Episode 7: Vaccine Hesitancy

*HYPOTHEkids lecture, 2021*

**Nina:** [00:00:00] I'm Nina and I'm here with my cohosts, Naira, Ellie, and Joanna. Just giving you a brief overview of what we're going to cover today. So one, what is vaccine hesitancy, how many people are hesitant, who is that ? The second will be, why are people hesitant? What are the predictors of hesitancy? And lastly, what are the concerns and what's the truth. Let's get into it. At a glance, I think it's always great for everybody to sort of start off on the same footing. So if you'll get the terminology we'll be using. A vaccine is a product stimulating a person's immune system to produce immunity to specific disease, protecting the person from the disease. Vaccination and the act of introducing a vaccine into the body to produce immunity to a specific disease is immunization. It's also synonymous with vaccination and inoculation. These three definitions come from the CDC and the final definition, which is vaccine hesitancy, is defined by the World Health Organization as a delay and acceptance or refusal of vaccines, despite availability of vaccination services. This phenomenon has been reported in more than 90% of countries in the world.

So looking at vaccines at a [00:01:00] glance, you guys know who this guy is? It's cool if you like, wouldn't just recognize his face. Don't worry. If you don't recognize this face, this is Edward Jenner, the vaccine pioneer. If you're not super familiar with the story, or if it's been a while since you've heard the story, he noticed that milkmaids didn't get smallpox at a time where plenty of people that get smallpox would be nearly scarred or would die from it. He decided that he would sort of like take some of the pus from people who had cowpox, and ended up like scraping the skin. He's the father of immunology and he really kind of kick-started the whole, vaccine thing itself. And people started thinking more about it after him. So thanks to hundreds of years of research, medicine, public health efforts all coming together, we have vaccines that present or that prevent more than 20 life-threatening diseases. Per the World Health Organization, immunization currently prevents two to three million deaths every year from preventable diseases. We are in the United States and immunizations are actually pretty big here, but we don't realize that sometimes in countries where they're not as tightly regulated or even in recent [00:02:00] years where you've had people opting out of them, we don't realize how much we actually end up losing or what we stand to lose when we're not vaccinated, but per of the world health organization, per UNICEF, two to three million people per year are saved from preventable deaths because of vaccination.

This is from the CDC, and this is just a list of vaccines that you would get. Now, this is not an exhaustive list. This is just kind of the vaccines that you're supposed to get. I don't know how many of you guys have traveled out of the country or have been other places, but if you're like me, you probably have like yellow fever vaccine and you have a couple other vaccines that might not be listed here as well. So as you can see at the bottom, and you can go into the CDC website and actually look at this. So for diseases that you almost forgot about, thanks to vaccines, there are 16 diseases that are here. So chicken pox, mumps, rota virus, whooping cough, everything in the second column. And then nearly everything in the last column. Meningitis and HPV are the two that we still consistently talk about, we don't think about despite the fact that we have vaccinations.[00:03:00] I guess the question is if we have vaccines to prevent these issues, then what's the problem, right? Well, just because we live in the information age doesn't mean that there's isn't disinformation, right?

So the thing is people are vaccine-hesitant for many reasons, and Naira will get more into that in her section. But whether it is maybe being scared of the science, maybe not trusting the science, not understanding the science, maybe cultural or ethnic history with certain things, people have a lot of apprehension about vaccines, right?

So when you also live in an age where you can Google anything you want. Literally within seconds, you can be connected to people literally across the world within seconds. But with that being stated, there's tons of information out there and not all information is not good. From what I remember in high school, they were really big on what's considered a "scholarly source" when we wrote our research papers and when we wrote our thesis papers. All sources are not scholarly sources, all sources aren't good sources of information. And the problem is when you don't know something or you [00:04:00] don't know better, or you're already kind of nervous about things, disinformation can be much worse. And we've actually seen vaccine hesitancy grow, not because people don't necessarily believe in the science, but they can't always trust in the science or they don't know better.

And they defer to people who may or may not have great intentions. In 2019, 2 years ago, the World Health Organization named vaccine hesitancy as one of the top global health threats alongside air pollution, climate change, below-satisfactory primary healthcare, and HIV. As you can see, this is actually really serious because this is right before the pandemic and the World Health Organization was saying that vaccine hesitancy is a really big deal and it stands to set back decades of progress. If you guys do some advocacy work like I do, one of the big things that we did whenever we had our congressional meetings this year was talk about the fact that with COVID-19, we've gone back decades in terms of progress, whenever you come to immunizations for different people, right?

Because not everybody's trusting them or you don't always have access to it. So per the Guardian, more than [00:05:00] 50% of the state saw a decline between 2009 and 2019 in kindergarten vaccination rates against diseases like measles, rubella, et cetera. When I started kindergarten, they were very, very adamant about having my vaccination records. There were no such things as exemptions, unless you were like immunocompromised, you didn't get exceptions. From what I've been told, that's not the case anymore. As you can see, there are plenty of people who maybe can't be vaccinated for reasons, and people who choose not to be vaccinated or their parents choose not to vaccinate them can stand to be a problem for people who cannot be vaccinated. Out of the 50 states, 26 are reported as having vaccination rates that fell below the target of 95%. And that's the rate that experts state is needed to provide maximum protection against diseases.

So, what does this mean in context, right? Because you've heard a bit of this, but what do these numbers actually mean? There was an actual survey that took place in February 2019, of course, just before the pandemic. And it was published, I want to say a couple months after the pandemic started, and it noted that parents with children that were surveyed across the [00:06:00] nation had these vaccine attitudes, 6.1% were hesitant about routine childhood vaccinations, just under 26% were hesitant about flu vaccines. 70% strongly agreed that routine childhood vaccines are effective versus just over 25% for the flu vaccine. So let's rewind that for a second, right? 70% of parents agreed that childhood vaccines are effective. Now, I don't know about you guys, but I've never had measles. I've never had certain diseases.

And that's because everybody's been vaccinated around me or I've been vaccinated. Maybe I'm not a danger to somebody else, or somebody is not potentially a danger to me, but you only have 70% of parents who were surveyed that agreed that they were effective, but what do these percentages mean? That means one in 15 US parents are hesitant about routine childhood vaccinations.

So when we talk about hesitancy, we have to think about the environment that people are in. We have to think about all of these external factors that really go into it, right? Because if [00:07:00] your parents question these, maybe you're going to question them as well. Or maybe that's not where your faith will be. Or if your friend feels this way, then maybe you may sway that way as well. Vaccine hesitancy isn't just not trusting the science. Sometimes it is trusting and deferring to people who don't know any better or believe that they know better than actual scientific officials or medical officials. Now that you understand that people are hesitant, what happens if people are already hesitant about tried and true vaccines and a public health crisis pops off like the one that we're living through?

Well, here are three pictures. And they're all from different eras. I'm going to assume the one that's small pox and measles is probably mid forties to mid fifties, less of a menace for the rubella one, which is the middle, I would say 69 or 70. And then this one is more recent. So if you just look at these three things and you just look at the framing of them, do you guys notice anything different within the framing of these things?

I think one thing to zero in on is [00:08:00] one, yeah. The last one is very open-ended too. Those two are very societal, right. "Join the fight." Like we're all together and we're fighting this thing together. I'm not sure if you guys are familiar with like the middle image, that's Dennis the Menace. I grew up like reading enough comic books and like seeing Sunday comics here and there. Obviously this is before my time, but it's the idea of being less of a menace to society because you're now vaccinated, right?

So this idea of we're all in this together, we're doing our part for these first two in a very passive way. And then the last one is getting back to the moments we miss, right? That's entirely different from joining the fight or you're less of a menace. The first two are very social contract-focused, whereas the last one is very individualistic, right? And beyond that, the first two are more or less, "you're fighting against this threat." You see, like in the first one they had arrows to fight against this barbarian, small pox or measles, the middle, this child being armed with a stethoscope, right? Like you can trust the medical profession. And then the very last one, this idea of getting informed, being [00:09:00] persuaded to literally seek out information to then trust this vaccine. Whereas the first two are less about, "this is why you should trust it" and more "you should trust it", right? So it's sort of this persuasive thing and just looking at that. So vaccine hesitancy in the era of COVID-19. So this comes from the Kaiser Family Foundation, the darkest color are people who are already vaccinated. The second darkest will get the vaccine as soon as they can. The cornflower blue would be wait and see, then only if required. And then lastly, the teal will be definitely not get the vaccine. But as you can kind of see here, like this is the total US population, this is the US breakdown by age.

Now, of course we know older people were given the vaccine first across the nation, then younger people were. But I think it's also really interesting whenever you see these age groups, you look at the people who will only get it if required, or definitely not get the vaccine, versus older people. And part of that has to do with the fact that again, these older people who've lived through an era where there wasn't a vaccine for polio, [00:10:00] where people were still getting vaccinated against measles. When you're living through something like that, it would make sense that about 11% of the population would only get it required or definitely not get it versus say 24% of people within the age bracket of a good number of people on this call. It also has a big party affiliation, it also does it by race.

These were a bit closer actually than I would've expected, and Naira will get more into that in a bit. But at least for me, I thought they were a bit closer than I expected and I was pretty happy to actually see where it was. Here, they're by gender. This kind of came out to be as I thought it would be. Educational level was interesting. You have healthcare workers. So you have about 10% of healthcare workers that would only get into required or definitely not get the vaccine. So again, that's one of those things that, is there a reason maybe some people are hesitant? Well, if you see a health care worker saying, "Well, I'm not going to get it if I don't have to." Again, people tend to defer maybe to one voice or to one person who may not always be best informed. You may have a personal agenda, right? And then you have community [00:11:00] types here. So what happens if you're not vaccinated? On the front end, right? Cause we've talked about vaccine hesitancy and we've talked about why it's important, especially in the era of COVID.

If you have access to it, it does make sense to just be vaccinated. You are still at risk for COVID-19, if you are not vaccinated, right? Just because cases have not been spiking for the past few months does not mean that you are not at risk. Again, we have people who are asymptomatic, plenty of people are. They're indefinite policy measures. Something that I feel sad about is that grad school has not been fun when you're doing it online and remembering high school, I can't imagine any of that stuff - prepping for AP exams. That would not be fun if I had to do it online. I'd probably be in tears consistently, but as this pandemic continues, because we can't necessarily have definite measures, you're constantly having things scaled back and then reintroduced to account for the rise and fall of the disease. You allow others to be put at risk for COVID and impacts last after [00:12:00] COVID. As I was stating, there are people who are asymptomatic or some people don't have symptoms for a long time. I had COVID in late 2020, and I was technically only really sick with like an actual fever for maybe two or three days. I would marginally say that the flu was worse. I had an annoying cough for like two weeks, but I wasn't sick for one or two weeks and didn't have anything really serious, but just because it wasn't serious then didn't mean it could not have been more serious. And it doesn't mean there aren't long-term impacts from it.

So the Lancet, which is a medical journal, the second- most notable one in the world, noted that six months after COVID infection, around one third of individuals had a neurological or psychiatric diagnosis. So please think about that. You guys may be symptomatic if you're moving and you're going to do something, that doesn't mean that it doesn't impact people. There are plenty of people who are asymptomatic, kind of going and doing stuff, maybe they don't trust the vaccine or don't want to get the vaccine, or they don't see the point in it. But if you understand that you're putting other people at risk for a disorder that potentially could lead to something way worse in the [00:13:00] future, would you not rethink it?

And then lastly, the micro and macroeconomic costs to society. So there's an entire branch of economics regarding this health economics, because it's what I do. So on the health end, it is more expensive, obviously, if you're going to the hospital and it's just a preventative measure because you're not built for the COVID vaccine. Like this is a national effort. You're not billed for it. That's entirely different from going to the hospital three months from now, and you may need a ventilator or you may need different breathing services, which are definitely going to cost far more than a vaccine, financially and society. Again, the longer that people have to work at home, certain functions can't happen. If you've worked in anything private equity, investment banking, a lot of that stuff kind of came to a standstill at first, sort of getting off the ground.

There was one point last year where like oil, crude oil, was trading in the negatives, which has never happened before. There's an economic cost to everything. And the fact that we can't be out and we can't actually function as we used to as much as we may have adapted. And the last thing I haven't written it here, but like I [00:14:00] noted before, the social contract, right? Like it's just a good thing to take care of other people in society. And when you're not vaccinated, I would honestly broadly state that you're not actually abiding by the social contract because you're not doing the best that you can do on behalf of society. You are doing for yourself only.

And individualism is not always terrific whenever you're living in a society, right? So if you're not vaccinated, there are plenty of ramifications for other people, but again, why don't people want to be vaccinated? Well, there are tons of reasons why, and I am going to hand it over to Naira to talk more about why vaccine hesitancy is happening and what we can do to sort of combat it.

**Naira:** All right. Thanks so much, Nina. I'll give you guys just a second to appreciate these tweets. A lot of these people kind of in like the the top left here are kind of arguing about why hesitancy is just humorous, right? And then people have all sorts of [00:15:00] very interesting theories about why it's not a good idea to get the vaccine. And a lot of them are really grounded in fear as you'll notice and not really in a lot of a logic. However, we will see examples of vaccine hesitancy and misinformation online that are very scientific in nature. And these are the bits of information, that are going to really be convincing for a lot of people and these are what's going to be contributing to a lot of the hesitancy.

When we talk about vaccine hesitancy, there's a lot of reasons that are very, very granular and I'm going to cover like three of these today. So the very kind of first thing I'll go through is what hesitancy really looks like? Who does it impact? The identity of the people that vaccine hesitancy ends up [00:16:00] impacting actually has a lot to do and might even be able to explain why they are so reluctant to get the vaccine and be a great contributor to society and protect not just themselves, but those around them. And then other thing that we have to keep in mind is how easily accessible misinformation is. You might scroll past misinformation on social media and depending on how much time you spend on social media every day, who you follow, who you trust, who you listen to, you'll probably end up being convinced that the vaccine is a very bad thing, that it's dangerous in some way, that the government is out to get you and it's completely fake, and all of these wild theories about what exactly is happening.

And of course the third thing, and maybe you guys have [00:17:00] seen this or perhaps noticed this in the past year, the politicization of the vaccine. The previous administration, throughout 2020, they did a really good job of confusing people and they did that for political gain. If the majority of Republican Americans and by the way, politics, and who you identify with in terms of politics, is certainly a predictor of whether or not you're going to be hesitant about the vaccine. And the final thing , and this part, I tried to go in as much depth as I could is scientific racism. Unfortunately, another predictor of vaccine hesitancy is if you are a part of what's called a minority racial group. If you are a Latino or Latina, if you are a Black American or an African-American, right? All of these things are also predictors of whether or not you or these people are [00:18:00] likely to be hesitant.

So, and there's going to be a lot of historical context here when it comes to why these groups of people specifically are hesitant about the vaccine. It doesn't really have much to do with identity, but unfortunately it has to do with a lot of very bad history that this community has had with scientists in particular and medical professionals. And we'll certainly talk about that as well. So here's kind of a little bit more detail about the predictors of hesitancy. So the study that I cite at the bottom of this slide, they had a pretty good sample size. They surveyed around 1900 people and really they found that there's a couple general predictors of hesitancy, so political affiliation and racial and ethic background are some.

And then the other one that was really interesting is if this person believed that COVID-19 was a threat to [00:19:00] themselves or their family, so at some point when cases started leveling out, there wasn't that many, you weren't hearing about all of these people dying every day. People started deciding, "Well, COVID isn't really a threat. I don't need this vaccine." And this is very much the position of a good percentage of vaccine-hesitant people. And of course, another interesting idea is whether or not they were a male or female. And interestingly, females do make up a larger proportion of vaccine-hesitant people, but in another study, it showed that they were also more likely to question misinformation, but nothing on males.

But yeah, that's kind of what they found in general. If we go a little bit deeper, people with children at home, this one is really interesting because a lot of you guys might have learned probably from what Nina was talking about, how we recently had this uptick in measles, which is super rare. But a lot [00:20:00] of people, a lot of parents are very afraid about the relationship between early childhood vaccination and autism, so that might explain it. But really the paper didn't offer that many explanation about what was the thing with like children at home, but they were just more likely to be hesitant, which is very interesting given that they would want to protect their children. But the other thing about political affiliation, so anyone that was a Republican or an independent, was also more likely to be vaccine-hesitant.

And of course, if they weren't really concerned about COVID, they didn't think it was necessary. So, here is kind of another quote from the paper. And I know this is a lot of percentages, but this is really saying that from the people that they surveyed nationwide from this 1900, 1800 people, 34% were [00:21:00] African-Americans, 29% were Hispanic, and then 25% were people that had children at home. Around 30% were people that lived in rural areas. Maybe they didn't have access to traditional healthcare and healthcare education, public health services, et cetera. These are kind of the hard numbers about who is vaccine hesitant.

Here is another very interesting study and what I really like about this is that the sample size is like many fold larger. So this is around 7500 people nationwide and it tells us virtually the same thing. And I think a really important trend to recognize here is that when you guys are looking at scientific data, especially in social research and biomedical research, sample sizes are really important. And if you could compare two studies that were done maybe in the same year, or even in separate years, right? And find like the same thing, that they confirm each other, that's a really [00:22:00] great, kind of fact check or sanity check so that the information that you're looking at is pretty much accurate to the most extent it can be.

But really here, this reveals that the population of vaccine-hesitant people among the racial and ethnic groups that we discussed - African-American or Black Americans, Hispanic Americans and White Americans - it might actually be a little bit higher than the percentages we got before, just because the sample size is larger. And of course, so 47% of Republicans, not just 30%. And of course, a very sad, unfortunate 49% of Black Americans, right? The 21% definitely would not get the vaccine and the yellow is like, they probably wouldn't get it, but at least for the majority of these, the yellow bars are slightly larger percentages.

So these people, we have a chance of convincing. "Definitely not" is super strong and it's questionable whether or not [00:23:00] we could sort of bring them back with enough information and things. But yeah, this is really an overview of what are the types of people that would be vaccine-hesitant. And of course, they have a lot of reasons for their hesitancy. And these are kind of, in general, they aren't coming from specific groups of people. The majority of vaccine-hesitant people are afraid of long-term illness or death. And this one is really ironic because like Nina mentioned, long COVID or having neurological symptoms after being diagnosed with COVID-19 and perhaps having recovered from the original symptoms is an actual, real threat.

Like there are people that spend months and months in physical rehabilitation to gain their normal range of motion after they've had COVID. This is really, really serious. And of course, we know that probably over half a million [00:24:00] Americans to date, I'm not sure of the exact numbers now, have died from COVID. It's like the, the top reason is long-term illness or death, and it's like, "Dude, this is exactly what we're trying to avoid." And when we think about vaccine efficacy, and I know that Ellie is going to go into this a bit later, but all of the vaccines, regardless of the company that made them, are a hundred percent effective at preventing deaths from COVID-19.

This is the only time when scientists can tell you "100% effective", right? Because really in clinical trials when they gave people the vaccine or they gave them a placebo, anyone that got COVID, which was a very, very small percentage - we're talking, probably less than 3% of people that got COVID even after having been vaccinated - they didn't die. Everyone survived. I'm not sure about the statistics on [00:25:00] whether or not they had long COVID. But hopefully not. I don't think, or I don't remember reading anything about it, so that's a really good sign as well. The second thing is allergic reactions. A lot of people, and of course, stories about allergic reactions, will circulate among certain people especially on Facebook. This one, sometimes there is an air of validity to it. I mean, and all of these are certainly valid, but then there's also the argument that having allergic reactions is incredibly, incredibly rare, but unfortunately, it's really difficult to be able to understand risk factors for allergic reactions sometimes, because a lot of it might come down to your genetics and accessibility to sequencing and understanding sort of all of these genetic variants, and how they could interplay, and induce any sort of risk when you take a [00:26:00] vaccine. It's super complicated and sometimes it might not even be genetics. It might be other factors like preexisting diseases. And this is actually one of the other reasons for hesitancy. And then, the three in the middle are really more based in fear, they might be based on stories that were kind of passed down between family members. So thinking of the vaccine would change your DNA since we're talking about an mRNA vaccine, which was like the first, the first COVID vaccine available, and then that it would affect someone's fertility, which I still don't understand that connection, but people absolutely have theories for these. Some might be rooted in some true science, but then it turns into pseudoscience and it's a very long drawn-out story about the connection. And it's like, "Well, this hasn't been scientifically demonstrated." And of course, the fact that they don't really understand what the ingredients are. Let's talk a little bit about misinformation.

[00:27:00] So this was a very interesting study. It was published in Nature Human Behavior. If you guys don't know already, Nature is a really great journal. Most of the what's published in Nature is really good material. It's been really well thought-out. There are a few exceptions though. But here they wanted to simulate the effect of misinformation on whether or not it would change someone's mind about getting the vaccine, okay? So they surveyed 8,001 participants across the United Kingdom and the US and they split those participants equally and they had what's called a "treatment group" and a "control group." So the treatment group was exposed to misinformation about the vaccine, maybe a tweet or a quote of some kind, or maybe someone took information from a scientific study out of context, and they started making their own conclusions about what it meant for the [00:28:00] vaccine, and all of these things, right?

And the control group received sound scientific information about the vaccine. And then they were asked to answer a bunch of questions about their feelings on the vaccine and their positions. And then after they were exposed to the misinformation, they asked them again, like, "Hey, would you take the vaccine? How do you feel about it?" And of course, they collected sociodemographic characteristics, so like age, gender, their employment, their education, and their political affiliation, ethnicity, et cetera. And really the most interesting, profound finding which I'll share in a moment, was really about what happened when people saw misinformation.

And this is an example of something that a survey participant would see in the treatment group. So this is a tweet. They actually have a link to it, like they linked it in the supplemental, but [00:29:00] I didn't link it here. But really this is a great example of something that's scientific misinformation. I want you to keep in mind a bunch of keywords. First, they say Yale University and the US government. Immediately, that establishes credibility, right? Well, it's Yale University and the US government. This can't be wrong, right? And then they're running clinical trials to develop propaganda messaging. Number one, clinical trials are usually only to test a specific scientific treatment, right? A vaccine, some kind of therapy, et cetera. And then to persuade Americans to take experimental, genetically-engineered, unlicensed, warp speed, zero liability.

You see where I'm going with this, right? First of all, they use words that aren't really understandable. So if someone doesn't understand what genetic engineering is, they're just going to be afraid of it. Okay. Straight up. "Experimental", "unlicensed", "warp speed", right? They give this air of [00:30:00] "They don't know what they're doing", right? "Experimental" means that we're still testing it out in mice and we don't know if it actually works in humans and it might cause all of these weird, crazy side effects, right? "Unlicensed", shutting down the credibility of whatever the clinical trials were about.

" Warp speed." Ellie's going to talk a lot about this one because this one scared a lot of people. If you don't know what this is referring to, basically the government had sort of this movement or campaign and they put a lot of funding into public and private pharmaceutical companies to develop the vaccine because they understood that COVID was a global emergency and they called this "Operation Warp Speed" because they knew they had to act incredibly fast. And interestingly, all it takes is just a lot of money to produce vaccines at the speed that we actually need them to be produced at. And our guests on the episode, one of our guests anyway, he's going to talk about how, if [00:31:00] this amount of money was invested in vaccines previous to the one for COVID, we would have had and met a lot more medical needs by now.

And then they end with like a very extreme statement at the end. So they're like researchers compared reactions in 12 focus groups using guilt, embarrassment, bravery, anger, trust, and fear, to overcome vaccine hesitancy. If the sentence before that didn't make you vaccine-hesitant, they just wanted to make sure that you were scared kind of about this whole thing. Of course, this wasn't real and the comments that the authors have about this tweet. They actually opened up the study that they were referring to. None of this actually happened. And the study was just comparing on whether or not having the flu increased your exposure, or increase the likelihood of your exposure, to COVID-19, et cetera. It was a really harmless study, but they decided to take it, pull some quotes from random [00:32:00] places and just string it together, and make this seemingly profound argument, that isn't really rooted in logic, or scientific evidence. So here's the outcome of this interesting study, right?

Basically when you showed people misinformation, and they originally, before seeing any of what you showed them, would want to take the vaccine, now you basically decrease the number of people that wanted to take the vaccine by around 6%, if you showed them misinformation. And unfortunately, people that are sharing misinformation, that are exposed to it, might not really change their minds because when we think about social media algorithms, right? Social media will recommend things that you want to see. So if it notices that you're sharing information of a certain [00:33:00] kind or content of a certain kind, it's going to recommend that content in your feed. So then all you're seeing is things that agree with your perspective. And this is what we call confirmation bias, or basically having this increases or enhances your confirmation bias.

If you're looking for something specific on the internet to validate your position, the internet will help you find it because that's the job of Google and the internet. It's really going to help you retrieve what you typed in and mirror kind of your positions. So just because there's a decrease, it doesn't mean that they're never going to change their minds in the future. Absolutely. But the fact that seeing like four or five pieces of misinformation was enough to change their minds is a little bit of a dangerous, thought, it's a little scary. So keep in mind that even [00:34:00] when you're trying to understand the problem of vaccine hesitancy, a lot of the studies that are done to try to interpret what's going through people's heads, how does this work?

There's a lot of external variables that you really can't control for. But now let's talk a little bit about scientific racism. And I know that I had politicization also on the list in the outline, but I think focusing a lot more on scientific racism was going to be very helpful just so that you get some context. And really, I want to talk about vaccine hesitancy among the Black and/or African American community, because they have dealt with a lot of unfairness, this is like a very small word, but very traumatic experiences in history when it comes to their relationship with scientists, [00:35:00] scientific experimentation, and clinical trials, et cetera. And to this day, there are disparities among the Black and African-American communities in healthcare. And of course, it has been demonstrated by nearly hundreds of studies at this point, that there is a disparity, and that Black Americans are more likely to get COVID-19. So this is a really important topic to talk about, and I'm going to start and introduce this by talking about the Tuskegee Experiments.

And this study, it was supposed to be a clinical trial, and what they wanted to do was record the natural history of syphilis. So they wanted to understand syphilis, which was a sexually transmitted disease. They wanted to understand how it progressed and what the outcomes were for humans. Of course, this is absurd, because scientists [00:36:00] found that penicillin is the treatment of choice for syphilis. All you need is an antibiotic, right? And of course it was probably known, at the time in mouse studies, what the progression of syphilis is. But they did this human trial anyway. And the very traumatic part is that the study occurred without informed consent, and basically they were told that they were going to be treated for what was called "bad blood" at the time. And this was basically a catch-all term, like an all encompassing or general term for many conditions like anemia, fatigue, and syphilis as well. But they were basically told that you have a problem and we're actually treating you.

And so they were enrolled in this study and of course they wanted to do it over six months, but they basically started taking batches and [00:37:00] batches of people, looking at syphilis progression over six months. Certainly some lives were lost, people became severely ill because they actually weren't receiving the treatment. So, in the long-term, they had to deal with the effects of chronic syphilis, which is incredibly, incredibly traumatizing. And of course, it's very clear you guys, at this point that they were taken advantage of in this way solely because of their race. And it really hurts my heart to present a case like this, but this is not the only case in history where this has happened to members of the African-American or Black community. This is just one example. And there's going to be countless, countless case studies like this one that are going to demonstrate how powerful scientific racism can be. And unfortunately, things like this did not happen and were just forgotten by the [00:38:00] Black and African-American community. This has led to distrust in medical professionals, distrust in the government, distrust in scientists, generations upon generations after it happened. And we're looking at the effects of it today, today in 2021. So when did this end, right? Essentially there's this reporter, her name is Jean Heller, and she's affiliated with the Associated Press and she broke the story of this study in 1972. And this, 40 years later, it was going on for 40 years and no one knew about it until she was courageous enough to report on it. And it led to this huge public outcry that forced the study to conclude. But only recently, maybe like over a decade ago or maybe two decades ago, when Bill Clinton was President, only then did [00:39:00] survivors of the study receive this very much public apology. But obviously that isn't really enough to reverse the generations that had to deal with the trauma of something like this. So let's think about what this means for the Black and African-American community today. So, like I said before, medical and scientific misconduct specifically on the basis that they were Black or African-American, is really a big reason for why a lot of communities mistrust science and scientists and medical professionals today. And let's take a look at the effect of this. So here I'm citing a study that was done in Pennsylvania and essentially these medical professionals from the University of Pennsylvania Medical School sat down with members of the African-American community kind of locally. And [00:40:00] they did what was called, like focus groups. So essentially a focus group is you sit down, with four or five people from the community that you're trying to survey, and then you ask them questions and you invite them to a discussion about their perspective on a specific issue. So here they were asked about their perspective on the vaccine, what are they worried about - and here they collected some statistics on the background of, these community members. So 79% of them said that they knew someone that got infected with COVID and even though all of the members of the study wear a mask in public consistently, only 42% of them said that their family members or people in the community consistently wore masks. And of course, this is just a very tiny spotlight on the reality of this, right? The problem in these communities[00:41:00] might actually be a lot bigger. The reason why a lot of Black Americans are more likely to get COVID-19 has a lot to do with where they're living. It has a lot to do with what access they have to healthcare, what access they have to personal protective equipment, and a lot of other factors.

And this kind of just captures a little bit of that, but let's look at what these community members said. And this is just one example, just to keep it brief. So this person, said that in the Black community, everybody is on high alert, right? They're very distrusting because we don't know what's going to be perpetrated against us. And on another level, you see what's going on with police brutality and things, and things have been caught on tape and it's not being addressed. So it's not weird in thinking that the vaccines that go to the zip codes, which is probably the zip code that they live in, and the zip codes around them would be [00:42:00] tainted, or maybe this is just my paranoia.

And it really broke my heart to read this. And of course, the sample size for this study was around 24 people. It was pretty small. And the author say like, "Oh this might not be representative of everyone in the Black or African-American community." But the fact that one person says this probably means that people in their social circle, people in their family can resonate with this and absolutely relate. And there's a lot of dimensions to this statement, right? So the first kind of thing that really stands out to me at least, is we don't know what's going to be perpetrated against us, right? This really goes back to a lot of times in history when this community specifically, in a scientific context, felt that something was perpetrated against them. And rightfully so, [00:43:00] as we've seen with the Tuskegee Experiments and a bunch of others, and then there's the dimensionality of current events, and more social justice issues, right? So the fact that conflict and protest and this uprising, in terms of police brutality and social injustice against this community also became incredibly severe during the pandemic.

And the fact that they didn't see action was being taken to protect them as a community also deepens or reveals an even deeper mistrust in the government and just leadership in general and any form of authority, in general. And of course this varies person to person, and then they would say that it won't be unexpected if perhaps the vaccines that come to our community are tainted in some way, or they're lower quality in some way. [00:44:00] Or maybe we'll be targeted again in a very similar way, as the Tuskegee Experiment, right? So it's really important when we think about vaccine hesitancy, especially when it comes to racial and ethnic groups to understand where they are coming from, when they are hesitant, specifically for this community. And now this really leaves us with the question of what can we do about this? And of course, Ellie is going to do a really great job of educating you guys about busting myths, right? So when you see a myth online, when you hear someone say something, you are essentially going to be prepared to talk back and say, by the way, that's not correct and here's why. But on a larger scale, what we need to do is figure out who vaccine hesitant people trust. And we're going to [00:45:00] teach these sources, these trusted sources, to address the concerns of vaccine-hesitant people and Reverend Holt in our podcast episode, she's going to talk a lot about this. And fortunately it was such an honor to sit down with her and talk to her because she is someone that was trusted in her community. And she's going to tell you all about how she leveraged that to help people understand why getting the vaccine was a good idea in her community. So here's a few statistics from the very first paper I cited and these are gonna point us to tools we can use. So first it says 50% of vaccine-hesitant adults usually trust their medical provider. So this means that if we teach medical providers to address vaccine hesitancy, to have a personal conversation with their patients about the vaccine, maybe do a live stream on Facebook or wherever else, their patients are connected to [00:46:00] them to answer questions and concerns they have, which has already been happening. The second thing is that trust in elected community officials was greater in Black adults and Hispanic or Latinx adults. And it was also higher among Democrats and Republicans, right? So this tells us that elected community officials, maybe the mayor of someone's town, or maybe an elected leader in a volunteer or community organization or community center, that these people are likely to trust.

This person should be highly educated about vaccines, vaccine science, to be able to address concerns. And finally, Republicans are more likely than Democrats to trust religious leaders in their communities. So this means that religious leaders also, we need to cover all of our bases, they need to be educated about vaccine science, and the importance of getting the vaccine, for their community members so [00:47:00] that they could call it out. I think Ellie, you could take it away.

**Ellie:** Hi guys, I'm Ellie. I am a first-year at Rockefeller studying tumor initiation in the context of skin cancer. And my section of the presentation will be focused on debunking all of these myths. We've gone into vaccine hesitancy. You guys have got some great instruction from Naira and Nina about what is the problem? What is causing this problem? And now that we have all of that we need to really know, what is the truth? And that's what science really is at the end of the day. It's the pursuit of truth. It's the pursuit of knowing what is real and what is not. And so we're going to spend some time just debunking some of the major myths that have been going around, either on Facebook or different sources of misinformation. So let's get started. So, I'm only going to tackle a couple of myths because I think it's more important to really delve into a topic rather than just cover it at the surface level. [00:48:00] And so the myths that I'm going to try to bust today is first, the speed.

I don't know about you guys, but one thing that I was very concerned about was the speed at which these vaccines were developed. Even though I am a graduate student, doing science, cancer, one thing I was really concerned about was the speed, because as I'm going to go into, vaccines take a long time to make. And so it was a little bit weird to me that it was so quick.

It was less than a year. And so this is the biggest myth that we're going to be talking about and one concern that we really want to address. The second one is one that stems from immunology, which is the "I've already had COVID, so I'm already immune. I don't need the vaccine." And this is not true. And so we're going to address that today as well. The third big one is the vaccine side effects, which I'm sure you guys have heard some very recent news about the side effects of one of the vaccines. And so we're going to talk about these as well. And so to really unpack the [00:49:00] speed of the vaccines, it's really important to know some vaccine history. And so I'm going to go into a couple of the prevalent vaccines in history and how long it took. So first is smallpox. Smallpox, was really, really prevalent back in the 1800s and in the 18th century. And it was actually the first vaccine administered in the US, was smallpox. And because of the vaccinations and a very, very worldwide inoculation program, we were able to eradicate smallpox. I don't think we even hear about it that much anymore. And so this was the first vaccine that was administered and this took, I think at least 30 years to develop.

And so that was the 1800s though, so they didn't have the technology that we have now. So that's maybe why it took so long. Fast forward a lot of years later, a century, we have the typhoid vaccine. So the typhoid vaccine fights against typhoid fever and this took 16 to 29 years to develop. And this was back in 1909. In 1937, almost 30 years later, the yellow fever [00:50:00] vaccine was developed and this took 11 years. In the 1950s, we had polio, the polio outbreak was really, really scary because it led to paralysis in some cases, and this took over five years to develop. So not that long, we see this trend of decreasing time throughout history.

And then in 1970, chickenpox, which I don't know if you guys have ever had concerns with when you guys were younger. But my mom was definitely worried about me and my brother getting chickenpox. And this took five years to develop and the vaccine was developed in 1970. Around the same time the Hepatitis B vaccine was developed and this also took five years. So the most recent one that I could find was the HPV vaccine and this took over 20 years to develop, and we're coming into the 21st century now. And so you can see that even though there seems to be a decreasing time at which vaccines are eventually produced, it still takes a long time. It does not happen in less than a year, right? Like with the COVID-19 vaccines. And so just for some illustration, smallpox is pretty similar [00:51:00] to chickenpox, although the rates of fatality are much higher. Yellow fever - this is a symptom of yellow fever and then polio, FDR was famously paralyzed by polio, and then chickenpox, which is a very recent concern that we have amongst children. And so here we have a pretty brief history of vaccines and what you can see as I said, is that it takes a long time. That's the bottom line. And so contrast this with the COVID-19 vaccine, where what we saw is a very quick creation, a quick rollout. And so a lot of factors contribute to this, but let's look at the facts.

The first thing to understand is that I showed how long it takes for the vaccines to be developed, historically speaking, about 10 to 15 years is the average throughout history. And so the fastest vaccine ever developed before COVID-19 was actually the mumps vaccine, which happened right after World War II. And this took four years. This was the fastest. This was the precedent. And so this was the bar, in essence. And so what really was the COVID-19 [00:52:00] vaccine timeline? Well, in March 30th, 2020, which was really when the US went into lockdown, the pandemic really, really started then, the Department of Health and Human Services, or the HHS, started a program called Operation Warp Speed, which is what Naira alluded to earlier. And Operation Warp Speed was very poorly named. And as our guest will go into, this phrasing really freaked her out. And a lot of health professionals decried this, they said that using these words or this terminology is cause for fear. How can something happen at warp speed like a vaccine and no regulations were skipped, corners weren't cut, all of these things you have to ask when you think about the term "warp speed." How is it so fast? And so this happened on March 30th, and with Operation Warp Speed. I'll get into this later, but this really jump-started and catalyzed the production of the COVID-19 vaccines, particularly by Moderna and Pfizer.

And so by July [00:53:00] or August 2020, the Phase I and II clinical trial data was published by both Moderna and Pfizer. And so already, we're getting into the clinical trials and as I'll go into later, these aren't even the first steps of vaccine development. And so we are clearly seeing a very fast pace of producing this vaccine, and by November 2020, the Phase III clinical trials were published by both vaccine companies already. And so clearly it's very, very fast. And so this is in direct contrast with all the previous vaccine efforts. And in a month later, emergency use authorization was given to both vaccine companies by the FDA. And so "emergency use", I just want to clarify this and Dr. Garcia-Sastre, who is one of our guests for one of the podcast episodes that you guys will listen to, talks about emergency use authorization. It's not fully approved by the FDA; emergency use authorization means that it's not accessible to children. But emergency use means that the risks of [00:54:00] getting COVID are way scarier or outweigh the risk of the vaccine. That's what it's saying. It's more beneficial to get the vaccine than it is to suffer from COVID or a COVID infection.

And so emergency use has never been applied for any vaccine in history. This emergency use authorization is very new, and this is the very first time that a vaccine has received emergency use authorization. And so this is an important precedent that's being set. And as Dr. Garcia-Sastre will go into we're in an unprecedented situation where over 570,000 Americans have died. And just to put this in perspective, this is 190 times more than the number of Americans that died from 9/11. And so a lot of people have died. A lot of people are experiencing neurological and psychological effects, as Nina mentioned and went into. And so this is a really scary time, and this is what really prompted the emergency use authorization by the FDA. And so let's go into Operation Warp Speed, because government's complicated as a lot of us know. [00:55:00] And so let's really unpack what is Operation Warp Speed? What does it entail? What is it essentially? And so at its baseline definition, Operation Warp Speed was a federal effort that supported multiple vaccine companies, there were six in total, to accelerate production of a COVID-19 vaccine. And so Operation Warp Speed was started in March 30th of last year, like I mentioned. And so Operation Warp Speed was a partnership between the Department of Health and Human Services and the Department of Defense. And so for those of you who got vaccinated, do you guys remember a lot of military members at your guys's vaccination sites? That's the Department of Defense. The Department of Defense encompasses the military and so they were actually a part of Operation Warp Speed and getting the vaccine out. And so they assisted with vaccine distribution. And so, Operation Warp Speed invested $18 billion in vaccine development. And just to [00:56:00] put that in perspective, the next largest or most expensive global effort to develop a COVID-19 vaccine was $1 billion.

So the US far outpaced every other global effort to create this vaccine. It's 18 times more than the next largest effort. And so that's why the US got priority, in essence, because they invested so much money in these companies that the US became the top client. And that's why the US has a lot of vaccine access in comparison to other countries because they spent so much money, in this initiative in essence. And so that leads us to the question of with Operation Warp Speed, were corners cut? How could we do something so quickly without cutting some corners without skipping some regulations? What, was it safe? Was this process safe? And so to really unpack this question, we have to know the stages of vaccine development. And so the stages of vaccine development are as follows. We first have the exploratory stage [00:57:00] or the R&D stage, the research and discovery phase. And so the R&D stage really entails learning about the virus, learning about the disease, the bacteria, what is it, how does it work? Why is it so dangerous?

All these questions are really part of that first exploratory stage. The second stage is the preclinical stage, where we start performing experiments on mice or laboratory animals. And we start thinking about what vaccine technology can we create or can we use, to fight this virus that we have explored in the first stage and so that's the second stage. And so the exploratory stage usually takes one to five years on average, if the disease is new and we've never seen it before. The preclinical stage takes about several months to a year. And the Phase I clinical trial, which is testing the safety of the vaccine in a very small, controlled environment. They're not even asking if it cures or provides immunity against the disease in question, they're just asking if it's safe,[00:58:00] if the vaccine is safe. And so this usually takes several months. The Phase II clinical trial, where you're testing the vaccine in a relatively large population, a couple hundred people, that takes one to two years. And this is asking, "Can it prevent infection of the pathogen or the disease that we explored? And then Phase III is the one that most of us really hear about. It's the one that's done in tens of thousands of people. And it's asking whether or not the vaccine is actually effective. And so the Phase III clinical trial takes one to four years and sometimes longer than that.

And then after all of these clinical trials, the FDA reviews them and either gives its approval or not. And then after, if it's approved, then the vaccine undergoes mass production. And so these are the stages of vaccine development which leads to eventual rollout. And so the question is, "Well, for the COVID-19 vaccine, what did this really look like?" Let's apply what happened with [00:59:00] COVID into this mold of the different vaccine development stages. And so let's start with the exploratory stage. So the exploratory stage, like I mentioned, is learning about the virus or the disease or the bacteria. And so what's interesting is that COVID or SARS-CoV-2, is very similar to SARS, which is Severe Acute Respiratory Syndrome. And it has about an 80% genetic similarity, so it's very similar genetically. And then it's also similar to MERS. MERS is the Middle East Respiratory Syndrome. Both of these viruses were discovered in 2003 and 2012, which is years ago. And they're caused by coronaviruses. The COVID-19 virus is not the first coronavirus that we ever discovered. And so we were already studying them and actually a vaccine had already passed Phase I clinical trials for MERS. And so once we had the sequence of the virus, which happened within a month of COVID discovery, honestly, especially in the US. We already had all the tools that we needed. We knew how the virus [01:00:00] works.

We knew how it replicated. We knew its symptoms and we knew how to spot it, what different characteristics the virus has. And so this exploratory stage, we already had a very solid foundation for understanding the virology of COVID-19. And so this did not take very long at all. And so this was a very accelerated stage. And so that's why it was so quick for COVID-19. Now for the preclinical stage, as you guys may have heard, the Moderna and Pfizer vaccines are mRNA vaccines. And I don't know enough about mRNA vaccines to really discuss this and go into detail, but Dr. Garcia-Sastre will, and mRNA technology in vaccine usage has been already used and studied for flu and for Zika virus and rabies and cytomegalovirus or CMV. And so mRNA technology already existed and was already being studied and had already passed a clinical trial and so the technology was there. We didn't have to develop it. And that's why these two stages went by so quickly. It's because we already [01:01:00] had the foundation prior to the pandemic. And so now we go into the clinical trials, which is what a lot of people tend to care about: whether or not clinical trials were skipped or maybe they were shortened; what was happening with the clinical trials?

And so for the first time, the Phase I and Phase II clinical trials for this vaccine were combined. They were combined and they were happening at the same time. And so that's why it was so quick. And if you guys remember from what I just presented, the Phase I and Phase II clinical trial data were published at the same time by Moderna and Pfizer. And that's because they happened at the same time. And so because of that, you didn't have to wait for one trial to end to start another, like what has happened in the past. It was both of them at the same time in parallel, and thus is more time-efficient. And so for the Phase III clinical trial, there are a couple of reasons why this went so quickly, but one of the big ones is the fact that there were a lot of volunteers that were ready to participate. So think about it, you're recruiting tens of thousands of people. I think [01:02:00] 40,000 people were in the Pfizer clinical trial. That's a lot of people. And if you think about how much time you would have to spend to sign all these people up for a clinical trial, usually it takes time. A lot of recruitment efforts have to be made and so all of these were bypassed because this pandemic clearly upended the lives of many people, not just Americans, but a lot of people. And so the volunteers were ready. They were ready to sign up. That part of bureaucracy and administrative details, those were already cleared before the Phase III clinical trial could even start. And so that being said, a lot of time was shaved off because of this. And so the next one is the FDA approval. And so the FDA approval did not really happen. It was emergency use authorization, like I mentioned previously, and what this enabled the FDA to do is to review the clinical trial data as it was happening in real time. And Dr. Garcia-Sastre will also go into this, but the FDA did not receive a huge packet or a [01:03:00] huge booklet of all the data, they were reviewing it almost on a daily basis. And so they could kind of see, "Oh, this is what the patients were going through, or the child participants, and so because of that, it was a lot more efficient than having to get all the data all at once and then spend however long it takes for them to review it, when they could review it in real time. And so because of that, that's how we were able to get the authorization relatively quickly because usually the review process takes quite some time. And then the last is the mass production. And so with the emergency use authorization, granted in December, vaccines were already on the rollout by December 13th, I think was the day.

And that's when a lot of health professionals, people in nursing homes, could get the vaccine. And so the question is how did that happen? Vaccines take some time, you got to get the factory set up, and factory workers have to be recruited. All of these things have to come together and that's where Operation Warp Speed came in. And so what Operation Warp Speed did is that it already established the [01:04:00] facilities and the factories needed to produce the vaccine. Those were already ready to go before the vaccines were completed. And so because of that, we didn't have to wait to create the facilities, clear out the facilities of whatever they were making previously, et cetera. They were all ready to go. And so because of that, that creates a lot of efficiency in this process and why we were able to produce the vaccine so quickly after its approval from the FDA. But these are all the reasons why it was so quickly. And hopefully you can see from all of these different components and elements that there weren't any cut corners. There weren't any compromises in regulation. And so it was really just about making the process more efficient and likely in future pandemics, God forbid this ever happens again, but this sets the framework, an unprecedented framework, for how we can get a vaccine out so quickly in the future. And so hopefully, this has [01:05:00] convinced you guys that speed really isn't a reason to be hesitant about the vaccines, because really this process was just more efficient. Before there was a lot of bureaucratic red tape, a lot of administrative details and work that had to go into developing the vaccines and an Operation Warp Speed just got rid of all of that and made the process way more efficient. And so the bottom line is that yes, the COVID-19 vaccines were produced at an unprecedented rate. It's never been seen before. It's a scientific feat and a huge accomplishment. But really what enabled us to do that was that we were in a good position to produce the vaccines because we already knew coronaviruses. We already had a lot of background from SARS and MERS. We were riding a wave of scientific and technological advancement with mRNA vaccines, and because of Operational Warp Speed, we removed a lot of inefficient processes that usually happen during vaccine development. And so that's the first myth that we really focused on, which is the speed at which the vaccines were produced.

And so the next one that we want to talk about is the "I've already [01:06:00] gotten COVID, so I don't need to get vaccinated." And so there are a couple of reasons why this logic is flawed. And one of them is the fact that you can get infected with COVID multiple times. And so during the pandemic, a lot of people were reporting that "I've already gotten COVID, but I got COVID again."

And so this multiple infections was kind of worrisome to scientists, especially because it wasn't clear whether or not the virus was mutating, et cetera. And so the fact that you can get infected with COVID-19 more than once would suggest that if you've got COVID already once, the vaccine may help prevent you from getting infected again, which has been shown to happen without the vaccine.

And so this is one reason why, even though you've already gotten COVID, you should still get vaccinated. And if you've already gotten COVID twice, you should still get vaccinated because you don't know if you'll get infected again. And so another reason why this logic is not so sound is because there are variants.

And so I'm sure you guys have heard that there are two very prevalent [01:07:00] variants, one from the UK and one from South Africa, and interestingly, the vaccines have been shown to protect against many of the variants. I don't think it's as high as the original strain of COVID-19, but it's still protective and still preventative.

And so it's very important to get vaccinated, even though you've already gotten COVID to protect against these variants that have been very, very prevalent in both society, in the US society and worldwide. And the third is an immunity-related point, which is that we don't know as scientists, how long immunity from COVID-19 lasts.

What we know is that if you get infected with the same strain of COVID more than once, that means the first infection doesn't confer lifelong immunity to COVID-19. And because of that, there still needs to be more data on this, we still don't know, scientists are still working on it, but this would demonstrate that we don't know how long you're immune after you've already gotten COVID.

So the third myth that I'm really [01:08:00] excited about getting into are the side effects of COVID-19, because I think this is where misinformation can really go crazy.

And so even though I've been fully vaccinated, I get a lot of notifications on the news, Facebook, et cetera, where it's like someone got the vaccine and then died. There are these fear-inducing things that are being propagated by the media.

And so it's really important for you guys as educated young individuals to be informed about what the side effects are, go beyond the headline and go into the facts. And so I'm going to talk about the side effects. I'm going to talk about the dreaded second dose for Moderna and Pfizer and I'm going to talk about the J&J blood clots.

How many of you guys had an adverse reaction to that second dose? I know a lot of people have. And when I say an adverse reaction, I mean any of these symptoms listed on this slide, maybe a fever, fatigue, chills, or a headache.

I had a really bad day. [01:09:00] I was very, very tired. I got chills. I didn't sleep all night. And I had a fever as well. And so I got all of these symptoms after my second Pfizer dose. And so really unpacking why this happened is a really important point.

And so the reason why your body gets a fever is because it's trying to actively destroy the pathogen. Bacteria and viruses cannot survive as well in very high-temperature environments. It's a protective mechanism by your immune system. And so without going too much into immunology, all of these symptoms are, are proof that your body is reacting.

Your immune system is working and that the vaccine is triggering an immune response, which is what you want if COVID-19 infects your body. And so these are the reasons why you have reactions from the second dose, and why it's not a cause for concern and why it's not a cause for you to feel hesitant about getting the vaccine.

And so the second side effect that I'm really excited to talk about today are the blood clots. And so if you guys have been keeping up with [01:10:00] the news, you might have known that the FDA recommended or instituted a pause on the J&J vaccine because of blood clots and so Johnson and Johnson is one of the companies that was supported by Operation Warp Speed. And it produced a vaccine shortly after Modernaa and Pfizer successfully created theirs. And what happened is that there were anecdotes of people, all women, getting blood clots. And so I don't know if you guys have heard this phrase, but I used it literally a week ago and while I was creating this lecture, I found out how inaccurate it was. So the chances of getting blood clots from birth control is one in a thousand. And the chances of you getting a blood clot from the J&J vaccine is about one in a million. And so people were arguing "Well, birth control is prevalently used and if you can take birth control, you'll have a smaller chance of getting a blood clot from the J&J vaccine. However, there's an [01:11:00] important distinction in this statement, which is that the blood clots caused from birth control tend to happen in your thigh or your calf, so it's mainly localized in your leg. The J&J vaccine is slightly different because the blood clotting that comes there or has been shown to be resulting from the J&J vaccine is actually in your brain. And so the blood clotting that resulted from the J and J vaccine, which I'm really hesitant about my phrasing because it's unclear what caused the blood clotting.

It's a very, very rare thing that happens. And scientists are still unsure what about the vaccine caused it, or if the vaccine even caused it. So it's really important for you guys to know and be well-informed about what exactly this blood clotting really is. And so the blood clotting situation that happened is called cerebral venous sinus thrombosis, or CVST, which is clotting in the brain that prevents blood drainage, which as you guys can tell is very, very serious.

And so what happened [01:12:00] in the timeline of the J&J vaccine is that in April 2021, the FDA ordered a pause on the J&J vaccine because six women developed CVST within two weeks of getting the J&J vaccine, one of whom died and then vaccinations resumed one week later after reviewing basically what happened with each of these cases.

And so just so you guys are really informed and as you guys are sure to be doctors and scientists, what is CVST and how can we determine what it looks like? What is the pathology? And so here in these images, you can tell from MRI what a CVST looks like because of these three specific circumstances.

So it's classified or diagnosed as CVST when we see these hallmark signs in the MRI, the first is called a chord sign, which is right here. You see, it's not on the right side, it's on the left, this little patch of white here. This will prevent blood from draining from your sinuses.

Another one is here. This is called a dense triangle sign. This [01:13:00] is another example of a CVST in a patient where you don't see it, here. And then another thing is called an NMT Delta sign, which is right here, where you can see this little triangle where you should see gray matter.

You don't see it. And so that would indicate that there is a clot of blood that's preventing drainage of the blood. And so this is what CVST is. And this is what specifically these six women had after getting the J&J vaccine. So now that we know what the problem is, what the pathology is, let's go into a bit more of the facts and the data.

And so if we look at the incidence of CVST blood clots in the population that was vaccinated with the J&J vaccine, it's 6.8 million. That percentage is 8.8e-06%. Now let's look at the general population. The general population is five out of 1 million. That is five times that of the J&J vaccine.[01:14:00]

And so this would suggest that you are not as likely to get it from the J and J vaccine as you are just by being alive in the general population. And so there are a lot of questions that we can have from seeing this data. And so I'd like you guys to kind of think about this as a scientist, you have this data, but what questions does this bring up?

**Naira:** One thing that I was thinking, what other things do these six women that got blood clots have in common other than the fact that they took the vaccine?

**Ellie:** That's an excellent question.

And so when I was doing my research, a lot of the women were between a very specific age group. And I think a lot of them were, they said they had hormonal factors, which I think means that they're either on birth control or some kind of birth control where they have some active hormones that are not normally active per se.

I mentioned one person died, right? How many people usually die of CVST? That's a question. And so I was doing my [01:15:00] research and the fatality rate of CVST is actually 8.3%. And so if we do the math, even though it's a super small sample size, don't tell my mentor I did this, but it's n = six, right? And if six women had CVST, one of them died. That's why not a six or 16%. And so even though we would need more data to look at this, it's not that dissimilar. The fatality rate is not as different as it is with normal CVST. And so even though we see, maybe we see prevalence of CVST, we don't know if it's more fatal because of the J&J vaccine.

There may be other confounding variables here as well. So confounding variables are variables that may be interfering your data in ways that you're not accounting for.

I think another question that I would ask that I don't think anyone has the answer to currently is it's all women, right? What about CVST? How frequently does it occur in men versus women. Why is this occurring in just women?

If this [01:16:00] was representative of the population, we would see almost all women having CVST in the general population when really it's 60% women and 40% men. And so this may be kind of getting at what is causing the blood clots and whether or not this is happening just in females because of a biological sex-specific difference.

**Naira:** But was the vaccine administered equally to both men and women, so that we can be sure that CVST may be only occurring in women for one reason or the other?

**Ellie:** So actually, that's a great question. It's 60% of the people who received the J&J vaccine were women. It was not 50-50. Yeah, so that's a great point. Those are other biases that are play because otherwise you're making the assumption that it's a one-to-one right? One-to-one males and females when really it's not.

So I'm going to keep going. So now that hopefully we've busted some of the major, major myths at play, there are other ones like vaccines cause infertility and miscarriage.

There is no concrete evidence [01:17:00] that supports that claim. Just like smelling a flower causes cancer. There's no evidence, and so it's really hard to address it when there's just nothing there to say that, that this is happening. And so hopefully we've kind of gotten into why are we people hesitant about the vaccine, who is hesitant about the vaccine, and what can we say or do or research to dispel these concerns in essence.

And so another thing with the J&J vaccine that I wanted to point out is I'm sure you guys have heard a lot about the "efficacy rate." Like you guys have heard that the Pfizer and Moderna vaccines are 95% effective against COVID and the J&J vaccine, that one, I believe is around 60 high, some high 60 percentage, I believe is the efficacy rate for J&J.

And so if you're looking at those two numbers, it sounds like you should get the Pfizer and Moderna vaccine, right? Not maybe the J&J vaccine, and so maybe this has led to a lot of people wanting one vaccine over another. [01:18:00] And so if you want to get the vaccine, you may be confronted with the question of "Which vaccine do I get?"

And so this video really helps kind of dispel a lot of myths surrounding the different vaccines. We just talked about the vaccine as a whole, but really there's a lot of confusion and misinformation about the type of vaccine that you should be getting.

And this is a video from Vox that explains why we can't compare the COVID-19 vaccines.

**Vox:** This is the new one-dose COVID COVID-19 vaccine from Johnson and Johnson. In early March, more than 6,000 doses were supposed to be shipped to the city of Detroit, Michigan. But the mayor said, no, thanks. "Moderna and Pfizer are the best. And I am going to do everything I can to make sure the residents of the city of Detroit get the best."

He was referring to these numbers, the vaccines' efficacy rates, the vaccines from Pfizer BioNTech and Moderna have super high efficacy [01:19:00] rates, 95 and 94%. But Johnson and Johnson, just 66. And if you only look at these numbers, it's natural to think that these vaccines are worse than these, but that assumption is wrong.

These numbers are arguably not even the most important measure of how effective these vaccines are. To understand what is, you first have to understand what vaccines are even supposed to do.

A vaccine's efficacy rate is calculated in large clinical trials. When the vaccine is tested on tens of thousands of people, those people are broken into two groups, half get the vaccine and half get a placebo. Then they're sent out to live their lives while scientists monitor whether or not they get COVID-19 over several months. In the trial for Pfizer-BioNTech for example, there were 43,000 participants. [01:20:00] In the end, 170 people were infected with COVID-19 and how those people fall into each of these groups determines a vaccine's efficacy.

If the 170 were evenly split, that would mean you're just as likely to get sick with the vaccine as without it. So it would have a 0% efficacy. If all 170 were in the placebo group and zero people who got the vaccine were sick, the vaccine would have an efficacy of a hundred percent. With this particular trial, there were 162 in the placebo group and just 8 in the vaccine group. It means those who had the vaccine were 95% less likely to get COVID-19. The vaccine had a 95% efficacy. Now this doesn't mean if a hundred people are vaccinated, five of them will get sick. Instead, that 95% number applies to the individual.

[01:21:00] So each vaccinated person is 95% less likely than a person without a vaccine to get sick each time they're exposed to COVID-19. And every vaccine's efficacy rate is calculated in the same way, but each vaccine's trial might be done in very different circumstances. So one of the biggest considerations here, when we look at these numbers is the timing in which these clinical trials were performed.

This is the number of daily COVID-19 cases in the US since the pandemic began, the Moderna trial was done completely in the US, here in the summer. The Pfizer-BioNTech trial was primarily based in the US too and at the same time. Johnson and Johnson, however, held their US trial at this time when there were more opportunities for participants to be exposed to infections.

And most of their trial took place in other countries, primarily [01:22:00] South Africa and Brazil. And in these other countries, not only were case rates high, but the virus itself was different. The trials took place as variants of COVID-19 emerged and became dominant infections in these countries, variants that are more likely to get participants sick. In South Africa, most of the cases in the Johnson and Johnson trial were that of the variant, not the original strain that was in the US over the summer. And despite that, it still significantly reduced infection. If you're trying to make one-to-one, head-to-head comparisons between vaccines, they need to have been studied in the same trial with the same inclusion criteria in the same parts of the world at the same time. If we were to take Pfizer and Moderna's vaccine and redo their clinical trial at the same time that we saw J&J's a clinical trial, we might see quite different efficacy numbers for those. These efficacy numbers really just tell you what [01:23:00] happened in each vaccine's trial. Not exactly what will happen in the real world. But many experts argue this isn't even the best number to judge a vaccine by anyway, because preventing any infection at all is not always the point of a vaccine.

The goal of a vaccine program for COVID-19 is not necessarily to get to COVID-zero, but it's to tame this virus, to defang it, to remove it ability to cause serious disease, hospitalization, and death. It helps to look at the different outcomes of an exposure to COVID-19 like this. The best-case scenario is you don't get sick at all.

The worst case is death. In between, there's being hospitalized, severe to moderate symptoms, or having no symptoms at all. In the absolute best circumstances, the vaccines give you protection all the way to here, but realistically that isn't the main objective of COVID-19 vaccines. The real purpose is to give your body enough protection to [01:24:00] cover these possibilities.

So if you do get an infection, it feels more like a cold than something you'd be hospitalized for. And this is one thing that every one of these COVID-19 vaccines do well. In all these trials, while some people in the placebo groups were hospitalized or even died from COVID-19, not one fully-vaccinated person in any of these trials was hospitalized or died from COVID-19.

One thing that I wish that mayor would have understood was that all three vaccines have essentially a hundred percent effectiveness in protecting from death. The Mayor of Detroit did backtrack and said, he'd start taking Johnson and Johnson doses, because it's still highly effective against what we care about most. Efficacy matters, but it doesn't matter the most. The question isn't which vaccine will protect you from any COVID infection, but which one will keep you alive or out of the hospital. [01:25:00] Which one will help end the pandemic? And that's any of them. The best vaccine right now for you is the one that you're offered. But with each shot that goes in someone's arm, we get closer to the end of this pandemic.

**Ellie:** All right, hopefully you guys have gotten a lot more information about not only the pandemic, but also the vaccines, why people are hesitant about taking the vaccines and also what are the differences between all the different vaccines that are available to us currently. And so with that, I think it's, it's good for us to open it up to questions and open up to free form discussion where people can really just ask whatever they would want.

**Naira:** How can students encourage people of color, minorities, and even their parents about the importance of taking their vaccines if they are hesitant?

**Joanna:** I totally relate to that, to the experience of being like a child of immigrant parents and speaking from my personal experience,[01:26:00] my parents were hesitant to take any other vaccine other than the Pfizer one and I'm from Canada. And right now, like Pfizer isn't like that readily available there.

And it's really the AstraZeneca vaccine that is available to them. And they were very, very hesitant to take it. And even with me as a scientist and me telling them all the facts, they were still hesitant to take it. My mom literally said in this chat, "The government is forcing us to take these vaccines because they're going to expire soon. So these are bad vaccines."

And I think it's just, it's very, very difficult, I think to convince someone one day, even if you do speak the same language and you do communicate and translate the right facts to them, which is what I've tried to do, they still seem to have this very strong hesitancy.

And what I've kind of realized is, is that a lot of people don't necessarily [01:27:00] trust experts or what government or public health officials say, but they trust people that they know. And so I think one thing to do would be to like lead by example. I feel like if my parents had friends that took the AstraZeneca vaccine and these people didn't have severe side effects or nothing severely bad happened to them, they would be more likely to take it.

And so I think leading by example is also like maybe also kind of a good suggestion, if you show that you taking the Johnson and Johnson vaccine and nothing has happened to you, maybe they might be more convinced. If they see like others around them doing just fine, and I also think there's like just with the news nowadays, people report on the most sensational stories and the most sensational stories are the ones where people are dying, but all these sensational stories are again, [01:28:00] super like rare cases, which is why they end up on the news.

**Naira:** Our cohost, Nina, shares more thoughts on strategies you can use to fight vaccine hesitancy and mentions Episode 3 of our podcast, where we talk to a community leader about ways she encouraged her community members to take their COVID vaccine.

**Nina:** So I think you touched on something really important when you guys listened to episode three with Reverend Hold, like that's going to come up a lot, right? Like trust matters. And people really don't necessarily think about the value of trust, right? But there's a difference in the way that you receive communications from somebody that you're friends with versus somebody you're not, right?

The way that you take information from a teacher that you like is probably very different from that of a teacher you don't like, or a class that you don't like. How do you communicate these things? Like Niara touched on, you do have some communities that have a history of this treatment.

My parents, my grandparents aren't immigrants, so I can't really speak to that experience, but for some of you in this like conversation, that's a very real thing, right? So how do you have that [01:29:00] conversation and you're communicating through a language barrier or a cultural barrier. There are these other factors that you have to account for.

And there's not, I don't think a perfect answer to this, right? Like it's a multi-pronged approach. And I know Joanna mentioned it with like science communication, a couple of you guys mentioned it. So like one, part of the problem that we keep going back to in this is that people are hesitant because they don't know. Science communication is not terrific in this nation.

And in a lot of cases, it's not because we keep science as lock and key as possible, right? And when you keep things as lock and key as possible, unfortunately, people don't know what to trust or they're trusting any information that's coming out. There were doctors that were saying like hydroquinone was perfectly safe, right?

Or whatever drug they're peddling, whatever thing it was that the administration at that time was saying was safe. You have people trusting different people. So I think part of that is, again, it's establishing trust. So who are the trusted figures in a community? If we're talking about like vaccinations, are there physicians we could go to? The thing is in this nation, [01:30:00] unfortunately we still have medical care that varies based on what your physician looks like. If your physician may be of the same race, they may treat you differently than a physician who is not of your race. In New York City alone, Black women are eight times more likely to die in childbirth than white women, right? And a majority of physicians who deliver babies in New York City are not Black. So that probably has a bit to do with it because there are plenty of studies that have come out where physicians don't believe that Black people have the same capacity for pain as white people, or they don't believe them whenever they're stating that something is wrong.

So that obviously plays a role in outcomes. So part of that is, are there physicians, are there medical centers, are there medical staffs that you could trust, right? Reverend Holt who we talked to is a registered nurse. And part of her advantage in communicating wasn't just that she was just a Reverend, but she was a nurse.

So she understood public health itself. And the community she was serving was mainly African-American just as she is. So there is a level of trust that exists there because they're coming from the exact same experience.

So one thing would be to find a provider, someone who might understand your experience and if you're an immigrant, if you're a person of [01:31:00] color that is really, really essential. My pediatrician growing up with biracial just like me and that probably paid a large difference in the way that she was able to treat me versus had she not been of the same ethnic background, right? So that's one thing. Another thing is you guys are young, you have access to everything. And like we said, misinformation is everywhere. I hate to sound like your teachers; trust your scholarly sources, right? If it's not a .edu, please do not just take information from it. If it is not a medical journal that's trusted: PubMed, et cetera, please do not just take any information, even then you should have some skepticism, right? Because information is constantly changing. It's constantly developing. You could state that so far, this is what we know. And we're going to know more in the future, right? That's totally okay. You can ask members of that community if you feel comfortable so that you can communicate it to your friends, your parents, cousins, whoever you need to. It's on us to actively take a role in understanding information and figuring out even where our parents, grandparents, et cetera, are coming from. Maybe a good place to start would be asking them, "So why do you feel hesitant about this vaccine? [01:32:00] So what makes you feel that way? So what has been your experience?" Part of alleviating some of the stress that people feel is to actually address those issues head on. So I think if we take this kind of approach, right, and you can't do it overnight, it's going to take time.

We can actually begin to address this and we can get people to be less vaccine-hesitant moving forward.

**Joanna:** And I think part of it is just that it's also like a psychological thing. And I don't want to get too much into this, but people are hesitant to do things that are new, that they perceive as risk-taking behavior.

So for instance, people drive every day and the chance of you dying in a car accident is like way higher than you dying of getting the COVID vaccine. But because my dad drives every day, he doesn't really necessarily perceive that risk as much as he does when it comes to taking the vaccine, right? So I think part of it is also like realizing that people have [01:33:00] this sort of perceived risk of the unknown, of like not knowing what they're getting into as well. Whereas every day that you live, you are taking some sort of risk.

When you go outside into the outside world, there's a small chance that some sort of freak accident is going to happen to you. And some people are like, "Well, if I don't take the vaccine, nothing is going to happen to me." Not like adverse side effects and whatnot, but a good point to make is you're taking a risk every single day and this is not the most risk-taking thing you can do, this is actually quite a very low risk event or a low risk thing to engage with compared to all the other things that you've risked your life for like every single day, like getting in a car or like crossing the street or yeah!

**Naira:** How can we be sure that there won't be long-term effects after COVID vaccination? If we can't be sure, how are scientists dealing with this uncertainty?

**Ellie:** Well, it's important to remember that [01:34:00] vaccines are different from medicines in that drugs build up in the body's tissues over time as we take them. Vaccines are different in that they are designed to deliver their payload and then are quickly eliminated from the body. This is especially true of the COVID 19 vaccines, which are mRNA vaccines.

mRNA degrades very quickly, thus long-term side effects are not much of a concern. We have never seen long-term side effects of any vaccine. And if we do see effects, they are usually short-term or within two months of vaccination. The FDA is also continually monitoring the clinical trial data in real time and we'll be able to immediately identify any long-term effects, though the possibility of that happening is very small.

**Joanna:** So I think, I think that's a great point that you made. I think that's certainly true. Scientists act on based on what they know in the moment and scientific information is always changing, like the stuff that you learn in your textbooks now it's [01:35:00] not necessarily going to be when your kids are going to learn, like 20 years from now.

Maybe the stuff that I learned in high school is not the stuff that you're learning in high school, because scientific information and research it's just happening at such a fast level, especially nowadays. Now that there's more and more people going into science, the rate of discovery is just happening super, super fast, and new information is happening all the time.

And public health officials change regulations based on new information. I remember in the beginning of the pandemic, people were saying that masks weren't effective and that there was no point of wearing this. And I later on, they changed that because they got new information showing that masks were effective.

**Naira:** Why hasn't pharmaceutical research and development been more transparent about the technologies they've been developing prior to the pandemic? If the public was more aware of these technologies, would it have reduced vaccine hesitancy?

**Joanna:** This is a major problem in the scientific community because there's competition [01:36:00] amongst research groups and pharmaceutical companies. They don't talk about what they're working on until they get a patent and they can like make money off of it.

**Naira:** Another thing to keep in mind is that awareness of a technology in the public might not necessarily mean they approve of it or are okay with it being used on them. Perhaps if the public was more aware of, for example, mRNA technology being used for vaccines, and there was an mRNA vaccine that was created before the COVID vaccine, it would have helped a little bit with vaccine hesitancy, but given a lot of the factors that contribute to vaccine hesitancy that we've talked about today, maybe it would have made only a very small difference.

What do you think scientists should do to make their discoveries more accessible to people who are nonscientists or members of the general public?[01:37:00]

**Ellie:** So, I don't know if you guys have tried reading a scientific paper, like the one with all the, like, I don't know if you guys have read studies with mice, but they have all these weird jargony things. Like even now, like I'm 20, almost 23. I'm doing my PhD. When I read a Nature paper, it takes me like a week and it takes me a long time to go through the figures, to go through the data, to understand the words they use.

Each field has a different jargon set and so I think one thing that would really help is if when you write a paper, you write of an article next to it, or in parallel, that communicates what you did in ways that the public can understand. Because that would be really helpful for people if they see a scientific paper with a really cool conclusion, but you have no idea how the data was done.

You have no idea how the experiments were done. You have no idea how the data was analyzed or collected. And I feel like if we had, if you [01:38:00] had to communicate your science to not scientists, but to the public, this would be a really helpful increase in transparency.

**Joanna:** Yeah, so really quick, I just wanted to mention that scientists because we're so immersed in our area of research, like a lot of scientists have trouble communicating their data or communicating their science to people who are non-scientists to communicate their data in a way that is simple enough for people not in their field to understand.

I just wanted to also kind of say that we try, I think a lot of scientists do try to talk about their science, but there needs to be improvement on the type of training that we receive or the type of mentorship that we receive, or more of an emphasis on being able to explain things to a non-scientist as well.

**Nina:** I remember when I was an undergrad, my mentor was a veterinarian and she did research, and we all had to take this mandatory [01:39:00] lecture on Fridays. And we'd listened to some research that someone somewhere from Yale or wherever it was doing.

And she said, "Well, sometimes even I have no idea what's going on because these people are really great at communicating to other people who were there, but not necessarily communicating to people who don't do what they do every single day." And the problem is if she was an actual researcher, right? She was a veterinarian researcher and she didn't understand, how is somebody outside of that supposed to understand? So if you can't even communicate within your field, I mean, I think part of that difficulty is anybody can say anything outside of that, right? And that's part of what's been happening, right? You oversimplify the message sometimes and people don't understand, they don't know any better.

But then people get this piece of information, like "66% efficacy." And they get nervous about that when, like, if you probably polled people like a year ago and you were like, would you take a vaccine from Pfizer or Johnson and Johnson?

Okay, I understand drug companies, so I might say Pfizer, but most people know Johnson and Johnson, right? They make baby powder. They make stuff that we use every single day. They make our band-aids, right? The name recognition [01:40:00] that we have that we wouldn't have for AstraZeneca in the same way or that we wouldn't have for... what's the other one? Sputnik?

So it does come down again to that science communication, but it also comes down to the way that we see science and society, right? Like we also live in an age where we think that because we can Google anything, we're experts too. And we don't have that cross doctor conversation. A large part of the problem is people in science have to have these conversations with people in public health too, so they can communicate it to the public, right?

Public health is meant to do that, but those conversations don't always happen and they're not always coming from a place of respect. So it's difficult to communicate with people who are meant to communicate the message to the broader public, right? If they don't feel like they're being respected, or if some of the people who are working in public policy don't feel like they're getting that so they can't inform people. So it really does come down to a communication issue and it's kind of like there needs to be an overhaul across the board, right?

So I think it comes down to the communication that we have and how we can tackle misinformation. And how would we reframe the conversatio, right? What does science literacy look like in this country? Should we be improving that so we can work on that so that [01:41:00] misinformation is not such a problem? Like there's so many different levels that I think right now we don't have the answer for, but in five years, sociologists are going to have like a field day just going through like the whole COVID phenomenon and being able to look at like, these are the myths that's happened.

This is where this happened. This is where that happened. A bigger question being, will it be too late at that point? Will we have moved further this way or that way? And will it be worse next time something like this happens, right? So I think it's a bigger conversation. It's not something I think any of us will have the answer to today or next week or next month, but it's certainly something that we should think about and consider as we move forward, as we're all going through as individuals living through this pandemic, as people who are going to relay this to people who are not alive during this period, et cetera.

**Naira:** Why do you think the concept that most COVID vaccines are a hundred percent effective at preventing death is not often communicated whereas the efficacy rates are?

So I think it's really important to recognize that scientists are very hesitant about making [01:42:00] claims that can be misconstrued. So the goal of saying the 95% or the 66%, they're really, honestly, just trying to say in human trials, here's the percentage of people that didn't get COVID after being vaccinated.

It really depends on the question that you ask. So the question that the public asks generally is, well, when you gave people this vaccine, how many people got COVID? Because that's the standard measure of efficacy, right? That's how they want the public to understand whether or not a vaccine is effective.

But if the public were to ask the companies, well, how effective is this at preventing death? Then they will reply a hundred percent. But that isn't the standard in communicating about the vaccine. These aren't the numbers that are reported on [01:43:00] more frequently because preventing deaths is a given. It should be a given, but unfortunately it's like people don't really think about it like that. And also like that video highlighted, right? The differences in efficacy between the vaccines or perceived efficacy, right, have a lot to do with when the clinical trial took place. And that, isn't something that's super, super widely reported on either.

But I think, we can certainly, like there are companies out there, like Vox, which made this video and other people that are really trying to combat misinformation in vaccine hesitancy by helping people in the public understand the data better. And I think it's just about what questions you ask, how are you thinking of what is it, what does it mean for a vaccine to be effective, right? Thinking about that concept a little bit differently can help you get to more [01:44:00] sound answers.

**Ellie:** What do people gain from spreading misinformation?

I think this is a really interesting question because I would ask you guys, do you think these people think they're spreading misinformation or do they think they're spreading the truth? It's what do people believe? We have to understand that what is true to us, may not be true for some other people. Like, I don't know if you guys have seen this one movie about a Holocaust denier, but he argued that "No, I'm arguing the truth. I'm not lying." And so he, like, even though it's a really extreme example, it really demonstrates that like what's true to us may not be true to other people. And so people that think they're spreading misinformation, they don't see it that way. They think they're spreading the truth. And so that's a really important distinction that we should be making.

**Naira:** And that wraps up today's episode of Putin podcast. We hope you learned a lot about the COVID vaccine, the history and current state of vaccine hesitancy and strategies to [01:45:00] overcome it within your local community. If you're interested in learning more, visit our website@politicsunderthemicroscope.com for more resources.