



AI'S HEALTH CARE PROMISE: GETTING IT RIGHT FOR EVERYONE

Juliana Chan 00:00

Good afternoon, everyone. Good afternoon, speakers. I'm Juliana Chan, and I'm a science communicator and a drug-delivery and nanomedicine researcher based in Singapore. It's my great pleasure to explore a very big question today, which is how human-centered AI design can help us to become more representative in health care and address the gaps that have left women underrepresented in clinical data for decades. So, for context, this is part of the Milken Institute's Women's Health Network, a USD1 billion initiative chaired by Dr. Jill Biden, aimed at channeling net new diverse capital towards areas like reimbursement, access, education, and regulation in women's health. Our exceptional group of speakers today bring perspectives from patient advocacy, from academia, big pharma, and clinical medicine. So, let's give them a round of applause, please. Thank you.

Juliana Chan 01:05

Okay, speakers, we have work to do. Let's get started, shall we? Can I start with Professor Henrietta Hughes? Welcome to Singapore. She is England's first ever patient safety commissioner. I just love that title, which is a great life mission. She spent her entire career putting patient voices at the center of health-care safety and delivery. I love, Professor Hughes, that your independent role was recommended by the report, *First Do No Harm*. Is there a backstory to that?

Henrietta Hughes 01:38

Yeah. So, *First Do No Harm* is widely attributed to the Hippocratic Oath, which is the principles by which doctors deliver health care. And the main reason for this is we want people to get better outcomes, but not be harmed through the care that they receive. But my role came about from a report where patients had been harmed, and their voices hadn't been heard. And these groups of patients were mainly women, who had been treated with medicines and medical devices, and they and their families had been harmed as a result. So, the report called for an independent champion of patient safety and of the value of listening to patients, and that's what my role brings. And more recently, I've been the deputy chair of our National Commission into the Regulation of AI in Healthcare, where we've listened to 12,000 people to understand what it is that we need to do to safely and quickly bring trusted AI into health care in the UK.

Juliana Chan 02:42

So, Prof. Hughes, you mentioned earlier that until the 1990s, women weren't even recruited into clinical trials. But then after the 1990s, women started to be invited into these trials, and now we're seeing them being tested, being screened, et cetera. But there remains a trust deficit between women signing up, volunteering their data, and also clinical trials recruiting them. So, what can we do to bridge that trust?

Henrietta Hughes 03:10

Well, I think for many decades, women have been excluded from trials, but also, we know that women are historically underdiagnosed and underserved by health-care systems that haven't taken their needs into account. So, we have to work hard to build that trust and maintain trust with all patients, but particularly women when it comes to AI. And recent research has shown that women are less enthusiastic about the potential of AI to improve health care. They have more concerns about safety. And also that it's really important for women that AI in health care is equitable, and that we have fairness in the way that it delivers improvements. So, I think that that's our job to actually listen to those voices, build that into the work that we do, and earn the trust, that the systems have to really genuinely deserve that trust.

Juliana Chan 04:03

That's a beautiful life mission. Thanks, Prof. Hughes. Let's go to Dr. Frida Polli. She is a Harvard and MIT neuroscientist. Dr. Polli, you've had an exceptional career. You launched and you exited a company, and then you've also won a slew of awards. Right now, you've chosen to invest all of your time, your energy, and effort into building a program at MIT called PRISM, which is PRecision, Sex-based Medicine, to ensure that sex itself is central to how we build AI models and understand human health. So, you make a very strong argument that a universal platform, a universal algorithm, is doing nobody any favors. Not men, not women. Could you explain why? And what happens when we stop treating sex as a noise covariate and make it front and center of the models that we build?

Frida Polli 05:02

Yeah, sure. So, this might shock everyone in the audience, but the genetic similarity between males and females is similar to the genetic similarity between humans and chimpanzees. And that's largely due to the fact that women have two X chromosomes, whereas men only have one. And that leads to a slew of biological differences throughout the lifespan. And so treating men and women based on these data that I presented to you, treating men and women similarly will yield not outstanding results, right? And so if we want to think about how precision medicine has advanced treatment, prognosis, outcomes for people, we need to look no further than breast cancer. Right? So, breast cancer is one of the most—a place where genetic information and information about the tumor type greatly determines many things about your treatment, and as a result, outcomes in breast cancer have advanced greatly. If we were to treat all breast cancer patients with the same regimen, which is essentially what we do in other types of medicine, we would have far worse outcomes. And so I think we need to move away from this universal health-care model where, as Henrietta said, one size fits none, to a place where precision is, at a minimum, taking sex into consideration because of the vast differences between male and female physiology. And again, places like medication, adverse effects, women are two times as likely to suffer from adverse effects from medication than men. Places like heart disease. The symptoms that women present with a heart attack are quite different from those of men, and oftentimes they can go to an ER with nausea, which is one of the presenting symptoms, and be told that they've eaten too much or something, right? So, there's just example over example of these instances where if we were to treat sex as a critical covariate as opposed to a noise covariate, I think we'd have far different outcomes.

Juliana Chan 07:10

One size fits none. I just had to chuckle at that. So, Dr. Polli, can you chat with us a little bit about what PRiSM is? Is it like a private-public partnership? Is it funded by companies?

Frida Polli 07:23

Yep. So, PRiSM is a new initiative at MIT, and it's housed at the Schwarzman College, which attempts to bring generative AI modeling into other forms of science. So, it's an AI-biology partnership. And if you think about generative models and how they've really advanced science, you have to look no further than AlphaFold, which won the Nobel Prize in 2024 for its generative modeling of protein structures, right? And so imagine that, but at scale. Imagine generative modeling really taking over many aspects of biology and biology becoming more like software engineering. And it's already happening. And MIT is just putting their hat into the race and saying, "This is a great investment." And the idea is essentially that because these generative models can work across different scales of biology, different modalities, they can really string together information in a way that wasn't previously possible and synthesize all of this information that's sitting out there. I was telling the panelists earlier that we've spent five decades generating tons of data, but all we've done is just sort of vomited that data out into these datasets that are available to everyone, but impossible to search. And so imagine having the power to search, access, harmonize, and so on and so forth, all these data that already exist. And that's really the power of this AI biology combination, is to, again, do all that synthesis across scales, across modalities, and then put sex as a central axis of differentiation. So, we're really excited about this initiative.

Juliana Chan 09:02

Very optimistic, too. Looking forward to what you publish, what you come up with. Let's now say hi to Dr. Arun Krishna. Dr. Krishna is a biostatistician. He's a geneticist, cancer researcher, which is a perfect fit for this panel. He is the area vice president for Asia at AstraZeneca. But before that, you led the portfolio for lung cancer for US oncology at AstraZeneca. So, Dr. Krishna, it's not just among laypeople, it's also among health-care professionals that we have to make certain stereotypes for disease. And it's not intentional because sometimes you need to make a quick diagnosis, right? You can't screen everyone. And you would know this best because you led the lung cancer franchise. You would know that in lung cancer, we often see it as a disease for male smokers. So, what happens when we make these stereotypes and how can AI help us challenge these assumptions and improve the way we diagnose and treat patients?

Arun Krishna 10:03

Yeah, Juliana, thank you. Thank you so much for the question and thank you for the opportunity as well. Yes, so the last five years have been in the space of lung cancer and it's been quite fascinating and the evolution of treatments and medicines and modalities in lung cancer. But all cancers have evolved so much over the last 10, 15 years. It's pretty amazing. 15 years ago, the only choice doctors had when a patient was diagnosed with cancer was which chemotherapy to provide. And now, the landscape has completely changed. But unfortunately, like you pointed out, there are certain biases that happen. So, when you talk about lung cancer and you ask somebody about lung cancer, two things come to their mind. One is, oh, it's predominantly for men and predominantly for smokers. And I need to break the honest truth that those two are not truly accurate, right? We all know now that there's a percentage, a large group of people who can get lung cancer who have never touched a cigarette in their lives. And it could affect and range from all the way from early 20s to the late 60s. There are so many people who

I've spoken to who have come and told me, "My God, I've never even touched a cigarette. How can I be diagnosed with lung cancer?"

Juliana Chan 11:18

Not even secondhand smoke?

Arun Krishna 11:20

Not even secondhand smoke, right? They've not even been around secondhand smoke. And also, startlingly, the second thing is that it's not only men. In this population, it's twice as likely that women, and Asian women, could get lung cancer, who have never smoked, than men. So, I think these statistics are something which is quite alarming. And I think there's a lack of education that has happened around it. So, for example, as I said, there's a lot of them who harbor the gene, like an EGFR gene that comes either through genetic variations or through hereditary factors that can cause lung cancer. And in Asia specifically, one in two people who have been diagnosed with lung cancer have never smoked, basically because they harbor this gene. So, how can AI now try and detect some of this much earlier? The bottom line, I think, is widely accepted and comes to my earlier point is there's so much of advancements that have happened when it comes to treatments and modalities that early detection becomes extremely important. Regardless, just not lung cancer, any cancer, right? Colorectal cancer, breast cancer, like Frida talked about. The sooner or the earlier you can detect, the higher chance you have to actually achieve cure in some of these settings. So, coming back to then how AI is going to help is, we are looking at programs where, in Asia for example, there are a large number of people who get their chest X-rayed. And if you can use AI to identify nodules that could be potentially cancerous much early through a chest X-ray with AI, we can then detect the probability of lung cancer much sooner, bring that person in, do whatever necessary to do. So, I think there's a lot of advancements that have happened in this space and through some of these partnerships with companies like Qure.ai, which is actually present in Asia, we can truly move that needle at pace.

Juliana Chan 13:22

It'll be good to—It's a bit terrifying to hear that in Asia we might have a higher predisposition to that. So, I'm actually a bit terrified right now.

Arun Krishna 13:30

Yeah. No, but I mean—

Juliana Chan 13:30

Thank you for sharing. Knowledge is important.

Arun Krishna 13:34

—if I just maybe—and it comes to, also, policymakers. So, for example, in Taiwan, is the only country in Southeast Asia where you get screening regardless of your smoking status. So, you're eligible for screening because of the stark statistics I just talked about—

Juliana Chan 13:51

It's very quality

Arun Krishna 13:52

So, I think we've got to see that more in most countries

Juliana Chan 13:53

Thanks for sharing, Dr. Krishna. Let's go to Professor Kee Yuan Ngiam. Professor Ngiam, he's the head of Artificial Intelligence Office at the National University Health System. This is in Singapore. Also a thyroid and endocrine surgeon. Prof. Ngiam, you represent on this panel the intersection between academic research and clinical implementation. Now, when you think about the next generation of health-care AI, we are very optimistic about all these models being worked on, all these clinical trials. But what differentiates a model that is impressive in a publication that goes into *Nature*, into *BMJ*, into *JAMA*, and one that is genuinely useful to a doctor or surgeon, and their patients?

Kee Yuan Ngiam 14:43

Oh, thank you for that question, Juliana, and it is a pleasure to be here.

Juliana Chan 14:46

You published a lot of those too, right, yourself?

Kee Yuan Ngiam 14:49

Yeah. So, I think publishing it's a marathon, right? People publish as a sport and they publish great papers. It advances science. I think we all agree to that. The greatest challenge for many countries, governments and funders is how do you translate that into real-world change, right? Yeah. And one of the biggest questions we've asked is, we have huge investments in AI today. But very few companies and institutions can justify the ROI. So, I think this is where health-care institutions like mine are at the business end of this, right? Where we are taking the science and translating it into practice. And that's where we face a lot of challenges and difficulties, starting from everything from whether the models are adequately trained or trained to that population. So, we heard earlier about bias, with the male and female. There are also biases in many other domains like race, age, and socioeconomic factors, for example. So, we first have to correctly evaluate that and then put it on the pathway towards implementation. And to answer Juliana's questions more directly, the whole idea of change management it's a very well-established process. However, in AI, and specifically in health care, you are now forcing the health-care practitioner to change. So, AI is now forcing the health-care practitioner to change the way they practice so as to get the benefit from the AI, and I can share that as a clinician it is highly, highly uncomfortable. You can imagine, for some of my doctors that we ask them, "Okay, use the AI scribe." Guess what? Less than 10 percent of them want to use it. They will go, "No, no, no. I'm trained five years, six years to be a doctor. I'm going to write my own summaries. I'm going to do my own reports." And, it forces a mindset change. And finally, even if you can get everyone to adopt the AI and change their workflows, then there's the issue of scale, right? Because really, to get the benefit of AI, you really want this to be able to scale. So, this speaks of a more, I would say, organizational kind of effort rather than specifically a research and AI problem. If I may.

Juliana Chan 17:21

So, we need to have the doctors adopt it. We need to implement it at scale, you're saying. Professor Ngiam, I think you might be the best person to tell us about a model that Singapore is developing. I understand that Singapore is funding a national program to build a foundational model such that health care is equitable on a population scale. So, this is not just sex, right? This is socioeconomic factors. This is race. This is ethnicity. This is age. Could you give us insights to why this would be a game changer for us, and if other countries could also build something like that?

Kee Yuan Ngiam 17:59

Thanks for that question. So, the program is called SIMFONI, spelled with an S.

Juliana Chan 18:02

SIMFONI.

Kee Yuan Ngiam 18:03

Yeah. And it's an NRF-funded program. It's a very large program, \$150 million. I'm the co-lead. And it's ambitious. It aims to build a Singapore-specific, almost sovereign health-care model. And why is that relevant? And our co-panelist has brought out the fact that there are variations across different populations, and certainly, many of the AI models that we've trained in the past are focused on specific groups of diseases or populations, right? And we find that there were issues with transferability. So, for example, a research published at MIT, which is fantastic, will be published in the *New England*, which is even better, will not be applicable to Singapore, for example. So, this particular program seeks to take population-scale data, which is all of Singapore data, including some of precision medicine data such as genomics, and train into a model that our clinicians and our patients can eventually use, to establish a Singapore-centric kind of health-care model. And finally, we want it to be, of course, accurate and reliable. Because, as you know, there are many models out there, frontier models that we have seen, ChatGPT, Claude, et cetera, that claim to be able to give health advice. I'll be the first to tell you, please take those health advice with large dose of salt and get hypertension, okay? So, yeah. I think it's great if you wanted some general information that you could find on Google. But if you're asking for specific information about yourself, we know that these models hallucinate to a certain level, right? Because they're generative in nature. It won't get the general things wrong, but you'll get specific things very wrong. I've seen this happen many, many times across multiple generations from frontier models. So, SIMFONI's foundation model hopes to address this issue.

Juliana Chan 20:17

Do you know the timeline for this? How long will it take?

Kee Yuan Ngiam 20:26

So, right now, SIMFONI is a two-phase program. We are well into the first phase. So, we expect that in the next year, we will have an initial model that is able to perform up to a level of a resident-level kind of capability. Critically, it should be accurate, right? It can come out with fancy things, but if it's wrong, I think we have failed ourselves, right? So, next year we should be seeing a model that is able to deliver accurate and safe treatment suggestions even to the doctors so that they can act on them. Yeah.

Juliana Chan 20:57

So, Prof. Ngiam calls it ambitious. I'm looking forward to seeing what the SIMFONI model comes up with. I just have a question now for all my panelists. We talk about the need to make AI more precise and a lot more representative. It's like building a house. You add more and more features to it. But there's a new tension here, right? The more we tailor a model to specific populations and characteristics, the more complex it takes to build, to validate, and deploy at scale. So, how do we find that sweet spot between accuracy and good enough?

Frida Polli 21:34

I actually would love to answer that and also have a question for you. So, again, I deployed AI in over 150 countries, and it was in the employment space, so therefore it had to be unbiased and fair, right? Across different genders across—

Juliana Chan 21:48

This is, of course, your company you built and you exited.

Frida Polli 21:52

Yeah, exactly. So, that was actually incredibly challenging. And so I'd love to understand how you're thinking about sex for this foundation model, when we know from just so much data that the outcomes, the symptoms, the presentation, everything is so different. And if it were me, and we actually even have some preliminary data that we have shown at MIT, where we've taken some of these global foundation models that have been published in *Nature* and split by sex and found that the incidence of disease is quite different. So, I'm happy to share. So, are you thinking about having sex-disaggregated arms of the model? Because it would seem—

Kee Yuan Ngiam 22:31

Absolutely.

Frida Polli 22:32

—yeah. Perfect.

Kee Yuan Ngiam 22:33

So, sex is, of course, one of the most important—

Frida Polli 22:35

Exactly, yeah—

Kee Yuan Ngiam 22:36

—variables because I'm a thyroid surgeon. Somebody tells me that, "Oh, I'm going to train a model with 50/50 distribution for thyroid disease in my model." And I look at them funny and say, "No, no. 90 percent of my patients are female." 90 percent. So, you cannot say that, "Oh, I'm just trying to reduce bias by adjusting it for 50/50." So, you have to train it according to the distribution in the population. So, ideally, one way of approaching it and considering factors such as gender, age, socioeconomic factors, and race, et cetera, is to ensure that we get a representative or large enough population-scale dataset. And in our case, it's for Singapore. And of course, you will

have generalizability issues if you want to, say, between Singapore and, say, the US. Obviously, there will be differences. I don't know that there is yet a method to adjust for these differences. But certainly those—gender, especially—is a variable that we consider very carefully when we represent the population.

Frida Polli 23:45

Yeah, happy to chat later at any time.

Juliana Chan 23:47

Thank you, Prof. Ngiam. I think Professor Hughes wants to add to that topic about what's the sweet spot.

Henrietta Hughes 23:53

Yeah, absolutely. And I think it's undoubted that AI has enormous opportunity and potential for improving health outcomes. But what we think is really important is that it needs to be safer, faster, or more cost-effective than what we already have. And safety is something which has got to be the bar over which everything can go. The other thing I was going to say is that trust, and trust not only of the public to trust the model and to trust the systems that are being used and the transparency to know when AI is being used in their health care, but also, we need the workforce to trust the models that are being used because it will be the workforce that will be brokering those decisions that are coming through from the AI models into making diagnoses for patients and planning treatment options for them. And what we found through the National Commission in the UK was that we immediately thought we must ensure that the public trust what's happening. But what we saw was that because the workforce had questions about where the responsibility sat, where the liability sat, that it was also so vital that the views and the voices of the workforce are brought in. And I think that's one of the things which is really important about the usability, the human factors, and the ergonomics so that people who are working in health care feel confident when a new model comes in that it will actually improve their working lives and not as a threat. And certainly, that's something we've seen in the UK as well.

Juliana Chan 25:34

Dr. Krishna?

Arun Krishna 25:35

So, it's a great point. So, can I just add—as a statistician going years and years ago, the fundamental question you've got to ask yourself is what are you trying to solve, right? It's very simple. I don't know, you probably all have Copilot, and you have Claude and everything. Do you know which AI engine to use to solve what problem, right? For example, if you want your inbox to be cleaned up, you probably won't want to use Claude because it takes five times the energy Copilot would take to do the same task, right? So, what I'm trying to make a point here is that predictive analytics existed a long, long time ago, right? When you're talking about generalizability of data, that's not a new concept that started yesterday. It was always the concept that we built foundational statistics on. So, we shouldn't lose those basic elements of, is your dataset representative of the population you're trying to predict? Yes, no, right? And then you've got to think about, okay, what is it that you're trying to solve? Are you trying to just predict what tomorrow's going to be? Great. Or are you going to then think about what you want to be in terms of generative AI? Are you going to derive content and predictive analytics on top of it? Then you start to think about large language models. So, to answer your question, a lot of people are trying to solve this, and everyone thinks that AI is the solution for everything, which is not the case. So, to your point, let's figure out what you're trying to

solve and then work backwards to understand are you using the right tools and technology to address the problem at hand? Because a lot of times the answer to that is no. Thanks.

Juliana Chan 27:20

But I know in AZ that many a times the AI is helping collect the data because from what I understand is, in many parts of rural Asia, there are not enough pathologists to even collect the data, right? So, AI is actually being useful here.

Arun Krishna 27:38

Yeah. So, again, it comes to the point of, okay, we're not trying to replace pathologists. So, you talked about breast cancer, so let's start there. Very simply, till five years ago, women were either classified when they had breast cancer as either HER2-positive or HER2-negative. It was binary. 0 or 1. Science has now figured out that there is nothing like this concept of HER2-negative. There are very few patients who are truly HER2-negative. It's a gradation of HER2, so you're HER2-low, you're HER2-ultra-low, and now we have treatments that are targeting HER2-low and ultra-low. Now, you can't find out whether you're HER2-low or ultra-low in most cases by looking under a microscope with a stained tissue slide. You need to now use advanced, sophisticated AI strategies and technologies to be able to do that detection. Otherwise, the patient is getting a totally different treatment at all. So, in rural areas, for example, where you don't have that many pathologists to be able to go through every slide, and even in places like Singapore, if you're able to use computational or digital pathology to be able to identify this, and then you have the pathologist who actually looks through it to make a quick check to say, "Yes, it makes sense," or, "No," that many more. I think the uplift is around 20 percent more detection rate and 20 percent to 30 percent more patients are getting the accurate treatment.

Juliana Chan 29:09

Certainly a very good use case for AI, in Asia especially. There's a saying, "You don't know what you don't know." I've done my research, I've done my homework, but I think we are speaking with a panel here who are at the frontier of health-care AI. So, I just want to understand what have we not spoken about, what are we not paying attention to? I want to know what are the blind spots in our attempt to catalog all of this data, to make sex-disaggregated data, and build models around them. This is a challenging one. Who wants to go first? What are the big questions that we have to answer?

Henrietta Hughes 29:48

Can I start on that?

Juliana Chan 29:50

Prof. Hughes.

Henrietta Hughes 29:51

So, I think the first thing is about mindset because historically we have been trained to think of a one answer, whoever's sitting in front of us. So, whether that's about numbers needed to treat, or whether that's about the type of treatment to suggest, or even the diagnosis, depending on the symptoms that a patient is bringing, whether they're male or female. And I think that this is going to be something really important. As we're presented with

more sophisticated, more detailed information, how are we going to change the clinical mindset? And an example that I was going to give is that with myocardial infarction, there's been a recent new global sex-based disaggregation of troponin levels. So, it's been identified that women's troponin levels are lower than men's. So, if you're looking at a standard troponin level for a heart attack, women don't get that level, and they are therefore underdiagnosed. So, this information is known, but how are we going to turn that into a change in clinical practice? And that's just one example that we're going to get more and more detail about different groups of patients who may benefit from different treatments, from different doses, or from different diagnostic pathways. How are we going to turn that into a new training program for undergraduate and postgraduate education, a change in the mindset for the doctor, the nurse, the therapist who's sitting in front of the patient? I think this is something which is a big societal issue, and I think it's one that we have to grasp because as the data becomes more available, patients are going to be expecting a more bespoke and personalized treatment.

Juliana Chan 31:32

That's a very important point you mentioned, Prof. Hughes. As the data becomes larger in quantity, we need to address the confounding data, and we got to accept that health care is going to become more complicated. And we want it to be. We want it to be. Dr. Polli.

Frida Polli 31:49

And if I could just jump off of that. I think you made an interesting point that you're a thyroid doctor, therefore if you're going to look at thyroid disease, 90 percent of the samples should be females, right? That makes sense. But then again, that just means you're going to train a model to look for the most average patient, which is not the—

Juliana Chan 32:06

Which is the female population—

Frida Polli 32:07

—which is the female population, but therefore the 10 percent of men are not going to be served that well.

Juliana Chan 32:11

It's exactly opposite, right?

Frida Polli 32:12

It is the opposite, yeah. And so what I mean by that is, I think, again, in cancer, we've understood that we need to segregate by certain variables. And so hopefully medicine in general will understand that we need to do that overall, and sex is important. And I'll give you an even more specific example of this, right? So, there's recent work out of Duke, a woman named Diana Dou, published in *Cell* two years ago, that essentially showed that a fair number of autoimmune diseases, which can skew 10 to one female could be caused by the actual ribonucleoprotein that shuts down the X chromosome. Now, men don't have that unless they suffer from some genetic disorder. So, if we then start building these models of autoimmune disease that don't even have that as a consideration, or that are not indexing on that, and it turns out it could be very important because the breakdown products of this are found in the sera of autoimmune patients, we will miss that entirely. So, I'm hoping that

medicine overall, the way we practice it, we'll stop looking for the average patient and will become more like cancer care, where we're really breaking it down by different variables.

Juliana Chan 33:21

So, Dr. Polli says stop looking for the average patient.

Frida Polli 33:24

Yes.

Juliana Chan 33:24

Thyroid cancer, we have to take into account that they're mostly female. But don't forget about the men. The 10 percent.

Kee Yuan Ngiam 33:32

Yeah, I can speak to that. An interesting fact is that the thyroid cancers in men, although the smaller proportion, are more aggressive than the ones in female. It's the same for male breast cancer. Male breast cancer is often more aggressive than female breast cancer. And I think the issue of average patients is something that I feel that we should put it in the rearview mirror for now because—the statistician would disagree with me—but today we have AI tools that are powerful enough to be able to dissect patients beyond just cohorts down to individual groups, down to even individuals. Where you can now determine specific pathways for specific diseases based on that particular variant. Just to share a quick piece of research that we're working on. So, we're working on a project called Cascade AI. So, what it does is that it just uses the variants of the patient's genes and predicts the entire pathway right down the line, whether it's autoimmune disease, whether it's cancer. And this is never possible with—just two years ago, I don't think it's possible because the amount of LLM capability, the amount of compute that's needed, it's just phenomenal to be able to compute the millions of different pathways that you could have. So, what we've done at NUS is that we've trained a model to assimilate all these myriad pathways to be able to then predict, based on the person's variant, what the likely phenotype can be. And I think we're just at the beginning of this. There are a number of different labs in the world that are working on this, and we would love to collaborate to see where we can go.

Juliana Chan 35:27

Exciting. Yeah. Looking forward. Cascade AI. Watch this space. Dr. Krishna, just to close this talk about what are the blind spots we have not seen because in big pharma you intersect with everyone from government to clinics, hospitals.

Arun Krishna 35:43

So, I think the word is partnership, honestly. I don't think there's one organization who knows it all and can do it all. And especially working in a big pharma space where we are looking to build all of these foundation models. We're looking to create synthetic arms of clinical trials. We need tissue. We need the brains behind it. We need the people who have the compute and all of that other stuff. You need to find the right partners, right? Who have the common vision and the common goal and the common purpose. And if you're able to identify those people with that common goal, vision, and purpose, then I think you can go much, much faster. But always remember—I always

say this to my team of people is—be clear on the problem you’re trying to solve because otherwise you can use large language models, you can use compute power, you can do crazy on genomic sequences, and at the end you’re just not going to have anything, which is because you haven’t defined the problem quite clearly. So, partnership and define the problem.

Juliana Chan 36:44

Define the problem, find the problem first before you bring out all the bells and whistles, right? So, let’s end on a very practical note. Professor Hughes said that she’s building a “do tank,” not a think tank. Which I love. I want to ask all four of you, what is the one thing that you want all of us in this room to do when we leave this conversation? What is your call to action for me, for them, so that we can support your advocacy, your research, and your business, your work?

Henrietta Hughes 37:22

So, what I was going to say to everyone in this room, thank you very much for being here because whether you’re a funder, whether you’re a founder, you’re a researcher, you’re a provider of health care services, you’re a patient, or you have loved ones who are patients, I was going to say, keep patients as your north star. The outcomes of patients is what really matters because it will mean that your work will be successful but also you or your loved ones may benefit from everybody else’s work in the future.

Juliana Chan 37:55

I love that, Professor Hughes. Keep your patients as the north star for everything we do. Thank you. Dr. Krishna?

Arun Krishna 38:02

Yeah. It’s hard to follow that because it’s always for the patients. I mean, the reason I’m in health care and I’ve always been is for the patients and the impact that we can make. So, that’s definitely the north star that we need to follow. Look, I think AI is here to stay. It’s not a bubble that’s going to burst at some point, right? But I think it’s the meaningful appropriate use of AI becomes more and more important. So, when you leave the room, really first don’t Google or don’t ask ChatGPT for advice.

Juliana Chan 38:36

Don’t go to Dr. Google.

Arun Krishna 38:37

Don’t go to Dr. ChatGPT now for advice. But again, think about how AI can really help improve health care and the systems that we are involved in because, I think it’s going to move at a pace that we need to be watchful of.

Juliana Chan 38:55

I thought you were going to say email you if you have some tissue samples.

Arun Krishna 38:59

We are also interested in that.

Juliana Chan 39:01

Thank you, Dr. Krishna. And Prof. Ngiam?

Kee Yuan Ngiam 39:03

Thank you. I suppose we are just scratching the surface of what potentially AI can do. Here, instead of advocating that everyone should just use AI, it's fantastic. I would advocate caution, right? So, let me—well, it's not just to echo what has been said recently by the big frontier model companies, but really we should not make the same mistakes that we've made in the late '90s, right? So, in the '90s, we had this thing called the dot-com bubble, right? Everyone remembers that. Most of us are old enough to remember that.

Juliana Chan 39:39

That dot-com.

Kee Yuan Ngiam 39:40

Yeah. Dot-com bubble. And that bubble really speaks of how humanity, as in general, if we don't organize ourselves to recognize and prevent the harms, we would end up with disaster, as we have now. So, an entire industry, the cybersecurity industry, is created because of that era, right? Imagine in the '90s, the internet was created and there were strong regulations to prevent people from writing malware, viruses, Trojan horses, never allow people to do that. We won't have a cybersecurity industry today. We don't need to be having VPNs and firewalls and what have you. So, think now, transpose that to today. If we can tell everyone we agree that we will not build harmful AI, and we stick to that as humanity, I think our generations down from here would thank us for that. Right? Never have AI that will harm us. I believe that this is a time for reflection, and I believe that we should really think carefully about how to make this happen rather than to just head straight into adopting AI no matter what happens. Yeah.

Juliana Chan 41:03

Very optimistic. Prof. Ngiam, also a little bit easier said than done. I mean, given all of what we've been reading in the news. Certainly hope with our national data you do that because it probably has my data inside, so from my point of view—

Kee Yuan Ngiam 41:17

I wouldn't know. I wouldn't know.

Juliana Chan 41:20

—Dr. Polli, please.

Frida Polli 41:22

Yeah, I think, as an entrepreneur scientist, I also have optimistic views of what the future will bring with AI. And I guess, I want to make a couple points. A lot of times when we think about sex-based medicine and women's health, we think we don't have what we need. We don't have the data. We don't have the funding. We don't have this and that. And I think that one of the things that's attractive to me about this new era is that actually AI is

allowing us to do with a lot fewer resources what we could have never done in the past. For example, I know PhDs in computational biology that now can do in half an hour what would've taken them a whole PhD. So, I think, yes, there's a lot of downside to AI. It shouldn't be used indiscriminately, and we should absolutely have a lot of safeguards put around it, but it does offer up a huge potential for doing things that we couldn't do in the past. And what I'd love to just put out there in the world is that if you're interested in sex-disaggregated data, sex-based differences, sex-based medicine, just like everyone else on the panel, we are very open to all sorts of partnerships. We're a pure research institution looking to advance the science, but would love to partner with other research institutions, industry, et cetera, to make this reality of sex-based medicine a thing in the near future. So, thank you.

Juliana Chan 42:43

That's wonderful, Dr. Polli. I love the reframe. It's not like what we lack, but what we can all do thanks to AI. I just want to leave us with one final thought. AI has no human feelings. It's dispassionate, but it really presents to us an opportunity to ensure that health care is more human and more inclusive for everyone. Now, isn't that something that all of us, especially the panelists, can look forward to? Once again, thank you to the Milken Institute and the Milken Institute Women's Health Network for bringing all of us here to this conversation today. Please join me in thanking our speakers with a big round of applause.

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