Fixing Healthcare Podcast Transcript

Interview with Anne Wojcicki

Jeremy Corr: Hello, and welcome to Season 4 of the Fixing Healthcare podcast. I am one of your hosts, Jeremy Corr. I'm also the host of the popular New Books in Medicine podcast and CEO of Executive Podcast Solutions. With me is Dr. Robert Pearl. For 18 years, Robert was the CEO of the Permanente Group, the nation's largest physician group. He is currently a Forbes contributor, a professor at both the Stanford University School of Medicine and Business, and author of the bestselling book "Mistreated: Why We Think We're Getting Good Health Care—and Why We're Usually Wrong."

Robert Pearl: Hello everyone, and welcome to the seventh episode of the current season. In this our fourth season of Fixing Healthcare, we focus on big ideas and the people behind them. Each of our guests have made major contributions in a broad range of fields and all were invited due to their unique expertise specific to the coronavirus. For those of you wanting more details about COVID-19 you can listen to our biweekly show titled: Coronavirus: The Truth. On it we provide the most up to date information on this pandemic. You also can check-out my website RobertpearlMD.com. There you'll find links to articles on the virus itself, along with information on its economic and social consequences.

Jeremy Corr: Our guest today is Anne Wojcicki. She earned her degree in science at Yale and then did biological research at the National Institute of Health. In 2006, she co-founded 23andMe, a genomics and biotechnology company that provides genetic testing to over 10 million people. The company is named for the 23 pairs of chromosomes in a normal human cell. In 2015, the company received FDA approval for its health-related tests. The company is currently working to understand the genetic basis for the variation in severity different individuals experience from COVID-19.

Robert Pearl: Hi, Anne. Welcome to the show.

Anne Wojcicki: Thank you, Robbie. Great to be here.

Robert Pearl: Excellent. This is season four of Fixing Healthcare. This season is focused on big ideas and the people who make them happen. You are clearly one of those and your company 23andMe is leading the nation and the world in genomics and genetic screening. We'll come to all those details in a second, but Anne, can you start by telling listeners a little bit about your background? How did you get interested in this particular area?

Anne Wojcicki: Well, like everyone out there, I'm a healthcare consumer. I've had my experiences in the healthcare system. I have to say, thanks to actually your previous employer at Kaiser Permanente, I felt like I actually had a real position about how I want to interact with my physicians and the system. I ended up working on Wall Street for about 10 years, investing in healthcare companies. I

learned through that experience that healthcare worked in actually a way that surprised me and that it was entirely a B2B business, meaning it was just from like business entity to business entity and that I, the consumer, actually didn't really have much voice.

Anne Wojcicki: When I interacted with hospitals and insurance companies and pharmacy benefit managers, all the way down the chain, I started to realize that what was in the best interest of the consumer was often lost and that you just didn't have a voice. I'd be on calls and everyone would be talking about a decision, but the patient was never there. I started to realize that I really wanted to have that voice. I could think back on my experience of, again, my physicians and how I felt like I actually was taught more about how to take care of myself. It was more of a partnership. When I saw that genetics, there was some real breakthroughs happening, the human genome sequence in the early part of this century. You had low-cost testing came forward with companies like Affymetrix and Illumina.

Anne Wojcicki: I started to think more and more that this was an incredible technology that was never going to reach consumers because the system wasn't necessarily ever going to be set up in such a way that it would make genetic testing readily accessible. I decided that I wanted to change that. At the same time, I happen to see the social networking world taking off. Again, I had the fortune of seeing Google start in my sister's garage. I saw the Web 2.0 world taking off of companies like Flickr, and I said, "Wow, there's not only this opportunity of having low-cost genetic testing, but there's actually a way to crowd-source healthcare, discoveries, research by allowing people to get access to the genetic of information and then to socialize.

Anne Wojcicki: 23andMe really came out of this vision that we wanted to have a company that was consumer first and that we were going to be crowdsourcing the discoveries of the genetic revolution that we would all then benefit from.

Robert Pearl: Before we get into some of the details about 23andMe, maybe for listeners, you could provide the basics on DNA and genetic inheritance for those who might not have been a science major.

Anne Wojcicki: For sure. Genetics was always something that fascinated me and I had this experience as a child where my mom one day was yelling at my sister about something and she kept yelling about her jeans and I was confused. I was five at the time and I was confused because she was wearing pants or she was wearing shorts. I kept thinking, She doesn't have jeans on, she has shorts." My mom then was explaining like, "No, this is what genes are. This is the genetic material that comes from your parents. You get half from your mom, half from your dad. It comes down and you actually share the same DNA with all of life on this planet, like everyone. You have the four basic building blocks, the A, C, G and T. That different combination, it's almost like cooking, you can like put together these different patterns and I could produce a banana or I could produce a monkey. I can produce a tree or I can produce you, the human."

Anne Wojcicki: What's so interesting is that humans are 99.5% the same. We are so utterly similar. It's this tiny, tiny percent of our differences that make us all unique. Frankly, it represents all this diversity on the planet. Frankly, it's each one of those mutations that is this phenomenal story of our survival, like how we have managed to all be a little bit different, but make sure that human species is around for a long time and that when there are significant viruses like HIV, there's some people who are genetically resistant to it. That's part of the beauty of having this diversity, is that we're all good at something.

Anne Wojcicki: What interested me back in that conversation with my mother as my mother was explaining like, "You have some things in your genes that you're predisposed for. I have a genetic combination to make me have a heart and to make my hair brown, but there's things like my environment about whether or not I'm going to be type two diabetic and I could have a genetic risk factor, but it's things that I do in my environment that are going to decide whether or not I actually have that condition." I just love this concept that there was ... Essentially, I got a deck of cards, I got my hand and I know that I have certain kinds of risks, but I actually have so much that's in my control because I can control many aspects of my environment.

Anne Wojcicki: What was exciting for me is that there's actually an opportunity for me to change my behaviors, so I could be as healthy as I wanted to be. That's, frankly, what excited me the most is this opportunity to learn about genetics as well as to learn about our environment and what are those environmental factors that really increase risk.

Robert Pearl: You mentioned DNA sequencing. How does the technology that you use in 23andMe differ from other people doing full DNA sequencing?

Anne Wojcicki: We don't do full genome sequencing. We do something called genotyping. The purpose of genotyping is to look at just the small areas that are known to vary from human to human. I mentioned that humans are 99.5% the same. In some ways, there's not a reason to go and sequence all of you because we're going to be repeating essentially the same sequence over and over again, but there's a reason to look at that point 5%. That's where we spend most of our time looking at that area that is known to be variable. That said, for people who have rare disease or they have a spontaneous, something that is really unusual, whole genome sequencing can make sense there because you can always have some of these new mutations that would not be represented in the technology that we are using now.

Robert Pearl: How many of those little snippets through does your laboratory examine?

Anne Wojcicki: We test for about 700,000 of those little mutations.

Robert Pearl: What are a few of the biggest findings you've uncovered with major medical implications?

Anne Wojcicki: We have over now 150 publications that we've come out with. One of the first publications that we came out with I'm really proud of and it was called the efficient replication of over 170 genome-wide association studies by 23andMe. The reason why I love that paper is because it showed the idea that we could really do research at scale because in the early days, people were really skeptical about our ability to ask our customers to self-report information about themselves and that we would actually be able to make novel findings. If you think about each time I read a paper, you look at me and you say, "Oh, here's a breast cancer finding or something in schizophrenia." Each one of those papers is incredibly expensive. It could be $5 million. It could be $10 million. It's expensive.

Anne Wojcicki: What I loved about our paper was that it showed early on that in a relatively efficient, scalable and inexpensive way, I could replicate over 170 known findings. That was, I think, is almost one of our seminal papers that came out. Since then, once we showed that we could replicate, then people had confidence in some of the new discoveries that we're making. I think one of the papers that I'm most proud of is a paper that we have on depression, where it was actually, thanks to the 450,000 customers who answered our surveys, where we were able to find a number of novel mutations associated with depression.

Anne Wojcicki: Most studies are in the hundreds or maybe a thousand individuals, but for us to have a study of 450,000 people, it shows the type of scale of research that 23andMe can do and the fact that we can make findings that no one else really can find. The depression one was, again, very meaningful because a lot of people wrote in saying, "Depression is incredibly hard disease to manage," and for people to see that they've potentially contributed in some way was very meaningful and that there are potentially genetic reasons for them to have this was also very meaningful. Just what last one of my other favorite papers was one that we did on a disease called prion disease and was also done with the Broad.

Anne Wojcicki: It was a woman who actually has the genetic risk factor for this disease herself and she asked us to look at our database at the 23andMe community and we looked at a number of mutations were thought to be causing this disease, but because we could see that some of those mutations have a certain thing frequency in the population, we could say they are not disease causing, meaning they're not pathogenic. It was really important because a lot of times scientists or people who have an illness are looking to see, "Is this mutation associated with this disease?" and being able to accurately call and let people know, "Yes, this mutation is actually disease calling," or, "No, this mutation is not disease calling," is obviously really meaningful in getting a diagnosis.

Anne Wojcicki: That was one of my other favorite papers because I feel like it's a rare disease. It was a person who herself was trying to manage her own conditions and I felt like we were able to really have an impact on people who are genetically risk for that condition.

Robert Pearl: What percent of disease do you think has a clearly defined genetics, either a dominant or recessive inheritance? What percent do you think is just purely multifactorial?

Anne Wojcicki: I would say that most, in my opinion ... That's a very good question, Robbie. I can't say percentages, but I can say that there are certain diseases like BRCA or Lynch syndrome, BRCA for breast cancer, Lynch syndrome for colon cancer, where you see a specific mutation really has a significant effect size. Frankly, those are rare. Maybe, some of the screening, when I've heard about people who are doing whole genome or whole exome sequencing on healthy populations, they say, between 2% and 3%, "Find something that is significant." The other area that we look at are what we call ...

Anne Wojcicki: Again, some of these mutations that have not as strong of an effect size or some areas that we're starting to look at called polygenic risk scores. That means we're looking at hundreds of mutations or thousands of mutation that add up into a score on a common disease, something like heart disease or Type 2 diabetes. That's where I think that you have genetic risk factors that really potentially predispose you, but there's a huge environmental component. I would say it's a small percent that's going to have the gene where it really is a big effect size. The majority of people are going to have genes where they have risks, but the environment is going to play quite a significant role.

Robert Pearl: When do you think we'll know scientifically whether these associations or correlations are causations?

Anne Wojcicki: I think my team would say pretty strongly that with the size of the data that we have that we know that these associations are not random, that these are causative.

Robert Pearl: No, by that, I mean they will understand how they cause the disease, exactly what they produce so that we can start developing new medications or new treatments to reverse it.

Anne Wojcicki: That that's a great question and that actually gets us into a lot of our drug discovery world where what happens is that I can absolutely see a number of mutations that are associated with a disease. Just because the mutation is associated with the disease doesn't mean that that's necessarily a drug target, but that puts us down the entire pipeline in the funnel of have what we call functional genomics of really understanding, what does that mutation do? Is that mutation actually in that gene? Is that the protein that is actually associated downstream of any kind?whatever the disease is?

Anne Wojcicki: That's where we do. There's a whole functional genomics work stream of trying to understand exactly then what is the biology that was translated by that mutation? I don't have specific numbers on that and I think that there were some estimates that roughly a small percentage, like under 10% of those

specific mutations, that it's that gene that's actually associated with the disease. That is actually rather that gene, that protein associated with some other aspect of the biology.

Robert Pearl: You're a biologist and obviously an expert in genetics. How are you thinking about the coronavirus and the current pandemic that exists?

Anne Wojcicki: Well, one thing, I am lucky to be surrounded by a lot of people who are much better biologists and scientists and virologists than I ever was. My team, when I've talked to them, there's, I think, a couple things. One, I think that there's a respect for the fact that there's very little that's actually understood about this virus and why it manifests in such a diverse number of symptoms, but secondly, I think that there is a decent amount of optimism about the potential for an antibody for treatment as well as a vaccine for prevention. Some questions about, "Is it a vaccine that [inaudible]? Will it be able to sustain itself over time?" I think that there is definitely more optimism than I would have expected about the potential for a vaccine and a treatment.

Robert Pearl: Did you contemplate getting involved in either the acute testing for viral infection of antibody testing to see whether someone's had the disease?

Anne Wojcicki: We definitely thought quite a bit about whether or not 23andMe should be part of the testing solutions for COVID-19. We spent a lot of time talking with individuals about how we could potentially help. It turns out we have a level of expertise around direct to consumer as well as around saliva that a lot of other companies starting the COVID-19 testing didn't necessarily have. We decided ultimately that companies like LabCorp and Quest and groups that already run their own labs were going to be better suited to manage that at least in the short term and that we were absolutely open to helping anyone and that we were absolutely interested in partnering when there is a true direct-to-consumer COVID-19 test out there. At this time, as you know, COVID-19 testing is in short supply still and a direct-to-consumer option seems like it's still a little bit further out.

Robert Pearl: What are your thoughts on the snafu? Here we are four months out and we can't effectively test with consistent results either for viral infection with a 20% to 30% false negative rate or antibody-wise where we can't get consistently lab results. What's your expertise to this area tell us about the snafus that exist.

Anne Wojcicki: I have to say that the snafus in testing, I haven't dug into it so deeply, but it confuses me because it's not ... We should be able to scale and our inability to have a coordinated plan, it confuses me. As I've talked to a number of individuals and various companies in the space, I think there's just a real lack of coordination. It's too bad because even we, in my close circle, we've had false positives and you get people who are sick. The lack of testing is hard. It's really, really hard on people. I think that it's going to be hard for us to ever really manage this until we have that. Again, we've worked with LabCorp as our

testing partner for years. I know that they're totally slammed, and hopefully, groups will be able to scale and there can be more centralized organization.

Robert Pearl: Your company obtains the specimens through saliva. I'm a big believer that if we're going to use testing to eradicate the virus, it's going to require a massive amount being done by individuals on a frequent basis. And I can't imagine doing that with nasal swabs or any kind of intravenous, drawing of samples, although that obviously would not tell you the acute disease. How can we get there using oral testing? I'm sure you've seen the research coming out of Yale that says the oral action may be better than the nasal. How can we make this happen in a way that we can now truly get our arms around this virus at a national level that today we're obviously not doing?

Anne Wojcicki: It's a great question. We actually spent some time in the early days, a number of groups and even some state departments or health departments had reached out to us to chat about saliva testing and our kit is not ideal for saliva testing because we have a number of enzymes in the buffer that inactivate, don't keep the virus alive. There's other mediums that would be better to use. That said, whether it's a nasal kit or it's a saliva kit, I think the key element is that more healthcare and especially this kind of testing has to be done at home because making it something that you have to go through a physician for or it has to be through the ... It's too complicated and you need to be able to make the testing affordable, cheap enough so that I could keep 10 kits in my house and I could just either spit and send it in regularly on a weekly basis.

Anne Wojcicki: I think the only way that you're going to get something like that is a centralized coordinated plan in partnership with the FDA. I am optimistic. I've talked to a number of companies that actually are developing low cost at home, coronavirus tests. The reality is they're going to have to get an approval. They're going to have to work first and foremost. They're going to have to get an approval and they're going to need support of the government. Scaling in this way is incredibly expensive. There will just need to be money and resources that support scaling a test like this.

Robert Pearl: There's more variation in people's response to this virus than any other disease I can think about, from 40% of people being asymptomatic to other individuals rapidly becoming hospitalized, intubated and dying. Do we have any insights into the genetic basis for this difference of response?

Anne Wojcicki: 23andMe launched a COVID-19 study on April 6th and we now have over a million people who've taken this survey. We have tens of thousands of people who said they've been hospitalized, tens of thousands who said that they have it, thousands of people who were hospitalized. We were able to make a number of discoveries. The only one that we've publicly talked about is the one in the O blood type looks like it's protective. Roughly, anywhere from 9% to 20% protective in terms of severity as well as susceptibility. That is exciting because I think it's been replicated a number of times. I think it's something that helps us start to understand a little bit about the disease.

Anne Wojcicki: Again, to the points of your other questions, one of the most important things here is just trying to understand how this virus actually works and why there is such variability. I am really interested to see, are there genetics of why some people are asymptomatic and some people have such an acute response? We will not be able to get to those kinds of findings without more academic partnerships. I have been really happy to see a number of these academic collaborators that have come together. That's something over time, as people start to pull together their data, we will absolutely participate in that and we would absolutely be eager to help make any of those discoveries that help us understand who is susceptible and likely to have a severe disease.

Anne Wojcicki: We said we are giving away over 10,000 kits to individuals who were hospitalized. That's also an aspect of the effort that we have, that we are underway on.

Robert Pearl: Getting back to the more general theme, where do see the next set of frontiers in this genetic testing realm and our understanding of inheritance going? Where are the big breakthroughs going to happen over the next decade?

Anne Wojcicki: I think the next big breakthroughs are going to be around these polygenic risk scores and really starting to break down each disease into much more specific subtypes. Look at something like Type 2 diabetes where I can see that there's a percentage of our customers that are genetically just much more likely to have it. You can see this also with drug response that some people are going to respond well to certain kinds of medications and some people are not going to respond well to those same medications. I think that every single disease is going to start to get classified into a genetically defined set of risks. You look at cancers or heart disease, osteoporosis, other areas where you'll probably start to break it down into a number of different subtypes that are defined based on their genetics.

Anne Wojcicki: I think another area that is going to evolve over time is right now, and again, along the same themes, right now when I go to a doctor, they look at me and they say, "Okay, you're a European woman. You're Jewish." I'm racially profiled and religiously profiled in my case, but the reality is I'm from a bunch of different countries and I'm half Jewish. I think about my friends who are African-American or could be African and Chinese. The reality is medicine is also going to go the direction of no longer being about the racial profiling when they see someone, but actually getting into the genetics of those individuals and that you have this type of genetic mutation and therefore these risk factors and not necessarily as much about that profiling of an individual.

Anne Wojcicki: I think a lot of medicine is going to start to just be defined based on the molecular level rather than some of the gross categories that people currently fall into.

Robert Pearl: I'm sure there's been some really interesting individuals who have either had the testing done for the disease or testing done for ancestry. Do you have any

favorite stories about people who made remarkable discoveries after getting the results of the tests?

Anne Wojcicki: I think you never get tired of hearing a story about somebody who you really saved their life. We get hundreds of stories on a weekly basis from our customers about ancestry related or health related and the ones that stand out are oftentimes around the breast cancer mutation or the colon cancer mutation where people say, "I did 23andMe. I was interested in looking at my ancestry or I wanted to find out my Neanderthal score. Lo and behold, I find out I'm genetically high risk for a potentially fatal disease." You hear the stories of people who go in and they find out they actually had early disease. They have young children and it's incredibly emotional. Because without that knowledge, they probably would have had the disease and died of it.

Anne Wojcicki: I think that there's no greater reward for me than knowing that we potentially prevented a preventable death. It's one of the things I think about is, one of the mottos of the company is, "Change what you can, manage what you can't," and these cases where customers can learn that they have a potentially pathogenic mutation and there's something that they can manage with a vasectomy or proactive screening and you can prevent a preventable death, it's hugely rewarding. I think, by far and away, the health side of our business produces incredibly meaningful results.

Jeremy Corr: Would you mind sharing one of the stories like you were talking about earlier where you did save somebody's life or made a huge impact on their life like that?

Anne Wojcicki: Yeah, we have one story in particular where it is a woman in New York and she's done some testimonials for us where she talks about her sister had breast cancer and she was told that there was no reason to do the BRCA testing. She did 23andMe for fun to find out whether or not she had the sprinter variations, she was very competitive and she wants to know whether or not she was going to be faster than her husband, you know for fun. She was really utterly shocked when it came back that she had one of the three breast cancer mutations that we test for. She ended up following up with her doctor and going forward and having a double mastectomy. She said, she's like, "Look, it was hard. There's nothing easy about getting that news, but we absolutely saved her life." She talks about how it would have been missed by her physician because she was told specifically that she should not get testing.

Anne Wojcicki: In some ways, that's the part that always confounds me the most because testing now is relatively inexpensive and accessible, so why not? Why everyone is not tested is beyond me. Everyone should get tested. Even for me, I was surprised. I had to argue about having genetic testing for my third child. It just amazes me that the insurance system makes it hard for people to get genetic testing when you might so easily be able to prevent an unnecessary death. This woman who again has remained a friend of the company's and has been very proactive about talking about breast cancer testing and BRCA and 23andMe and

the advantages of being able to easily get a test and learn something that's potentially lifesaving.

Robert Pearl: Where do you see the company going next?

Anne Wojcicki: It's really interesting because we're at the intersection of significant scale for 23andMe. We have over 12 million customers now. We have an incredibly exciting pipeline on our drug discovery side and I also have COVID-19. COVID-19, while awful for the world has been miraculous in how it has transformed digital healthcare. One of the core tenants of 23andMe has always been helping, that we believe our customers should have access and that they can understand their genetic information. That's part of the reason why we did fight the fight with the FDA to say, "This can go without a physician and it can be at home and it can be affordable and you don't need to go through your insurance provider."

Anne Wojcicki: I think there's a lot more of healthcare, thanks to COVID-19, that is going to have to be delivered at home. I think policies have started to change and adoption curves have absolutely skyrocketed. I think that there's a really exciting world where you're going to have true at-home health. I think the beauty about home health is you stay healthy. When I think about the genetic risk factors and environment, if I'm going to change my exercise or change my diet or stop smoking or think about my sleep and my stress, all key factors that impact my health, that's all stuff that's going to happen at home. I feel really optimistic about the potential to really understand your genetic risk factors and opportunities for digital health to take off and really have meaningful outcomes for people to not just live longer, but to live longer, better.

Robert Pearl: I know your company obviously doesn't do this, but what are your thoughts on things like CRISPR and other aspects of genetic change? Once you understand you have a genetic problem, where do you see genetic change going?

Anne Wojcicki: I think CRISPR is a fabulous tool for research and I think our therapeutics team definitely looks at that as we're thinking about drug discovery and treatment options. I think there's a long discussion and ethics conversation around using CRISPR and genetic mutations for embryos. Again, almost similar to what I said about coronavirus, I have incredible respect for the human genome and the complexity, and that even when we understand a little bit and a little bit more about the genome, we will never fully understand it, and that you start to move things around and you CRISPR one area. Understanding what those consequences are, it's risky, knowing exactly what those outcomes are going to be and you're playing with lives there.

Anne Wojcicki: I think that there's great opportunity for really treating and potentially curing rare disease and I think that's a really exciting opportunity. I think there just needs to be real ethics oversight about how we want to approach it.

Robert Pearl: If there's one thing that you could change from regulatory or an oversight perspective, what would that be?

Anne Wojcicki: I think that right now we're in a very interesting time period because 23andMe is the only direct-to-consumer genetic test out there, yet there's a number of genetic testing companies. A lot of them use a loophole where they have a physician service on the backend that is often not transparent to the customer. They return genetic results. The reason why the loophole worries me because as I look at these other products, they don't go through the same rigorous analytical testing and comprehension testing that 23andMe has done. I worry that when you tell someone something about their health and about their genetics, that you really do have opportunity to do harm.

Anne Wojcicki: As much as it was hard for us when we got our warning letter in 2013, everything that we have done for the FDA has made us a much higher-quality company. I worry now that there are 100+ companies out there returning genetic results to customers and it doesn't have the same kind of review. I worry about the true opportunity for harm.

Jeremy Corr: I actually want to dovetail off of what you were just talking about because actually a couple years ago, I went on a work retreat and there was a woman there who was like an alternative medicine healer, but they were giving everybody on this work retreat the ability to do a DNA test that they would send into her company, and then, she would come back and give you medical advice based on the findings of the test. It was interesting because even though she was an alternative medicine healer, because there was that aspect of the DNA test involved, everybody, except for a couple of us, instantly was like, "Wow, yeah. She must really know what she's doing." It was just super interesting to me.

Jeremy Corr: Can you talk a little bit more about that? What does this look like where people could use the term or use the concept of a DNA test, but really be maybe not that qualified to really discuss or utilize the results correctly? Are there a lot of, I hate to say it but, quacks in your space?

Anne Wojcicki: Yeah. I think that there's a lot of people who use the genetic testing and try to associate it with science and some reports that are out there. As you guys know, you can have a publication that comes out in a journal, but it doesn't necessarily mean it's true. One of those important concepts I had to get to my mother to understand, I was like, "Just because something's published once doesn't necessarily mean it's true." You want to get things that are replicated. You want to see what study it was done. For example, there's lots of people who want to associate your genome with vitamins.

Anne Wojcicki: In fact, there are some people who will look at the 23andMe, the raw data, and there's a specific mutation that they look at. People will actually stop me at the farmers' market and they're like, "Oh, I looked at this mutation, and now, I take this vitamin and I just love it." It worries me because I've asked my scientists

over and over again, "Can we please look at this mutation?" and there's no genetic association that we can find with the vitamin, with anything else, with any other kind of phenotype. I worry that a lot of things end up being sold that have not gone through the same kind of validation process that we have gone through.

Anne Wojcicki: In some ways, a vitamin is not as harmful as someone telling you like, "Oh, you might have a risk factor for sudden cardiac death, but maybe that mutation is not valid. That's what really scares me for these people is that you can genuinely cause a lot of anxiety and worry for people. Again, if it's not based on science that I would necessarily feel comfortable or my team would feel comfortable, then I worry about it. I do think that genetics and DNA is often used as a way of making it seem like, "Oh, I'm a scientist. I know a lot here." Sometimes, like I said, I worry about if the government is not going to regulate it more aggressively that people can really get led down the wrong path.

Jeremy Corr: One of the other things I'm curious about too is you talked about that personalized medicine knowing, "Hey, maybe I'm at more of a risk for this cancer or maybe I'm going to have a negative reaction to this medicine." When you take all of that information and put it together and mix it with that whole health primary care concept to where it's more of like that relationship with the primary care doctor and they really get to know each other and it's more than just, "Okay, I'm here because I have a cold," what do you think the future of a primary care provider, having this information and customizing the way they treat and advise their everyday patients on how to live their life and maybe how often to get tested for certain kinds of cancers or do certain screenings? What does that look like to you in the future?

Anne Wojcicki: I think it's a really good question and one that I've often posed. I think, Robbie and I, we've even sat down chatted about this. One of the issues is that no one makes money in healthcare by keeping you healthy. Fundamentally, if I tell you, you're diabetic, lots of people in the system, in the healthcare system as it is today will make money, from the companies that make insulin to the needles, to the testing, to the doctor's visits, to all of the downstream consequences. If I tell you you're genetically high risk for Type 2 diabetes and then you change your diet and you check in with your doctor, and you're like, "Yeah, I've lost weight. I've done this. I exercise more," no one's making money.

Anne Wojcicki: I've always struggled with this that in some ways, it gets back to what I first talked about why I started the company. What's in your best interest isn't represented in the system, not because the people who are in the system don't care, but that the payments and the way we monetize, and fundamentally, money is what makes the world goes round, the money isn't there to keep you healthy.

Anne Wojcicki: When I think about primary care and the ideal situation of where genetics goes, and again, I said, my kids were all tested at birth, I look at them and I can say, "Okay, someone is genetically high risk for Type 2 diabetes or high cholesterol,"

and I think about like, "How am I using the environment to make sure like can I train them to eat in a certain way or be more mindful of exercise? If they're genetically high risk for macular degeneration, can I teach them the importance of wearing sunglasses?" Frankly, the excitement for me on the digital healthcare world is that it's not necessarily your doctor's responsibility to get you to change your diet, lose weight, stop smoking. They're not the ones who are coming to your house or checking in with you on a daily basis.

Anne Wojcicki: That's potentially more where a digital health app is going to step in. Between your annual doctor visits, you need some service that is, frankly, going to text me as often as my Instagram app is reminding me like, "Come and check here. Come and check. Hey, how's your stress? Thinking about meditation or your diet? Did you exercise?" I think that primary care in the dream world would change, but until the reimbursement system changes where there is an incentive to get people to actually be healthier, I'm skeptical it will ever change, but I do think that consumers, since the consumer themselves have an interest in being healthier, I do think that there's a really interesting consumer world that is paid for by customers and is direct to consumer. I think that that will start to, in some ways, replace primary care.

Jeremy Corr: One of the other things that I find super fascinating about the world you live in is I hear a lot of people who are just terrified of doing the tests primarily because they're worried about the security aspect. In their minds and a lot of people's minds, getting your bank account or credit card hacked is one thing, but having somebody come in to control of your DNA data, your genome, that's terrifying for a lot of people. Can you talk a little bit about what the privacy concerns? What are you doing to prevent people or to help ease people's concerns about that, and also, are their concerns founded?

Anne Wojcicki: We've always said that we have no business if we can't protect your privacy. We do everything we can reasonably to protect privacy. You talked about that bank accounts, etcetera. When I think about like, if I'm talking to you, Jeremy, and I say like, "Would I rather get access to your genetic information or your bank account?" Frankly, your bank account might have more utility for me today.

Anne Wojcicki: As much as your genetic information is unique to you, your bank accounts actually are more interesting to the majority of the world. We can learn a lot from the banking system and about their data and their privacy. We were really lucky and that a number of our earliest engineers came from the banking industry and really came to us with a mindset of absolute privacy and choice and the highest level of security. We just hired a chief security officer. I've been really happy with the team about how proactive they are in terms of protecting the privacy of our customers, being on top of it, the practices that we have in-house as well as what we put out to our customers.

Anne Wojcicki: You can never be 100% in data security, but it's about making sure that you're on top of it, that you have the right team and that we, as a management team,

are funding to make sure that we're doing everything that is reasonably possible. It's absolutely a top priority for us.

Jeremy Corr: Do you ever come into contact with the people who just want to keep their head in the sand? They don't want to know what their risk factors are. They just want to go through life not knowing those things, just the concept of, "If I knew I was going to get hit by a car tomorrow, would I want to know?"

Anne Wojcicki: Yeah, we meet them all the time and we do say, "It's great. That's part of the whole tenet of 23andMe is choice. We're not the right product for everyone." What's really interesting for me is it's amazing how disarming that is for people because I think a lot of people are used to being bullied in healthcare. We're very clear, "It's a choice. It's absolutely your choice about how you want to live your life. If you don't want to know, you don't have to know, but if you do want to know, we're going to tell you. If you want to share that information with your family, we're going to enable it. If you want to share that information with your doctor, we'll absolutely enable it."

Anne Wojcicki: In some ways, the fact that 23andMe gives people choice really confounds them at first. It takes a while because you're just not given that kind of choice ever in healthcare.

Robert Pearl: When people ask you, "What percent of who we are is nature, what percent is nurture?" what do you tell them?

Anne Wojcicki: I tell them it's a fabulous balance between nature and nurture. I think it's so interesting to me, and especially as I've three kids, I love looking at them, and on the day they're born and the genetics. I know their genetics and I'm thankful I've had all of their genomes done at birth. I think about that almost on a daily basis. It's now my environment on a daily basis that is interacting with their genes. In some areas where the genetics has us, there's a limit to how much I can influence eye color and hair color and certain genetic mutations for disease, but largely, a good aspect of my children are the environment is going to influence them.

Anne Wojcicki: There's a great movie, I don't know if you've seen this, but "Three Identical Strangers" that talks a lot about this specific area of genes and environment and there's no one formula for any one trait. It's going to be the fun mystery for us to figure this out for a long, long time.

Robert Pearl: Thanks, Anne, for being on the show today and for your willingness to help figure out the role that genetics plays in our susceptibility to COVID-19 and the risks of people becoming critically ill from this coronavirus.

Jeremy Corr: Robbie, what are your thoughts on what Anne said?

Robert Pearl: Genomics is one of the fastest moving frontiers in science. Precision medicine will offer people more personalized medical care. The coronavirus will be a fascinating area for discovery. It is obvious that our immune system has a powerful influence on whether we become critically ill, but exactly how is unclear. We also know that if one's parents have a particular chronic disease that you have a greater risk. But we don't yet understand exactly why and how it happens. Once we do, I believe major avenues will open up to not only increase longevity, but also to improve our health and the quality of our lives.

Jeremy Corr: Please subscribe to Fixing Healthcare on iTunes or other podcast software. If you liked the show, please rate it five stars and leave a review. Visit our website at fixinghealthcarepodcast.com. Follow us on LinkedIn and Twitter @FixingHCPodcast.

Robert Pearl: We hope you enjoyed this podcast and will tell your friends and colleagues about it. If you want more information on these topics you can visit my website: RobertPearlMD.com. Together, we can make American healthcare, once again, the best in the world.

Jeremy Corr: Thank you for listening to Fixing Healthcare with Dr. Robert Pearl and Jeremy Corr. Have a great day.