

An up-to-date and very brief history of medical technology

00:00:01

Bradley Howard: Welcome to Tech Reimagined, an Endava podcast. I'm Bradley Howard, your host. To all of our listeners. In Season 3, we take a look at how technology shapes the fabric of our society, with the good, the bad, the useful, and the less useful that it brings into our lives and how we work. We do so with passionate professionals who also have a deeper interest in technology. And our guest today is Dr. Gillian Halley, a dedicated healthcare professional with over 20 years experience as a medical consultant in frontline healthcare delivery. She's also spent five years as a service director and extensive experience and knowledge of navigating healthcare strategy. Hi, Dr. Gillian, how are you?

00:00:55

Gillian Halley: I'm good Bradley. Nice to see you again.

0:00:57

Bradley Howard: You too. Thanks so much for joining us and sharing some of your time with our listeners. So the topic of today's episode is an up-to-date and very brief history of health technology. So Dr. Gillian, please can you share with us what the health technology landscape was like when you first started working?

00:01:13

Gillian Halley:: Well, so many centuries ago, it's hard to remember, but yeah, it was certainly a lot of things have changed since I started working. And I can give you an example of an early pathetic attempt at artificial intelligence that I was involved with. I can't really call it that, so this was going back to the early nineties, and I was doing research in the neonatal intensive care unit. So there's pre-term babies, and we had this idea that sometimes the breathing tubes would block, and all of a sudden you've got this resuscitation.

If you imagine a child that might weigh 500 grams, it's quite challenging to be putting in lines and tubes and all that sort of thing. So we thought, well, if a tube blocks, surely there's a sign in the physiology before that. So the heart rate goes up, the carbon dioxide level goes up, then eventually the oxygen level goes down. So there's a few changes like that.

And we thought, well, if airline pilots can see early warnings and maybe things go from green to red, could we do something similar? And we started looking at the online monitoring, which was second by second, that wasn't detailed enough. And I took the heart-rate signal and then sat in the signal processing lab in Heriot Watt University and got some of the engineers to work with us.

And we had to buy an analog-to-digital converter and convert the heart-rate signal into a digital signal, and then take it on a disc, we used floppy discs in those days, if you remember those, and I would drive halfway to the university, and the engineer would drive the other half, and we'd stop in (inaudible), and I'd hand over this disc that you would then put through a fast Fourier analysis program.

And that ideally would give you a sympathetic and parasympathetic burst of activity. And you could perhaps measure that in some advanced way. And we looked at neural networks, machine learning, a bit of chaos mathematics, and nothing really was powerful enough to actually deliver a direct benefit, but it was interesting to see now, where are we with that bedside monitoring?

And I think there's still some potential there, that we could be developing more pattern recognition through AI of your intensive care monitoring. I know some people are trying to do it, but we've not quite got there yet, but that was that sort of early, "wouldn't it be great if we could get some way of detecting something and preventing a disaster." So that was an early experience with health tech for me. And I'm so glad we don't have floppy discs anymore.

00:04:03

Bradley Howard: And did you find a correlation?

00:04:05

Gillian Halley: No, I think there was too much noise. We did look at normal babies. We tried to measure that as a baseline, but, again, with all sorts of AI, what's your data bank that you're collecting the data from, and how biased is it? So the people that consent to us measuring their normal babies were perhaps different from the whole population were in Edinburgh, different than parts of the states, for example. So I think you've got to be aware with any sort of algorithms you're developing about ethics and bias and explainability of that. So I think using it as a way of detecting something about to happen still has potential, but we have to manage that variability and that noise that's within the signals as well.

00:04:56

Bradley Howard: I saw you recently on stage when you discussed the history of medicine, and it really focused on resuscitation. It was such an amazing presentation. Are you able to share some of these insights and highlights from that presentation?

00:05:10

Gillian Halley: Sure. I like looking back at historical things to see what we used to do in the past and how many similarities there are as well as differences. So I particularly like 18th-century Georgian medicine because that's a time of enlightenment and being a Scot, it was a Scottish enlightenment. So there's a lot of Scots brought down into England and London in particular.

And one of my favorite personal heroes is a man called John Hunter, who was a surgeon. And he started off as a farm boy somewhere near (inaudible) in Scotland, and his brother, William Hunter, studied theology. So you get paid more if you did theology than medicine in those days. But William Hunter went down to London, became a successful obstetrician. In those days, midwives generally were female, but it was the male midwife starting. And he brought his brother there, because his brother was someone who liked to get his hands dirty.

So he was a hands-on surgeon, not hugely educated or literate, but somebody that could draw and dissect very well. And in those days in the 18th century, they had all sorts of weird medical treatments. So a society was set up, and I think it was about

1725 for trying to save people who had nearly drowned from the Thames. And they set up resuscitations through this charity that became the Humane Society, then the Royal Humane Society, where they would pay 4 guineas or so for anyone that successfully resuscitated people from near-drowning.

And a lot of the quacks at the time were using tobacco, which was passed in a pipe up the bottom end, before they realized that actually you need to put air in the lungs to resuscitate someone. And that's what John Hunter did. So he wrote the first guidelines, really, about how to resuscitate people. And this was happening in parallel in the states, so they did putting air in the lungs, getting the patient breathing, so they used bellows that you used to light the fire, and circulation.

So they had things called Leyden jars, which were early electricity jars that we'd sometimes use to start the heart. And there was one little girl who'd fallen from a window who had her heart started with a Leyden jar apparatus. So the airway breathing circulation of resuscitation was beginning in those days, and it traveled through various iterations, but keeping the same principles of A, B, C until, I don't know if it was five years ago or so, but the resuscitation guidelines have now changed to do compressions first, because that's been now shown that for-

00:07'54

Bradley Howard: So for some of our listeners, A- B- C is airway, breathing, and circulation.

00:07:59

Gillian Halley: Oh, yes. Airway, breathing, circulation. Yeah. So that was how I was trained, as airway, breathing, and circulation, but for the person in the street, if you see someone now who's had a heart attack, and you don't have a defibrillator to hand, then chest compressions is what you start with rather than rescue breath. But I think that some of the parts that are missing to me that tech could help, is that people don't necessarily understand what the recent guidelines are, or they don't know how to do proper chest compressions, or what resuscitation really involves, or that you can get pocket defibrillators that could be more useful, or you can get alerts from your phone to call emergency services.

There's a lot of tech things that I think we could perhaps educate people. So I think TikTok would be a good place to go. You could have like little short videos on resuscitation and start sharing some of that knowledge, I think. But, yeah. So going back to those early surgeons and the Georgian medicine is very interesting to see how things have developed.

00:09:06

Bradley Howard: And you also showed the history of those defibrillators, I remember. The oldest one that was basically handheld wasn't actually that long ago. And then you showed some of the most recent ones, some of the brand-new ones that I think was from Australia. Can you talk a little bit about when was that first defibrillator?

00:09:25

Gillian Halley: So I think, from my recollection, the defibrillators when I was training, they were basically hospital-bound because they were so big. And then they became mobile, so they get moved onto a cart and a trolley. And then they became in about, I think it was '85, the first Phillips one that you could actually use outside a hospital, and still quite bulky, still quite intimidating, I think, to use some of those devices. And I think that's

when you think, even for a junior doctor, "How do I get the paddle to where I switch it on," et cetera, going into having them in the home. So people that are risk of heart attacks could have them in the home, but they're not extremely portable, but you can certainly get trained to use them.

And then the one in Australia, I think was a man whose wife perhaps had a heart attack that had developed this, but it's essentially a pad that you crack open, and it gives you voice instructions. And you use that pad to stick on the chest and to detect the rhythm and to do the defibrillation for you. So it is very much a pocket one. And I was just about to place an order when I saw that it's got a 12-month shelf life.

And so when I was at the tax summit, I spoke to someone, I said, "Oh, actually, how many volts do we need? Oh, maybe we could actually put that into ear pods. So if you could imagine, all you would need in the future would be a couple of sticky pads with those connectors, you put your ear pods into those sticky pads, that would detect the rhythm from your phone. And you could do shocks that way. So maybe that's the future of the defibrillator from back in the early days of 17-hundreds.

00:11:07

Bradley Howard: That's amazing. And even the Australian, the new invention that can only keep this charged for a year, was only the size of an iPhone, correct?

00:11:15

Gillian Halley: Yeah. Just not much bigger than an iPhone, yeah. You could basically hold it, just crack it open between your hands.

00:11:21

Bradley Howard: It was amazing to see how the pace of technology changed from that 1985 first mobile defibrillator all the way through to the 2021 iPhone-sized one. And you're already looking into how you could do that for air pods in there as well. So how much technology was involved in your day-to-day activities when you first started? You mentioned a couple of points about some of the baby ICU units, but how else was technology being used in those days?

00:11:52

Gillian Halley: In those days in the neonatal ICU, we started using something called ECMO, which was extra-corporeal membranous oxygenation, which is you bypass the lungs. So for babies that aspirated meconium, which is this fecal matter when they're born, and they used to have a terrible outcome, but it was shown that if you could bypass the lungs so that they completely rested, they could survive and essentially have maybe some lung disease later, but they could survive to a normal life.

And then I did a little bit of work when I was in Australia on liquid ventilation, which was not having any air in the lungs, and that didn't really take off. And then going back to the resuscitation loop, that mobile ECMO, and having the ability, say, in Boston Children's Hospital to call the resus team, and they bring heart-lung bypass with them. So that technology from those early days of just using a machine to bypass oxygenating blood to having full heart-lung bypass as a post-op or a resuscitation technique has been a huge change, but essentially everything else around hospital care was paper-based. So it's a lot of manual data. If you wanted to do any research or audits, you had to basically collect data and bits of paper, and then put it in the spreadsheet. So I think there's been obviously a lot of changes in the data analytics.

00:13:22

Bradley Howard: And looking towards the future, what specific new inventions are you seeing coming very close into the kind of tools that we're going to see inside hospitals or other areas of healthcare?

00:13:37

Gillian Halley: I think for home, I think some great things like the artificial pancreas, perhaps 3D printing, growing organs from tissues, and that sort of thing. And I think from being inside the hospital, what I would like to see is a lot more process improvement. And that sounds a bit boring, it's not really the innovative being a surgeon and doing exciting stuff with robotics, but basic things about process improvement or optimization, using technology, using AI. So instead of having people hiding in waiting lists, you're opening up a process that's end to end. So the patient can see, "Where am I in this process? When I get a flight from here to Canada, I understand I get on, I do certain things. I'm on the flight. I get off. I have to do certain things to get to my destination. I have a process."

And I think we hide things from patients far too much. And I think technology is the way that we can open up those processes to say, "Well, okay, if I've got a concern and I've gone to my family doctor, what is the next step?" I wonder how many people really understand what happens when they get to refer to hospital? Who makes a decision? Where does the investigation go? And then what happens when they're waiting, what's going on? And I think there's a lot of anxiety around waiting that could be improved or helped by using some AI to optimize the process, but also feedback to patients: where you are in the queue and what's happening behind the scenes, and maybe have some dialogue going on there to reduce anxiety. That's what I would like to see.

00:15:20

Bradley Howard: Us too, as well. That was so interesting, to go back and look historically at innovations that we now take for granted. Thank you so much, Dr. Gillian, for this great conversation. And I really hope that our listeners will enjoy it as well.

To all of our listeners, if you found this episode insightful, please spread the love and share it with your network. Or just follow us on any of the major podcast platforms. We're always interested in your feedback. So please either go to [Endava.com](https://www.endava.com) and click on the contact button on the right-hand side, or contact us at Endava on any of the major social platforms. Until next week, I'm Bradley Howard, and this has been Tech Reimagined.