



No Time To Lose

Meet the Physician Predicting the Healthcare of Tomorrow

By Eyal Zimlichman, MD, MSc¹ & Caitlyn Allen, MPH^{*2}

Introducing Dr. Eyal Zimlichman, chief transformation officer at Sheba Medical Center. His job is to predict the future of healthcare—then figure out how to make it reality.

Caitlyn Allen: What does your role as the chief transformation and innovation officer entail?

Dr. Eyal Zimlichman: We try to predict what healthcare will look like five to 10 to 20 years out and how we can innovate to get there by solving many of our major crises that healthcare has: the challenges and gaps. One of them being quality and patient safety. I have a saying that “innovation is the fun part,” because you get to deal with interesting people and cool toys. But transformation is the difficult, even the painful part, which actually deals with change—changing how we do things, changing the culture, which as we know in healthcare is always the major challenge.

Handling innovation and transformation allows me to design solutions but then implement them on a large scale and not just settle for the innovation itself. My origins are quality and patient safety, which is what I've been doing most of my career as a doctor.

I'm an internal medicine physician by training and have done quality and patient safety in Boston, working at Partners HealthCare (what is now Mass General Brigham) and here at Sheba, and then was the chief medical officer at Sheba.

I view quality, patient safety, and innovation as being on the same continuum where we're always trying to improve what we're doing. Never being satisfied with what we have, but rather always looking out for ways to do better. Innovation is about thinking differently on how to engage with those problems.

You mentioned that one of your roles is predicting where healthcare will be in the near future. What do you see?

It's a long answer, but one major change we're seeing is transitioning from hospital care to home-based care, where many patients who would have been admitted are now being treated at home, which involves digital health transformation and virtual care.

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Number two is a much bigger emphasis on prediction and prevention. Again, using digital health tools like artificial intelligence [AI] and precision medicine to understand the individual patient better and to predict what's going to happen: for example, complications developing or response to therapy, whether it's for cancer patients or other types of illnesses. Moving towards prediction and prevention rather than treating illness.

Another change is moving from just focusing on healthcare, which is treating the sick, to looking at a much broader scope, the “social determinants of health.” We have to look at patient education and patients' capacity to be more active in their care.

All are a major shift from the more traditional, paternal system that tells patients what to do, towards a system with patients at the center. We're equipping them with the right knowledge and right tools to take an active role in care. There are others, but these are the major changes that will impact everything we're

doing in healthcare. Of course, the first to see the benefits will be the patients themselves.

How might we navigate the transition to home-based care?

We need to identify how we can improve care. We're not just moving from hospital to home so patients stay in their environment, which of course makes sense, but also because we think we can provide better care. We think outcomes can be better at home, which can seem counterintuitive.

The key would be to reach better results at lower cost while having patients move from the traditional hospital environment, well-equipped to treat sick patients, to the home environment, not so much equipped to treat sick patients.

This will be the main challenge. Digital health solutions, innovation, and transformation will allow us to make that leap. There are technologies today that allow us to monitor patients at home, to be able to figure out whether a patient is in the right environment, because if his condition is deteriorating, maybe we do need to move him back to the hospital.

We have technology today that allows doctors, nurses, and other health professionals to treat patients from afar without the need to physically be at the home, because that's not a sustainable model. We will not be able to drive nurses and doctors to every patient's home to the extent that we're used to having them be at the bedside in the hospital, because that just won't work from a financial perspective.

Plus, we have a well-known crisis in workforce shortages, and most doctors and nurses aren't willing

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*Corresponding author

¹Good Shepherd Penn Partners

²Patient Safety Authority

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to spend time driving around the city, visiting multiple patient homes a day. So, how do we solve this issue by using technology again to allow clinicians to provide care to patients at home virtually? I think these will be the main challenges we see that will allow us to improve outcomes for patients treated at home while reducing cost and turn this to a viable model.

You mentioned the social determinants of health, which are routinely a challenge in healthcare. How would you recommend hospitals start to look at them and what solutions could they implement to try and address them?

We need to realize that it's up to us as healthcare systems to solve these problems. We cannot say, "Well, this is beyond the scope of what we do," because we are more and more accountable for those patients. Payment models are changing. We're seeing it with value-based healthcare. We're seeing this with accountable care organizations.

In that regard, we will be held fully accountable and paid in a way to motivate us to keep patients as healthy as possible. We will understand that it is within our scope and within our capabilities to impact what patients eat, for example, or what kind of education they're receiving or transportation if they need to get somewhere.

All of those, which traditionally were outside our scope, are becoming central in the modern healthcare system and what healthcare systems will have to do over the next couple of years.

Well, especially if we do move to a home-based model. Arguably things like diet will affect you more in your home than if you're staying in the hospital for a week.

Absolutely. Consider dietary restrictions. It's cheaper for us as healthcare systems to buy the right food for our patients, rather than to treat those patients later if they develop a disease, which will obviously become much, much more expensive for us.

We need to look long-range financially and understand that we're investing now in saving costs later for those many patients. Sometimes for chronic disease patients, this can be very quickly gained. For example, patients with congestive heart failure who eat a high salt diet will more often require hospitalization because of episodic deterioration.

If we can make sure they eat what they need to eat, we can prevent those hospitalizations. Then it even makes sense financially, and of course it makes sense from a patient's perspective and from what healthcare is trying to achieve.

How would you grade innovations in patient safety compared to other areas of medicine?

Patient safety is the number one area where we need innovation. One thing that we've seen, and repeatedly over the last few years, is that we're making very little progress in preventing harm for patients, especially in the hospital.

We're not just moving from hospital to home so patients stay in their environment, which of course makes sense, but also because we think we can provide better care. We think outcomes can be better at home, which can seem counterintuitive.

Earlier this year, David Bates and his team at Harvard¹ showed that there's been little change from the initial numbers we measured back in 1991 in the Harvard Medical Practice study—almost 30 years where there's been very little progress.

So, we're frustrated with how much has been done and how much money has been invested in patient safety. Governments have put forward programs to try and tackle this and provide incentives. There's a large industry that has developed and so on, and still, we've made very little progress. We have to start thinking differently.

If we continue to just go back to the old paradigms of quality and patient safety, we will just have the same outcomes that we've seen over the last 30 to 40 years. We must start thinking differently. Technology, specifically digital health, will have to play a growing role.

For example, a major known problem in patient safety is adverse drug events and medication errors. We've been trying to tackle this for years using solutions such as decision support systems on CPOE, computerized physician order entries,

which have caused a huge amount of desensitization and alert fatigue among staff who ignore those alerts as they pop on the screen because they're used to the false alerts.

As we advance with artificial intelligence, we will be able to create alerts that are much more accurate with minimal alert fatigue. This happened at Sheba Medical Center when we introduced an AI solution on top of the traditional decision support system. Staff said they are paying much more attention to the alerts coming from the AI system versus the alerts coming from the rule-based approach that has been used around the world for the last couple of years. Innovation; digital health; and, in this example, artificial intelligence can enhance these types of systems.

Another example is being able to read CT scans within milliseconds, because that's how quick the AI works. Say a patient who has come in with a stroke, maybe cerebral hemorrhage, might be delayed in diagnosis for another 30 to 60 minutes, because it's a busy ED [emergency department], and by the time the radiologist gets to read the scan, those 60 minutes might have passed and could be critical to really impact the outcomes on these patients. We know diagnosis of stroke very early on is critical so that we can initiate therapy as fast as possible and prevent any long-term effects and disabilities.

Within milliseconds, the AI can read the CT, identify the hemorrhage in the brain, and alert the doctors very early on about a possible hemorrhage in the brain so the doctor can log into the CT, acknowledge that there is a hemorrhage, and initiate the protocols to treat those patients. By that, we have shown that we have been able to reduce mortality considerably, reduce long-term disability on those patients, and reduce cost because of improved efficiency in the emergency department setting.

AI is undoubtedly a game changer and the future of healthcare. However, there is a presumption that AI always outperforms humans. Have you found that to be the case?

We look at AI as augmenting doctors, not replacing them. AI can alert doctors to something that may have taken us longer to get to. Not because we're better or worse than the AI, but it's a fact. We're unable to read a large number of CT scans the same way that the AI would.

Als are not costly. They are a data algorithm. And implementing an algorithm is much cheaper than buying a surgical robot or another MRI scanner.

In this regard, it can prioritize which CT scans I should read first. If I'm a radiologist in the ED, just that is enough. And maybe the AI made a mistake such as wrongly diagnosing the CT. But if the accuracy is high enough, we will be able to see clinicians enjoying this augmentation and improving our outcomes.

The same would be, for example, finding the right medication for cancer patients. AI is better at looking at very large-scale data sets coming from our patients and suggesting how we should start treating this specific patient based on his genetic material, CT scans, pathology, and laboratory information. The AI could suggest a first therapy, rather than trial and error like we often do today, and potentially improve our ability to hit it right on the first time.

If we can hit it more accurately on the first try, we could save a lot of money and, of course, more importantly, improve the outcomes and improve the quality of life for those patients.

What are some things that you could implement that may not cost as much money as a new AI system?

First, AIs are not costly. They are a data algorithm. You need an electronic medical record, which is quite common today. And implementing an algorithm is much cheaper than buying a surgical robot or another MRI scanner. AI can also improve decision-making in rural hospitals that may lack the right manpower that you would see in the major cities. An AI algorithm that can be implemented easily everywhere will improve health equity. Unlike many other technological solutions that are typically costly, AI can extend care remotely and create a huge amount of value for patients.

For example, small rural hospitals may not have a doctor in their emergency room or ICU [intensive care unit] during the night. However, tele-ICU allows one

centrally located doctor to take care of 10 ICUs in 10 rural areas.

Of course, that has economies of scale, and it's more financially sustainable than having a doctor in each of those sites 24/7. That's the advantage of digital health rather than say a robot, to improve patient outcomes and reduce cost.

That makes a lot of sense and underscores that implementing AI does not need to be costly.

We're seeing very high uptake of these solutions. For example, that AI I mentioned that reads the CT scans in the emergency department is a company called Aidoc that came out of Sheba after a successful pilot here in 2018. In a short time, it's already deployed in more than 1,200 hospitals around the world. I think about 800 in the United States.

The AI allows us to deploy those solutions quickly and for a fairly minimal investment, yet with a huge impact on patient outcomes. This is one way digital health promises to transform patient safety and improve quality over the next decade.

Tell me more about the pilot with the CT scans. Was there any resistance, and if so, how did you overcome it?

When we started this, 2016, 2017, AI was still not well accepted, and there was a lot of initial resistance. Implementation takes a lot, and sometimes a great technology can fail during execution because you haven't really thought it through.

The workflow needs to be seamless for the clinicians and does not impose on them. We stated originally, "The only role of this AI is to prioritize for the radiologist what to read first, because something might be time sensitive."

We got the usual response from some radiologists who said, "So what? You think this would replace me and I'll be out of a job?" Which we hear a lot when we talk about AI, and not just in healthcare. But when we say, "No, this is just setting priorities for you to read," it takes away much of the tension, and opens up clinicians to work with this new technology.

After they started using it and confirmed it could diagnose dangerous complications early (not just, by the way, bleed in the brain, but also pulmonary emboli and hemorrhage in the abdomen and

other critical diagnoses), we heard from radiologists who said, "This was great. I'm becoming a fan of this technology, and I'm going to use this for the rest of my career."

We've heard more and more clinicians refer to it as a great complement to their skillsets rather than competition. So how do you bring this to the clinicians? How do you package it? How do you intuitively incorporate it into the workflows in a non-threatening way to clinicians that actually reduces their workloads? These elements are critical to success.

Beyond the CT scans, you're changing culture—the white whale in healthcare.

Culture change is a daily topic when we deal with transformation. And as somebody who came from the origin of quality and patient safety, we know how important culture change is. We measure culture of patient safety using surveys in every hospital in the U.S., and we always try to improve it.

How can we create the right environment for this to happen? How can we drive the changes? Because healthcare, as you know, is not a very dynamic industry, and we have to change some of the ways that we've been handling things to drive meaningful and substantial improvements.

Culture change is a daily topic when we deal with transformation.

What's been my guiding light through culture change wherever I worked was to start with champions. We always need to find the right champions in any environment and create the evidence locally. It's not enough to base your arguments on evidence created in some other hospitals, many times in another country, maybe on another continent, and then say, "Well, there's evidence that it works."

But rather test it in your own environment using your clinical champions. And clinical champions always exist. Create the evidence on the production floor of your specific location and scale up once you have a local proof of concept. That's a huge motivator to push these changes forward locally at your environment.

You would recommend starting smaller and more focused and then try and scale up like a single unit, single hospital, as opposed to trying to implement a broad change across the whole facility.

Exactly, and work with your local clinicians to always be dynamic. That's part of why you're starting small, because you want to learn. And again, not everything that has worked in another institution will work in yours. Learn what needs to change for your environment, work with the clinicians and provide them the confidence to change what is needed.

If it were just the world according to you, what is one thing we should do to improve patient safety?

We need to more actively create evidence from technological solutions in the U.S. and most developed countries. Again, when I say technology, it doesn't need to be very costly.

And even in developing countries, we're seeing digital health play a major role, because it's affordable. Not just artificial intelligence: telemedicine and augmented reality [AR] and virtual reality to improve our ability to treat patients.

There are many avenues that we still need to tap into more seriously to drive solutions. Take augmented reality: We have augmented reality glasses for surgeons that enable us to be much more accurate, because we're able to navigate much better to reduce the length of time for surgery.

For example, we have seen the length of the procedure for implants specifically for spinal pacemakers reduced by 50% from about an hour and a half to 45 minutes just by using AR. But not just the length of this procedure being cut in half, but also the number of complications was lower, because we were able to implant the specific pacemaker at the right location without cutting in the wrong location and creating more blood loss or other complications of surgery.

This is something we're going to see much more of. Apple recently came out with their augmented reality glasses. They're still expensive, but 10 years from now, every surgeon is going to use augmented reality glasses to be much more accurate, reduce complications, and reduce the time of surgery.

It sounds like science fiction, but it's already happening and there's a growing literature to show the benefits. But again, as you're asking me what needs to be done over the next few years, it's creating more evidence for the use of these types of technology and the benefits they can produce.

This will be transformational to surgery at large. So taking all of this in together, digital health offers us the possibilities to drive quality and patient safety forward in a very sustainable and cost-sensitive fashion. This is what's going to create most of the transformation in the next decade.

That's astounding. What do the glasses allow you to perceive that you wouldn't otherwise be able to?

Because we've already done an MRI on this patient, we know exactly where there's a tumor we need to cut out, or if there's a specific location to implant the pacemaker, or whatever the procedure is. When we're just looking at the patient with our bare eyes, we don't have all this knowledge we've gained from the scans.

At best, we have the scan on a wall on an LCD we can look at, but then we need to go back to the patient and try to orient to where exactly we need to make the cuts. But if I have my augmented reality glasses on, and they are being fed the MRI, then I will see overlaid on my patient the exact tumor or the exact location or when I need to make my cut or implant my pacemaker. With that, it makes surgery much easier, much simpler. It doesn't take as long and can reduce complications.

That's incredible. It's like *Star Trek*-level medicine.

Exactly. It sounds like science fiction, but it's already happening and there's a growing literature to show the benefits. But again, as you're asking me what needs to be done over the next few years, it's creating more evidence for the use of these types of technology and the benefits they can produce.

The costs will go down considerably over the next few years and will become something that every hospital and clinic will be using five to 10 years from now.

We need to shift our way of thinking because traditionally, as somebody who's lived my life professionally in the world of patient safety, it's always about trying to do better next time.

If a nurse or doctor makes a mistake, we apologize and try better next time and hope it will be the last time. But we need to move away from trying better to a place where technology will enable us to really have zero errors being performed. Only technology will allow us to do this, because otherwise we're all humans.

The Institute of Medicine report that came out in 1999 was called *To Err is Human*, so maybe this is where we need to start thinking differently and have technology able to compensate for our failings as human beings.

Reference

1. Bates DW, Levine DM, Salmasian H, et al. The Safety of Inpatient Health Care. *N Engl J Med*. 2023;388:142-153. doi: 10.1056/NEJMs2206117

About the Authors

Eyal Zimlichman is an internal medicine physician, healthcare executive, and researcher focused on assessing and improving healthcare quality and value, patient engagement, and patient safety. Dr. Zimlichman currently serves as chief transformation officer and chief innovation officer at Sheba Medical Center, Israel's largest hospital. In this position, he oversees the transformation efforts carried out at the Medical Center as it aims to redesign healthcare to be focused on patients, while being more effective, efficient, and equitable.

Caitlyn Allen (caiallen@pa.gov) is director of External Affairs for the Patient Safety Authority and managing editor for *Patient Safety*, the PSA's peer-reviewed journal. Before joining the PSA, she was the project manager for Patient Safety at Jefferson Health, where she also was the only nonphysician elected to serve on the House Staff Quality and Safety Leadership Council.