Exploring The Past, Present and Future of Health Technologies with Dr. Joseph Cafazzo

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Dr. Joseph Cafazzo

It was during his time as an undergraduate engineering student at the University of Toronto that Joseph Cafazzo first became interested in biomedical engineering. He later went on to complete a Master's of Health Science in Clinical Engineering and a PhD in Health Informatics, also at the University of Toronto. Today, Dr. Cafazzo serves as Executive Director of Healthcare Human Factors (HHF) at the University Health Network, the largest Human Factors team devoted to research, design, evaluation, and consulting related to interactions between humans and technology in healthcare. He is also the Lead for the Centre for Global eHealth Innovation, a research institute focused on the development of new technologies designed to improve global health systems. Dr. Cafazzo is Associate Professor in the Department of Health Policy, Management and Evaluation as well as the Institute of Biomaterials and Biomedical Engineering. In 2010, Dr. Cafazzo received the Career Scientist Award on behalf of the Ontario Ministry of Health and Long Term Care. Now in his 20th year working with the University Health Network, Dr. Cafazzo continues his efforts towards improving healthcare globally through world-class research, innovation, and the development of information and communication technologies.

UTMJ: Could you describe how you ended up here at the Centre for Global eHealth Innovation and what it is that you do here?

JC: I think it was in my first year of Engineering […when] I got introduced to something called "biomedical engineering", which was bizarre to me – it was this intersection of medicine and engineering. I especially liked the idea of a program called "Clinical Engineering", which is a very applied form of biomedical engineering, [and] which [trains] an engineer [who will] be in the clinical setting. I did that master's program and then my career started as a biomedical engineer. I did that for nine years and then I got the itch to do further graduate school, a PhD, and I of course gravitated towards another degree in biomedical engineering. But then I met Alex [Alejandro] Jadad* who was the founder of the program in eHealth at that time and he kind of convinced me that I should do something different and not necessarily in engineering but in eHealth. That was in 2000/2001. This was also around the same time that he was doing a major Canadian Foundation for Innovation (CFI) grant to build this place [The Centre for Global eHealth Innovation]. I was still a staff engineer here but I was starting grad school and we built this centre to sort of realize his vision of a very multidisciplinary environment that allows people to solve problems with the use of information and communication technology.

Although I'm extremely proud of the accomplishments of biomedical engineering over the past 50 years, we've also created technologies that haven't served us well, haven't served the people using the technology, and haven't served patients very well. Around 2004, at the time that this centre was finally built through proceeds from the CFI funding, we founded this group called Healthcare Human Factors which, again, was meant to have a very critical look at the use of technology in healthcare. We were set up to evaluate technologies and inherent in that is a very critical approach [that is] not about functionality – not whether or not devices fail in a traditional sense – but more of a qualitative view from a behavioral-cognitive perspective. How do people interact with technologies that supposedly were designed for their interactions? And what we find in most cases, especially in health technologies, is that there's a huge gap between the expectations in the abilities of the people who use these technologies and the actual design. And so, in more recent years, digging deeper into that, it's been more a question of not just finding the problems but solving them.

** Ed. Note: An interview with Dr. Jadad is also featured in this issue's 'Interviews' section.*

UTMJ: You've mentioned that you have an appreciation for how technology can "do as much harm as good." Can you tell us what the three most important factors are in distinguishing the good from the bad with respect to healthcare technology?

JC: Really good technology is when you don't even notice it anymore; it becomes transparent. It kind of just disappears. We're inherently critical beings as it is and we only really start noticing technology when it's not working for us. But when something works absolutely as it should, you don't even make note of it. So, I love the technology that simply gets out of the way. There are times when people remark that "that's a really

reliable device; I love that device" and so on. But I think one of the examples […] was that the home telephone was such a simple device that actually never ever broke down and had a very simple interface. People don't think about their home phone […] very much anymore. A lot of people don't have them anymore, but it was the device in the home where there was absolutely nothing that would go wrong with it. It was always there.

UTMJ: And you think that is because it stayed out of the way or because it was reliable?

JC: It was highly reliable and had a very simple interface. Anybody could use it.

UTMJ: So simple is good, is what you're saying?

JC: Well, I think the adage we have is 'simple, but not too simple'. So, it still has to have the functionality that we need, but it's amazing how we make things unnecessarily complex. One of the examples I love to use is hemodialysis machines. When we were contemplating the use of hemodialysis machines in the home, operated by patients, people thought we were crazy…and they were right because the devices were unnecessarily complex. What we're seeing now after 10 years of home hemodialysis is that some smart companies are out there redesigning the technology for patients and it's a lot simpler. It should be no surprise that it's not only simpler for them [patients], but simpler for the nurses who have been struggling with the technologies for decades.

UTMJ: OK, so the three things defining great healthcare technology might be boiled down to technology that gets out of the way, is simple but not too simple, and that is reliable?

JC: Yes, that's right.

UTMJ: What do you see as the major themes in healthcare technology today?

JC: Well, from my perspective, and I have this huge bias, but I'm particularly interested in the consumer side. So, the necessary shift towards the patient being more involved in their own care. As a consequence of that, patients are having access to the same information that the providers have fundamentally – as a right,[and] as something that they are entitled to as owners of their own data. As a consequence of this, [a major theme is] tools for patients to be able to manage their own care more directly. And so, again, the migration of technology into the hands of the patient, services that were traditionally only available to them within the four walls of the clinic, are now available at home.

UTMJ: You've said before that a primary goal of yours is to extend care from the hospital to the home. Is the impetuous behind that an attempt to move people out of hospital? Why or why not?

JC: Yeah…well I think some of it is purely pragmatic because from a hospital perspective – and a lot of people have been asking this for a very long time – why do we continue pouring money into acute care when our problem is chronic disease? My response to that is a couple of things. [Firstly], don't underestimate hospitals in terms of their ability to deal with chronic diseases. They are changing. Princess Margaret is now the Princess Margaret Cancer Centre. It's no longer Princess Margaret Hospital. So, we're in some sense dumping the baggage associated with the word 'hospital'. which gives people the impression that it's really only treating acute exacerbations of chronic illness. Hospitals have to change, there needs to be greater continuity of care, and we can't just discharge a patient and hope for the best. So, I'm being pragmatic about the fact that, yes it's true chronic illness is what we need to focus on, but it's not going to be in the traditional way of pushing the provider out into the community. We have patients who are capable of doing a lot more than we allow them to. We don't give them access to information, we don't give them access to tools, [and] we don't give their family members the ability to help manage. Yet they do this. There are 1.7 million Canadians who define themselves as an informal caregiver and they do that without information and are just sort of flying by the seat of their pants, basically. We don't make use of those people and, quite frankly, we don't respect them the way we should. For me, the only means I have in order to change the system as an engineer is through the use of information and communication technology and design.

UTMJ: Do you think more doctors should take an interest in designing medical technology tools? Why might this serve in creating better tools?

JC: Of course physicians have to have a hand in the design, but it may not be what you think it is in terms of sitting down across from a physician and asking them questions like "what do you think of this feature?" and " what do you think of that feature?" That's a very linear, direct way of the involvement of the physician in the design of technology. What we tend to do is not listen as much as watch clinicians work because the problem with physicians is that they're experts in what they do and it's somewhat paradoxical, but they can't actually articulate how they work. They miss out on immense amount of detail that's important in the design of technology that's intended to support them. So there are lots of examples of this: the world famous thoracic surgeon who is brilliant but can't teach

because they have trouble articulating to their residents how it is they do what they do. A concert pianist that is a brilliant pianist but can't teach piano because they cannot articulate how it is they do what they do. And so, their role is to open up their clinic and allow a designer of technology, an engineer or otherwise, to come in and observe how they work, have a conversation about the details, [and] be involved in all the iterations. This is not something that happens overnight [i.e.] that you list a number of specifications and then on the other end spew out a product and think that it's going to work instantaneously. The design of technology is very iterative, and to get it right, that's the level of involvement we have to have. So, by being open to having people observe how they work, [physicians] can contribute more in that way than in any other way.

UTMJ: What do you think are the greatest barriers that prevent physicians from adopting the use of new technology?

JC: Well, I think physicians are very pragmatic. Unless it's self-evident that it's going to help their practice, they're very wary of technology…probably because they've been burned by it before. Especially, the promises of electronic health records. We go as far as having to pay people to use electronic health records, which is absurd. I see even young physicians opting for file-folders and paper-based records because the electronic systems don't meet their needs, and that's kind of shocking when the new generation of physicians still can't see the virtues of electronic health records. On the surface and in principle, electronic health records are supposed to make a lot of sense but, pragmatically, if you look at a lot of the products that are produced, they take more time and not less. It's really hard to beat pen and paper so you have to be very thoughtful in terms of the design of these technologies in order for the adoption to be there. I think in recent years with the popularity of a lot of consumer electronics, things like iPads and so on, a lot of physicians and nurses alike have an experience with this at home that is quite whimsical and they love the use of this technology… then they come to work and they feel like they're stepping back in time 10 or 20 years. I think there's a great deal of frustration and they just want basically the same experiences they have in the consumer realm.

UTMJ: Do you think perhaps another aspect to slow adoption of healthcare technologies is not just ease of use, but also fear of losing the human side of healthcare? For example, many physicians have argued that there is something disconnecting about have a computer between themselves and a patient during an interview.

JC: Again, I think it's a missed opportunity because that record is shared and should be shared. So, what's the harm in turning the monitor, or the screen or the iPad, towards the patient and having a discussion about what's happening in the record that they're documenting? And [mentioning], "by the way, when you get home you can see it for yourself." It is their [the patient's] record, so to me the idea that a physician being concerned that technology will stand in the way of the patient… that record is just as much theirs as it is yours in the management of their condition. So don't use it as a barrier, use it as an opportunity to have a dialogue.

UTMJ: You've mentioned the importance of moving technology into the hands of the patient. Do you think that will be more difficult for those within the ageing population that maybe aren't as tech-savvy?

JC: No. It all comes back to the design. We hear this a lot that older patients can't do this stuff, that they're not good with technology. Everything we've learned in the last 10 years shows that if the design is right, they can do it. In many of the trials of the technology we've developed we have had octogenarians use the technology. They have no problem, again, if it's well designed. In two instances of consumer applications, both in the area of heart-risk assessment and diabetes management, we've learned that it's the older adults that tend to use the technology more intensively and for longer periods of time than the younger patients. So, it's a myth that older adults can't use this technology nor will they. In fact, they use it more frequently and they're more engaged for longer periods of time than their younger counterparts. I think that maybe it also has to do with [the fact] that when you're sick you tend to be more engaged. There's a big difference between someone who has been recently diagnosed with diabetes and someone who has had their foot amputated as a result of diabetes. There's a big difference between someone who smokes and is overweight and someone who is entering heart failure. Big diagnoses and big traumas in your life can change your behaviors for sure. Maybe that has something to do with it as well.

UTMJ: Is there a role for education in this process as well? Motivated patients still need to learn to use new technology.

JC: Yes, but I think the education is not didactic as you might think it is. The education is, to me, through self-awareness. That's where the tools come in, in helping people interpret their lab results, because there are a lot of people walking around with chronic illness who don't have a full appreciation of why a hemoglobin A1C is important and why your potassium level is important if you have CKD and there is

no understanding of what can effect those lab parameters. So, the education [involves] building up the self-awareness around the seriousness of the chronic illness and, in fact, the bright spot of this is that it's potentially very manageable. But I don't think the traditional means of education are necessarily that useful in an electronic form. You're either going to educate people face-to-face or through some other means, but the electronic education…I'm not necessarily a big fan of.

UTMJ: What major healthcare innovations do you see on the horizon over the next 10 to 20 years?

JC: Well, we're not finished on this design Human Factors [work]. You know, a lot of it is advocacy for the patient. We're a ways away from the patient being empowered to do more self-care. On the surface, when we show tangible examples of people being very successful at this [using self-care technology], a lot of the decision-makers, the policy people, are very receptive to it and then the conversation ends. We're so focused on ourselves in the healthcare system and the challenges of treating people coming in our door that we aren't thinking far ahead enough to anticipate how we prevent that patient from coming through our door. I guess it's the whole health promotion question all over again. So, to me, the advocacy still needs to be there. The technologies will evolve and we're [working on] different technologies, like wearables, and the work that we've done in smart phone technology is being expanded. What enabled the smart phone to be such an innovative device is now being used in wearable devices that allow us to capture vital signs on a continuous basis as people live their normal lives. Beyond that, we also see the home being full of sensors that are able to monitor patients unobtrusively. So, those are things that will progress over the next 10 or 20 years but, fundamentally, beyond the technology, it's about the role of the patient in self-care and for us to let go in a certain extent. We always try to reinsert ourselves…even when there is a new technology that enables patients to do self-care. We kind of reinsert ourselves into that mix and to a certain extent we have to let go of that. We can set directions and so on but we need to allow patients to be able to manage because we can't afford it any other way. As well, just keeping people aware that the future of technology design in healthcare is not creating a medical device for the home but more about taking what we've learned from the consumer realm and informing health technologies for the future. There's really no distinction between that doctor or that nurse when they're at home sitting in front of a consumer device and when they walk through the four walls of the clinic. They're the same person but we tend to treat them differently and we tend to treat the design of the technology differently. So that design philosophy needs to be more pervasive through a lot of the health technology manufacturers.