I.equalcare Research - Global Report on Al Development and Use for Healthcare (Singapore)

1. Background

In this paper, we will dive into the global engagement of nations in the realm of AI-driven healthcare and pinpoint areas of enhancement that can foster equity, fairness, and inclusivity in AI-based healthcare technology. Generally, being the potential lack of representation of minorities in medical databases, and the other being misrepresentative or discriminatory data that is not addressed when developing Al models are two issues that potentially impact on AI-powered healthcare. These challenges give rise to biases in AI systems, which may exacerbate disparities rather than enhancing healthcare quality, particularly for marginalized populations. This research aims to provide an overview of the participation of various nations in the development and integration of AI models in medical applications and to highlight the apprehensions expressed by healthcare professionals regarding the sources of bias and inequity within these models.

1.1 Current development of medical AI

a) Jarvis DHL

Jarvis DHL is an AI system used to transform chronic care for diabetes, hypertension and hyperlipidaemia. The development of this AI-based medical technology is contributed by National University of Singapore (NUS) and SingHealth Group (SingHealth). Their aim on this project is to integrate multiple solutions into a consolidated AI platform that designed to enhance the delivery process of healthcare, particularly in the context of the "3H" care framework. In the meantime, they also target to develop an AI system to gather local healthcare data to create AI algorithms and models, while facilitating evidence-based personalised care and shared decision making by primary care physician.

b) Explainable AI

This AI technology which has NUS and National University Health System (NUHS) involved serves as a service for community healthcare. It focuses on advanced AI with prototype devices built for deployment and testing in a community setting. It aims to use an “AI as a service” approach to provide advice, tools (such as food logging) and lifestyle coaching.

c) An End-to-end Adaptive AI-assisted 3H Care

This adaptive model is built by Nanyang Technological University (NTU) together with National Healthcare Group (NHG), functioning to periodically assess the status of 3H patients, and identify pre-3H persons based on early behavioural patterns,

health symptoms and other non-medical factors. This project is also aiming to develop approaches to create long-term behaviour change through gamification.

1.2 Applications of medical AI in treatment and diagnosis

a) Early-stage detection and prevention[6]

SELENA+ system is applied for analysing eye retina images to detect three types of eye diseases in support of the national diagnostic retinopathy screening program.

b) Targeting for clinical treatments as well as targeting for related special health support programs

Medical AI can be used for prediction of hospital inpatients with a high risk of multiple readmissions in support of the hospital to home national program.

c) Resource optimization within hospitals and polyclinics, and across the entire public healthcare supply chain and service delivery network

Short term and near-term emergency department arrivals are able to be benefited from the application of medical AI. Moreover, number of people entering and leaving hospital via all entry points, and number of people in key hospital areas susceptible to crowd build ups via real-time video analytics (C3 centre uses various AI enhanced simulation models to support action planning and option assessment for dealing with current or impending congestion, load imbalances, and resource constraints across key hospital resources).

d) Administrative support

The use of robotic process automation and wireless sensors to facilitate covid patient discharge from special facilities set up as covid community care facilities.

2. Local AI healthcare assessment

a) Data on underrepresented groups and reasons for their underrepresentation

In Singapore, the largest ethnic minorities are Malays and Indians, making up 13.5% and 9.0% of the population in 2020. Although they make up a significant proportion of Singapore's population, Singapore's ethnic Chinese population take an even larger portion of it, making up 74% of the population. This causes Malays and Indians to be highly underrepresented in medical trials and studies. In fact, the first medical study across equally sized samples of all three minority groups is done in 2018. Given that fairer representation was only done recently in a few studies, the majority of medical data in Singapore would likely be oversaturated with data from the ethnic Chinese population, causing greater data bias in medical AI towards the Chinese population, reducing its effectiveness and fairness towards Malays and Indians.

Although the disparity in underrepresentation may not be as vast between biological men and women, it is nonetheless a significant problem. The Integrated Women's Healthcare Programme has found that women tend to be an underrepresented demographic in global clinical trials, much less Asian women. In North America and Europe, where major medical agencies are located and conduct trials, the Asian population is a minority. Furthermore, while there is some improvement, most efforts to include sex and gender are inconsistent in nature. The approval of these major bodies influences the global medical sphere, including Singapore. This leads to a lack of medical data available on how the effects of chronic and acute illness and their various modes of treatment differ from Asian men. While existing clinical trials in Singapore would likely have more gender equity due to increased medical studies focused on women, this disparity in existing medical data no doubt still exists.

b) Methods of medical data collection in Singapore

In Singapore, medical data collection primarily occurs through a combination of electronic health records (EHRs), healthcare information systems, surveys, and administrative databases. Here are some of the key methods of medical data collection in Singapore:

1. Electronic Health Records (EHRs)

The NEHR is a central repository of patient health records that allows authorized healthcare providers to access and share patient information electronically. It contains key medical information such as diagnoses, medications, allergies, and laboratory results.

2. Healthcare Information Systems

Healthcare Information Systems (HIS): Each hospital in Singapore has its own HIS to manage patient data within the institution. It includes patient demographics, medical history, treatment plans, and billing information.

Note: Clinic Management System (CMS): Similar to HIS, CMS is used in outpatient clinics to manage patient information and appointments.

3. Surveys and Studies

Health and Population-based Surveys: The Ministry of Health (MOH) and other agencies conduct periodic surveys to collect data on various health parameters, such as the Singapore Health Promotion Board's (HPB) National Health Survey.

Clinical Trials and Research Studies: Academic institutions, hospitals, and research organizations conduct studies to gather specific medical data for research purposes.

4. **Administrative Databases:**

National Registry of Diseases Office (NRDO): NRDO maintains registries for chronic diseases like cancer, stroke, and heart disease. It collects data from public and private healthcare institutions to monitor disease trends.

Birth and Death Registration: The Singapore Registry of Births and Deaths collects demographic data, including information on births, deaths, and causes of death.

It's important to note that data collection in Singapore is subject to strict privacy and confidentiality regulations outlined by the Personal Data Protection Act (PDPA) and other relevant laws. Patient consent and data security are paramount concerns in all data collection methods.

c) Evaluation of Efforts Towards Inclusive Data Collection and AI Development in Singapore

Involvement of Singapore in international AI research and open science efforts

1. **Singapore and global medical AI**

SEA-CoreNLP: It aims to promote the development of NLP in Southeast Asia and be the central hub for it. The current focus is on "core" NLP – tasks such as part-of-speech tagging, syntactic parsing or semantic role labelling etc. for Southeast Asian languages.

2. **AISG x Egypt**

AI Singapore and Egypt's Ministry of Communications and Information Technology (MCIT) have signed a cooperation agreement to implement in Egypt two of AISG's premier talent development programmes in AI, the AI Apprenticeship Programme (AIAP)® and AI for Everyone (AI4E) ®. This collaboration will help Egypt in its strategy to launch capacity-building programmes to propel the country's AI capabilities.

3. **GPAI**

The Global Partnership on Artificial Intelligence (GPAI) is a multi-stakeholder initiative which aims to bridge the gap between theory and practice on AI by supporting cutting-edge research and applied activities on AI-related priorities.

Built around a shared commitment to the OECD Recommendation on Artificial Intelligence, GPAI brings together engaged minds and expertise from science, industry, civil society, governments, international organisations and academia to foster international cooperation.

AI Singapore is the co-chair of the working group on Innovation and Commercialization and the Broad adoption of AI by SMEs sub-committee.

4. AIRI

AI Singapore's AI Readiness Index has been adopted by companies and associations globally. This includes GPAI within the workstream of the Broad Adoption of AI by SMEs, in which the SMEPortal embeds AIRI as a core feature.

Health conditions, complications, and symptoms that are specific or more common for people in Singapore and Southeast Asia

1. Diabetes

Singapore has the second-highest proportion of diabetics among developed nations, a report in 2015, by the International Diabetes Federation (IDF) revealed.[1] The recent National Population Health Survey showed an increase in the crude prevalence of diabetes from 8.8% in 2017 to 9.5% in 2020,[2] in compare with the latest and most comprehensive calculations show the current global prevalence rate of 6.1%.[3] In 2010, 1 in 9 Singapore residents aged 18 to 69 years were affected by diabetes. Indians and Malays consistently had higher prevalence of diabetes compared to Chinese across the years. An estimated 430,000 (or 14% of) Singaporeans aged 18-19 years are also diagnosed with pre-diabetes.1 in 3 individuals with diabetes do not know they have the condition. Among those diagnosed with diabetes/aware of their disease, 1 in 3 have poor control of their condition, which increases the risk for serious complications. Diabetes was the 4th and 8th most common condition of polyclinic attendances and hospitalisation respectively in 2014.

4. Problems have met and improvements that you think could be made for more inclusive medical AI in Singapore

a) Problems:

1. AI tools are yet to be perfect, through machine learning and deep learning algorithms, Selena+ reads these digital retinal photography, identifying diabetic damage to the eye with an accuracy rate of over 95 to 97 per cent.[4]

2. The Multiple Readmission Predictive Model identifies high-risk patients for better care intervention to reduce their risk of being readmitted to hospital. This AI model analyzes

multiple facets of a patient via hundreds of indicators, and has an accuracy of 7 in 10 patients correctly predicted.[5]

Questions for Professor Joseph Sung:

1. Are there any ongoing projects or initiatives focused on using AI to address specific healthcare challenges or disparities in Singapore?

Yes, at TTSH, there is the AI chest radiograph used for pneumonia detection. In that case, X-ray will be scanned by AI. Moreover, diagnosis of mental health using AI is still undergoing development. It's a chatbot for subclinical mental diseases with multiple functions. For example, it helps to monitor elderly, pick up the sign of early dementia, and used for people who are afraid of social stigma. Although it reduces embarrassment of seeking treatment, it's computer needed. This tool is planned to work with community healthcare workers, community centres (CCs).

2. As an expert researcher in Hepatology and Gastroenterology, do you think it is necessary to develop AI technology? To what extent does the AI technology integrate in Gastroenterology and Hepatology, and what does it help with?

Yes, AI for diagnosis of polyps, as screening of colorectal cancer. The technology could help in detecting the location and the size of polyps, characterising its malignant potential and further reduce risk of complications. It helps to improve detection rate by 30%, together with rising the accuracy by 90% as compared to manual/human operation.

3. Are there any interdisciplinary collaborations between AI researchers and healthcare professionals to improve the integration of AI technologies into clinical practice? And how do you ensure that it is safe?

There's one called Tumour board which is for the area of cancer.

4. In Singapore's multiracial society, are there any efforts or specific procedures taken to ensure that every patient can enjoy the improved outcome of AI treatment? Are there any differences in the process of treatment for different groups of people (ethnicity? Age? gender?) ?

Cancer, early detection, evidence showed that diff ethnic groups or socioeconomic, portrayed diff behaviour and acceptance level towards health screening. If we develop an AI/ app to educate, bring awareness, can penetrate the importance of health screening into the community better than current measures.
Screening vs diagnosis: AI applied

5. Are there AI technologies that help to prevent gastroenterological diseases? As many of them are from unhealthy lifestyles such as bad eating habits etc, are there AI technologies for the general public to understand how to eat healthily or cultivate good habits for their digestive system?

For gastroenterological diseases prevention, lifestyle modification is the first thing to do. Daily activities should be monitored. For example, do more exercises while control and take healthy diet. The person should quite drinking and smoking as well.

To understand how to eat healthily or cultivate good habits for their digestive system, study on psychology and social science should be performed to find out the barriers and enablers, further increasing the acceptance of such knowledge. Also, family members with history tend to show much more acceptance in prevention measures, or when recommended by family or doctor. Accessibility (pay/ procedures/location/etc) also matters.

6. How do you think that AI technologies that are currently implemented in Singapore can be further improved, especially in ensuring such technologies are beneficial for all patients in terms of effectiveness?
The areas of improvement are healthcare equity, economic wise, technology gap, affordability and accessibility, respect values and rights of patients, patients autonomy. To improve this, we can try to design something user-friendly while affordable. Government subsidies will also help. In addition, the technologies should be simple, clear-cut, accurate and user-friendly.

7. How do you validate the performance and accuracy of AI models, especially when applied to diverse populations with varying healthcare needs?

Randomised Controlled Trial (RCT), sub-group analysis.

8. How do you engage with the broader community, including patients and advocacy groups, to ensure that AI technologies are developed with their input and meet their needs?

Personalised, cancer prevention, high risk people, social and health data, AI to combine diff factors to gauge the risk, lifestyle and genomics, more persuasive to convince ppl to uptake screening, save cost as it helps to filter better based on risk level,

9. In the event of a pandemic, like SARS or Covid-19, how AI integration helps to mitigate or slow down the outbreak? What could have been done better in your opinion?

AI could help in early testing and contact tracing, further finding out source of spread. To do better, development of drugs and vaccines could implement the technology of AI. It could also accelerate the treatment technologies for the general public to understand how to eat healthily or cultivate good habits for their digestive system.

Question for Prof Dean Ho:

1. Are there any ongoing projects or teams looking to use or are using AI to address specific healthcare challenges in Singapore?

I know two institutes. One is called the N1, which means N of one, which means we tailor treatment to everybody that is in our trials. The second is ISDA, the Institute for Digital Medicine. We do some analogous work here too.

The main thing is that I think the term personalised medicine is defined very differently between different communities. And in our case, personalization is dynamic. It means the right dose for the right person can be very different for even that same person over time. And that's actually not widely acknowledged at all in clinical practice.

The term, optimisation, is totally defined differently. From a regulatory standpoint, it means dose escalation, ramping up to the maximum dose one can tolerate. We don't think that's the right thing, right? We think it changes over time as well. Not saying the regulations are bad. It's just more like we think there's a better way to do it. Um, we run a number of trials here.

Our institute is very different from a traditional institute because our trials are intervention based, which means they are treatment driven trials with AI. By and large, when people talk about AI, they talk about diagnostics, pathology, image analysis. That's diagnostics. We don't do that. It's important work, but we don't do it. AI often involves big data. We'll get more into this as we talk about bias, etc. We don't do big data. We use only a patient's own data to manage only their own care. Yeah, dynamically. Nice. And so for cancer, and we're unique because interventional trials, most institutes in the world, and especially in academia, don't harness AI to use in intervention. It's mostly diagnostics. Intervention being treatment. So we have patients right now or under trial, where we dynamically adjust their dosing in chemotherapy or targeted immunotherapy. Right. To try to optimise their outcome continuously. We have a patient, right, we have a trial right now doing hypertension, which is definitely an issue here. We have digital therapeutics trials, which is the use of a gaming approach, but instead of dynamically changing the dose, we're dynamically changing the difficulty. analogous, but it's not a pill, right? You're actually playing a game. There's no pill. It's actually the software that is the treatment. Digital therapy is often mistaken to be the use of digital technology and AI to develop drugs. Digital therapeutics is the use of software as the therapy, as the intervention. not the same as wellness. In digital therapy, there are clinical outcomes, endpoints you're trying to reach, right? So there's evidence based, right? So it's cognitive training, hypertension, cancer, and other things you can explore as well.

2. What are the most popular AI innovations in healthcare under development?
Imaging is still probably one of the more widely used for areas like radiology, SLAD (Surgical Laser Aiming Device), epilepsy. I would say AI in drug discovery. So, the use of AI to either design new drugs or to repurpose drugs and say, which happened during COVID, right? Which

is to say, hey, these existing drugs may actually work for this new disease or this other disease we didn't think it would be useful for. So that's discovery. Okay, very different from development in dosing, right? Development is where you take a drug and you say, hey, maybe this drug should be combined with that drug. That's development on, but to come up and predict. A drug structure that could be useful has raised a ton of money. Okay. Microsoft is in it. There's a lot of companies that focus in this area. Very, very popular. So discovery, imaging, diagnostics, probably the core areas right now.

Interviewer: May I ask like when you're discovering a drug, right? So a condition is based on symptoms and again, symptoms can be dynamic in certain sense, right? So how do you think AI will predict the repurpose of a drug?

Prof Dean Ho: Well, it's based on a target. The disease origin, the cause, the mechanisms that drive it, there is some target involved and the AI can try to predict what could optimally address that target. Now, as you address the target, eventually the person's getting treated, but as they're being treated, they're going to have symptoms, toxicities, that's when you then try to modulate the dosing, et cetera. But that's only when the drug is available to be given to a person. It's totally opposite ends of the spectrum. Discoveries when the drug is new, you kind of predict something that could work. Dosing is when you're like actually giving it to people or animals or whatever.

3. The next question is about nanomedical technology. We've seen some researchers, yes. and we understand that you are a professional in this area. We found that nanomedicine is very useful in dealing with cancer and cardiovascular diseases. So how is nanomedicine and AI used together?

We've done that. Actually, I published a paper in 2015, in ACS Nano (journal). It’s a super complex title. I would totally change it if I had a chance, like Mechanism Independent something. Okay. Mechanism Independent Optimization. Anyway, so, Nano is cool because as you also know, the mRNA just won the Nobel Prize. Today, you can deliver larger, targeted amounts, concentrated amounts of drugs, hopefully to the right place. You can target it. You can load multiple types of drugs.You can keep drugs in circulation in the body longer, right? But the question we have here is, if you look at infectious disease, if you look at cardiology, if you look at cancer and other things, the combination there is common. Okay? Multiple drugs. The thing is you can give multiple drugs to the nanoparticle, put drug A and drug B into the nanoparticle and deliver them together. And that happens. It's actually FDA approved drugs that do that. But the thing is, as I mentioned earlier, optimization is dynamic, personalization is dynamic. Synergy between two drugs is dynamic. So if you deliver two drugs fixed into a nanoparticle, you actually cannot modulate the synergy between the two, right? If you need drug A to be reduced, but the two drugs are fixed within a nanoparticle, what do you do? One way you could do it is to put drug A in a nanoparticle and then drug B in another nanoparticle and then do it that way. But then you've got to relook the pharmacokinetics and things like that.

I just gave a talk about these really great nanobeads. And I haven't done nanowerk, to be honest, in years. Even my most recent paper, I think a year or two ago, was from work from years before that. But I want to speak to this community, because they're my friends. And the second thing is, I was like, think downstream, right? When designing nanoparticles, dose changes. Okay, optimal dose changes. And so, I think to combine nanomedicine with AI is to first figure out what drugs you should combine in the first place. AI can do that. How to adjust dosing dynamically, that can be AI. The design of the nanoparticle itself can be AI driven. There's wonderful work in that space too. The ratios of drugs, nanoparticle material, all of those matters of the design. Design of the material, design of the drugs to put together, the design of the dosage. All of it all can be addressed by AI.

4. What are the advantages of the combined use of AI and nanomedicine treatment over the traditional treatment like surgeries?

Well, you can't necessarily sub out surgery for nano and vice versa. Like when you can surgically remove cancer tumours, you should surgically remove that. Okay. That can be a curative effect. Okay. But when there's cases of inoperable cancer because it's completely everywhere, then you need treatment. You can augment surgical treatment, right? Like after surgery, sometimes people still need chemo. So one example I can imagine is that AI can find residual disease, leftover disease. Because right now, you operate just from conventional imaging. You're like, oh, hey, we got all of it. Still gonna do chemo, but we got all of it. AI can potentially catch, capture areas where it's still there, then it could retailer the design of the follow up treatment, right? So, I don't know if true replacement is the thing, it's just to do both better. Right. Image guided surgery matters to know if the surgeon is getting the tumour and there are people in AI who create and develop that. And then for treatment, you can make the treatment better, like using AI to figure out which drugs to put together.

5. Throughout the development of such technology, there must be a lot of collaborations between AI researchers and healthcare professionals. Could you briefly elaborate about them?

Sure. Yeah, I think even more recently, of course, AI people work with, you know, oncologists, cardiologists, cognitive neuroscientists, and neurologists. And when we talk about clinical, it's not just doctors, right? It's nurses, it's pharmacists, allied health professionals. I have to say that in the clinical world, there's a workflow. A patient gets seen by a doctor, they examine them, they know what they have to do, and then they treat them, right? And there's a workflow involved. And there's many people in the workflow. And the workflow goes all the way to the home. Thinking medicines at home, caregiver driven. In my opinion, true collaboration is addressing the whole world. So something great about our institute is we can, thanks to our team for identifying this, that the workflow needs user engagement. We even know who the user is, where they are. Okay. Because they, the user may not be the patient, the user may need to be the doctor, the user may need to be the nurse, right? So. We work way beyond clinical and technical. We do behavioral sciences, we do implementation sciences. We look at economics, right? Because if it's too expensive to implement or if it takes too long to implement, it doesn't matter. So that's operations, right? Business school can help with that too. So to really

make AI something that's pervasively there in our medical world, we need to have a whole thing with that.

6. In Singapore's context, we have a multiracial society. Did the team ever engage with a broader community? For example, with patients or advocacy groups to ensure that AI-based technology is developed with their input and meet their needs?

That's a great question, and the answer is yes to all of them. Something about our platform that I mentioned earlier is we don't take population data, big data, train an algorithm to then see the next person that walks in, okay? Patient A's data has no impact on patient B. Patient B has no impact on patient C. And the other thing is our AI platform is designed in such a way that even the demographics are not needed, okay? We don't need to know their weight, we don't need to know their ethnicity, we don't need any of that. We just need to know how they respond to various doses. So when it comes to bias, and we'll talk more about that, our approach is quite good at avoiding that issue, because if you're going to use the population and train a model, how do you reduce that population into a law? It's not just ethnicity and gender as well, but we take each person at their own pace. That's it.

And so engagement wise, as I mentioned, do user engagement, where we engage with seniors, we engage with populations. If some of our gaming platforms, the language is built in, the translation is built in, will depend on which community we're trying to serve, patient advocacy groups as well.

I think I can reach that up with one in like a few weeks from now. Understanding what the patients want matters to us. That's why we run a lot by the user's data and input to answer, what is it that will allow you to recover, do you even want this treatment? And if you do, what will, what questions do you have to take, right, for you to sign on to the trial, et cetera, we want to know.

7. Since the treatment is very personalised, how do you validate the performance and accuracy of AI models?

Good question. So a lot of this is that the patient has their own control, right? One thing we don't do is use patient A's data alone. So what happens is patients are initially calibrated right to get this data, they check the markers and all that stuff. And so we get to kind of understand the optimization, how is this person performing after we calibrate them, not just a few data points, then we initiate efficacy guided treatment. So that's what we start doing, so we can compare across patients, even though they're different, and we know their data doesn't impact how we treat them, we can also look at variance between patients. Okay, so we did a trial, very small number of patients, like two cohorts. Nobody's data is affecting each other, but we looked at the variance between the control and the optimised one. Because control, you kind of, this is their risk of what happened. You stay with standard dosing to patients all over the place. If we say we can hyper personalise, each person's data should be tighter, right? It should be more to what we think it's going to be when we try to do optimization. In the variance analysis, there

should be less variance in the personalised contribution. Standard of care is the one size fits all approach given to everybody. And it showed, even with statistical significance, that we could tighten that gap.

8. Are there any recent technologies or applications you feel has room for improvement?

I don't know if it's because we don't think we know enough about each one and what they report on whether it's good or not. But I do think that we don't think enough about a different workflow. Okay, let's talk about drugs. Drug discovery, and I actually just wrote a paper on this. Drug discovery, drug development, and drug administration or dosing. Discovery, development, dosing. It's three segments. Right now, for AI, we largely only think about the first discovery. Why? Because using AI, you can discover all these great drugs. AI will improve the design over what we know before. And if the drug is good, then it's going to get approved, and it's going to work. Right now people say the drug is good, then it's going to work. But that's not how medicine has ever worked. There's always promising drugs and they fail 95 percent of the time. Never approved yet, we continue to use AI to churn out more compounds, more agents. But we don't think enough about how to combine the agents together. Sometimes when you take a drug that doesn't work very well on its own, and then fails, and then you never think about it again. But when you combine it together with other drugs, that drug might actually be very useful. Okay, and that's not how the system is built right now. So, hey, let's come up with good compounds that are new. Nobody else is studying these. They fail most of the time, 90 plus percent of the time for oncology, and then we never think about them again. We're not combining that properly. Then the next step is, let's dose as high as we can.

But I'm thinking of better ways to get drugs. So, it's not so much things that could be better. It's that we have to first recognize that this workflow exists.

9. We know diabetes is very prevalent in Singapore. Is there an AI solution for it? How does AI benefit patients with it in terms of providing medical support or improving and simplifying their knowledge on it?

10.

Just to make sure nobody's trying to hunt you down there. Here is one example. This is called Selina Plus for a diabetic retinopathy. It is very, very important work. I'm friends with the crew that does this. Very good work. Like if someone has diabetes, they may have hypertension and other symptoms and conditions may manifest, like diabetic retinopathy, right? And so with it, anytime you can not only find disease faster, but also track the progress of treatment without constantly either bleeding a person or biopsying a person, whatever, an eye exam can be fast, maybe even something done at home, and then track the trajectory of the disease, just for example. And I think Selena and some other applications are very good ways to take data that people are getting regularly. And to pull out even more information that could help with either diagnostics or longitudinal tracking. I think for diseases like diabetes and disease in general, longitudinal monitoring over time. It's essential, and the more non-invasive it is, the better, okay? And these are good examples.

Interviewer: I'm just curious because there are a lot of AI platforms now currently working for diabetes. Yeah. So, are there any diseases that are difficult for AI technology to have a effect on?

Prof Dean Ho: That's hard to say, but I will say because AI is used in cardiology, it's been done for transplant, but I would say that the treatment for what we do, there are certain diseases that are easier than others. Ones where there are biomarkers that exist. We need a marker to know if the treatment is working or not working. For some cancers, the biomarkers are not dependable at all. Some of the biomarkers take too long to change. Imagine you give a dose to a cancer patient and then the doctor says, it'll take three months for the biomarker to change. And we're like, okay, then we'll come back three months and we need another biomarker. It'd take nine months before we can optimise their treatment. That takes too long. So some diseases are easier than others, but I would say that by and large, if you look across the disease spectrum, there's something that AI can help with. It can help with emergency medicine, with triaging and predicting readmission. For cardiology, imaging, diagnosis, and treatment. Same for cancer. I think that the sky's the limit.

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