Doppler Assistant**	Reduces time, keystrokes, and reach.	>20% time savings >50% key stroke reduction
LOGIQ E10/E10s LOGIQ Fortis	**Auto Lesion Segmentation**	Automatically traces nodule boundaries and generates two-dimensional measurements with just a few keystrokes.	
LOGIQ E10/E10s LOGIQ Fortis	**Breast Assistant, powered by Koios DS**	Results in two seconds or less.	Sensitivity increased from 92%-97% to 97%-98%. Specificity increased from 38%-46% to 45%-52%. Benign biopsy rates were reduced by 34%-55% without a reduction in sensitivity.[xxi] A study by Dr. Susan Love and Dr. Wendie Berg found a cancer identification rate of 100% with a 69% reduction in benign biopsies.[xv] 6 additional cancers found per 100 cases presented. Reduced BI-RADS 3 follow-up recommendations. Improved consistency of interpretation, both inter- and intra-operator.[xxii]
LOGIQ E10/E10s LOGIQ Fortis	**OB Measure Assistant**	Reduces keystrokes and enhances reproducibility by automating key fetal measurements.	

Technology	AI Tool	Workflow Productivity	Clinical Decision Support
LOGIQ E10/E10s LOGIQ Fortis	**Thyroid Assistant, powered by Koios DS**	Interpretation time fell by 24% compared to non-Koios-aided exams – enhancing the patient experience as well as department productivity.[xxiii]	In research studies, the tool helped users across all levels of experience make more informed FNA decisions compared to their own interpretations alone[xxiv]: • **Variability** from reader to reader was reduced by 41% – enabling more classification consistency across the department • **Specificity** for FNA recommendations improved by 37% – contributing to fewer unnecessary biopsy orders • **Sensitivity** for FNA recommendations increased by 14% – reflecting the ability to detect more true positives
LOGIQ E10/E10s	**Volume Navigation Image Based Registration (Vnav IBR)**	Research only tool.	
Vivid Cardiovascular Ultrasound			
Vivid E95, E90, E80 Vivid S70N, S60N Vivid T9, T8 Vivid iq EchoPAC™	**AI Auto Measure 2D**	Achieves fast measurements of left ventricle dimensions: • Up to 80% fewer clicks[xxv] • Up to 85% time saved on LV caliper measurements in the EchoLab[xxvi]	100% reproducibility.[xxvii]
Vivid E95, E90, E80 Vivid S70N, S60N Vivid T9, T8 Vivid iq EchoPAC	**AI Auto Measure - Spectrum Recognition**	Semi-automatically detects appropriate measurement of spectral Doppler images, enabling the system to fast-forward the path from scanning to measurements with 98% accuracy and 100% reproducibility.[xviii] Enables fewer manual interactions by automatically opening the appropriate measurement tool.	100% reproducibility.[xxviii]
Vivid E95, E90, E80 Vivid S70N, S60N Vivid T9, T8 Vivid iq EchoPAC	**Easy Auto EF**	Ejection fraction results in just one click.	100% reproducibility.

Technology	AI Tool	Workflow Productivity	Clinical Decision Support
Vivid E95, E90, E80 Vivid S70N, S60N Vivid T9, T8 Vivid iq EchoPAC	**Easy AFI LV with AI View Recognition**	Ejection fraction and strain results in 15 seconds on average.[vii]	100% reproducibility.
Vivid E95, E90, E80 Vivid S70N, S60N Vivid T9, T8 Vivid iq EchoPAC	**Cardiac Auto Doppler with AI Spectrum Recognition**	A wide range of Doppler measurements can be completed with 2 clicks. Up to 93% fewer keystrokes.[xxix]	
Vivid E95, E90, E80 Vivid S70N, S60N Vivid T9, T8 Vivid iq EchoPAC	**AI View Recognition**	Automatically detect which standard 2D scan plane is acquired and store this label in the image file to be used later for streamlining workflows.	
Venue Point of Care Ultrasound			
Venue Family	**Auto B-Lines**	Highlight and count B-lines in real-time. With counts as reliable as visual counting performd by experts.[xxx] Just press “freeze” to display the frame with the highest B-line count.	
Venue Family	**Auto IVC**		IVC measures were equivalent to those of an expert user 87% of the time for minimal diameters and 92% for maximal diameters.[xxx]
Venue Family	**Auto VTI**	Experience up to 82% time savings[xxxi] by quickly trending VTI over time and assessing the heart in a single step.	
Venue Family	**cNerve**	Use cNerve to identify the nerve landmark and see it highlighted on the image. Helps detect and track the nerve during scouting in 99% of cases while scanning or reviewing a stored clip.[ix]	

Technology	AI Tool	Workflow Productivity	Clinical Decision Support
Venue Family	**Real Time EF**		Continuously calculate the real-time ejection fraction during live scanning with results within +/-10 points of experts in 86% of cases.[xxx]
Invenia ABUS Automated Breast Ultrasound			
Invenia ABUS 2.0	**QVCAD™**	Reduce reading time by 33%.[xi]	Experience up to 93% sensitivity for lesion detection.[xxxii]
Invenia ABUS 2.0	**Breast Assistant, powered by Koios DS**	Results in two seconds or less.	Up to 31% decrease in benign biopsies on Invenia ABUS 2.0.[xxii]
Versana Primary Care Ultrasound			
Versana Premier Versana Balance	**Whizz Label**	2-4 steps reduced to spend more time caring for patients.	

Endnotes

i. "Radiology Staffing Shortages Nation Wide?", AHEC online, Sept 27, 2021.

ii. https://www.bls.gov/ooh/healthcare/diagnostic-medical-sonographers.htm

iii. World Health Organization, "Global Strategy on Human Resources for Health: Workforce 2030: Reporting at Seventy-fifth World Health Assembly", Departmental News, Geneva, June 2, 2022. https://www.who. int/news/item/02-06-2022-global-strategy-on-human-resources-for- health--workforce-2030

iv. Source: As of October 2022: https://www.fda.gov/ medical-devices/software-medical-device-samd/artificial- intelligence-and-machine-learning-aiml-enabled-medical- devices

v. Check local markets for availability. Not all products are available in all markets.

vi. JB20479XX / DOC 2727504.

vii. Time to strain measurement result may vary with heart rate, frame rate and Vivid system. Verification of performance done by GEHC clinical application specialists using Vivid system (DOC2739637).

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ix. Venue Family R4 cNerve study DOC2725435.

x. DOC2173180 – PC410 Claims Voluson SWIFT BT23.

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xvii. Koios Medical internal data. Available upon request.

xviii. The Role of AI in Streamlining Echocardiography Quantification White Paper, Kristin McLeod, Jurica Sprem JB20789XX.

xix. JB24039XX - 2023 Voluson Expert Series Product Claims.

xx. JB25187XX - 2019 Voluson Expert BT20 messaging.

xxi. Barinov L, Jairaj A, Becker M, et al. Impact of data presentation on physician performance utilizing artificial intelligence-based computer-aided diagnosis and decision support systems. *J Digit Imaging* (2018). https://doi.org/10.1007/s10278-018-0132-5. Barinov L, Jairaj A, Paster L,Hulbert W, Mammone R, Podilchuk C: Decision quality support in diagnostic breast ultrasound through artificial intelligence. IEEE Signal Processing in Medicine and Biology Symposium (SPMB)., 2016.

xxii. Mango et al. Should we ignore, follow, or biopsy? Impact of artificial intelligence decision support on breast ultrasound lesion assessment. *AJR*. June 2020;214:1145-1452.

xxiii. Koios Medical internal data. Presented at Society for Imaging Informatics in Medicine annual meeting, 2021.

xxiv. All Thyroid Assistant stats from Koios Medical internal data. Available upon request.

xxv. Applicable to the AI AutoMeasure-2D algorithm. Results based on GE internal data (DOC2361011).

xxvi. Based on an internal GE study where three observers were doing both manual and automated caliper measurements of LV study parameters on 25 PLAX acquisitions. The achieved timing varied both for the automated and the manual measurements, but on average, over a total of 71 data points, the manual measurements took 76 seconds, while just 11 seconds with AI Auto Measure 2D.

xxvii. Applicable to the AI Auto Measure – 2D algorithm. Results based on GE internal data (DOC2367624).

xxviii. Applicable to AI Auto Measure – Spectrum Recognition. Results based on GE internal data (DOC2292732).

xxix. Based on results of time and motion study conducted by GE "JB49055XX – Cardiac Auto Doppler"; study results indicated time savings related productivity.

xxx. Supporting evidence for Venue and Venue Go is documented in DOC2391130. Supporting evidence for Venue Fit is documented in DOC2454794.

xxxi. Supporting evidence is documented in ¬DOC2254811 Venue family - Auto tools.

xxxii. Performance and Reading Time of Automated Breast US with or without Computer-aided Detection. Read More: https://pubs.rsna.org/doi/10.1148/radiol.2019181816)

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