AI for Good Global Summit
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>> For those moderating sessions today and also the co-chairs, the leads, please come up in the front. Stephan.
>> Colleagues, good morning. First of all, thank you, all, for coming to this, I consider interesting session. All the other sessions are proceeding equally. We have all of your -- this is a great body of knowledge and a lot of intellect that is in this room. We are to harness this to advance our common goal. Before I go any further, let me introduce myself. My name is Ramesh Krishnamurthy. I'm sitting advisor at the World Health Organization. We have moderators and co-leads. What I would like to do before we start is to have our colleagues introduce themselves very briefly with name and affiliation and also the role they are playing for today. And I would like those moderators if they are not here I would kindly ask them to come on to the podium please. With that said, please go.
>> SAMEER PUJARI: Good morning. My name is Sameer Pujari. I work at the WHO and work with Ramesh. I also manage a program intended for digital health globally across different countries. It's a pleasure to be here. Thanks for coming. And we look forward to your feedback today all day so we can guide this going forward. Thank you.
>> Thanks. Good morning. I'm professor at dpfl. I'm a

co-chair of the session. Very much looking forward to what we're going to hear and learn today.
>> Good morning. My name is Stefan Germann. And I will be having a dual role. I will be presenting at the beginning of the session and looking forward for that.
>> We have two other moderators here. If they are, please use your microphone to introduce yourself if you wish to come in the front, please do.
>> Good morning. I'm Dominic Haazen. I'm moderating the second session on epidemic response and disaster preparedness. I work on digital health.
>> Very good. We have another person who was also moderator. Okay. I think I'm just going to adjust my time here. Could we have our first light please?
Thank you very much. What I would like to do is to essentially give a background and the context to what we set out to do and perhaps we can keep that in mind as we discuss AI for health. So we are going to give some framing of the concept of AI for health as to how we want to see this go. With that said, we want to give two key messages. Number one is AI applications in healthcare settings are most effective when -- this is really key. Almost every one of you who are doing AI-related projects need to associate yourself into the health agenda. The second one, I think, is for more ministries of health to start thinking through insofar as having an appropriate policy and governance mechanism to assure success and full utilization for AI for health. Because there are a lot of nuances as we discovered yesterday and discover today. These are the two critical messages we need to think about. For those of you who are new to Geneva, I want to give you a quick intro to World Health Organization. We have offices in six regions. And we have 194 member states and 700 institutions that we work with including many of them are collaborative centers for WHO. And our regional offices are in Cairo, Egypt, KongO, Denmark and Copen Hagan. And Washington DC. So this is our headquarters in Geneva. You are all welcome to visit. We are a few minutes from where we are. This is world health assemble mentioned by director general. This assembly is about to meet next week in discussing and deliberating. And one of the Kia gened aitems is on digital health. This is our governing body which gives us the mandate to perform our work. There are three things we do or three items we work on as far as World Health Organization is concerned. One is to double up standards, facilitate policy and governance mechanisms and the third one is to convene a global dialogue. So consider this as part of that matter in the last item with ITU collaboration. So this particular document is of relevance of all of us. It is about 13th general program of

work as to how we execute our work in the next five years. And it squarely focuses on innovation and digital health as one of the key ways of accomplishing SDGs. I would encourage you to read this document and be familiar with it. When you are talking to the countries in member states, they'll begin to refer to some of this work. I think also as subject matter experts in both health sciences as well as AI, you may want to also have a conversation in mind about how what you do fits in the broader context of world health. This is our sister agency organization for animal health. It's actually this is a very interesting slide. This one and the subsequent one. Which the health is working as principle mechanism for which we need to account for. And also if you'd take a closer look, 60% of existing human infection are of the signe region. And 75% that have a relationship to the Eco systems of the animals that we live in. This particular drawing you already saw. Health is at the center to which all the 16 other indicators are linked to. As you can see, each of those pictures represents in some form of health agenda to all of those other goals outside the health goal. WHO has a very dedicated mechanism for distributing information related to that. I would encourage you to consider taking a look at this insofar how you want to address your outputs how it relates to the world agendas. This particular picture I put out because it simply says sustainable development goal number 1 through 17 all have a broader pictorial representation of the agenda. If you are working in these areas, you will identify. We have disasters and humanitarian response and public health emergency response. And you can see several of those pictures. You also have primary care. If you are in that area, talking to that particular goal. This is one way to think and grasp about what is it we're talking about. Also, I want to you kind of keep this drawing in mind. Take any country for that matter, they have SDGs they are keeping in mind for the next few years until 2030 and they also need to map what technologies they need to come up with in order for them to solve the problems they are solving. The output screen you are seeing is they are responding to emergencies, managing health agendas, creating innovative space for epidemics and so on. And normal public health services are going to be augmented with this process. The third slide insert that I have is a textual representation. So some of you may actually help them to understand. So AI for health means that particular insert needs to be getting clarity in the country. This is also one matrix I want you to keep an eye on. Even though we're talking about SDG for health, cross matrix of SDG 1, 6, 10, 13, 14 and 15. Some of your innovations can interface in these areas as well. Now, there are many documents that are on the web that I don't want

to go through it. I think what I want to show you is we have to keep this historical context in mind and I will go through examples of this. Starting from e-health, now we are in digital health and talking about AI for health. Historically, we have to keep this context in mind. 2000 is when we discussed at WHO on e-health and the code of ethics. If you think about the code of ethics in AI, there is a lot of correlations here. Start thinking about extracting some of the lessons learned. There's also e-health resolution that formed the basis as a unit in countries. That is through the WHO resolution 5828 followed by there is another global forum that we had and where ITU and many other organizations presented to start thinking about standardization as a mechanism to go forward. Followed by another resolution called the e-health standardization. This resolution like today countries are implementing it. When you are thinking about standardized way is an important part to be embedded in your AI approaches to digital health. Now, there are examples of many activities. And this is a very key activity that is highlighted. Sameer is our WHO in charge on this matter. And leading this area in work. So be healthy is another major effort. And now AI is being super imposed in this matter. Also, we have several other global forums to discuss what we are talking about followed by lots of other activities. Now, the science of public health and health related technologies, we are beginning to now see many documents that UN agencies are focusing on. So I would want to kind of take some examples. If you want to monitor change in large pattern detection overtime and where algorithms are going to be used, we need to figure out what are the best methodologies. When you figure out methodology that works in one pattern recognition process and see where it can be applied to others. That kind of exercise we have to keep that in mind. This is another example for we need AI based algorithm for linking the data to counter measures in heat strokes. Many countries are now focused on large cities where elderly population live and how do we actually identify and forecast what will happen?
This is another problem in mind that if you are not thinking about, that is one other potential issue. Also about water sanitation and hygiene and neglected tropical disease. Forecasting the potential threats that it might lead into. It's something that AI has an area to contribute to. And also advanced AI methodology is needed for future extractions. Road feature extraction. You can do it for many other future extraction. Available for monitoring the spread of diseases. This is another way AI has a broader promise. Insofar as identifying hot spots. This is an example of identifying a monitoring site for polio in Nigeria. So we have to manually go

through process and identify and if there are methodologies that are applicable that is available, this is an example that can really be used in many countries. And I think also what I want to show you here is extraordinary amount of data is available. How do we harness that in relation to AI?
This is a resolution of an image of Grand Canyon. But this is available for the whole world. The point of it is how are you going to extract so much detail inside there in relation to where the communities are and the public health services that needs to be provided to them?
In terms of clinical care setting, there are many examples. I don't need to go through this. In the area of telemedicine itself, there are a lot of opportunities for detection. And our colleagues yesterday discussed with skin cancer and the role of AI in it. The same analogies can be used and applied as far as techniques are concerned. We also need AI teleapplications where people are dispersed and accidents can happen that would lead into a quick resolution. Of course, robotics and healthcare are not new and there are some promises going on there. I would say that AI insofar as addressing telehealth medicines. To be cognizant of the privacy security confidentiality that is quite prominently there and confidence building about AI technologies that need to be used. We go back to the two key principle messages. I would simply say please keep in mind that SDG goals are what countries are after. And whatever you do to help them assist is going to be a key role. And those projects that will amplify that will actually go forward much closer. Insofar as the tracks are concerned, there's four tracks. And we really need to figure out quick areas for all types of AI applications. So our each moderators in each of the four sessions will be focused on identifying those areas followed by we also need to be cognizant there are bottlenecks. Need to know how to go forward in making that happen. Also need to mobilize community support insofar as the proof of concepts that can be demonstrated which has medium and long-term and shorter impacts. I think the last piece of bullet here is about express challenge to transform community health through AI and this is something you can think through what projects to go forward with. These work streams, the first one is going to be on AI for primary care and service delivery. The second one is on out breaks emergency response and risk reduction. The third is health prevention and policy. The last one is critical for WHO's perspective how we advise countries. We're going to follow very carefully each one of those. With that said, I'm going to stop here to simply say we would like to give the floor to moderator for the first session. AI for primary care and service delivery and take our seat back. Thank

you very much.
[ Applause ]
>> Thank you very much. I ask the panel to come up. One panelist might still join us. Might have a delay. But we want to get going. This session is really looking at the primary care space. There is a strong indication that healthcare is moving from the hospital room to the living room. And that's happening already. And we see a very rapid acceleration in this space. AI powered digital health solution has a transformative potential but only if you really understand the technological solution on its own is not going to give us that magic bullet that we are seeking in terms of addressing some of the enormous challenges towards achieving universal health coverage by 2030. It requires echo systems innovation. We need innovations in ethical issues, in new financing models, new business models. We need to use human to design approach. Enhancing the point and quality of care that we are delivering in a dignified manner. So this panel is quite diverse panel. When I looked at the presentations, I had privilege to have a preview on it. It's an exciting panel. I would like each panelists to quickly introduce themselves with your name and where you are from. I might get your names quite wrong in terms of the way I pronounce it.
>> Is it on?
Good morning, everyone. My name is Arun Shroff. I'm a co-founder and CTO of Medindia.net running out of India. Also director of technology and innovation at STAR Associates in the U.S. been an entrepreneur for a long time and digital health and AI are passions of mine.
>> Hi. Good morning, everyone. Thank you for being here. My name is Shinjini Kundu and I'm from the University of Pittsburgh in the United States. I'm an MD Ph.D. scientist. I actually studied electrical engineering before going to medical school. In my Ph.D. I focused on biomedical engineering where I did work on looking at medical images for early signs of disease using AI. So today I'm going to touch on some of that work.
>> I'm -- my background is actually from higher education, social entrepreneur. Have built an organization over the past three years for refugees and higher education. What is sort of the red line in all of this is I'm passionate about using technologies, digital solutions to create social good. And I'm excited to do the same.
>> Adam Perold from Element Inc. There's only three or four others doing deep learning. The others were doing video games in advertising. We decided to get together to build population skill systems as a mobile software service and links of the national health system together across all the different

activities and here we are. Lot to share today. Thank you very much.
>> My name is Nao Sipula. I'm a medical doctor by profession. I represent a company that I co-founded and the work that I do has a lot to do with innovating for primary healthcare products.
>> Good. Let's get us started. I'm representing a foundation that is based in Bosil. A foundation going on since 2003. On the relatively small, sort of, level. And in 2015, they required to set up a management office, develop a full-fledged strategy and I've been developed the CEO of that foundation. Our chief investment officer and chief program officer. So if you have some more questions, you can touch base with us afterwards. But as we started last year to set up a management office, we feel like we are a start-up company ourselves. And we developed the strategy that very clearly focuses on the issue of how can artificial intelligence enhance health issues and safety issues but as well on the digital health space specifically on that last mile. Every foundation is a small actor in the grand scale in terms of governments, investments and corporate investments. We see that foundations can have a critical role in addressing certain issues that might otherwise not be addressed. In terms of the challenges that we are trying to tackle collectively within this room and collectively with the global health community is there is tremendous shortage of health workers that is accelerating as we have growing populations and specifically growing aging populations which require increasing care. And we've seen the brain drain. We have programs in rural Romania. Doctors are moving into the cities first and into the capital cities and move into Germany. And you have that sort of movement of people. And at the end, if you are sort of in a community disadvantaged, it's kind of tough luck. We believe the power that is building digital health technologies and AI support it, this can be transformational in the coming years if we get certain fundamentals right. One of the key issues is there is a tension between privatizing leverage. If we want to leverage analytics for the purpose of achieving global health then we need to ensure we have this global public goods. This is going to be massive challenge for all of us from a health governance point of view if you want to achieve and depersonalized health data will become globally available and business models could be created by actually looking at the quality of the analysis rather than in terms of the data and selling health data. If we look at these sort of challenges we can see unless we collaborate across different sectors to academia and health professionals, it requires a combined approach. This is to illustrate these advantages that communities face in terms of

the need spaced health workers and what is actually within the global landscape. So as a result we are exploring and want to emphasize its exploratory. We hope to work with Stakeholders together which what is launching next year. Around the challenge to basically leverage AI digital health solutions by 2030. The details at the moment are still very much on that moon shot level. We are in discussion with some other foundations to join so it can be a significant price. We're in discussions with UNICEF and WHO and others and we hope within a year from now this, sort of, challenge I'm presenting to you with other Stakeholders, we can actually get a good investment pulled together in community health a possibility. That is my input in terms of the challenge and I would like now to go back to my place and start to introduce the rest of the panel. Thank you.
[ Applause ]
>> Okay, great. Thank you, Stefan. Good morning, everyone, again. It's a pleasure and privilege to be here today with this panel. I would like to thank the ITU and organizers for inviting me to pitch my idea for a project for AI for Good. Now, a quick background based on what we've been discussing so far. To give a little more detail. At Medindia, one of our goals has been to give consumers tools to manage health better. And the technologies we've used so far have been mostly the internet, web applications, and mobile applications. Today with AI in the last few years, it's allowing us to offer a whole host of new capabilities which makes our applications smarter and easier to use. I want to focus on one application most excited about because it ties so well with the aim of this track and the AI for good summit. They wanted a quick win application that can have huge impact. When we looked at portfolio of applications we have, we found one we think is really low hanging fruit and it has tremendous potential for global impact. That's the application we're going to talk about today. Puts millions of people at risk for total vision loss of blindness. And that global health challenge -- it's an eye disease caused by diabetes. DR for short basically damages the blood vessels in the retina. If it is not detected and treated early enough, it leads to vision impairment and total vision loss of blindness. And indeed, it is the fastest cause of blindness worldwide today. Just to give you a magnitude of the problem, the reason why that is a global challenge today is because of the epidemic of diabetes the world is facing. In 1980 according to the WHO, there were 108 million people with diabetes in a population of 4.5 billion. Today, according to the WHO again, the number is 402 million. The number is probably much larger today. That's basically 400% increase in about 35 years. The

population's only gone up by 60%. Clearly, it is a global challenge. Because of diabetes, very few people with diabetes know they have DR. 148 million people have some sort of DR. And out of that, 10%, 11% have vision threatening DR which is basically DR that can lead to total blindness. So obviously, DR is a challenge. You see 642 million people with diabetes. 225 million of those with DR and 64 million will have vision-threatening DR. The key to controlling this is early detection and treatment. How is diabetic retinopathy detected today?
They screen your retina and take a picture with the back of your eye. And then manually scan the image for signs of diabetic retinopathy. Small legions. You can have hemorrhages and depending on the number of the presence of these tiny defects in your retina, they do a diagnosis. So it can be normal or mild, moderate, severe and what's called nonproliferative. The worse it is, the closer you are to vision loss. If you can detect it at early stages, good chance you can arrest the development of total blindness. You have to go to a trained professional to do this. And the real problem now is because of the lack of trained opthamologists worldwide and developing part of the world. This is a map from the international Council of opthamology. Five different shades of color here. The lighter shade represents countries with less than one per million population. Most of them are in the Africa/Asia region. Somalia has 4. That's 4 total. And that's shocking. If that number is correct, they have 4 for a country of 17.5 million. Not 100% sure if that number is accurate but this is from the ICO. And India has 15,000 for a country with 1.3 billion people. That's 9 per a million. So clearly, you realize there just aren't enough ophthalmologists worldwide. This has to be done every year. This is precisely the kind of area where AI -- it's a quick win. Low-hanging fruit. Somebody should be doing this. One of the easiest problems to solve is image recognition and image classification. It's gotten better and better over the last five years. Today the image looks at everyday objects in thousands of different categories and identifies them correctly. The error rate has gone down from 30% to less than 5%. Pretty close to human level accuracy or better. Using something called transfer learning, we are able to take that model and retrain it on medical images or any kind of image. And you feed it through a network which is basically a deepNural network. And then different kinds there and you got to play around with parameters. The image in terms of whether it's normal, mild, moderate, severe and so on. The key, of course, is you want to get a model to be as accurate as possible and approach the human level of expertise. So how good is this?

In 2016, Google published a paper in which their retinopathy model had a score of 195 which was better than the median of 8. Done?
Oh, one minute. Sorry. Okay. So this is the proposed solution. Our key here is low cost, easy to used, AI based and apply remotely. We call it lead. Everyone lead the way in DR detection. We start with the innovation possible is we use smart phones to do the same thing. The image is uploaded to a server in the cloud and the AI model on the server basically goes to the image and gives a diagnosis on automatic basis. If it is high level of confidence and go directly to the patient. In most cases, 80% would be that. If the AI model doesn't have enough confidence level, the probability is lower than 50%. Can look at the image and validate it and assess treatment options and then go to the patient. We are doing a pilot on this project with a group in India. There are 150 centers. Our mission is to make this retinopathy detection like doing an eye exam. Should be as simple as that. The challenges, next steps would be currated data sets. These need to be addressed. In areas that have internet connectivity is low. Privacy and regulations are always an issue. And resources to scale of the model and deploy it. In summary, I would say it's feasible to use AI. And that really would be for good. Thank you.
[ Applause ]
>> Thank you very much. We are taking all the questions later. Write down your questions and as soon as we are through we will open.
>> Good morning, everyone. Today I'm going to talk about the invisible side of medical imaging. And how sometimes the key to early detection might be contained in what we can't see rather than what we can see. But before I talk further about this, let's take a trip back in time. Last year we celebrated the 40th anniversary of the first magnetic resonance image. You see the image here. This is a cross-section of the human chest. I can use someone's help in interpreting this image. This blob in the middle, what do you think that is?
The heart. And this is the?
The body wall, the ribcage. And this black here?
The lungs. So this image may not look very impressive to you today but at the time it was deemed a fantastic success at 4:45 a.m. and this was 1977. Let's fast forward in time. It's 2018. IBM Watson estimates 90% of all digital healthcare data is in the form of medical healthcare images. There's a reason for this. Technology has exploded since the first MRI. It offers a way to look inside of the human body without having to slice somebody open. So how many of you have had an x ray, CAT scan, mammogram?

Nearly everybody in this room has gotten some form of medical imaging. And we're only going to find more and more applications. Many diagnoses touches every field of medicine and every part of the human body. So this is a transformative technology. But there's a dark side to imaging. A side we can't see and a side we didn't even know existed until recently. Today I'm going to talk about that dark side of imaging and how we found sometimes it's in the small invisible changes in the human body that we can atact a disease before symptoms. So let me give you an example. How many of you have heard of osteoarthritis?

The thin accusation between two bones falls apart. We see an image here. This is normal cartilage. This is damaged cartilage. And what we see here are images. There's one image per person and all healthy subjects. No signs or symptoms. These images are from a larger date base. These are a subset of these images. The interesting thing is even though none of these subjects have any evidence of osteoarthritis today, one of these groups will go on to develop pain and bone damage and the other group won't. Turns out the progressers are these and the healthy subjects are these. But it's puzzling. Our eyes can't seem to pick out the common pattern that separates these groups. Since this is a forum on AI, you can kind of guess that AI is going to play a role in this task. But I wanted to highlight there are unique challenges of using AI in medical images. Because it's not enough to consider the pixels one by one individually. We need to consider each pixel in the context of all the other pixels. And find patterns among the pixels. This is what we need to train the algorithm to do. We've come up with a technique which I'll call TBM in this talk. It looks at the collection of pixels as a whole. Using TBM, it turns out we're able to train a classifier based off of healthy subjects and we put the labels based on the outcome in three years whether osteoarthritis progression or healthy. The classifier's able to find a common pattern we can't see by eye but it can differentiate these groups. Now, when we use this pattern to classify brand new subjects that the algorithm has never seen before, able to achieve 86% accuracy in predicting whether a healthy person will develop osteoarthritis. There's no way that doctors can predict osteoarthritis three years before symptoms. So this is something that AI and TBM can do that humans currently can't do. And certainly, we can end here and a lot of AI talks do. 86%. Now we can go grab coffee and celebrate. But it's unsatisfying to leave it here. We want to know what is the algorithm seeing that we can't see?

And this is kind of where the black box of AI has traditionally posed an obstacle. The most exciting part of this work is that

TBM allows us to look inside of the black box so that we can understand the reasoning of the algorithm. So now we look at cartilage images and these images are actually generated by TBM to illustrate for us the pattern it has found to differentiate ostearthritis progression from controlled subjects and TBM is showing us that what it uses to classify subjects as healthy subject is this pattern right here. So as we go from a healthy cartilage slice to one that will develop osteoarthritis in three years, we see an area of redness that appears and it just gets bigger and bigger. And the redness indicates brightness in the image and brightness suggests the presence of water. Just like pot holes can accumulate water, there's a weakening of cartilage at that location and water is kind of coming in to fill the holes. Seems there's already damage in the knees and healthy subjects that we can't see by eye but that the computer can pick up. But it can show us what it's seeing so we can learn and see through its eyes. Now, I want to make a couple of points about medical imaging for early diagnosis. In the 90s and the 2000s, there's the human geno project and we were excited that might be able to indicate disease. But in reality what happened is that we realize that disease is much more complicated than just the genes. Very rare diseases are correlated with the gene 1-1. They are caused by confluence of genes and exposures. And medical imaging offers a snapshot. The second area is privacy. Unlike every other forms of medical data, if we randomize and deidentify, there's no easy way to connect it back to a person's identity. The third point I want to make is because this is a technology that can be applied to any form of imaging to any part of the human body, the potential for this technology is enormous. Many of this already exists in digital form across the world. And we just need to take a second look for not just the visible changes this time but the invisible changes that might tell us something about the future eminence of disease. Thank you.

[ Applause ]

>> Thank you very much. Sorry that I have to be a bit annoying on time keeping. We want to have enough time to interact with this knowledge in the room. Adam, over to you.

>> ADAM PEROLD: Thank you, everyone. Thanks to the conference organizers for having us here today. Really, what our company is all about is looking at identity systems to connect the health systems of countries. So connecting people to the systems and the implications of these digital foundations are pretty deep. So I got together in 2012 to build a company. And the observation that we had in 12 was basically there was smart phones around the world and life had completely changed. The ability to leverage this computing everywhere meant we could

connect with services like never before. This was about a year before. No bi oh,metric -- bio metrics on any phones. and -- connecting everything together. And our original idea was not sensors. Things are fragmenting between the OEMs. But the original idea was a portable software mobile platform where a person can create an account with recognition and be able to not have a device and access identity in health services through a different device. And that's very exciting. So I want to quickly go through a few warmups and I'm going to stay within 8 minutes, I promise. A quick few warmups. The world has completely changed. It's today closer to 3 billion smart phone users. And that's going to go to 5 to 6 billion. What's so exciting is even though the SDGs seem ambitious, the opportunity of the tools we have can change the way we think about these goals. With identity, we're thinking about populations. This is pretty remarkable when you look at it. Took us 200,000 years to get to the first billion people on the planet. Over the next three decades, we're going to add 2 billion people. It's the biggest impact by far. And all of this is coming from Asia and Africa. The problem statement of why we created the company was just this. It was already apparent maybe to everyone in this room that the world is becoming mobile device led and the key thing that we focused on is that addressing the identity needs of larger populations is critical to addressing the greatest challenges over the next three decades and we can solve this. So just a quick overview. The point actually isn't biometrics. It's health systems and banking systems that we're connecting and powering. And the idea is leveraging any modality convenient for a person. Whether that's fingerprints which is in development. And building the world's first platform which is a development we'd love to talk to you more about. The performance is state-of-the-art. This is better than many of the legacy systems. And it's getting just better and better over time. Some of the big dramatic features of this are the essence it can be cross device. You do not need to own a phone. You can have a community health worker be a point of connection across services. And I want to talk about an example of that. You can enroll and be able to recognize the person local to the device and a person shows up with no credentials which is often the case and you can link them to their services. I'm going to briefly go into why AI. What I want to say here is that when we talk about things that are important, a lot of it isn't AI. It's just getting the data. Sometimes you just need data and that's hard to get. So AI is really the processing. AI isn't the only thing that's important. For us, it is. And here's why. In population scale systems with current tools like fingerprint sensors, the goal is inclusion but you have

exclusion from many people. That includes manual labors. The false reject rate for their population skill system was up to 36%. And I can tell you an element which operates across many countries, we see it time and time again. And these reject rates for the populations that can't use those systems are really the -- one of the key things the people may have been formally rejected from systems or the classifiers were based upon nearly defined rules that didn't always fit the person. And those classifiers can recognize them. When you are talking about population scale systems, you cannot ignore this. You have to figure this out before we do anything. How do we keep it safe?

And so when you think about security, quite often we think about the wrapper. We think about encryption and maybe whole variety of fancy things and stuff like that. That's just the wrapper. And good systems need to think about a risk of penetrating that wrapper and ask the question what can they get?

So the best security systems are the ones that look at the architecture underneath. If an attacker gets through, what they get is useless. This is so interesting. We formed five years ago at the earliest stages. These systems that are built upon generating extractions of the signatures of users have nonreversible extraction. The way we built the platform is with fragmentation. The identities across the cloud are not sufficient to be able to match a person. Cannot be used to reconstruct the person's features. And the principle -- the matching only happens local to a device on the cloud side. Those are components to the system. And then just a quick note here. When you are talking about software delivery as a mobile application that can embed into our partner's national scale and program applications, you cannot get lower cost. Really, what we've stepped forward is the lowest common denominator. And all the different applications we talk about are becoming sort of mobile led, this integrates right into those applications. Say a set of 70,000 community health workers that are using android tablets. This is right there on the tablet. And every single one of those touch points connecting everything. And I want to go through a couple quick case studies. So this is in Bangladesh. 15,000 program being served by 250 community health workers on android tablets. And what's so interesting about this case study is that really it's bringing two migrant populations together. So on the one hand you have -- right, thank you. 15,000 women changing locations. And off line local to the android tablet, a worker can link her to those digital health services. Those user models can sink across 250 tablets of the health workers. If they change to a different location and meets a different community health worker, she can still

have a link to her account through that tablet. This can be national scale and this is a very mature stage process at very large scale. This is exactly what we're talking about. And our company is directly involved in this across so many countries, it's really happening. And we can unify not just a single important health service but global immunization programs, continuity care applications and help build aggregate data systems that can inform better health agencies. And this almost goes without saying. Not building a system that seems it will work at a point in time. As the world becomes mobile driven, going to be sitting across any of the devices a person comes into contact with. So here's the express global challenge framed as transforming community healthcare through AI and digital technology to empower community systems for long-term impact. Shift healthcare from hospital to front line, empower health workers with modern technology platforms. Our call to action is basically we would love to begin discussions with any and all countries that are ready to talk about this. We are already having so many discussions with countries about this. And the time is now. Everything's ready. And then, of course, fund raise to help us scale this. This investment is an investment that will generate building blocks. This will reinforce not just the current investments but the future investments in health systems. Thank you very much.
[ Applause ]
>> Thank you very much. And I think what we can sort of see that I've been listening to the different presentations and just sort of to keep in mind as we go into the discussion is probably a big challenge will be in terms of AI and health. We see it as a strong leading towards diagnostics and assessment types and that will help to increase in terms of the diagnostics and assessments.
how do we leverage that in terms of providing the needed treatment support and needed care or cures. So let's keep that in mind as we sort of move on to our next presentation. And our next presentation is Nao from South Africa. Please have the floor.
>> Good morning, everybody. Ladies and gentlemen, the world has been here before where we are. In 1978, we adopted the alma mater declaration professing healthcare to all beyond 2000. 40 years later, we are articulating the same old dream and aspiration of a premise yet to be fulfilled. Compare that with the MRI residency where they are. In 2011, the united nation high level meeting resolved to strive for 2% increase in reducing death. Today as we speak, the situation has actually gone worse. And now, we're aiming for 25% reduction. In our company, when we set out to innovate for health, we had the

context in mind and whatever we do, we do not fail. Africa's greatest problem is not the inability to deal with diseases and other chronic diseases but it's an ability to embrace and harness technology to offer the little that we have in increased coverage across multiple interventions and across different segments and populations in a way that all particularly the disadvantaged. What I'm going to be sharing with you here is what our problem is and what we're trying to actually address. And this we address in context. Our application is a high-impact clinical application that addresses universal healthcare and SDG and nothing else. Africa has a problem with lack of healthcare force. To manage NCDs to manage HIV and aides and take care of children who are under 5 who are very special group that requires special care. And also have got an overworked and overburdened healthcare system. This is what we intend to address. Our solution is to provide an integrated and patient-centric approach to primary healthcare. That is equitable, efficient with improved quality to access of services. Our platform is a multi platform and very high impact application that is designed for primary healthcare in resource constrained communities. As early as 206 we positioned this as a precursor to AI. I remember going to the bank and saying can you finance this and the bank says we cannot finance your nightmare. And we're using ITC as a task-shifting tool. That helped us to incorporate into main stream clinical work and help us to obscure -- we can get one doctor to assist multiple clinics in real time from a remote location and strengthen the healthcare system. Our application is preconfigured as a clinical system. So we actually do it manually. It comes with IOT devices, web based and cell phone enabled. Works on and off line as you might imagine in Africa. Off line is very important. It is both compatible and highly scaleable. This is a real life example. We created the patient by stressing the system. Now, I'm going to give you a quarter of a minute to go through that. That's what we mean by incorporating a community healthcare worker into a main stream clinical work. The work that you see there was produced by community healthcare worker after one week of training. And that is made available and that's what we talk about obscuring. We have to consult and refer a patient should he or she encounter a problem. You can have one doctor supporting numerous clinics from a remote location. All the other outcomes full of clinical knowledge and medical information that actually assist to navigate complex. And you can see rarely looks at the patient as one single entity and not silos of diagnosis. Our current needs are collaboration with the global AI organization that will help us to conduct a proof of concept on the use of AI and primary healthcare in

resource constraint communities. And the case we chose is a high impact integrated service. We incorporate machine learning disabilities and the resources we're looking for are access to device IOT technology, mobilization of partners, machine learning capabilities, the ability to handle big data and analytics. And to strengthen the capabilities. And strengthen our proper compliance. The outcomes are to demonstrate and proof of access to universal you healthcare and scaleability and demonstrate how we strengthen health system and improved quality of care. In this way, we hope and dream we will be able to provide care better than we have before. Provide health better than ever known. Thank you.
[ Applause ]
>> Thank you very much. I think your anecdote we went to the bank asking for money prompted me to ask how many finance and investments experts are in the room in here?
Can you raise your hand?
One, two, TLAE?
That illustrates a little bit the challenge. As this field grows, how we can connect with some of these others in that Eco system in terms of finance, business model, et cetera to really get us some of the solution inside a sustainable manner. I'm lucky that he just arrived. Maybe you can introduce yourself at the beginning of your presentation. Thank you so much.
>> Good morning. Can I have my presentation please?
This one. The one you showed. My name is Salem Alelyani. Actually, today I'm talking about diabetes. I'm pretty sure someone already mentioned that. So it's not hard to convince you diabetes is a really problematic in the world these days. Today, diabetes is a real problem in the whole world. Not only in our country where I'm concentrating this morning. We at the lab try to predict the consequences of diabetes. And making management of diabetes way better for diabetic people. According to WHO, the number of people getting diabetes is increasing by 100 million in the world. So by 2040 we're expecting to have more than 600 million comparing to around 400 million these days. And the number of nondiagnosed people with diabetes in the world is more than 46%. 46% of those people don't know they have diabetes. In the region I came from, we have like six of the richest countries in the world and percentage, Kuwait, Qatar, Saudi Arabia. Diabetes is real issue. Around 26% of those people are diabetic. It's almost one out of four. In Saudi Arabia, we have 24% having diabetes. Some statistics showed more than this number. So I brought the most optimistic numbers here. And the problem is diabetes is a huge burden on the Saudi government in terms of budget. Around 30% of the ministry of health budget goes to diabetes and

diabetes communications. That's around $10 billion a year. If we could work on this problem and improve this number, we will save more than $300 million a year. That's only 1%. How about if we could do more?
So what we did is we classified the problem of diabetes to two things. First, the complications of diabetes. Diabetes is the major cause for strokes, for amputation, for heart disease, for blindness. Most of these problems in the world are coming from diabetes. If we could predict the complications area, we would allow early intervention from doctors to save those people's life. The other is the physical visits they don't need to see doctor if they have a better way. Usually, most of these problem like visiting doctors, an average. Most of the people they don't go to the doctors. Those people who usually visit the clinic who already had complication. They visit because they have complication. So on average, even if they have complications, it's once a year they visit their physicians. that's in the center we're working with. So most of this time are avoidable. If we could introduce a better platform for them. The good news that there are two types of diabetes, in general. There's two types.
type two diabetes is largely avoidable. According to Harvard school of public health, nine cases out of ten cases could be prevented. And they could prevent it by changing lifestyle like losing weight, healthy diet. Exercise more, stop smoking. If we could work on these things besides prediction, we could also improve the number I mentioned earlier. So we designed a platform called Salim. We are optimistic it will be healthy. It's a platform for patients and their physicians. For patients to just get readings. They could also synchronize their devices. The readings is according to doctors there are a bit of time to take readings. So we designed the platform on this. It's easier for physicians to monitor. Besides that, also keep health record for this patient. The wholly electronic health record. We also allow real time communications between doctors and patient. If he has problem, immediately get contact with his or her doctor. The two layers that we have, first now is data analytics. So the data analytics layout to allow doctors to analyze their data and we have recommendation for doctor. We have some notifications. If any patient needs urgent care. The doctor will be able to see that as well as the patient. The layout we will introduce and we started to do this and we have good result on predicting the hospital admission is the intelligence layout. The intelligence layout is where we could predict communications to allow doctor to interfere with their patient. We hope we will work with other parties to introduce such a platform to more people. Thank you.

[ Applause ]
>> Thank you very much. And compliment previous with the retina-related issues. Thank you so much. Our last presenter, please go ahead.
>> Thank you very much. Is this turned on?
Perfect. Great. I always knew that health is one of the most important things in life but to be honest, I fully you knowed the meaning of that when my dad, my father was hospitalized in October 2015. He had an array of alarming symptoms. Took him there for two weeks to do test and going trying to find out what is it that's troubling my dad and how can we treat it effectively?
What really puzzled me was they didn't find it out. He was released and continued. He went on to see many more doctors. I remember I got really worried so I started Googling and 1 out of 20 Google searches is relating to checking symptoms for yourself or loved ones to find out what people have. And eventually, my dad, they found out months later what it was. He got the right treatment and health improved. But I remember this experience left me wondering that if in Germany one of the wealthiest countries with one of the most elaborated health systems, it proves to be a challenge to get the right diagnosis, what would have happened if my dad would have been in his home country Afghanistan, one of the least developed countries where even accessing primary healthcare proves to be already a huge challenge?
And this is not just a thought experiment, it's a reality for over 4 billion people that are currently lacking access to basic healthcare services due to an array of barriers that all of you are aware of. Ranging from the shortage of health workers, geographical barriers, a lot of out of pocket expenses driving families into poverty because they have to pay for healthcare.
It is our vision that everyone on Earth has access to the healthcare they need and deserve at the exact point of time.
And our mission is to do this to achieve this goal. We have developed a personal health guide helping people to understand their health and also guiding them to the next relevant steps.
So what is the appropriate care once we've identified what is really the diagnosis?
So you can see an overview. It's made very intuitively that is asking you what's troubling you, how can I help you?
And then you give in all the symptoms that you have. And doesn't really have time pressure like a doctor. Continue asking you and asking you until she has a feeling of what are all these symptoms and linked to the relevant condition with the reasoning running behind the interface. So I want to go a little bit back. Ada was founded years ago. There's

development put into before launching a product for over five years. And the idea has never really been to say we developed a machine that is able to do diagnosis. The idea was to say how can we support doctors in decision making and develop a tool that is increasing the diagnostic capability and the work doctors are doing anyway. And how can we solve this?
There are roughly 12,000 conditions, diseases out there correlated with over 8,000 symptoms. So that's quite a complex space that we are navigating in. And there's a lot of knowledge out there. For the human brain to process this is quite complex. And that's exactly where AI can come in and solve this problem once and for all for consumers and for doctors. So what we have done is we've gone back to the theory of thinking. What kind of mode of thinking do doctors actually need to be able to come up with a diagnosis?
That is on one hand the logic of thinking but also other thinking. Really take into account and then detect the diagnosis. In our case, we have developed a system that is linking symptoms with conditions. Whenever you give another symptom, you say I have a headache, now I have the next symptom, always checking that symptom against all possible conditions out there. This mechanism guaranteeing high accuracy. You can see here we have refined the system for the past 7 years with 60 medical experts within our team. So doctors that have been working on modeling all the diseases and feeding that into the system. And launched a product at the end of the day in 2016. I will share a bit more where we stand with that. And here you see a real case. A woman was diagnosed with acute appendicitis. Continued asking over 40 questions and you can see on the one hand the positive evidence that is pointing towards that. But at the same time, you have high transparency. The negative evidence really at every point of time giving doctors as well as the patients the overview of what's going on. And why does S deficiency a -- Ada come up with what she's coming up with. There are 5 million assessments that have been completed. Roughly 100 employees based in Germany and rated one of the best medical apps in over 130 countries in the app store. And the interesting aspect is the 80 those reviews you you've just seen. So what is the feedback?
And I looked into our system yesterday and I saw a review I did not intend to share. It struck me so much. It was a user that said I'm baby sitting a 10 year old boy for the past week. And I realized he had all of a sudden such huge pain that he was crying all the time. The mother went with the boy to the ER. They sent him back and said this is growing pains. It's normal. So the baby sitter was there the next day and said something is wrong. I don't think this is just growing pains. He's not able

to move any more. She asked the mother and Ada said the boy has arthritis. I have not seen a case like this. The doctor said this is correct. He got surgery that day and also she shared that this surgery prevented him to have long-lasting damage on his nervous system for his entire life. So this is sort of an example of the impact it has already. In low and middle income countries, it's quite interesting. We receive the feedback from this user here who is the sun of a drug shop owner in Nigeria. I have constantly people coming in to my drug shop and asking for medical advice and we're unable to provide that but we're pushed into that role to do so. He said he started using Ada and providing people with medical advice. He said he found it helpful. In low limited resource setting where physicians are maybe miles away, better to have access to an AI system robust and give some direction. Health facility or maybe staying at the pharmacy. And this is actually bringing me to the project pitch I have here today. I'll keep it short. Here you can see an example of a rural echo system. Currently, a project we're working on how we can deploy in a setting and see what is the validation for the Stakeholders to use. You see community health worker. One of the most important points to achieve the SDGs. They are really going door to door and there are studies have compared community health work hes. Both are having the function of triage. What is happening once identified that there is a condition?
The same is also for drug shops. 40 to 60% of the population first goes to the small drug shop to get advice and referred to health facility, for instance. And at the same time, we have the global app that is freely available for any of them to download. So you make sure people can on their own make better informed decisions. In this context, the interesting aspect is I'll come to an end in a minute that we can validate here by deploying each of these Stakeholders with devices and community health workers to track all the information and be able to refer them to the appropriate care that is needed. What you can see here is within this AI powered infrastructure, you have the possibility to gather all this data which provides the basis essentially for government to also do effective public healthcare provision when it comes to infectious diseases, combatting malaria. You can then also increase the power Ada have with rapid diagnostic symptoms. And able to deliver the test, give the right care and connect these systems and taking that information into account. I'll leave it with that and look highly forward to your feedback. Thank you very much.
[ Applause ]
>> Thank you very much. We have now about 20 minutes time to

really open it and interact. I don't know whether there is any walking microphone that could be utilized. Go ahead.
>> Thank you. Good morning. We're from a company called biosensors beyond borders. We're developing in the area of disease testing and low area countries. What strikes us listening to the wonderful examples presented this morning. If we take a step back, I suppose which could be a potential missing piece that overlays all of the presentations is the issue of diagnostic adoption and roll out. And this question is addressed to our colleagues from WHO in the room. Is there a practical project that brings together on the one hand WHO's expertise in the review and approval of IVD whether it's RTD, POC or Lebartry based testing together with practice in the area of diagnosis by software?
So the question that we're interested in and as a young company while we talk to our investor community is actually is there something here that WHO can do with us that can help stretch the thinking around diagnosis by software in low income settings that relates to the pivotal role it has around diagnostic adoption and roll out.
>> Thank you very much. I give that to Ramesh from WHO.
>> RAMESH KRISHNAMURTHY: Thank you very much. That is insightful question. We have to capture what you said and get back to you because this transcends multiple departments. And it's a good discussion. We need to host a broader forum. So we made a note and will come back to you. Thank you very much.
>> I would just like to add the UK foreign office is hosting end of June a consultation around some of these bigger AI and health in low middle income policies and WHO is involved in that one as well. Adam, go ahead.
>> Great question. It wasn't for me, it was for WHO. Great question I have contribution to. I think we were asked to look at primary care. We look at disease diagnostics. It's all about the people and connecting the people to the services. And so we're involved in several country national disease diagnostics initiative connecting the results back to the people. People can submit loads. When the person shows up with an English name and second case with a native name, you can't match it to the person. And how do they treat it?
And that at a bigger level goes to the statistics and databases to be able to address a variety of issues. That's front and center for us. I'd be happy to talk with you directly. They are so involved in that. Thank you.
>> Thank you. Some more questions?
Comments?
>> Thank you. I have a question for the last presenter about application. I think it's very well done especially this part

of people being able to check themselves about eventually what kind of -- how do you plan to integrate other languages? This kind of application is needed in countries where they don't speak English or German. The position of your company of this other languages.
>> Yes, absolutely. We are a global company that is trying to solve a global problem. So we have just launched Spanish and Portuguese and we plan to really speed up also translating into other languages. The translating process in itself is quite complex. I can say a few things about that. If you model certain diseases in different languages and cultures, you express pain differently. We also have to make it culturally sensitive to be able that the system is coming up again with an accurate diagnosis. So this is a bit of a -- there will be a time gap but we intend to come up with a lot of languages in the next year or so. Chinese, Mandarin, Arabic. And to really roll it out. Swahili is also on the list. We'll work towards that. But it will take some time, I'm afraid.
>> The language in Afghanistan, do you also plan?
>> Me personally, I'd love to do that. If you look at the challenges in Afghanistan on health, yeah, I will definitely work towards that.
>> Thank you. A question for most of the panel. Those are fantastic innovations. The hope that those innovations will be adopted at the health system. And not only one application or solution but many of those. So I just want to get a sense of you from your experience and what you have seen in countries. What does it take, what needs to happen in order for those types of solution to be adopted and integrated?
>> I'll start. I think one of the important criteria for AI solutions in healthcare is basically transparency. And I think this is kind of a problem with AI, in general. We talked about AI being a black box and not being able to understand or explain its reasoning. And this posing a problem for many sectors. In particular, this is very important in healthcare. These AI decisions are going to be used to inform treatment. For example, if we have an AI system that assesses your risk for a type of cancer as being high and it's a false positive and that patient undergoes an expensive biopsy and there are both costs in terms of patients suffering as well as costs in terms of monetary costs and allocation of resources, that's kind of -- the stakes are very high. One of the biggest things is trust in the AI system. And one of the key challenges in the technology is how do you make it transparent both for doctors and patients to be able to understand what the AI system is using?

That's useful both for doctors in terms of if the AI system is saying something unreasonable to override that. Also if the AI system is giving something with what the conventional thinking is. It might be that it's wrong or might be it's teaching you something. We really need to know. And that is some of the motivation coming up with this technique which is one way we can look inside of the black box and have the system explain its reasoning. But I'm sure there are other ways we can do this outside of medical imaging. Person LEESHGS I -- personally, I think trust is one big issue.
>> The question is quite focused. Gets enormous number of -- on a daily basis, on offers for add ministry to consider. For many individuals and institutions. Do not really have a way to vet the process through. They can't experiment on the people. They are responsible for operationalizing particular opportunity. What was focusing and asking was how administers of health can operationalize this. So there is a two-part answer. They mediate many of these conversations. They facilitate discussion in dialogue. And what often we find is the policy-enabled environment that needs to be present for the ministry to adopt digital technologies means they are taking a liability for using that to operationalize. They will see whether there are any liability issues. So I think the second part of what WHO proposes a point of reference which is policy-enabled environment to be present. I would highly encourage if you are operationalizing in countries to promote, for example, AI based technology, use the help of the WHO offices to help facilitate the conversation. I think that is really important. And WHO headquarters is informing the officers to make sure the innovation is in the center stage for advising the countries. This fits in the conversation. So I think in a way what you presented is interesting and important especially in cities. That's the biggest challenge right now. So I think it's really important that you need to operationalize now from going beyond prototyping to say you want to roll out at the national level. For WHO and other health partners on the ground to take this idea off so the country can receive this in a proper way. Thanks.
>> Just to mention what is critical in WHO is part of this to be the development principals which any company that looks at developing solutions should do them along these lines. Now, last one because we are told they are having coffee already out there.
>> Very quickly, if I may. As you worked on developing the system and the tbm, were there moments where you said I wish there was a standard format for the data. I'm with ITU and look after the study groups that develop the standards and we're

curious to know if there are interfaces or data formats or ways that standards could be developed to enable a large scale deployment of these systems.
>> I will go back to the previous question regarding the collaboration with the ministry of health. We started working with the ministry of health. Started working on diabetic center and another thing is computer scientist. Open to adopt new technologies and we have office called initiative office. That will have return investment. When we convince them with any kind of return investment, we don't come and say we will do this and that. From 1958 own data, then I think they are open to collaborate. I'm talking about the Saudi Arabia where I work.
>> Let's give another five minutes and we really have to close it down.
>> I like the point about data standards because I think it's important. I think it's a conversation that should co-evolve with the AI technology. The initiative is database that was currated for resource purposes. The same across all the sites and the T2 fitting is standardized across the different images. So you can compare them. But I think that this isn't necessarily the case on scans that are sort of collected in different conditions and different environments. So the issue of standards we do need to talk about that in conjunction with AI technology and especially as we scale these technologies, I think standards are important.
>> Good.
>> I would like to address myself to that last question. I think in my experience working with government in our region, the kind of solutions that we all have here are all important and very good for them to have. Looking at population health. It's not interested in what was your diagnosis for it. We got to go with one solution. But on the ground, we have to integrate every aspect of that. Government is not able to take up solutions in silos and be left with the responsibility of connecting them. So it is up to us to understand what is it [Inaudible]. And I'm going to need to deal with patients in their homes and that's good. And then I'm going to need technology on orthopedics. And that's good. And you put together and you offer that to government. But importantly so. It must not change the business of government. It must not change the government's work flow. Anything that you provide to them must not look strange. I always tell my team. Write even the spelling mistake.
this is their form. Most of the people are not necessarily doctors.
>> Thank you very much. We have one last from the audience and we have our own who hasn't been able to contribute on the panel.

>> Hello. Good morning, everybody. I'm Dr. Lieu. I'm a cardiovascular surgeon. I'm sensitive about the burden you all mentioned. I would like to congratulate you for your remarks. Especially in Africa.
my question is regarding your really exciting presentation. When you talk about affordability, what is the cost of your diagnosis for one patient?
When you talk about scale ability, what is the model you apply? How do you monitor?
What is your KPIs to all of your echo system. And how working together you can create a global platform that will work with different ministries?
I was with this gentleman in Africa last week. The president said my business is to do business. So basically, to allow each one of us to be better prepared to do what we do best. Either our job or either business or working for an institution. But I've been traveling 17 years in Africa. Now as an entrepreneur businessman I address ministry of finance, prime minister, ministry of youth. That's why I'd like to understand what is the impact, business model and the cost.
>> Thank you very much. I think you summarized, actually, the need for echo systems innovation. We cannot just focus on simple technological solution as complex as AI might be unless we match it with exactly all these.
ministry of economics affairs. All the different Stakeholders. That means private sector needs to be part. And I would like to close that rich panel. Shows we would probably need more time for just that sort of topic. Given there are a number of other tracts today, I would like to thank all the panelists. Thank you very much. I would like to thank a very active engaged audience for this rich session. There is now coffee/tea out there. Refresh. We are still here if you want to interact with us a little bit until the next session starts. Thank you so much.
[ Applause ]
[ Coffee break ]