

Episode 2 – History of Vaccines Part 1

With Dr. Frank Welch

Deon (00:00):

Hello everyone. This is Deon Guillory.

Diane (00:03):

And I'm Diane Deaton. It's time for another episode of Vax Matters. Hi, welcome to Vax Matters. The health focus podcast series from the Louisiana Office of Public Health, created to give you the facts about immunization. I'm your host, Diane Deaton.

Deon (00:28):

And I'm Deon Guillory. And I'm excited to join you Diane, for the next few episodes and take a closer look into the who, what, where, when, and hows of vaccines.

Diane (00:38):

I'm so glad to have you with me, Deon. In today's episode, we'll be exploring the history of vaccines. In fact, we have so much to cover that we're going to break it down into two segments. Part one is today's episode and part two will be uploaded in the coming weeks.

Deon (00:55):

Without further ado, let's dive into the History of Vaccines, part one. And joining us today is immunization expert and former Medical Director for Emergency Preparedness at the Louisiana Department of Health, Dr. Frank Welch. Welcome to Vax Matters, Dr. Welch.

Dr. Welch (01:11):

Thank you for having me.

Diane (01:13):

Dr. Welch, why don't you tell our listeners a little about yourself?

Dr. Welch (01:16):

Absolutely. So I originally come from New Mexico where I started my career in chemical engineering. I then went to medical school in New Mexico and did an internal medicine residency there. Following that, I came to Tulane University and did a public health and preventive medicine residency. Since then, I've worked both at the federal and state level in vaccination policy and immunization programs, um, since about 1996.

Diane (01:44):

Thank you, Dr. Welch. So in today's part one discussion, we're going to go back in time and learn more about the first vaccines and then take a closer look at why they were created. So, Dr. Welch, let's begin with these two questions. When was the first vaccine invented and what's the story behind it?

Dr. Welch (02:04):

So the first vaccine that was created, um, is actually the smallpox vaccine, and it is a very interesting story. Uh, the process is that, uh, many people throughout time, starting in China, noticed that people who got cowpox did not get smallpox. And so throughout the years, people would expose people to cowpox in order to not let them get smallpox, which is a much more serious disease. So in 1796 was the first published reports by Edward Jenner, where he actually took, uh, uh, some fluid from a milkmaid who had cowpox and injected it into an eight year old boy. And then later exposed that boy to smallpox and the boy did not get smallpox. So that was the first published example of using cowpox to inoculate someone and prevent them from getting smallpox, which is a much more serious human disease.

Diane (03:03):

I, I know that, uh, a lot of folks are familiar obviously with smallpox, but I think now in this day and age, we heard so much about polio. So let's talk a little bit about the polio epidemic and how that came about.

Dr. Welch (03:18):

Polio has been a disease that has been around for centuries. And the vast majority of people who get polio get the disease and recover just fine. The problem with polio is about 1 to 2 percent of people get nervous system damage. And of those people, especially children and people who have weakened immune systems, cannot only be paralyzed, but can actually die from it. So it is a very serious debilitating disease. We all remember the pictures of people in iron lungs when, when their, um, nervous system had shut down from polio.

Dr. Welch (03:53):

Unfortunately, unlike other diseases with modern sanitation throughout the early 1900s and as we went into the 1950s, polio became more prevalent, and polio became more prevalent in places you wouldn't typically expect. We often think of infectious diseases affecting people who are in more crowded conditions and more poor conditions and things like that. Well, with polio, it was the exact opposite. And let me tell you why. In those areas where people had very crowded conditions and poor sanitation, people got exposed to polio through drinking water that wasn't that clean. And they got exposed in very small doses.

Dr. Welch (04:33):

So people who lived in these crowded conditions and, and were, were poor, were exposed to small doses of polio and therefore became immune over time. Whereas those people who had better sanitation and said... say lived in higher educational standards and places where you lived further and further apart were not exposed to small doses of polio in their drinking water. And so polio was disproportionately affecting those upper and middle class children, um, because of better sanitation. And so in the 1950s, um, there wa- there was called the polio panic, where people were very, very worried that their children would become paralyzed from polio. And that led to the acceleration and, and the widespread use of the polio vaccine.

Deon (05:18):

And so we... you, you mentioned smallpox, you mentioned polio, these vaccines. But, but... and we always hear, especially now, you know, with the pandemic that we're in, uh, we always hear about vaccines, the word vaccine, uh, what exactly is a vaccine just to kind of break that down?

Dr. Welch (05:35):

What a vaccine is, is giving you something that triggers your immune response to prevent an actual disease from happening. So the different types of vaccines that we talked about, you can either, uh, take something, say for example, uh, uh, pertussis and kill it, and then inject that into someone in the hopes that it would provide immunity to that. Other techniques could be, you could take a disease like measles or chickenpox and weaken it in a certain way so that it would still replicate in your body, but it wouldn't cause the, cause the disease and you couldn't spread it to other people. There's other ways of, of attaching parts of a, of a disease agent to something else like the common cold that would cause immunity. So again, there are lots of different types of vaccine, but the intent is to prime your immune system to recognize a serious disease before you get it.

Diane (06:33):

Some of these diseases have been eliminated from most countries. Is that correct?

Dr. Welch (06:40):

That is, that is correct. In fact, smallpox has been eliminated from the world. There is no smallpox except in laboratories due to the effectiveness of, of the cowpox... the vaccine that we have. Now, there are other diseases that are very, very uncommon now, especially in industrialized countries in the Western world. And one of those would be polio. However, polio has not been completely eliminated from the world. And unfortunately, these diseases, once, once we stopped vaccinating would very, very quickly come back and cause serious disease. And that's why we still have to vaccinate against these really, really rare diseases like polio, um, just to prevent them from coming back because they still do exist in the world.

Diane (07:24):

I just assumed that it didn't exist 'cause you don't hear anything about it anymore. So that could be a misconception right there about some vaccines or some diseases that we still need to have a vaccine for.

Dr. Welch (07:34):

Absolutely. There's, there's pretty rare diseases like diphtheria, like polio. Um, but they still do exist in the world. And most of those places, unfortunately, are not places that, that have the financial resources for vaccination programs and then oftentimes are war torn countries. So it's very hard to do public health programs. And because of those difficult, uh, conditions, these diseases are still spreading.

Deon (08:07):

Mm-hmm (affirmative). And it's, it's great to hear that, you know, with these vaccines, with... we're hearing successes when it comes to, uh, getting rid of these diseases and everything. Have there been any vaccine failures and are there certain vaccines that we no longer use because they caused issues?

Dr. Welch (08:14):

Yeah. And, and we're gonna talk about this a little bit more when we talk about the testing of vaccines. Um, but due to the extensive testing and follow up of vaccines, they have found that some vaccines, and I'm gonna give you two examples, although they made it all the way through the process, we no longer use because of the intensive monitoring we've found. And you do a risk benefit analysis and say is the risk of giving this vaccine and possible side effects worse than the

disease itself. Also, putting in there, are there other vaccines that are better at it that don't cause these side effects?

Dr. Welch (08:49):

And the first example I'm gonna give you is many people remember in 1978 when there was a swine flu epidemic, which is very similar to, to influenza. And there was a widespread vaccination program in 1978 to vaccinate people against the swine flu. But the problem is they found that people who were vaccinated with that swine flu vaccine had about four times the rate of Guillain-Barre syndrome. And Guillain-Barre syndrome is a, a disease of the nervous system where your own immune system attacks your nervous system, and it can be quite debilitating. And they found that the swine flu vaccine caused Guillain-Barre syndrome four times more likely in those were vaccinated and completely stopped the program. So they did find that, that they felt that the risk was more than the benefit of the vaccine. And we no longer have swine flu vaccine in that particular form.

Dr. Welch (09:41):

The second example I'm gonna give you all is the oral polio vaccine, um, vaccines are manufactured to kind of replicate the way the natural disease infects you. For example, polio is a disease of your gut. It, it goes through your stomach and your gut and that's how it causes all these problems. So then you wouldn't wanna create a vaccine necessarily that you inhaled or injected. You would want it as close to the way, uh, the natural disease infected you. And so for quite some time, we used a weakened form of polio vaccine called oral polio vaccine or OPV.

Dr. Welch (10:20):

And what they found over time is that oral polio vaccine, since it was a live virus, very, very rarely, and we're talking incredibly rarely, reverted or mutated back into a wild type and could cause paralytic polio. And, uh, so they were weighing those risks with are we eliminating polio? Well, fortunately we have a different polio vaccine that is injected into your arm that works not quite as well as the oral polio vaccine, but as we mentioned, polio is mu- basically almost completely eliminated from the world. So what we've done is we've switched from that oral polio vaccine that had this possibility of reverting to real polio and replaced it with an injectable form that does not have the ability to do that.

Dr. Welch (11:06):

So, um, both of those vaccines, the swine flu vaccine and the oral polio vaccine, are not used in the United States anymore. And the reason is because vaccine are so incredibly well followed up even after they're in production and use that if we find these, these small side effects or, or medical problems, we can find a better solution or pull the vaccine.

Diane (11:30):

I have to tell you Dr. Welch, I had never heard that that polio goes through your gut.

Dr. Welch (11:35):

Yeah. It's, it's... And, and again, we'll, we'll talk about that when we talk about the different types of vaccines, and I know that there's gonna be many speakers in this podcast over time and they'll reinforce these points, but the vaccines are often manufactured in a way to not only give you that immunity before the disease, vaccines are obviously made for serious disease, not the ones that are common, and also manufactured in a way that triggers your immune po- response much in the way

the same... uh, the disease would. And so vaccines are actually highly specialized to focus on the disease that it's preventing, how serious it is, and how your immune response responds to that particular disease in a way that makes the vaccine more effective.

Deon (12:24):

And Dr. Welch, you, you mentioned, uh, you know, with the, uh, some side effects with, uh, with vaccines and the reason why certain, uh, vaccine methods aren't used anymore in the United States. Do vaccines cause SIDS, MS, or any other long term problems?

Dr. Welch (12:41):

So again, there... After a vaccine is produced and put into the market, there is extensive follow up, and there's even a system in the United States that allows anyone to report what they feel to be something that happened after a vaccine. And it's called the vaccine adverse events reporting system or VAERS. And what that allows providers, doctors, nurses, or, or even parents to do is report what they feel is a vaccine side effect or possibly related to a vaccine. And by using this system, we can find very, very rare side effects from vaccines.

Dr. Welch (13:17):

Now, Deon, the most common, uh, side effect from a vaccine, which almost everyone gets is a sore arm. You can get, um, a red arm. Sometimes it can be hot. Um, sometimes people can get headaches or maybe not feel well the next day. That is the most common side effect. Other side effects like seizures, uh, are only associated with a few vaccines, but they do happen like one every 10,000 or 20,000 vaccines. But again, that's monitored.

Dr. Welch (13:45):

In addition, very rare side effects, and the most serious one is anaphylaxis, when you get a vaccine and you're severely allergic to it. That happens in about one in a million people. And again, it's depending on the particular vaccine that we're talking about. So we have to think of vaccines as medical interventions. They are not 100% safe. They do have some common like red, sore arm side effects and some very rare side effects. But what is important is that we're monitoring these very, very closely and trying to find patterns. And if we do find a pattern, then we're gonna do that risk benefit analysis. Is the benefit of getting the vaccine worth the risk of whatever this side effects is? And then try and work on a better solution.

Dr. Welch (14:26):

And, and Deon, I'm sorry, I didn't answer your question specifically. So there have been postulated, um, side effects and serious diseases that have been postulated to be associated with vaccines, like multiple sclerosis, like, um, autism. And there have been extensive studies which show that the rate of autism or the rate of, of multiple sclerosis or even SIDS, which is the, the childhood disease, happens in the same frequency in people who are vaccinated and not vaccinated. So what that tells you is the vaccine is not associated with this particular complication or side effect.

Diane (15:04):

But I think so many people, uh, Dr. Welch, in a period of time, especially, uh, maybe a little bit like the, the polio kind of a panic. When you talked about autism, people, young parents were terrified-

Deon (15:19):

Mm-hmm (affirmative).

Diane (15:20):

... of vaccines causing autism. And it, it was really... It was frightening to them.

Dr. Welch (15:29):

And, and that's why it's important that, that we expect of our scientists and researchers and medical professionals to do this thorough research and make sure that, that people understand the difference between speculation and medical research or speculation and opinion. Anyone can have an opinion or speculation, but science doesn't work that way. The way scientists do it is there is some speculation or suggestion. And then they do a clinical trial, which is randomized and blind, where they don't know the results. And then once they find out those results, then they publish them and allow other scientists to critique their work. And if those scientists, these additional scientists, critique their work and can't find out that there's anything wrong with it, then it starts to become scientific fact.

Dr. Welch (16:13):

And so there's a difference between opinion, "Oh, I think vaccines cause autism," and the scientific research would suggest vaccines do not cause autism. And I think it's important in society that we recognize the difference between an opinion and scientific research and scientific fact.

Diane (16:31):

And again, basically, that's that fact or fiction-

Deon (16:33):

Yeah.

Diane (16:34):

... coming in again, Deon.

Deon (16:34):

That's, that's why we're doing this, you know, to make sure that people understand what the facts are, um, when it comes to vaccines. And, you know, you mentioned the, the, the common side effects as, you know, the sore arm and, you know, possibly headache and, uh, fatigue after, um, a vaccine, but can a vaccine give someone, uh, the disease it's supposed to prevent?

Dr. Welch (16:58):

So that's a, that's a great question. And, and the answer is most likely not. I, I talked about the oral polio vaccine, again, which, which doesn't exist anymore. We don't use it anymore. But that one did have the ability to give people the disease. But then most vaccines Deon are, are not live virus or bacterial entities. Therefore, they could never recombine to give you the disease. But the, the... what we hear most often about is the, the flu and people say, "Oh, I got my flu shot. And then I got the flu." Well, the, the flu shot does, does not have live virus particles in it. Therefore it cannot recombine somehow and give you the flu.

Dr. Welch (17:41):

What most often happens is either someone was exposed to the flu, you know, in the days before they got the flu shot, or we, we confuse the flu with, uh, any one of the numerous cold viruses that go around in the winter around the time we get the flu shot and say, "Oh, it must be because of the flu shot." Most, uh, vaccines, if not all currently do not have the ability to give you natural disease and cause the, the complications, the serious complications that, uh, natural de- disease can cause.

Diane (18:12):

You know, you've mentioned it a couple of times and I'm just interested in knowing the differences. We are talking about vaccines, live vaccines, and some that are inactivated. What, what is that and what's the difference?

Dr. Welch (18:29):

So there are multiple different kinds of vaccines. And again, what vaccines are based on are first, the seriousness of the disease. We wanna focus on those diseases that are really serious obviously. The second thing is, is how, how the immune response is triggered. Meaning do you eat it, did you breathe it, did it go in through your skin. And then, uh, the third thing is how the, the agent or whatever it is that we're trying to prevent, how it actually operates within the body.

Dr. Welch (18:54):

So there are... Based on these criteria, there are multiple different ways you can make a vaccine. And the first one is you can actually take a virus like measles, mumps, rubella, or chickenpox, and you can weaken it somehow. And typically the way they do that is pass it through eggs, uh, multiple times, multiple generations through eggs, and it progressively weakens so that it can affect chicken eggs, infect chicken eggs, but not really be so infectious in humans. And that's the way measles, mumps, and rubella vaccines were made. But the thing about it is when you inject measles, mums, rubella, it's actually a live virus. It actually replicates within your body and causes a great immune response.

Dr. Welch (19:35):

And that's why typically we only need one or two doses of measles and mumps and rubella. But also an interesting fact about that, I'm sure you all have seen the immunization schedule, we actually don't give measles, mumps, and rubella vaccines until after a child is one year old. And the reason for that is live vaccines don't work in babies who are breastfeeding and getting the immune system of their mother. So again, another reason to pay attention to the different types of vaccine and when they occur, they are based scientifically on we want to give it to someone before they get the disease and prevent the disease, but we have to make sure their immune system, uh, is ready to take it.

Dr. Welch (20:15):

Now there's other diseases that are, that are, um, killed vaccines. And the, the most common one we talk about is DTP, which is diphtheria, tetanus, and pertussis. What they did is they just took these three bacteria, killed them, and injected them into people's arms. Well, we've, we've got better technology than that now. We have, uh, diphtheria, tetanus and acellular pertussis vaccine, but essentially what these are are killed pieces of the actual bacteria that we inject. Now, your immune system doesn't really respond to those all that well. And so that's why we need multiple doses over time of a killed vaccine.

Dr. Welch (20:53):

There's other vaccines that are manufactured by taking a little piece of the bacteria or virus and attaching it to another, um, mostly virus like a cold virus. And what that does is it makes your body, as it goes into you, it makes your body not only recognize the cold virus but this piece of the more serious disease and cause immunity to it. And then there are, there are newer vaccines which conjugate, um, pieces of viruses or bacteria, meaning you attach it to something that your body really doesn't like, which causes a better immune system. And now we have the newer technologies, the mRNA technologies, which has your body create... well, produced first proteins that can be recognized, uh, uh, to the outside of the bacteria virus, which causes an immune system. So there is constant research and development of new vaccines using new technology that are making these vaccines not only safer but more effective.

Deon (21:50):

Yeah. And you mentioned mRNA, and I- I'm glad you mentioned that 'cause that's kind of helping us navigate our conversation here. Um, highlight when mRNA vaccines were discovered and how that all started with their development.

Dr. Welch (22:04):

The discovery of MR- using mRNA technology in terms of our immune system was begun in the 1960s. It has been around for, for 60 years. Now they have made progressive achievements and advancements in using mRNA in terms of vaccines and other technologies. But it really sort of exploded in the 1990s where people really learned how to use mRNA, what it is useful for, how it works within the body, and then how to make products or vaccines that, um, that use mRNA technology. And essentially what it is, is, um, a little piece of mRNA that goes in the injection site and has the cells right there locally produce proteins against, uh, a disease, in this case, produce proteins against the COVID-19, um, uh, virus. Then your immune system attacks these proteins and you become im- immune to COVID-19 by recognizing these proteins that the mRNA had your body produce. Um, and it's just a local reaction. It doesn't go all over in your body.

Dr. Welch (23:10):

But as we've seen these mRNA vaccines, even with the rapidly changing COVID and variants, they're still very, very effective. So this technology has been around since the 1960s, really advanced in the 1990s, been propagated in the 2010s. And now we see some incredibly effective vaccines coming out in 2020.

Diane (23:29):

So this isn't just happened just recently in the past year or two because of COVID-19. That's what all the uproar I think has been about very, very polar opposites. Some people thinking, and that's that's everybody's right, of course, but the bottom line is this has been around and been tested for a good long time. This just didn't pop out of nowhere, Dr. Welch.

Dr. Welch (23:56):

You, you are absolutely correct. This has been a, a longstanding technology. And then you just see the success rate of the mRNA vaccines in, um, not only preventing disease but most importantly, preventing serious illness and disease and hospitalization. And they are incredibly effective at doing that.

Diane (24:10):

Then we're talking about the future of vaccines, and you- you've given us so much wonderful information, an awful lot for our listeners. And I'd kind of like to break it down when you were saying too that, uh, there is something that's always on the horizon it seems like. We've gone back in time talking about now looking at the future. I think a lot of our listeners would benefit from maybe having a conversation with their family doctor. You know, when you're talking about the vaccines they should have as adults, their children, the time schedule, this is a lot, this is a lot to take in today.

Dr. Welch (24:42):

With, with the access to information and the access to opinion on the internet and Facebook and, uh, just in general, um, it's hard sometimes to separate opinion from fact, as I, as I talked about before. However, the person that has the most vested medical, uh, uh, you know, importance in your family and safety in your family not only are the parents, but also the pediatrician. And your pediatrician is gonna inform you on the best available medical, scientific knowledge about vaccines, how they work, the possible side effects, any complications. And so the best person to get valid, scientific, accurate information about vaccines from is your family doctor or your pediatrician.

Deon (25:30):

And that's the, the best advice anybody can give anybody is to, to do consult your doctor, if you ever, ever have any medical questions, no matter what they are, vaccines or anything else. And... So the, the question now is, you know, we- we've, we've kind of gone through the history and the timeline of, of vaccines. So, so what's next for vaccines? What do they look like in the future and are scientists developing any new types of vaccines that we may not have even heard of or seen yet?

Dr. Welch (26:01):

A- absolutely. So, so again, I think the, the hottest thing right now is the mRNA technology. And I think that is going to continue. And the reason for that is the success of the mRNA vaccines. They have just been so incredibly successful. And again, there are some very rare side effects from the mRNA vaccines, but they far outweigh, um, the seriousness of COVID-19. I think oftentimes when we talk about vaccines or you go to a- an informational thing about vaccines, they just talk about the side effects of vaccines, but they don't weigh that against the seriousness of COVID-19. And we're now learning that not only does COVID-19 affect the lungs, but also the vascular system, can affect your internal organs. Um, and based on the seriousness of that inflammation in the response to COVID-19 can possibly down the road cause very, very serious and longstanding illnesses.

Dr. Welch (26:56):

We all hear about long COVID currently already. Now with the vaccines and the mRNA vaccines there does not seem to be any long term consequence. Again, it was just telling your immune system, hey, watch out for this. It didn't give you the disease and inflame your whole body. Um, so on the horizon, I think there's gonna be more mRNA vaccines, but there are also other vaccines, Deon, and I'd like to highlight one in particular. Um, the, the technology is actually a little further along in other countries like Japan, but they're developing a universal flu vaccine-

Deon (27:29):

Oh.

Dr. Welch (27:29):

... which we hope in the future will, will hopefully significantly reduce or possibly, fingers crossed, I don't know if, if I'll be around for that, but, but eliminate the seriousness of the flu. As we all know the flu and recognize the flu, you know, there, there needs to be a recognition that before COVID, before people were wearing masks and washing their hands and staying home, the flu killed about 25,000 people and was responsible for about a 100 to 150 thousand hospitalizations, um, in the United States every single year, including deaths in children.

Dr. Welch (28:03):

So the flu is not a innocuous disease that you can get every year. And some people get very, very ill and in a regular year, fortunately not the past two years, the flu can cause serious illness and death. So I'm really excited about the new flu vaccine technology. And the difference is here... I'm sure you all know that the flu shot changes every year. And what they're working on is a universal flu vaccine where maybe you only need to get one or two shots and then you're immune to the flu, no matter if the flu changes or not.

Diane (28:32):

Really?

Dr. Welch (28:32):

So that technology's on... yeah. That technology's on the horizon. And, and I really am, am hopeful about that one.

Deon (28:39):

That's a game changer.

Diane (28:40):

That... Absolutely, that would be fabulous because so many people always kind of think, "Am I gonna get the flu shot this year? Should I not?"

Deon (28:47):

Mm-hmm (affirmative).

Diane (28:47):

"Should I... when do I get it?" And we are going to talk about that in a, in a later episode as well, Dr. Welch Is there anything else? We've had... we've gone through so much information today. Is there anything else, uh, you can think of that you'd like our, uh, listeners to know about on our very first episode this morning so that, uh, they'll be aware of, uh, anything that, that is maybe not to compromise themselves and to be, uh, just focused on, on the future?

Diane (29:15):

It's kind of like now that we're talking so much about COVID-19. It was interesting you're talking about the flu because we're not hearing so much about the flu. It's all COVID 19. So what, there are still many things that we need to keep in mind. So to wrap up today, is there anything in particular that you would like our listeners to really be, uh, on the, on the forefront with and on the horizon?

Dr. Welch (29:42):

I really want your listeners to be open to information. When I talked about talking to your primary care doctor or family physician about vaccines, don't be afraid to bring them hard questions. Their job is to answer those questions. But what I also need people to do is just know that your pediatrician has studied the immune system has studied medicine and then has reviewed medical journals that had been, uh, scientifically peer reviewed. So the information they've given you is the best scientific information we have at that time. It is not their opinion.

Dr. Welch (30:07):

The, the medical community doesn't have opinions. We work on scientific facts or the best available information at the time. So A, don't be afraid to talk to your family, a physician or doctor, and don't be afraid to ask them the hard questions. But when they give you an answer, just note that that is scientifically the best information, not opinion.

Diane (30:25):

And pay attention to those answers.

Dr. Welch (30:28):

Yes.

Diane (30:29):

We have so enjoyed, uh, having you on this morning, Dr. Welch, and discerning vaccine facts from vaccine fiction. We really appreciate all of your expertise, your years of knowledge, your years of doing what you do the best. Uh, thank you for joining our conversation.

Dr. Welch (30:45):

Thank you for having me.

Deon (30:47):

And thanks, Dr. Welch again. And as a teaser for our next episode, we'll be addressing questions like why do we vaccinate against mild diseases such as chickenpox, and who creates the schedule? You know, Dr. Welch did mention the schedule. Who creates that schedule for when we get these vaccines? You may not expect the answer that you'll get. So it'll be very, very interesting, uh, when we have that conversation.

Diane (31:10):

Yes, I'm sure it will be Deon. Until then thanks again to everyone for joining us. And we hope you'll tune in for more Vax Matters next time.