

THE ORTHOPAEDIC INNOVATOR: HOW WE CAN PROVIDE BETTER CARE FOR OUR PATIENTS

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As surgeons, we are the face of healthcare to our patients and oftentimes, the recipient of all their frustrations with the system. As our patients live longer and medicine becomes increasingly complex and costlier, it's no longer enough to be an excellent surgeon; we need to conduct research, teach medical students, and more often than not, come up with solutions for the very problems our patients are facing. How can we deal with the silver tsunami of geriatric patients and the epidemic of arthritis needing treatment? What can we do about the bed crunch and lack of community care facilities for patients with musculoskeletal disease? Why is it that the uptake of conventionally effective treatments like physiotherapy, weight loss, and regular exercise is so low in our local population?

Innovation is the hottest topic in the healthcare ecosystem lately and orthopaedics is no exception to the rule. Furthermore, as a discipline, orthopaedics is closely intertwined with technology as we work with implants, scopes, and navigation every day. The very nature of our work means we are a community of action driven individuals who like to solve problems working with our hands. We *want* to solve the problems our patients are facing. Unfortunately, as much as one might like to, it's not possible to plate poor access to healthcare resources or nail the issue of high bed occupancy rates.

It's not as though we're dealing with a small problem either. The American Academy of Orthopaedic Surgeons estimates that musculoskeletal disease affects over 126 million Americans annually, with musculoskeletal conditions surpassing cancer and heart disease as the largest cost driver for employers (1). CDC statistics show that arthritis affects about 25% of the population at any given time, is a major cause of work disability, and one of the most common chronic diseases and causes of chronic pain in the United States (2). Chronic neck and back pain were amongst the top 5 contributors to global disability as estimated by the WHO, with up to 84% of adults experiencing lower back pain in their lifetimes, of which 31% will never fully improve from and 25-64% will develop recurrent symptoms (3).

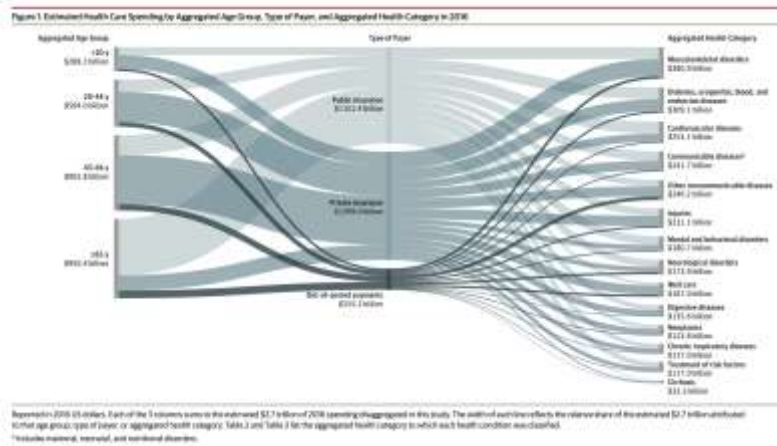


Figure 1. Estimated health care spending in the US. Musculoskeletal disease accounts for over \$300 billion (1).

While this is hardly news to the orthopaedic community, it seems that the rest of the world is just catching up. Particularly with the COVID-19 pandemic accelerating the development of digital health and remote care, startups like Hinge Health, Kaia Health, and even MNCs like Google are hungry to get a piece of the \$213 billion dollars spent annually on musculoskeletal care (4). In its latest Series D round, SWORD Health raised \$163 million in its oversubscribed round and was valued at over \$2 billion, joining the table as one of the first musculoskeletal health unicorns (5). Hinge Health’s remote physiotherapy programs, Roam Robotic’s exoskeleton knee brace, and even Canary Medical’s collaboration with Zimmer to develop smart total knee implants with inbuilt sensors are just the tip of the iceberg when it comes to orthopedic innovations (5).

The question therefore becomes not *why* innovate in orthopaedics, but *how*?

There’s the popular idea that innovators depend on some kind of creative magic to be successful. A lot of buzzwords get thrown around these days - AI, 3D printing, blockchain, robotics - to name a few and it’s tempting to think that innovation means just throwing technology at healthcare problems and hoping something sticks. But as failures like Amazon’s Haven Healthcare or Theranos demonstrate, healthcare as an industry is conservative, slow to move, and driven by a complex set of stakeholders, including physicians, hospital systems, and insurers (6). And with good reason too - at the end of the day, we are dealing with people’s health, their livelihoods, their wellbeing, and their families. Trying to “disrupt” healthcare like Grab disrupted transportation or Lazaada and Shopee disrupted online shopping just doesn’t work.

In 2018, I was fortunate enough to be selected as one of the Singapore-Stanford Biodesign fellows and took a year off residency to immerse myself in medtech and healthcare innovation. For me, it was a homecoming - as a Stanford bioengineering undergrad, I could only dream of joining the Stanford Biodesign fellowship. Now, as an

orthopaedic trainee, I was returning to Stanford and looking at problems through the fresh lens of a surgeon. We spent the year in Silicon Valley, Shanghai, Jakarta, and Singapore and met with hospital systems, venture capitalists, and startup founders to better understand how to translate clinical problems into viable innovations.

At its heart, the Stanford Biodesign process believes innovation is a process that can be learned, practiced, and perfected. With roots in design thinking, empathy, and multidisciplinary collaboration, the Biodesign process focuses on three key steps to healthcare innovation:

- 1) Identifying and screening clinical needs
- 2) Inventing concepts to address clinical needs
- 3) Implementing solutions via strategy and development

As of 2022, over 7.6 million patients have benefitted from technologies developed by Stanford Biodesign alumni and over 50 health technologies companies have been spun off from the program, which goes to show that the process works.

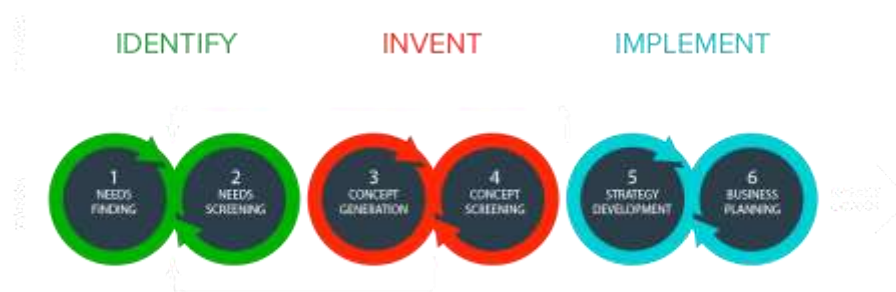


Figure 2. The Stanford Biodesign process (7).

So what *did* I learn from the fellowship? How does this apply to orthopaedics? How can we effectively innovate in our field and deliver better care for our patients? Ultimately, it boils down to the same thing we learned in medical school: empathy. Unlike technology-driven innovation, Stanford Biodesign believes that innovation centers around unmet clinical needs and patient-centered care. At the end of the day, healthcare starts and ends with patients - providing better outcomes, reduced costs, and improved satisfaction mean nothing if patients don't benefit. Putting yourself in the patient's shoes and walking a mile is the best way to identify a clinical need that needs addressing. By being technology-agnostic, needs-driven innovation focuses on finding the *best* solution for a need, not the newest or most technologically sophisticated.

In fact, some of the most effective innovations in orthopedics have nothing to do with the latest technology and everything to do with patient-centered care. Development of enhanced recovery after surgery programs meant that total knee replacements could be

done as day surgeries, ensuring patients debilitated by knee arthritis could still receive timely surgeries during the pandemic (8). Implementation of orthopaedic telemedicine consults translated to patients safely receiving care at home without having to risk a trip to the hospital and COVID-19 exposure (9). Development of triage and treatment protocols for spine patients helped to allay patient concerns and ensured critically ill patients received appropriate care (10). What these examples illustrate is that the shiniest, newest technologies are not required to innovate in orthopaedics. Rather, innovation comes from identifying an unmet clinical need that affects real patients on the ground and addressing it accordingly, whether it's through policy change, implementing existing technology, or developing new clinical workflows.

Above anything else, Stanford Biodesign taught me that anyone can be an innovator. It doesn't require a scientific breakthrough, creative genius, or a degree from a top university. In healthcare and in orthopaedics, what it takes is an earnest desire to identify an unmet clinical need and to always put the patient first. Imagine yourself in their shoes. Think of them as your grandparent, your spouse, or your child. Empathize with their challenges and their concerns. It might be time consuming. You'll probably fail at least once. And it certainly won't be easy. But when it comes to innovation, start with the patient sitting right in front of you and you can't go wrong.

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