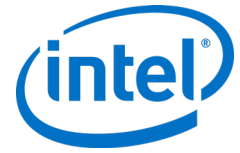


GE Healthcare Leverages AI and ML to Improve Patient Experiences



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Customer Spotlight Webinar

Mary Killelea: Welcome everyone. Thank you for joining us for Intel's Customer Spotlight Series. This series highlights innovative industry leading companies that are undergoing digital transformations, have tackled business and technology challenges, and created new opportunities using Intel's data-centric technologies and platforms. Today we're excited to welcome GE Healthcare for a conversation on how they are using artificial intelligence and machine learning to dramatically improve patient experience and health outcomes. Today's host is Tim Crawford. Tim is a strategic CIO adviser that works with enterprise organizations. Tim I'm going to turn it over to you now for introduction of today's guest.

Tim Crawford: Great, thanks a lot Mary, and welcome to everyone joining us live on the webinar. We've got a great conversation teed up for you today with GE Healthcare. And first let me introduce my guest which is Karley Yoder, who is the VP and GM for Artificial Intelligence at GE Healthcare. Welcome Karley.

Karley Yoder: Thanks so much Tim. I'm excited to discuss this topic with you today.

Tim Crawford: I think we have a lot of material to get through today and a lot of interesting insights. But maybe we should set the stage for folks that might know who GE Healthcare is, but maybe you can provide a little bit of guidance in terms of what aspects of GE Healthcare we're going to talk about today. And tell us a little bit about yourself and your role at GE Healthcare.

Karley Yoder: Sure Tim. Many of you may be familiar with GE Healthcare, but GE Healthcare is a leading provider of medical technology and digital solutions, really focused on enabling clinicians all over the world to make faster, more informed decisions through intelligent devices, data analytics, applications, and services. All of this is underpinned by our Edison Intelligence Platform, which I'll certainly talk about later. Simply put GE Healthcare is operating at the center of an ecosystem, working towards precision health, looking to digitalize healthcare, helping drive productivity, improve outcomes—a really energizing mission that makes me excited every day to get to play the role I do.

My role as a general manager for our AI segment is to partner across the GE Healthcare product line from our MR devices to CT devices to ultrasound to software solutions, to partner with those businesses and help strategically pick the right AI solutions to bring the most value, the most impact, the most improved outcomes to our providers, clinical partners all over the world. We at GE see AI as a technology with a really exciting potential if it can be harnessed in the right manner and used to simplify workflows, drive efficiency, and improve clinical outcomes. And it's really neat to get to lead that AI mission at a company with the trust and the healthcare impact that GE Healthcare has had for decades, if not centuries, with some of our product lines.

Tim Crawford: That's great Karley. And, I think it's always interesting to listen to someone talk about how they're using technology to change healthcare and change the patient experience. Let's maybe delve into that a little further and talk about the challenges that GE Healthcare is facing.

Karley Yoder: Sure. When we think about the challenge GE Healthcare is facing, we actually position it in the challenges that our customers are facing, the providers and clinicians that we support around the globe. And at the provider level, when you take a step back and look at what they are managing right now, the cards in many ways are stacked against them. They are constantly trying to do more with less, drive better outcomes at lower prices, treating more people at a faster pace than ever before. You know, we all in healthcare understand the dynamics of driving for better outcomes at a lower price, greater access.

On a personal note, actually my husband is a primary care doctor at a large institution here in California, and he comes home and talks about how COVID has even taken these challenges that our providers are facing around the globe and amped them up a level.

We at GE Healthcare really see it as our challenge to tackle those challenges head on, on behalf of our customers and see how we can help health systems use the best of digital technologies; whether that's AI, whether that's data aggregation, whether that's analytics, to help our providers be in the best possible position to respond to those macro challenges that continue to grow across the globe, across geographies, across different clinical practices. And we see that COVID-19 has accelerated the pace of this technological change, which in many ways is exciting, right? Some of the virtual care models that used to be nascent are beginning to become more and more accepted, but it also means it's a lot of change really fast; and we're seeing these changes dramatically in the medical imaging community where GE Healthcare has a strong core of our customer base.

As specialists are required to operate more products, work with more customers, deal with more images, there isn't always time to bring on new users, get through the volume that you wake up to in the morning. It's really important for us at GE Healthcare to build products, devices, and healthcare solutions that help providers work in the most efficient manner possible.

The question we've been trying to answer here at GE Healthcare even before COVID-19 was: how do we help providers around the world do their job better and faster to improve outcomes that truly matter for their patients?

Tim Crawford: And Karley, it might be beneficial for some that are listening to this to understand the process. Could you walk through what it means from a patient experience, from a physician's perspective, what it means to image a patient and what they have to go through to understand some of those challenges?

Karley Yoder: Great question Tim. There's lots of different scenarios where imaging as a modality or a way of collecting healthcare data, getting insights into a patient is used. One example is if you come into the emergency room and one of the very first things that a clinician will do to check your condition is often to use either a mobile X-ray or an ultrasound to get that first look into your lung and chest cavity

to see if everything is intact. And so imaging is often used as that first line of defense, that first insight to how an individual is doing in an emergent case. Once that imaging modality is used to collect data, that data goes to a radiologist who sits and reviews these images as they come in one by one. The current protocol there is kind of first-in, first-out, but AIs beginning to change that, and we'll talk about that a little bit later.

That's the imaging workflow. We use it in both these more emergent cases like the Emergency Room or in the ICU. If you have more of a chronic condition, you've been in the hospital for a while, or you're battling cancer, and you're coming in every few months we're able to use images to track the progression of various diseases; and all of those different images then get read by clinicians, radiologists in particular, to track and get insights into the health view of a patient. And at GE Healthcare, we create the devices that capture and create those images, also solutions that allow clinicians to view those images and make the right decisions for their patients in a quick manner. Tim, does that kind of that help put a workflow around it?

Tim Crawford: I think so. One of the things you mentioned in our past conversations was that it really requires someone with a specialty to be able to operate these devices as well as moving the patients around which then creates a whole new cast of unfortunate characters into the process. How did those things fit into these challenges?

Karley Yoder: Great question. Especially in our ultrasound space, which is a handheld probe, the training of the operator of the device is paramount. You have to know how to operate the imaging modality to collect the right information so that the clinician has a chance to make the right clinical diagnosis. And that training, whether its ultrasound, holding a device, or MR or CT, operating large scale machinery, can be time intensive and require a deep expertise. One of the things we're using AI for is to see how we can make that more intuitive, more simple for our users, so that folks can come up to speed quickly on how to use these devices.

Tim Crawford: Sure. So let's delve into that enabling aspect and how AI is really kind of stepping it up for GE Healthcare for the clinical experience from both the provider as well as the patient. Let's talk a little more about how you're addressing those challenges.

Karley Yoder: It's a great question, Tim, and really something to talk about. Before I speak specifically about AI, when we think back to all those challenges I described earlier in our conversations—the higher volumes, the rising costs, the need to drive access further—we say at GE that the way we'll tackle those macro problems and solve them is by enabling precision health. And the way that we define precision health is building products that allow providers to do the right thing at the right time for every patient at a global scale. And that's a big vision, that's a big mission. And one of the levers that we really use to try to move towards that vision is harnessing the best of digital and the best of AI in every product we create.

However, before I go into some of the use cases, for that technology to be as powerful as it can, it truly has to be invisible. What do I mean by that? If we build these beautiful technological solutions that actually make a clinician's job harder, we're not improving their experience. We're actually detracting

from it. Think about it like Google Maps, if every time there was traffic and you needed to take a different route you have to go open up a new app or go buy a new cell phone, that would be a mess, right? This is how AI is leveraged in all of our consumer devices. But something we really focus on doing at GE Healthcare is really delivering AI in this invisible manner. In order to do that, we've invested deeply in our Edison Platform, which is a platform for building artificial intelligence and other digital solutions quickly at great scale, but then also solving for that last mile; solving for the way you package artificial intelligence and embed it within the healthcare workflows as they exist today. So providers can do what they've always done; just faster and better with higher confidence.

Some examples of ways that we've delivered this AI right at the point of care is—think back to that use case I talked to you about where someone comes into the emergency room. Let's say it's after a car accident, and one of the very first things that will happen is a mobile X-ray will get wheeled over. They'll take a scan, an image of the chest cavity, and right now, the best practice would be for that image to go sit in a radiologist queue. If you're at a great institution, this could be a thirty-minute to hour turnaround. If you come in in the middle of the night and radiologists aren't looking at it until the morning, you could be waiting hours. What if there is a critical finding in that scan, that can be too long. So what we've done with our critical care suite in our FDA-cleared mobile X-ray is we've actually embedded a deep learning model that can recognize this critical condition called pneumothorax, flag it at the point of image acquisition, and take that case right to the top of the radiologist reading queue, so they can respond with the whole care team in that moment for the patient who needs the care.

Tim Crawford: So, this isn't replacing the radiologist, this is really augmenting what they are capable of doing and improving the time to resolution or time to visibility at the image, you might say?

Karley Yoder: That's exactly right Tim. And, for those of us who have been in radiology for a while, there is an accepted way of thinking about how artificial intelligence will impact radiology, you know, a little tongue and cheek. But AI will never replace radiologists, but radiologists who use AI might replace those who don't. And what that means is it's not man versus machine, it's man and the machine working together to help the radiologist focused on those high-end tasks where the brilliance of their training and decades of experience are used, but take the mundane out of their job. Take the system that's been first-in, first-out for decades and flip that on its head.

Very few of us look at our inbox, our email inbox, and just reply to the email that's been sitting there the longest. We know how to sort and reply to the most urgent things. We need to help radiologist be able to do the same thing by previewing and triaging the images that show up in their work lists and help them spend their time on the most important topics.

Tim Crawford: That's great. So, when we talk about the technology, and we talk about how the different components come together, you have to look at the underlying components, right? The individual pieces that go into this entire solution that becomes the experience. There has been a partnership between GE Healthcare and Intel for some period of time. Can you talk about that partnership, that relationship, and where Intel fits into the mix for changing that experience?

Karley Yoder: Absolutely Tim. I'll talk about that and I'll also highlight a little bit of the COVID-19 specific work in this section. So, you know, one of the things that I think is really important for any industry, healthcare absolutely falls in this, is companies have to form strong partnerships and play to their strengths. GE is a brilliant healthcare company that has partnered with clinicians for decades, sometimes institutions for longer than that. And Intel is this brilliant technology company that has learned how to run AI within devices, within hardware in really efficient, powerful ways. And when you step back and think about how you can bring the two strengths of these organizations together, the results are really powerful.

When you think about COVID-19, there are two use cases that our companies worked on together, one around better detection, and one around better response to emerging chronic conditions. So, let me just spend a second on these two use cases.

Better detection: we think about how AI-assisted portable ultrasound can be used to review lungs and COVID-19 has driven unprecedented demand and use for this worldwide. Our venue-portable ultrasound system allowed clinicians all over the world to save immense amounts of time by quickly identifying the clinical sides of COVID-19 in seconds, and automating measurements and image optimizations. Now, we're able to run that AI at speed in the device because of the technologies that Intel provides and the partnership we have with Intel. Same with when you're thinking about some of these chronic conditions. And one of the spaces that still isn't known but it's coming to light around COVID is there are emerging chronic conditions, unfortunately, that are resulting from COVID even if the patient recovers quickly. And this is another opportunity to use ultrasound to look at the heart, which is one of those places where, as you and I chatted about before, it traditionally requires deep, deep operator expertise to capture the right images.

And something we've done with our Vivid Cardiovascular Ultrasound is we've leveraged AI to actually automate tools that help diagnose the function of the left and right chambers of the heart, which are both affected by COVID-19. So, clinicians can use this bedside ultrasound as a readily available tool to identify patients with COVID-19 infection at the high risk of adverse outcomes. And how does this tie back to Intel and GE Healthcare? Well it ties back to Intel and GE Healthcare because we as the healthcare company are able to focus on what is that use case, what is that opportunity to best partner with healthcare providers, make their workflow more efficient, and we can look to Intel as a trusted partner to provide technologies like OpenVINO™ [toolkit] and other technologies that allow AI to run at a very accelerated pace.

Tim Crawford: That's great. And it's great to hear how that partnership really goes deep, and in our past conversations another thing mentioned is that this is much bigger than imaging. The partnership goes well beyond just imaging.

Karley Yoder: It's great to have a partner who cares as much about the patients and providers as we do and a partner who's been in healthcare for decades and understands this regulated space. It's been really neat to have a partner on this AI journey at Intel.

Tim Crawford: That's great. You touched on a couple of things Karley that I wanted to go into a little deeper and how this is changing healthcare in terms of changing the playing field for both the clinicians as well as the patients. You mentioned the impact of COVID, you touched on the Edison Platform and maybe we could go a little deeper into what the Edison Platform is and how this becomes kind of that connective tissue for the experience.

Karley Yoder: The Edison Platform—let me tackle it in two parts. First of all I'll explain a little more about the Edison Platform, and then I'll touch on how this is changing that playing field for clinicians and patients.

The Edison Platform very simply put is about unlocking data and unleashing intelligence. So what do I mean by unlocking data? I mean right now so much data is locked in separate disparate data silos when you think about the hospital, and there would be so much more inside efficiency we could bring to treating patients if we break those silos and allow data to flow together. So, we've created the Edison Platform to be embedded at hospitals to allow that data to flow, so that's one. The other one is unleashing intelligence. So, what we've done with the Edison Platform is we don't just think about the clinical deployment of the platform but it's also a platform that developers all over the world, GE and our development partners, can use to build applications. It's the platform we use to build the AI examples I talked about above in ultrasound and X-ray, and it's the platform that development partners are using across the world to create game-changing applications. And when you think about the Edison Platform, it's really how we build the best solutions, but then also how we deploy them into that last mile, into that workflow in an invisible way.

So what does that mean for patients? What does that mean for providers? On the patient side, it means that it can change the way they are receiving care even if they don't realize it. Like I mentioned before, when AI is used best in the consumer space, you don't realize you're using AI, you just realize your life gets a little easier. When you have that load of laundry in your arms and you realize you are out of detergent, you can yell to Alexa to order another round of detergent, you don't stop to think that this is artificial intelligence understanding your voice, translating it into an Amazon order. You just say, thank goodness I didn't have to drop laundry all over the place, right?

This is that same kind of thing for a patient, we want to be able to use the Edison Platform to bring them the best partners and solutions from all over the world and deliver it to them through the care of their clinicians that they are already used to receiving. On the provider side, it's all about helping folks do what they've always done, just better, faster, and with higher confidence. And with COVID we've seen just a kind of stepwise change in the needs that clinicians have. They've always had this large volume of work sitting on their plate. Those volumes have gotten even higher, and now they're needing to do it in a way where they kind of segregate patients that may be coming in for COVID from their more normal populations. And so efficiency, productivity, moving quickly through your workloads, is becoming even

more pressing, and if we harness AI in the right ways and deliver it through the Edison platform right to the point of care, the provider experience can be more focused on the interaction with their patients and less focused on wrangling the technology.

Tim Crawford: That kind of goes to something you said earlier where the key here is to be invisible. You know, it just kind of slips into the existing workflow, it doesn't require this massive change to your workflow, and training time is not an option especially in the days of COVID where you need to scale and ramp up fast. You mentioned earlier about changing fast and, I think you're the only person that I have ever heard talk about COVID being exciting, but I understand the context of that comment and the importance of it too.

Karley Yoder: Right. A global pandemic is not worth the technology acceleration, but as a healthcare industry, if we can take the opportunity to learn from some of the things we were forced to do because of COVID and embed them into our practice once the global pandemic hopefully is in the rear view mirror. I really think there will be some powerful changes about how we practice care.

Tim Crawford: That's great. Karley, you've talked about a number of things that you're looking forward to and I think COVID has kind of really brought healthcare into the forefront and given us a lot of great opportunities. Talk a bit about what's next, what's coming, what we can look forward to?

Karley Yoder: I love this, Tim. There are some really exciting things on the horizon. So, I'll talk about two: scale and virtual health. Let me tackle those one by one. Virtual health, as I mentioned, is the rapid rise of telehealth and the demand for patients to be able to receive care outside of the typical brick and mortar encounter. I think it is a technology trend that's here to stay, and at GE Healthcare we're looking at how we can move fast, partner close with our clinical partners all over the world to support those trends, and listen to the voice of patients demanding this to be the new normal in how they access the healthcare systems. So that's one, virtual health.

Number two is scale, and scale is why we invested in our Edison Platform to build faster internally and to bring things to market like X-ray, ultrasound, and some of the MR work we've done with Intel. But the tens of products we've brought to market in the last couple of years are simply not enough. It's going to take hundreds to thousands of AI solutions strung together and working together in an ecosystem, in a partnership, to really move the needle on some of these pressing problems we talked about at the beginning. And so, this is why at GE Healthcare we're really focused on building an ecosystem, building a partnership program.

If you look at the investment in healthcare, medical imaging startups alone, the potential is huge. There are more than 200 startups in this space, and they've secured just south of a billion dollars in external venture capital funding. These are real, important, game-changing technologies. But they have to be harnessed in a way that they're delivered where they don't break the clinical workflow, right, as you and I discussed earlier.

And where GE Healthcare is partnering with Intel, thinking about how do we build a powerful developer ecosystem through our Edison Developer Program and help everybody to deliver in that last mile in the

same kind of way we've done the X-ray with Intel, where we saw over a 3X efficiency gain¹ and the speed of that model running in production.

Tim Crawford: Wow.

Karley Yoder: How can we bring those same kinds of productivity gains to this developer ecosystem so that the end people who benefit are the patients and providers all over the world? So, I think that's really what's next, watching this rise of telehealth but also this leaning into the scale we have to achieve in order to really address some of the macro trends in healthcare.

Tim Crawford: That's great. Karley this has been fascinating, absolutely fascinating. We need to get to the Q&A section. So, first question up: can you talk to the regulatory and compliance impact of this technology? This is probably a question really around where that fits in. I know there are a lot of questions that often come in around innovation in the healthcare theater, if you will, and maybe you can touch on that question around where regulatory and compliance impact the technology.

Karley Yoder: Oh, I am so glad someone asked this question. Everything we do at GE Healthcare is within a regulated space. And it should be. When you're delivering healthcare to patients, the bar should be really high about the devices and solutions you bring into that healthcare workflow. And so, this is the place where actually we lean heavily on our Intel partnership because they have been developing hardware sitting inside medical devices for decades.

Let me talk about one that's regulatory cleared. So, at GE Healthcare we have an FDA-cleared solution called AIRX within our MR solutions. What it does is: it is an automated workflow tool specifically for brain scans but sets the plane for that scan to run. Previously this plane was set by humans, which meant that there was opportunity for inconsistencies, and it took time. By using AI, we take time out of the process, and we take human error out of the process.

By partnering with Intel, we actually saw over four times acceleration¹ in the speed to run this process. Why do I bring this up? Because we couldn't do this with a partner who didn't understand the regulatory base and the compliance needs when you're working on a medical device. And so it's really important to be eyes wide open as you're developing this technology and understand the implications from both the regulatory and compliance standpoint as you are bringing the best innovations to clinicians and patients, but you've got to do it with the bar held really high.

Tim Crawford: And you know, it's a really complicated space just from my experience, and obviously you're much deeper into this than I am, but it's incredibly complicated. So, it's good to have a trusted partner that you know also understands the complications that come from that.

Karley Yoder: That's exactly right.

Tim Crawford: The next question. So is this technology only available in new products? I think the question is really about all of the GE Healthcare products that are currently deployed in the field? Can they take advantage of this new technology, and maybe where does Edison kind of fit into that too, if I could add on to it a bit?

Karley Yoder: Sure, great question. Since Edison launched in November 2018, end of 2018, we've received multiple FDA clearances across Edison-powered devices like the examples I spoke of, that harness AI and bring them in new products as they go to the field. And that's great, but GE has a massive install base of existing products today that also could benefit from this type of technology being brought to them. This is exactly to your question Tim, where the Edison platform can play a really powerful role because it means that we can take some of these technologies back to existing devices, without customers having to buy a new device.

Now this will roll over time, it's not 100 percent coverage right now, but it's one of the best analogies I kind of used for this is, it's a little bit like buying a car. Right now, when you buy a car and drive it off the lot, that moment it is the best that car is ever going to get. Over time there is going to be wear and tear and you're not going to be able to improve on your car. Tesla flips that model on its head. You buy a car and the software continues to be updated and improved over the lifetime of that car, and that's what we're trying to do with the Edison platform, where when you buy a device it actually gets better and better over time; because we can feed those improvements into our medical devices through the Edison platform.

Tim Crawford: Now that's great, that's great. So next question, can this technology be used to diagnose conditions?

Karley Yoder: This goes back to our regulatory question for sure. Right now, most of the clearances in this new AI space are not making a final diagnosis, but are instead aiding a clinician, a radiologist, a technologist, to make the diagnosis by teeing up the relevant information for them and helping them more efficiently arrive at that solution.

So, think about ultrasound as a little bit of a pyramid. The first thing you have to do with an ultrasound is help the operator actually collect the correct image, right? You're holding a handheld probe, you have to move that, you have to make sure you're getting the entirety of the heart in our exhibit example. AI can be used to help clinicians correct the right image. If you go a level up, then AI can help once you have the right image, automating certain calculations that clinicians had to do on their own, right? Counting certain number of lung nodules, measuring certain distance between different anatomy, et cetera et cetera. AI can help with that. And then right at the top of that pyramid, we start getting into diagnostics. But I would say that's not where we're focused right now. We're really focused on the efficiency and prioritization that AI can do for clinicians, and then leaving diagnostic decision making to the clinicians themselves.

Tim Crawford: No that's great, that's great. I think diagnosis is such a complicated aspect of it when you get to that end of the pyramid as you kind of outlined it. Next question, is this limited to ultrasound, can it be used for X-ray and maybe other imaging types?

Karley Yoder: Great question. So it can be used across imaging but also other areas of healthcare. You know, I mentioned this already, but one of our first FDA-cleared solutions was actually in the X-ray space—being able to detect critical solutions and highlight them for the radiologist. Also actually as

part of that X-ray solution there was a quality aspect, where it was able to make sure the orientation of the image captured was correct on the device itself before you ever send it into the radiologist.

So just think how powerful that is. If you capture the wrong type of image, send it into a radiologist. The radiologist has to send it back, you have to drag the machine back out, you have to do it all over again. You are just creating this churn. By embedding AI right in the device, we remove that churn right away.

With MR and CT, actually some of the AI where we have FDA clearances on, is actually more in the upstream image creation even. So, applying AI to create images with higher quality, but in a faster amount of time, because you're taking some of the physics-based image reconstruction steps and replacing them with AI. So that's the bottom line, so the application of AI goes across the spectrum of medical imaging and extends beyond medical imaging as well.

Tim Crawford: And, you know, Karley you've talked about how it's not just about the technology but it also changes the patient experience, because I know in scenarios you might have to take the patient from where they are residing, to a specialty room or location, to do that x-ray or do that imaging, and then wheel them back. During that time, they are exposed to everything that's happening in between one location and the other.

Karley Yoder: Sure.

Tim Crawford: So, this has other consequences beyond just simply what's happening during the imaging process, right?

Karley Yoder: That's absolutely right. I mean if you think about the example we talked about earlier with the brain scan for MR, one of the best outcomes for patients that we've seen is it reduces recalls. So, imagine you come in, you get your brain scan—you're an oncology patient so you're getting your brain scanned every couple months. You go home—you get a call saying, "Oh the technologist messed up and got the wrong plane. Can you please come in again tomorrow so we can rescan?" Those are the kind of inconveniences for patients we should be able to eliminate if we build AI in the right way to create that consistently.

Tim Crawford: That's great. So we probably only have time for one more question. So I know we have a number of questions, but let me just ask this one. What are the products that are core to this effort?

Karley Yoder: The way we think about it is: how do we take every product that GE Healthcare creates and think about how AI can step the game up or step the impact up for that product line for the patient needs that they have. And so, I would say AI is a technology that we have been focused on harnessing before COVID was even discovered and started being a pressing matter in the healthcare space. The investment we had done actually saw many benefits with COVID that we hadn't even built specifically for COVID. We had already been thinking about efficiency gains and helping our clinicians. And so I would say when you think about the areas of impact, it's really across the whole clinical workflow, just understanding what are the outcomes you most want to drive, and then harnessing the technology to drive those outcomes.

Tim Crawford: That's great. Karley, this has been absolutely fascinating. I think there is a lot of additional material to kind of tease apart here and learn about. Thank you so much for taking the time to share your expertise and also tell us a little bit about what GE Healthcare is up to. So at this point I'm going to turn it back to Mary to close us out.

Mary Killelea: Thank you so much for this wonderful conversation and for joining us today. Please look for other exciting customer spotlight webinars that highlight data-centric innovations coming real soon.

1. Based on internal GE Healthcare data.

Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.

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