Why do so few digital health innovations disrupt practice? An iterative technological, business and clinical use-case model

Associate Prof Andrew Stranieri

Institute of Innovation, Science and Sustainability,
Federation University, Australia

The topic that I'd like to talk about is digital health innovations and how are they, so few of them actually have resulted in disruption, and there's the point that I I'd like to make the points by reflecting on some of the experiences that I've had with artificial intelligence applications in. And then in health. First, let me make the general point that I don't think I need to tell too many people here.That information and communication technologies have disrupted. Just about every aspect of life. If you consider that the World Wide Web may have been a emerging technology in the early 90s and has disrupted as much as it has. But right now we have a number of emerging technologies, including artificial intelligence. And Internet of Things and. The, the 5G6G and many others. Each of them have the potential to disrupt phenomenally. We certainly live in interesting times. As an example, back in in the early 2000s. My PhD research then was in applying machine learning and integrating it with argumentation theories in order to develop models that could do. Things in law. So one of them was the stood up system where we predicted the split of assets that have family court judge would award. Our husband and wife following divorce. Another one was to do with eligibility for legal aid, which was decisions about the merits of the case and the likelihood of winning a case were made in order to determine legal aid funding, and we model that and built a electronic logging. System so that lawyers could apply online have a intelligence system. Make a merit based decisions and. Immediately, rather than wait for in those days 2, two or three weeks for paralegals to do the same thing. If you do law, nursing law, sentencing law. That led to a spin out company that now no longer exists, could just exist and we developed a commercial versions of many of these systems and other systems as well, including ones for state government departments and. Education departments and other. Are the bodies. For a number of commercial reasons that the that start up wound up in the mid 2000s, cash flow and other problems not unfamiliar to. Start-ups. And at that point I thought, look, you know I want a new life and returned to full-time research and to I wanted to change of scenery and I thought let's move into health. Let's apply some of this sort of AI in to health. Where there was a great. Potential benefit. As professor. Other cool has just outlined some 4. AI to be applied to health for great benefit and some of the technologies like the Internet of Things,

telemedicine, wearables, AI modelling, image processing. This been very active. Research areas for quite a quite a while. However, very few of the applications actually end up in clinical practice, so that led us to say, well, why not? OK now? Our conclusion is that in order for a. Innovation to. So you. The progression from a good idea in a research environment. Practice we need a convergence of three. Quite different things. And the convergence is quite rare. The three things is the technology's got to be good. The AI has to be smart. The hardware's got to be robust, reliable, accurate. But that's not enough. There's got to be a strong business case. It's got to be cost effective. It's got to be affordable. The customer who is going to purchase it. It's got to be the person. Who benefits from it? If there's a mismatch? There we're in trouble. That's not enough. It's also going to be a a strong clinical case. In that. It's actually going to be clinically useful for practitioners for nurses for patients. In the healthcare system. Now I want to demonstrate with a few examples how this convergence is actually quite difficult to achieve and that it is and then suggest things that can be done to. Realize this convergence a bit more easily. So first of all. Let's say, well, why is this convergence difficult? Well, let's start with technological innovation. Well, typically, typically that's done in universally research innovation. Well, quality is measured by publications and grant income, so there is no incentive or very little incentive for in university researchers to take into account the business or clinical case behind the programs are run and on I'll. I'll go through a few. In a minute. The business case really only kicks in now when entrepreneurs hunt around for research outcomes that might. Attract investment and. You know, being the right for startup. And the clinical case is typically only examined in a in, sometimes in in the university, research projects run pilots, but typically a the clinical sort of case is really only explored when. Minimal viable prototypes that developed in order to test business models and that's after well after the original research has been done. So there is this separation of activity between those 3. So let me let me use this as an example. This is a piece of work that a piece of research that has done in in Victoria funded by the state government that are LED in. 2012 to 2015 and what we were interested in is whether we could come up with the technology that would transmit 3D. That that's yeah, left and right images. And then into leave it over the Internet. With low enough. Bandwidth so that we could run video conferencing in 3D. So that the. The practitioner, the health practitioner at the at one end with 3D glasses and a. 3D smart TV. Could see the patient who was transmitting images from a 3D camera. At the other. End and we had different applications of this. One was for wound management, where nurses would go into patients home and take a 3D image of a wound. They were still images. In a store and fork system, another application was in psychiatry, where it was a video stream, another was in dentistry. With tele dentistry and nursing homes. And but the psychiatry use case looked pretty good because. The stochiometric there at our partners at the University of Melbourne

would often travel into the country to do cognitive. That that they could do things like finger to nose tests and things like that we were surmising if they had 3D sense of think a wound specialist thing can view a wound. In 3D, and make a better assessment. So we spent a fair bit of time getting the technology to work in low enough bandwidth for the Internet links that we had. And we used the. Cisco hardware to do a first iteration. Then we use the web RTC library, then to build in 3D in software. Where was the? Business case well, we thought, well, you know psychiatrists wouldn't have to travel as much. To the country areas and that saves them money and time that translates directly into money and the clinical case. We thought, well, you know they can make these assessments where. You really do. Need a sense of time and space. And it made. Hence, scheduling was a huge challenge because you had to get the patient at the at the same time at one end, but you needed the healthcare professional to be with the patient. The psychiatrist is was at the other end and the technology had to work at the same time and. It was a challenge, yeah? When we looked at the business case. The saving time of the psychiatrist was actually not a very strong incentive because they needed to go to the country for. Other reasons anyway. So it didn't take much to blow the business cards out. Of the water. Didn't take much to blow the technology case out. Of the water. But we did overcome most of the technological. Problems and we did run the system. So when you. Stand back and say well what went wrong. Is what we. Really would have been better to do is to. A little bit of the technology examined the business case without fully developing the technology and seeing if there that that there was a business case for the technology as initially developed. And if so, proceed and see if there's a clinical case and then keep on iterating slightly changing the technology to see if there is a business case that will emerge and slightly changing the business case means you probably have to change the clinical case and you just keep on iterating. You know, until you have something that looks like it might work. So we put that idea to practice in 20. 2012 25th 202015 we started in in with IO2 sensors to transfer. Biophysiological data to cloud service to process the data. In real time. Lots of applications. My colleague Venky wallet Subramanian had just finished his UTS PhD at in 2008 with monitoring heart rate during pregnancy of mothers and we got some philanthropic funds. To develop a word metric technology that would stream the data. But we stopped there. What we did. Is start looking for a really good use case that might have a business case and what we found was that the use case is. In remote monitoring of vital signs outside of intensive care and there's many settings, particularly in India where patients in in transferred out of intensive care. Into general wards, but still benefit from having continuous monitoring of their vital signs. And there's been a number of studies that have demonstrated continuous monitoring and vital signs and genital warts leads to earlier detection of patient deterioration and better treatments. So this is a few photos from back then we ran. A an initial trial in 2016. And that led to a

redesign of the technology which led to a tweaking of the business case which led to the spin out company, Allegra and A which was launched in 2016. And the next three or four years was spent doing clinical trials, mostly with hospitals in India and. And the. To fine tune that business case and the clinical case, and. And so when we when we look at the technological case here, well, the hardware is pretty robust, it's CE. And now TGA certified the smart alarms were came from. Sort of some research ideas that we had with machine learning. Tailored for early warnings. For the business case for hospitals we've sold to the Indian Defense Force to hospitals and. And The Who benefit because of this early detection. And now we're moving into patients at home with different use cases. And we've got to tweak the technology a little bit more, and the and the clinical cases. Essentially the early detection. Is that leads to better outcomes and it's worthwhile for hospitals and patients to pay the relatively small amount of money for the continuous monitoring in the general reward, particularly if they can no longer afford to stay in intensive. Court care at a quite high costs.

So what we say, well, you know in.

The in the startup space there is a simplified business model called the Business Canvas that is used to help miners define a business model. What we argue. Is that a similar structure? Simple can be useful that describes the technology, case and the and the elements of the technology canvas are different. It's things like to do with the technology. It's not. It's how complex is the technology. How safe is it? What's the usability? All of those things that are relevant for making the technology case and similarly the clinical model Canvas. As a way, and again, a very simple way, and it's really just like the business canvas. It's a simple template that you can use to brainstorm and different configurations of clinical workflows, and you know does it for them. This workflow is what is the value proposition for the end user. What training is required? What are the environmental factors? Things like that and what we believe is that this relatively simple model technical business clinical case can be used to encourage this kind of convergence.

Thank you!