Andy Browne (00:00:01):

Greetings and welcome to Bloomberg New Economy Conversations, I'm Andy Browne. Big pharma is redeeming itself. No sector has emerged from the COVID 19 pandemic in a more heroic fashion. Allied with cutting edge biotech companies and buoyed by billions of dollars in government investments, the pharmaceutical industry delivered up a modern scientific miracle at the end of 2020. A slate of remarkably effective vaccines as well as breakthrough advances in therapies and diagnostics. And it did all this in record time. The victories were built upon years of scientific research and accelerated approval process that required partnerships across the public and private sectors and collaboration between rival pharma companies in the manufacturing process. There is every chance that the technologies that have come of age in this effort can be adapted to combat an array of diseases, reshaping the way scientists approach illness. But first, how do we ensure that vaccines developed in the rich world for COVID-19 reach the poorest countries?

Andy Browne (00:01:17):

What's the answer to vaccine nationalism? And what steps should governments and multilateral institutions be taking right now to ensure we're even better prepared and can mount a faster response to the next pandemic? We have an incredible panel of experts who are going to help us answer those questions. I'm joining you today from Bloomberg headquarters in New York. And I'd like to welcome our global New Economy community. We also welcome our viewers tuning in on social media and via the Bloomberg Terminal. There will be opportunities throughout this conversation for real-time input from you, our audience. I encourage you to submit questions in the text box in the bottom right of your screen. And I'll invite you to vote in live polling in the top, right of your screen. If at any point you encounter technical difficulties, a simple refresh of your browser should help get things back on track.

Andy Browne (00:02:16):

Now let's get right to first guest Katalin Kariko who likes to be go by the name of Katie is the senior vice president at BioNTech. She's also adjunct associate professor at the Perelman School of Medicine at the University of Pennsylvania, where she developed a patent together with Drew Weissman to create the revolutionary MRNA vaccines produced by BioNTech Pfizer and Moderna NIH. Welcome to the program, Katie.

Katalin Kariko (00:02:51):

Thank you.

Andy Browne (00:02:52):

I really should start by thanking you. I've recently received my second shot of the biotech Pfizer vaccine that uses the MRNA technology you pioneered. It may literally have saved my life and countless other lives now and in the future. What was the moment when you realized that the technology you'd spent your whole working life developing could actually help to end this pandemic?

Katalin Kariko (00:03:23):

Yeah, of course, I was very happy to learn how potent it is, but telling the truth. I expected that because we have already worked long years and in animal study, we could see how potent it was protecting with different kinds of viruses. Of course, not for Corona, but we tested for influenza and Zika and we published it. And we could show that very similarly formulated the nucleoside modified MRNA, how effective it is. It was very surprising, especially that very small amount was effective. And it was very

different from previously tried the DNA vaccines where you have to scale up the amount when they try to use as a vaccine. So I was very, very happy and yes.

Andy Browne (00:04:20):

So the COVID MRNA vaccine represents really one of the greatest victories in the history of science. What's the simplest explanation of how it works? We actually have a graphic. Maybe you could talk us through the graphic and so our viewers get a sense from the expert on how it actually works in the human body.

Katalin Kariko (00:04:49):

So, Chinese scientists who provided the sickness information and thanks to the technology, and many, many people developed based on the information, gene could be synthesized coding for the critical protein, which is on the surface of the virus. And we have to neutralize this to protect against the virus so that the gene provided template to make messenger RNA.

Katalin Kariko (00:05:16):

The messenger RNA is present in our body. So, this modification, we introduced a result that the body will not destroy immediately when it is used as a medicine. So this messenger RNA was put in a liquid particle to coat it, so make sure that it will not be degraded because the RNA degrades very easily [inaudible 00:05:43]. And so this is frozen down and then injected very small amount, 30 microgram is the one thousandth of a piece of rice. So very small of RNA is sufficient. And when it gets to the muscle of the human being, then it will be taken out by immune cells and translating this protein. The RNA in two three days is already gone. The protein is also short time, just enough to kick in the immune system to generate the antibodies and memory cells and T-cells, and then this person's immune system will be ready when any time, even months later we'll get an infection, they will be perfected.

Andy Browne (00:06:33):

You are famously and indomitable spirit. You persevered in your research and the face of widespread skepticism from fellow scientists. You found it hard to get your work published, venture capitalists weren't interested in investing in you at one point at the University of Pennsylvania, you were actually demoted. What in the world was going on, and where does that grit and determination come from?

Katalin Kariko (00:07:07):

Maybe it's coming from my humble beginning, because my father was a butcher and we, I was raised in a very loving but simple family. And my parents didn't have the higher education, but they are very intelligent and encouraged us to study. And thanks to my great teachers, I could manage to get to the university where I studied and did very well, but again, in the small town, I didn't learn English. That's why strong accent I have. But so at the university, I had to catch up again with the others. And so it was always kind of catching up, but working hard and managed to get a very good position in [inaudible 00:07:59] Biological Research Center. And then I started to work on RNA there in 1978. And due to limited resources, I had to leave Hungary, although I love to live there and came here to Temple University where I, again, studied this small RNA molecule, which had an antiviral effect.

Katalin Kariko (00:08:25):

So it was always a viral field and try to develop an antiviral compound. And getting to the University of Pennsylvania, started to work on messenger RNA to use as a therapeutic molecule. And thanks to my

enthusiastic colleague, Elliot Barnett, and even I couldn't get the money that he supported from his own grant. And I was on the faculty, but because without support, I was demoted, not having any help. Even every day, I went out to venture capitalists. We presented the RNA as a technology messenger RNA to use it. But maybe we were too early, or we were not to articulate it well enough. And again, this was in cardiology. But again, I was after demotion, I was saved by a colleague David Langer, who was a resident at neurosurgery and convinced the chairman that neurosurgery needs a molecular biologist.

Katalin Kariko (00:09:34):

So this is how I get my first laboratory and paid by the department. But again, I had difficulties and luckily, I met Drew Weissman and he wanted to develop vaccines. And when I said that I can make RNA, we started to work together and it was 1998. So 10 years I was already working MRNA with a lot of failure, and we could develop it for a vaccine. And we had published first time that a very similarly formulated, very similar composition, the vaccine for against Zika was a very effective. And so this was the first time it was published in 2017. So, well, a couple of years before.

Andy Browne (00:10:33):

Your daughter seems to have inherited your determination. We have a picture of her, which I'd like to put up. She won two Olympic gold medals for the US as a rower. Is it in the genes?

Katalin Kariko (00:10:57):

With my husband, we were athletic, but not at that level. But perseverance and hard work, definitely. Maybe just watching us or maybe genetic, I don't know that my parents were working very hard and I also took from them.

Andy Browne (00:11:16):

So, few people ever imagined the vaccine for COVID could be developed so quickly, within a matter of a few months. The previous record, I think, was four years for the mumps vaccine. What were you surprised at how quickly it sailed through clinical trials?

Katalin Kariko (00:11:32):

Yes, yes, of course it seems like very quickly, but I have to tell you that we were already ready with Pfizer together with BioNTech to start the human trial with the influenza, which is the same composition, only the coding segments. So the order of nucleotides were different in that case because it was against the influenza virus. But otherwise the other part on the composition of the vaccine was the same. And we were ready to start a human trial when it was switched over the coding sequence to the Corona spike.

Andy Browne (00:12:14):

What were the critical factors or combination of factors that allowed this astonishingly rapid development. One thing of course was massive financial support from governments that essentially de-risked the vaccine development process.

Katalin Kariko (00:12:30):

Actually Pfizer did not take that part in our considered in BioNTech and Pfizer, but it was important that taking over the risk, and it was also in Europe. The EU took over the risk and said that they just proceed and they fail, then we will compensate that. But definitely it was critical that the messenger RNA was

already ready and it was developed for decades and very well in advance with Pfizer and BioNTech. And also that the large pharma companies had the ability to scale up quickly.

Katalin Kariko (00:13:13):

They have all of these expert who would know how to run quickly, a clinical trial, how to scale up the production and the shipping and every part, that I was just amazed. Great respect for all the colleagues at BioNTech and Pfizer that could do that. Everybody's such an expert and I am just so impressed and all of the credit should go to them as well. As well as for the competitor company, Moderna, which also use those similar composition of vaccine and together with the NIH, they could accelerate and perform well at the clinical trial and succeeded to get the authorization.

Andy Browne (00:14:09):

Do you worry Katie about the COVID variants that are emerging now in Brazil, South Africa, is there a risk that they could render the current vaccines ineffective?

Katalin Kariko (00:14:21):

Right now, all of the current variants, the vaccine is still very protective. The UK and Brazil variants is just as good as against the Wuhan type and a little bit less for the South Africa, but this is just for the antibody response. And you have to know that the messenger RNA also generate a cellular immune response. So meaning that the vaccinated person can eliminate the viral infected cells, not only the freely floating viruses circulating in the blood. So it is a second layer of protection is still there. And then for the variants to get around, it is very difficult. [crosstalk 00:15:08].

Andy Browne (00:15:10):

I want to get to an issue, Katie that I mentioned during the introduction is an important one. Given the risk that variants pose, should governments be doing more to ensure that the entire world has access to these vaccines now to prevent more variants from emerging? It's become a commonplace that the pandemic isn't over anywhere until it's over everywhere.

Katalin Kariko (00:15:36):

Obviously yes. So, ideally we should have it right of way everywhere, to make this vaccine and many other vaccines, which is developed by other countries, available and help those people to get protected from this deadly virus. And I don't know how to do that, but I am sure there are experts that could-

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Katalin Kariko (00:16:03):

... to do that, but I am sure there are experts that could figure it out and help.

Andy Browne (00:16:08):

I want to go to our first audience poll to see what our viewers think. What should governments in rich countries do to ensure that COVID-19 vaccines and therapies are available and affordable for the rest of the world? And the options are in this audience poll. First of all, should they implement laws or regulations to force drug companies to waive their patent rights? Should they negotiate with drug companies to buy their intellectual property using taxpayer funds and put it in the public domain? And

the third option is nothing, hope that the public relations pressure forces private companies into voluntarily waiving their IP rights.

Andy Browne (00:16:55):

While we wait for the audience to submit their answers to the poll, let me get your take, Katie. What do you think should be done to expand access to COVID-19 vaccines in the global south? India and South Africa have approached the WTO seeking a waiver on vaccine patent restrictions. What's your perspective on the patent issue?

Katalin Kariko (00:17:18):

We have mentioned many times with Drew Weissman, we didn't want to patent at all because we were thinking, naively, that we want everybody to use this nucleoside- modified mRNA for any kind of therapy, not just for vaccine. And this was in 2004. We learned that if we don't license or no patent, then nobody will develop it. And for us having the [Torbay Act 00:00:17:49] that is saying that if the taxpayers' money were spent on the research, then it should be available freely, that patent. I hundred percent agree with it. I don't want to get rich, I want to help everybody. And I understand also that the companies who are developing, they invest a lot of money and they need to collect back. So I don't know how to handle that and what kind of solution would be.

Katalin Kariko (00:18:25):

But in the case of this vaccine, our goal was at BioNTech and Pfizer for use as quickly as possible. Because we had most experience with the minus 70 storage, that's why we proceeded with that. And we needed to collect data to show that in minus 20 is also safely can store a certain period of time. I have to mention that minus 70, we have similarly formulated mRNA, can be stored for years. So it is also important that stockpile can be created and then shipped as different viruses will occur in the future, of course. So right now, if we would say that everybody can make the BioNTech Pfizer vaccine, the problem is right now that some components has limited availability that are synthesis issues and other, I had to figure it out. So this is the reason not for greediness that it is not available for everybody. So even if it is available, the technology, they couldn't do it.

Andy Browne (00:19:42):

Well, it's pretty clear what our audience thinks about this issue. 57% of them think the government should negotiate with drug companies to buy their intellectual property using taxpayer funds and put it in the public domain.

Andy Browne (00:19:56):

Okay. I'd like to get to our other two speakers. I'd like to welcome, first of all, Janice Chen. She is the co-founder and CTO of Mammoth Biosciences, a biotechnology company, harnessing a revolutionary gene editing tool called CRISPR for rapid and affordable disease detection. Thank you for joining us, Janice.

Janice Chen (00:20:20):

Thank you, Andy, it's really great to be-

Andy Browne (00:20:23):

I'd also like to welcome Rodrigo Yanez. Rodrigo is Chili's undersecretary of international economic relations and has served in the Ministry of Foreign Affairs since March of 2018. Thanks for being here today, Rodrigo.

Rodrigo Yanez (00:20:40):

Hello, Andrew. Good morning.

Andy Browne (00:20:43):

So Janice, I'd like to start with you. You're pushing the frontiers of this revolutionary technology platform, CRISPR, which is used to edit DNA. Your goal at Mammoth is to create CRISPR based Coronavirus diagnostic tests that are as simple as a home pregnancy test, cheap, disposable, fast. Tell us how it works and when you expect it will become widely available.

Janice Chen (00:21:10):

Sure. Yeah. And I think maybe to explain how the CRISPR technology works, it also helps to understand its origins. And actually there are some really beautiful parallels between CRISPR and what we're seeing today with the mRNA vaccine and how humans have evolved their own immune system to fight against invading pathogens, and we have new ways of introducing vaccines to help them fight against these pathogens. But actually bacteria have also evolved their own defense mechanisms to fight against their own viruses.

Janice Chen (00:21:45):

So in that way, CRISPR is actually like a bacteria's vaccination card where there are little bits of virus information that's stored in the bacterial genome that are then used in the future to fight against the same virus that will infect them. So, in 2012, Jennifer Doudna, my former PhD advisor, Emmanuel Charpentier, and their colleagues were actually able to show that you could take these core components of the CRISPR system, engineer them to then target any sequence of interest. And that really opened up this tremendous opportunity to have a programmable gene editing tool that anyone could use to edit genetic diseases, for instance.

Janice Chen (00:22:27):

So that has really kicked off this CRISPR revolution. And this recognition that CRISPR is a really powerful platform technology to develop new medicines. It was in the last couple of years that we realized that CRISPR isn't just a single system. It's not just the Cas9 protein, which is so well known today for its gene editing capabilities, but actually there's a whole world of CRISPR systems with different features and capabilities that we didn't even really understand until we started to look into that. So there's a new protein called Cas12 that we looked at a couple of years ago that we recognize had this unusual activity, that it doesn't just cut the DNA that it is programmed to recognize, but also it can provide a real time signal that actually can detect that DNA sequence. And so that really opened our eyes to the possibility that you could use CRISPR as a diagnostic tool.

Janice Chen (00:23:22):

From that discovery, we wanted to really quickly see if we could use it as a proof of concept as a diagnostic and worked with our collaborators at UCSF to actually show you could detect and diagnose HPV patient samples. And so of course, when the coronavirus pandemic rolled around last year, we

realized we had a tremendous opportunity and responsibility to reconfigure this CRISPR diagnostics platform to go after the SARS-CoV-2 virus.

Andy Browne (00:23:49):

Jennifer Doudna, of course, who you mentioned, won the Nobel prize for chemistry last year. And as you say, you worked in her lab. Do you imagine that the diagnostic kit that you're developing will end up as a requirement for air travel, a test you'll take on your way through airports, a step you'll take before entry into sports venues or theaters or schools or workplace. How will it work?

Janice Chen (00:24:21):

Yeah, so our vision from day one has really been to develop CRISPR diagnostics to democratize detection and diagnostics at large. CRISPR really brings in three core components, which is the usability, accessibility and reliability that you need to have a powerful diagnostic tool. So, as a new technology, we have a lot of milestones and proof points to achieve. And I'm really excited to say that our first product that we'll be launching very shortly is a high [inaudible 00:24:52] COVID testing workstation that can be used in hospital laboratories to screen through thousands of samples in a single work shift with very minimal FTE requirements. And so what we're excited about this technology is the ability to, like you said, place into areas like schools, workplaces, where people need to know very quickly if there's potentially someone who's infected in a certain environment. So you can imagine that this type of technology will be used very widely to help screening as we get out of the pandemic as well.

Andy Browne (00:25:28):

It's absolutely critical in reopening the global economy and getting travel going again. Perhaps as important as the vaccine itself, given the problems that we've heard with rolling out a global vaccine passport.

Janice Chen (00:25:46):

Exactly. I think all of these different solutions have to work together. In order to understand how this virus is changing, we have to be able to track it, we have to be able to detect it. And that requires being able to roll out diagnostics very widely so that we can be prepared. So I think all of these different solutions, we have to work together to get out of it.

Andy Browne (00:26:10):

So in building this diagnostic kit, you've taken a very collaborative approach. Have I got that right? US and Chinese scientists have been working together, not against each other on this project. And you've sort of set to one side the issue of patents for the greater good of rolling out the diagnostic tests. That's interesting because, as we've just been discussing, vaccine development is almost the opposite. Vaccine makers are competing for market share, competing for profits. How do you explain that difference in approach?

Janice Chen (00:26:45):

Well, I would say certainly, the CRISPR patent landscape is very complex and there have been a number of pretty high profile battles that people have heard about through the press with respect to the CRISPR Cas9 gene editing technology. I would say that for the COVID-19 pandemic, the goal was for all developers of CRISPR diagnostics to say, "Okay, can we actually take this new technology and put it out into the world as quickly as possible because we are facing an emergency crisis." And so questions

around patents were essentially put aside and, for us at Mammoth, one of the things that we did very early on in the pandemic was put together a white paper with all of the details for actually deploying a CRISPR based diagnostics. So our goal was here are the sequences and the chemistry's required to actually enable anyone to take this protocol and get it started in their own laboratories.

Janice Chen (00:27:48):

We're really excited to see actually a number of companies leverage our sequences and our protocols, as well as other academic groups using this information that we put out widely to enable their own programs and to accelerate their own testing programs as well. So, certainly we've seen our colleagues around the globe do the same thing, and I think that's been one really remarkable outcome of this pandemic is that there has been this shared vision to do something good.

Janice Chen (00:28:17):

I'm really inspired by the way that people have come together, not just within companies, but really private public partnership to push new technologies forward. And I think, what we've seen over the last year really proves that collaborations are a way to really accelerate discoveries and translations of those discoveries into something very meaningful.

Andy Browne (00:28:44):

The argument you often hear from big pharma companies for patent exclusivity, is it incentivizes innovation. So what incentivizes you? What gets you, your team, up in the morning to develop these technologies?

Janice Chen (00:29:02):

Yeah. I think very similar to what Katie said that the goal is to help as many people as possible. And I think that there are just very few opportunities that you have in this world to create something with such tremendous impact. And I think that's what keeps us going, is understanding that there's a huge unmet need and we have the potential to fill that. So certainly, the patent issue is very complex and there's certainly many really good arguments on both sides. But at the end of the day, I think for us as test developers, as scientists, is people who really just are so passionate about developing these technologies, it's really about taking that to the next step and being able to do good.

Andy Browne (00:29:42):

Rodrigo before we get to the situation in Chili, how would you answer our audience question about patents? How should governments get these vaccines and therapies into poorer countries? Should they be putting more pressure on the pharma companies?

Rodrigo Yanez (00:30:02):

Well, maybe not. I think the answer goes better in a way that both the pharma sector and the government sit on the same tables and talk. And that is why, what we are encouraging in the past few days, also with other countries like New Zealand, Australia in a joint statement in the context of the WTO, we had yesterday, a meeting with the new DG there. And the idea is that we get pharmaceutical companies and governments to sit and discuss this issue, increasing production and making it flow faster to the developing world.

Andy Browne (00:30:45):

It's playing out on the ground in Chili. You don't seem to have had any difficulties at all securing vaccines. In fact, Chili is on track to become one of the first countries in the world to achieve herd immunity. You're right up there with Israel.

Rodrigo Yanez (00:31:03):

Yes, we did that with a very pragmatic approach. I would say, it's a three way strategy, which encompassed a phase three clinical trials in Chili with the very close participation of the local scientific community. Also, we went for advanced purchase agreement, like the one that we had with Pfizer and BioNTech, which are not running phase three clinical trials in Chili. And third, our participation in COVAX. So from the very beginning, we somehow envisioned that there would be shortages that this could maybe turn into some nationalistic sort of discussion and export restrictions were also something to be faced. So we did not need any vaccine out of the scenario. The only thing that mattered for us was that this was effective and safe.

PART 2 OF 4 ENDS [00:32:04]

Rodrigo Yanez (00:32:02):

... for us was that this was effective and safe.

Andy Browne (00:32:04):

We actually have a chart that shows just how well the rollout has gone in Chile. As you say, you locked in supply contracts very early in the pandemic with just about every vaccine maker from the US, Europe, China, Russia. How did you get so far ahead of the game? Some say having a billionaire president, President Pinera, was your secret weapon.

Rodrigo Yanez (00:32:32):

Well, his stye is pretty hands on. And therefore his involvement in this, to me, as the lead negotiator of this was a very powerful tool to trigger. But this was also a very, I would say, broader job. And that is somewhat the secret I think. We were able to put up a very fast decision making process for decisions as complex as this one, right? From a scientific perspective, economic, and others. So we had a decision-making process that made us possible to secure batches as soon as we identified them. And also, it's no secret that one of our main bets was also an agreement with Sinovac from China. Which has a background has also an alliance with our top university, which is one of the leading universities in Latin America too, which let us know the vaccine way before the moment we signed for the advanced purchase agreement.

Rodrigo Yanez (00:33:42):

So the goal was to secure our vaccines for our high risk population, which is nearly over 5 million. That goal was achieved a week ago, and now we're approaching 6 million people with at least their first dose and half of it already has their second dose. 10% of that number is with Pfizer BioNTech jabs and the rest of the 90% is with the Sinovac vaccine, that will change over time. Second quarter, we expect the more heavy percents of the Pfizer BioNTech jab, and also new players such as AstraZeneca and other vaccines, such as CanSino and also we are in advanced negotiations with Sputnik V.

Andy Browne (00:34:28):

So how's that worked out? I mean, let's face it, Sinovac vaccine from China isn't quite as good as the BioNTech, as the mRNA vaccines, do people get to choose or do they take what they're given?

Rodrigo Yanez (00:34:47):

No, you take what you're given. In my case, I got the Sinovac jab. And it's true that in terms of the symptomatic disease, the Pfizer BioNTech jab is more efficient. But what we look for here is people to not end up hospitalized or in an ICU unit and die. And the vaccine has proven to be highly, highly effective in that. We can have a case here, which is not representative in terms of statistics, but we had an elderly home where we had an outbreak where 51 people over 75 years with co-morbidities got infected only with the first dose of the Sinovac vaccine. All of them, it got the moderate disease and only two of them needed intermediate hospitalization. One of them unfortunately died, and it was the only person that decided not to take the vaccine. So that gave us hope that for the purpose of what we look to avoid, this vaccine is highly effective.

Andy Browne (00:36:04):

So you're not getting public pushback against what you might look at as potentially possibly a sort of a second rate kind of vaccine?

Rodrigo Yanez (00:36:14):

No, not really. It was like that before we started the campaign, but people realized that it had an extremely good safety profile and that it's starting to prove very effective. And also the involvement of an independent external player such as our top university also helped get people trusting the vaccines in process overall. Today, only 10% of Chileans would not get the jab and that fell and dropped from nearly 40%, a few months ago.

Andy Browne (00:36:51):

So unlike many of its neighbors in South America, Chile has a well-developed primary health system of clinics, even in the most remote parts of the country, plus a history of rolling out immunization programs that goes back a century. How did Chile become such a model country in terms of public health?

Rodrigo Yanez (00:37:17):

Well, rolling out vaccines in particular has a 40 year story here and tradition. In this particular case, also we have what I would say, yearly training which is our influenza vaccine which half of our population gets every year. That's nearly 8 million people and that has allowed us to have a very efficient system that involves also city councils and local, at the local level, health authorities. So even we can get, in past campaigns, up to 800,000 vaccines or shots a day. And that is what has allowed us to be at the forefront of the rollout of the vaccine. But Chile has a long standing tradition in its public health. We have over 1600 different points of inoculation, 26 different distributions in a 4,000 kilometer long country, right? So it's a mix of that and also in facing the pandemic, we have also a very strong private health system, but the health authority made the decision that both public and private systems were a single one to face this pandemic. This has also a better efficiency in distributing the ICU beds and beds more generally for the pandemic, but also in distributing the vaccine.

Andy Browne (00:38:49):

So Chile didn't do so well when it came to controlling the spread of the vaccine. But as we just heard, it's done amazingly well to deliver the vaccine. So how do you explain this discrepancy given it was the same public health system that was sort of responsible for both aspects of the program?

Rodrigo Yanez (00:39:16):

Well, I'd say we have done an average job. If you look at excess rates, Chile comes only in Latin-America region after Costa Rica and we are at levels similar to Europe. The second thing is that our numbers, I think have a better quality by far. Chile leads in PCR testing in the Latin American region. We perform nearly 70,000 a day now. And half of our population has gotten already a PCR test. So, of course numbers might be higher, but we are in terms of OECD countries at the average, and if you look at excess rates, we are at levels similar to Europe.

Rodrigo Yanez (00:40:05):

We have what we call the dynamic quarantine system or approach. So at this point, I think also quarantines are extremely difficult for our people. They increase poverty, they have made us lose what we have advanced in the past few years, and we try to avoid them, certainly because they are painful for people. But also that goes along with the 19 billion US dollar package to support the middle class and lower income people. So we are standing also firm waiting for and hanging tight for the herd immunity to come, and hopefully that will be by mid of this year.

Andy Browne (00:40:55):

So I want to go to our first audience question. This is from David Klaus, and David is an affiliate at the Stanford Center for International Security and Cooperation in Bethesda, Maryland. David asks, would this have happened, the vaccine development I guess, without the significant involvement of the US government? What could government have done better? What did it do differently that helped the initiative succeed? Katie, do you want to take that one? The role of the US government here and how it could have done better?

Katalin Kariko (00:41:36):

I am not sure that I am expert to answer this question, but definitely the decision to have and bring together all of the players and make sure that they will proceed because at the beginning, nobody knew except me. I knew that the RNA vaccine will work very well, but of course, not knowing that which vaccine will be the most successful. So government effort to invite everybody together and then provide support for all of them, whether they developed a protein based, whether the viral based vaccine. So they provided help for each of them and so that was very important. So, that gave us coordination. So it was critical.

Katalin Kariko (00:42:33):

I don't know what could have been done better. Of course, it is difficult to give information out and of course, people say, "Oh, now that we have to have a mask, no mask," but people have to understand that as the situation evolves, people and the opinion about what is helpful or not is also changing. And so not saying that they are talking different sayings. So, the information, maybe that was also sufficient which came out, it is just people like to blame somebody for something and we're not, and of course, everybody was frustrated with the lockdown. But I don't know what could have been done better, but definitely inviting everybody and then helping all of the players, it was important.

Andy Browne (00:43:31):

Janice, what's been the role of government in the development of your diagnostics and indeed in the CRISPR area generally?

Janice Chen (00:43:40):

Yeah, in the same way, the government has really stepped up in terms of providing investment into development of diagnostic technologies and helping them scale and bring new technologies to market. So in our case, we've been fortunate to have the support of the NIH RADx initiative, which was part of the $1.5 billion stimulus package for investment in diagnostics. And through that program, we'd had the benefit, like Katie said, of connecting with many experts within the entire process of concept all the way through commercialization and for a new technology like CRISPR, we're only scratching the surface of what's possible. The RADx team and NIH has really made a significant investment in helping take this new technology to market. So I think that these types of partnerships are extremely valuable and they can certainly accelerate that whole process and that's something that we've seen throughout this last year. And I hope that this type of urgency and acceleration focus will carry on [inaudible 00:44:52] pandemic.

Andy Browne (00:44:53):

I wanted to ask you, I mean, is this a sort of a one-off collaboration which has been accelerated and initiated because of this massive threat to the global economy posed by COVID? Or is it a model that you think that will continue after we've got COVID under control?

Janice Chen (00:45:15):

I do hope it's a model that will continue because, certainly a lot of the investment in helping these companies have been part of building a broader platform where for instance, with the mRNA vaccine, the hope is that you would be able to really reconfigure that to attack any other emerging virus. In the case of CRISPR, again, it's a programmable system where you could ideally simply replace the guide RNA molecule to target another foreign pathogen. So in that way, we've set a foundation I would say, as far as proving what can be done in a short amount of time and done effectively. So I think that this is a model that we'll continue to look back to and say, "Well, what are the things that worked? What are the things that we can improve?" And be able to take that in the future.

Andy Browne (00:46:00):

Rodrigo, what's the situation in Chile? I mean, has the government stepped in? As it taken a greater role in medicine and in healthcare? How's the government responded to this?

Rodrigo Yanez (00:46:13):

Well, in terms of this pandemic from this ministry also, secondly we think there should be a more concerted effort. And I said that in the beginning, but we think that scaling up the production of the vaccine is central. And we advocate for the W2 to be the place where this should be discussed and in this initiative that I mentioned, what we asked the director general is to sit with companies and identify the issues that could solve these issues in terms of under capacity, under utilized, et cetera, and also identify also any kind of trade barriers for vaccines and not just for vaccines, but also for first aid supplies.

Rodrigo Yanez (00:47:09):

And from a local perspective here at the government, what I said is also to react this as a national united system, both private and public. So when we think in emergency beds, for instance, ICU units, we have a national capacity. So when a city, for instance, is near to collapse or has filled the capacity, we transport that people by plane to another city, and that has let us reacted better and to avoid the last bed dilemma. And certainly in the future, we will have to try to see how we could be more resilient doing stockpiling, but also trying to identify regional value chains in the region and by the discussion that I think should have-

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Rodrigo Yanez (00:48:03):

... and by the discussion that I think should have at its focus and the new DG is also very important because she used to be the head of the Gala Foundation and because it has to do a lot with trade and it has to do a lot with sitting with stakeholders and private and pharmaceutical companies. So that's what we are advocating, Andrew.

Andy Browne (00:48:23):

Okay. Thanks. I'd like to bring in another audience question. This one is from Jose Cafouri, who is the CEO of Marubeni Gravas Brazil based in Sao Paulo. He asks, "How will international borders and vaccine passports work?" Maybe we could start with Janice. I mean, what's your prediction? Are we going to get vaccine passports or are they really unworkable?

Janice Chen (00:48:53):

Yeah, I think that's a really good question. I think there's a lot of debate on both sides around, well, okay. How do we want to protect the greatest number of people? At the same time, you can imagine that this type of passport could lead to sort of, I think some level of discrimination as well. So, I certainly am not an expert to really dive into the complexities of this issue, but I think that the goal right now is to get as many people vaccinated as possible. And I know that there are certainly questions on whether employees can even ask or force their employees to get vaccinated, right? There's a lot of kind of legal challenges as well, as far as what can be required. So I think that while we're still working around the issue of equitable distribution of the vaccine, it's hard to start implementing policies when we know that there are people who are still struggling to get even that first shot.

Andy Browne (00:49:57):

Right. Well, as you say, it is complicated. As an example, China insists that to get into China, you're supposed to have the Chinese vaccine Sinovac, and yet in the United States, you can't get that vaccine. AstraZeneca has not been approved yet in the United States. So Rodrigo, should there be, do you think a more centralized global system that sets common standards recognizing vaccines at an international level? Is that achievable?

Rodrigo Yanez (00:50:28):

Well, we all have been in these past few years talking about the crisis of multilateralism. And I think there is an opportunity here to lead by example. And we think that the WHO is a place where we can have this discussion, that vaccines that are recognized by the WHO are eligible for these passport ideas, that we do not restrict them to the vaccines recognized only by the national regulators of the issuing parties. And we're following that discussion. There are initiatives in the OECD right now. At the WHO we

are looking with a very close eye what this green passport of the EU and Israel and others. But I think the response will have to be multilateral and to be consistent about it. So hopefully we will all converge into something that recognizes vaccines that are WHO backed.

Andy Browne (00:51:29):

Finally, let's talk about future applications for all of the technologies and learnings that have come out of this pandemic. Katie, what comes next for you and your mRNA research? Do you pick up cancer research again? I believe that's where that some of the initial focus was. Do you start looking at diseases like malaria, like HIV? What comes next for mRNA?

Katalin Kariko (00:51:56):

We already heard today from the Boise Journal that actually Pfizer decided that they will go for the other infectious diseases. So develop vaccine. And that is very good. We already know from the messenger RNA therapy meetings, that the many order of antiviral vaccines developed and not just for against viruses, but even for malaria. And so that is one field so that the more vaccine will be developed. And there are also efforts using the cas9 and the other cas system to, and special delivery of the messenger RNA to bone marrow, to help those who are suffering sickle cell anemia, or maybe HIV to introduce some genetic alteration to bone marrow to make sure that those people will not suffer anymore. And so that is also a plan for several companies. It needs very much to develop a formulation that will be targeted special ordinance or special cell types.

Katalin Kariko (00:53:16):

So of course the cancer vaccine project was always in the forefront in all of the messenger RNA companies. But there is also a big challenge because there are so many different type of cancer existence and identifying the right target is a big challenge. So, in the Coronavirus, it was obvious that it is the spike protein but for the cancer, identifying the driver mutation and generating a response against that. So it is still a lot of science has to be done before that. And there are many other applications which is already in the clinic with heart disease, already phase two in injecting into mRNA into the heart and treating wounds and many other things, which of course not for [inaudible 00:54:17] but definitely sickle cell anemia and vaccine against other viruses, against malaria is very important for many, many people.

Andy Browne (00:54:31):

Yeah. We have a question again on that topic from Tamara Norris, a senior advisor at Ontario Power in Toronto and Tamara asks, "How are mRNA and/or CRISPR useful in potential cancer treatments?" Maybe Janice, you could speak to the CRISPR technology.

Janice Chen (00:54:53):

Yeah, absolutely. I mean, I think CRISPR has shown to be a really exquisite tool for precision editing and for a lot of cancers, these are genetic diseases that we may understand the biomarkers that are involved in the progression of disease. So once you can understand that target that is needed to be edited, CRISPR really plays a critical role in helping design genetic medicines that can specifically go after that target sequence and hope to repair that faulty gene. So in that way, as a gene editing tool, the flexibility of the CRISPR system is really powerful in helping treat those types of diseases.

Janice Chen (00:55:35):

Of course, on the diagnostic side, the same thing, right? Whether it's seek and edit or seek and detect, CRISPR can be reprogrammed to go very specifically after these sequences. And I think in general, we're seeing healthcare shifting away from a one size fits all model to something more along the lines of precision medicine. I think we're going to need more sophistication in our tools, whether that's in the diagnostics, vaccines and therapeutics to really go after very specifically individual profiles to help us manage and treat diseases.

Andy Browne (00:56:05):

Is there a risk that these new fancy high-tech very expensive vaccines and therapies could end up getting hogged by rich countries as is happening now with with the mRNA vaccines and that this could actually widen global disparities measured in lifespans? Rodrigo, how do you look at that potential problem?

Andy Browne (00:56:48):

Rodrigo maybe is not hearing me. Let me ask the same question at Katie. Is that a worry? Expensive therapies, CRISPR, mRNA that simply won't be affordable in poor countries and it could exacerbate global disparities, inequalities.

Katalin Kariko (00:57:12):

No, I don't think. The one that I might mention that the messenger RNA is actually used for the coding for those editing enzymes. And so the two technology is actually combined, and then the main target is used for, as I mentioned, sickle cell anemia or vaccines against malaria. And those are all-

Rodrigo Yanez (00:57:32):

Well, we have seen some of it now. I mean, it's no...

Andy Browne (00:57:40):

Sorry, go ahead, Rodrigo. Yeah. Sorry.

Rodrigo Yanez (00:57:47):

Oh, I'm sorry. I have a delay, so I got...

Andy Browne (00:57:52):

Go ahead, we can hear you.

Rodrigo Yanez (00:57:58):

Okay. No. I was saying that that was happening already at some point. It's no surprise that many of the vaccines have been distributed first to developed countries or the one that had invested them at first. We were lucky to secure a deal with Pfizer BioNTech, but we had to resource to these other multiplatform, multideveloper vaccine, if not, we would not be in this position today. It's as simple as that. And that is why we need to have this discussion when thinking in the future, because it's not sustainable. And definitely if we are talking about making our countries secure by years from now and having the developing world getting so left behind in the queue, we will not solve this. And there is a risk of this to happen, but this must be a multiplayer, I would say, dialogue. Not from the top down perspective, but rather a multilateral approach with the private sector on the table.

Andy Browne (00:59:07):

Janice, what's your view?

Janice Chen (00:59:10):

Yeah, I think that it's not just the vaccine. I think we've seen that in general with the widening gap of socioeconomics that has played out last year, where we have tremendous winners and also people who have really struggled to get through. So certainly there is a risk and a worry that without equitable distribution, you're going to potentially see that gap widen. And I think there has to be really a proactive effort to help close that. And that goes well beyond the vaccine, but really so many parts of our economy as well.

Andy Browne (00:59:44):

We're going to have to leave it there. Unfortunately, we've run out of time. Janice Chen, Katie Kariko, Rodrigo Yanez, thank you again for joining us. We're grateful for your participation and for your perspectives. And to our audience, both within and beyond the Bloomberg new economy community, thanks for joining us. You can follow the conversation with @neweconforum on Twitter, or like us on Facebook. Join us next month for our conversation on the ascent of digital money. That's right here on Tuesday, April the 20th. Until then, stay well.

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