COVID-19 Vaccines with Dr. Benjamin Greenberg

Part IV

You can view of this video at: https://youtu.be/ZurDimLwY7A

GG deFiebre: [00:00:00] Thank you again, Dr. Greenberg, for joining us for this fourth video on COVID-19 vaccines. The last time we spoke was back in January. So it's great to get an update on what we've learned since, since then.

[00:00:18] So to start, can you talk a little bit about the Johnson and Johnson vaccine, how it works, because it's been in the news recently in the US in terms of getting reviewed by the FDA and emergency use authorization.

Dr. Ben Greenberg: [00:00:32] Absolutely. Thanks for having me back. So you're right, there, there's a new and exciting announcement that came out relative to the emergency use authorization from the FDA about the J and J or Johnson and Johnson COVID vaccine.

[00:00:47] And as a reminder to everybody listening, an emergency use authorization is not full approval. It's basically saying there is enough efficacy and safety data to make the vaccine available on a wider use with certain parameters. The J and J vaccine is different from the two currently used vaccines in the United States.

[00:01:09] Both under EUA is the Pfizer and Moderna vaccine. So as a refresher, those two vaccines, the Pfizer and Moderna, use something called mRNA, which is basically a little piece of genetic code injected into muscle and then taken up by cells. And then the human cells express a single protein from the COVID virus known as the spike protein, and it primes your immune system to react against that protein, such that it, when walking through the grocery store, you walk past the aerosolized particle of COVID and it enters your body, you will already have antibodies and T cells that react against that virus and will essentially not get ill from the virus.

[00:01:55] The J and J vaccine achieves the same goal - priming your immune system against naturally occurring SARS-CoV-2 viral infection, but it does so in a different way. Instead of putting in mRNA that had been coded with substances to enter the cell, Johnson and Johnson takes use of a benign common virus known as an adenovirus. And there are dozens of adenoviruses in the world that cause the common cold. They've deactivated the adenovirus and inserted the gene for the spike protein, so that when they inject this viral capsid, it can't replicate, it can't cause a common cold or a disease in the human.

[00:02:41] But once it enters the cells, it can get those cells to express the spike protein and prime your immune system. So that the end goal is the same, getting the spike protein to be expressed in the human body, but not as part of an actual infectious virus, so that we can prime the immune system against it.

GG deFiebre: [00:03:01] Great. Thanks for that overview. And so are there any other viral vector vaccines currently in use other than these ones? Have we used them for other things before?

Dr. Ben Greenberg: [00:03:11] So, we in the United States have not used viral vector vaccines in any wide-ranging use in the past. The AstraZeneca Oxford vaccine is an adenovirus-based vector.

[00:03:25] And so that's been being used not just in the UK, but in other places around the world and is based on a similar technology. In the past, the other viral vector-based vaccines were actually some of the early Ebola vaccines that used viral based vectors to get an Ebola protein safely into the human to try and promote an antibody response.

[00:03:49] But to date there aren't any widespread use adenoviral based vaccines in the United States.

GG deFiebre: [00:03:56] Got it. And then we've talked on prior videos about live vaccines. So are viral vector vaccines considered live vaccines or are they a different type of vaccine?

Dr. Ben Greenberg: [00:04:05] Yeah, it's a great question. And the answer is these don't get classified as live vaccines. And the important distinction between the two is a live, sometimes called attenuated viral vaccine - those terms get used interchangeably - means we are putting a replication competent virus into the human. So if you think back to the days where we used the nasal spray for influenza vaccine, there were some years where you could take that shot or the nasal spray. That nasal spray was a live attenuated viral vaccine, where it was a weakened flu virus that would replicate in your nasopharynx, in your nose, in your throat but really would never make anybody sick. We weren't seeing people hospitalized from a live attenuated virus, it wasn't a very virulent virus, but it could replicate and trigger your immune response to get primed such that if you ever saw a serious influenza virus, you'd be ready to fight it off.

[00:05:03] Historically, the other live attenuated virus that used to be used in the United States all the time was the polio vaccine. So going back over 50 years, there were two polio vaccines that were developed, an inactivated polio vaccine and an oral attenuated polio vaccine. And over years the US shifted to using just the inactivated. But still throughout the world, we will episodically see the use of the oral polio vaccine.

GG deFiebre: [00:05:33] Okay. And then we've talked a lot about the mRNA vaccines, the Moderna and Pfizer vaccines. So is this Johnson and Johnson vaccine, this viral vector vaccine, potentially safe for those with rare neuroimmune disorders like transverse myelitis or neuromyelitis optica, since it doesn't use that mRNA technology?

Dr. Ben Greenberg: [00:05:51] Yeah. So what's common between the Pfizer, Moderna, and the J&J vaccines is the safety data from the trials that led to the emergency use authorizations were quite similar and quite reassuring. We were not seeing adverse events of neurologic events or issues arising in the trials. The difference between the Pfizer, Moderna, and the J&J is we now have more data with the Pfizer and the Moderna. So we've now gotten tens of millions of doses of those vaccines into human beings. And so if there are going to be rare safety events, we're, we're just now starting to see them. And you'll see single case reports of events, allergic reactions, or inflammatory events after the Pfizer/ Moderna. I'm not aware of any new neurologic events we've been watching. There've been concerns in the past about Guillain-Barré, and we have not seen that reported with either of those vaccines. And so what I'd say is they're similar in the sense of the initial safety data leading to the release is quite similar and reassuring. We just have more and longer-term data with the first two.

[00:06:59] Based on what we've seen reported to the FDA leading to the emergency use authorization, I'm not seeing anything to raise a unique concern about the J&J vaccine.

GG deFiebre: [00:07:09] Okay. And then we briefly talked about the AstraZeneca vaccine and how is this different from the J&J vaccine and is one kind of safer than the other for those with rare neuroimmune disorders?

[00:07:20] Because, you know, I know over the summer, we heard about reports of someone developing transverse myelitis, who was in the vaccine trial for AstraZeneca/Oxford. And I know that it's the AstraZeneca vaccine is being given in the UK, for example. So any thoughts on that? \

Dr. Ben Greenberg: [00:07:34] Yeah. So, we don't have any head-to-head studies to say if adverse events are higher with one or the other. And there was the case - reported case - of transverse myelitis in the AstraZeneca trial. I am unaware of any further cases reported since the release of transverse myelitis. And I'm not aware of any myelitis cases happening during the trial of the Johnson and Johnson vaccine. And so, it's too small a sample size to say if one is going to be safer than the other. They use different adenoviruses - if you remember, I said there are dozens of different types of adenoviruses. There are human adenoviruses. There are chimpanzee adenoviruses, and the AstraZeneca uses an adenovirus that tends to infect chimpanzees more than humans. We don't have a reason to suspect that that is a unique safety issue. It's not coming from chimpanzees. It's just, that's the natural host to the virus. So we don't have a reason to say one is safer than the other.

[00:08:28] When we think about the notion of expressing the spike protein in the human body, one of the things to remember now is we've had millions of people expressing spike protein in the human body, whether it was from mRNA or the hundreds of thousands through an adenovirus. And we're not seeing patterned events of myelitis or ADEM. And, in a given year, there are going to be a certain number of cases of transverse myelitis and ADEM that happen. And if we're in the middle of a mass vaccination campaign throughout the entire world, there is going to be somebody who gets transverse myelitis or ADEM in the 90 days after their vaccine. But it's going to be very difficult to know whether or not there's causation between the two. So we look for statistical patterns: are the rates of transverse myelitis reports going up? And so far, we're not seeing that signal.

GG deFiebre: [00:09:24] Okay. And then also in previous videos we talked about how there's the potential that these mRNA vaccines might not be as effective in people who might be on some sort of immunosuppression. So, are there any worries about that same sort of issue with the J&J or AstraZeneca vaccines?

Dr. Ben Greenberg: [00:09:41] Yeah, it's a great question. And it's important to note, to separate out safety and efficacy. And so on immunosuppression, since none of these vaccines are based on replication competent viruses, we don't have a reason to withhold it from somebody who is on immunosuppression. But the efficacy is a different question, and unfortunately, we have very limited data on the impact of the immunosuppression to the efficacy of a vaccine because those people aren't normally enrolled in clinical trials. Now, we're starting to get that data from the mRNA vaccines from studies that are going on. We do them here at and UT, colleagues around the world are doing them. And it's too early to know for sure. If we look at other vaccines, so there've been research studies that looked at the influenza vaccine. And what they found was the efficacy of the vaccine was lower in immunosuppressed individuals than in people with a normal immune system.

[00:10:41] But what they also found was it was still worth it to get the vaccine, because maybe you didn't get as big a priming of an immune system, but you got enough to prevent fatalities, but maybe not prevent illness. And so, in general what we're saying to our immunosuppressed patients is it's safe to take the vaccine, but it doesn't mean you can throw caution to the wind and know that you're immune or anything along those lines. We still all have to do the things day-to-day: masks, physical distancing, et cetera, to cut down on the risk of exposure until we get to a place in the world where the transmission rate is getting so low that we don't have those level of concerns.

GG deFiebre: [00:11:23] Okay. And then you mentioned how someone might be able to do an antibody test after, you know, several weeks after the vaccine to see if they mounted an immune response. So someone sent in a question that they received the Pfizer vaccine. Three weeks later, they had an antibody test that was negative. Does this mean that the vaccine didn't work for them? Should they try to get a different vaccine or do they maybe just get the wrong kind of test looking for a different part of the, you know, antibody for, for the different part of the virus?

Dr. Ben Greenberg: [00:11:49] Yeah. It's that latter part GG, you ask, you set up the answer beautifully. So, going back to the basic biology of what we're doing: we are introducing one protein from the virus into the human body - the spike protein. That's the part of the virus that attaches to the human cells and lets the virus in to start replicating, causing damage to our body. So, if we create an immune system that's ready to block the spike protein, then you can breathe in coronavirus and it won't infect your cells through the gradient and replicate and cause issues. So the immune response that's primed by the vaccine is very specific. We're not introducing the whole virus. So, if we were to give you a live attenuated virus, you would then develop an immune response against all different parts of the virus - the spike protein and other pieces. But with the viruses that, that, or the vaccines that we're using right now, you're getting very specific response.

[00:12:46] The blood test that was developed and has been used the most to determine "have you been infected or not?" is looking for an antibody against what's called the nucleocapsid protein, a different protein on the virus. So, there are anti-spike protein antibody blood tests, but they're not universally used. So depending on what tests your clinician orders, you could get the vaccine, have an adequate response and yet test negative on the blood tests because we're looking for a very different antibody. So it's important to make sure as clinicians that we're ordering, and as individuals in the community asking your clinicians to order, that we're testing for an anti-spike protein antibody and not the anti-nucleocapsid antibody, which is the one that's most often tested for.

[00:13:39] Now, let's say you're vaccinated and let's say you get an anti-spike protein antibody test, and you test positive. Does that mean you are free to move about the world, carefree, mask off, not washing your hands, going to rave parties and warehouses in Manhattan on weekends and doing whatever you want? And the answer unfortunately is no. For two reasons.

[00:14:04] One is from a public health perspective. While you may not get sick from an exposure to coronavirus, you may actually still be able to replicate the coronavirus in your nose or mouth and spread it to other people. So, for the good of all of us, we're, we're asking even for people who are immune to still take precautions.

[00:14:25] Secondly, as you read about in the news, the variants of coronavirus that are popping up around the world, the New York variants, the UK variants, the South Africa variants, they get named based on the cities or countries where they're first identified. Those variants, the reason they're a variant is they're mutating in the spike protein. So, if a virus mutates in a way that the antibody you developed doesn't adequately block it anymore, you might still be at risk. And so what we need to do as a, as a world community is recognize, and we talked about this the last time, that if we can just hang in a little longer - which is months longer - and get the transmission rate low enough, there won't be an opportunity for more mutations to occur. We will essentially stop the ability of the virus to create a mutant that would get around the vaccine. And so for the good of everybody, not just those who get the vaccine and those who don't, but future folks, we need to make sure we're still keeping those precautions going.

[00:15:32] But yes, after the vaccine you need the right blood test to determine did it work or not.

GG deFiebre: [00:15:37] Okay, thank you for that information. And so the Johnson and Johnson vaccine is just one dose. But the other ones have, the mRNA vaccines, are a two-dose vaccine. So we had someone who was worried about getting the second booster shot.

[00:15:52] So the first one acts to get your immune system ready to go, and then there's the booster shot. And so, the reason why they're concerned is that they had the typhoid vaccine and they were fine. And then the booster dose is when they then developed transverse myelitis after that second, that, that booster dose. And so is there any kind of thought behind maybe an increased risk after that second dose where your immune system is then, you know, working extra hard to respond to the virus or any, any thoughts on, on that?

Dr. Ben Greenberg: [00:16:20] Yeah, I, I think with the small numbers we have and the limited information, it's near impossible to draw any conclusions. What I'll remind people... So, the world of vaccines and immune-mediated attacks on the brain and spinal cord remain a very controversial area. And it's due to the fact that thankfully it's an extremely rare event.

[00:16:40] The overwhelming majority of people who develop transverse myelitis, optic neuritis, ADEM, neuromyelitis optica, even multiple sclerosis, the overwhelming majority of people do so at a point in time with no relationship to a vaccine. So we know, first and foremost, the overwhelming number of cases have nothing to do with the vaccination.

[00:17:01] So then you move into a situation where you have cases that occur with a temporal relationship to the vaccine. And then the question is, is there a causation or not? And a lot of the individuals I've treated over the years who were concerned about an association between a vaccine and their event were doing it in the phase of vaccines where there was only one dose and not two and not a booster dose. The classic being the influenza vaccine, people have been worried about the influenza vaccine as somehow being related to their myelitis and they weren't getting boosters. They were just getting one. And so this, we can craft stories and narratives, and theories about, well, it was the booster dose. Hmm, but that would be telling everybody who had a concern about their single dose vaccine related event that it couldn't have been the case.

[00:17:42] And so, so I understand the theoretical concern completely. And it's something where we've been pushing for there to be more study. But thankfully the statistics reassure us that if, and I stress, if there is an association it's an extremely rare event. And, as I look to my patients who have had transverse myelitis in the past, who have gone on to have subsequent vaccinations, we don't see a pattern of re-emergent transverse myelitis. And so I think overwhelmingly we can sleep well at night about the safety of not just taking the first dose but if, if you're on a two-dose regimen taking the second dose. And it's, it's worth it. We haven't mentioned it yet. It's worth it to note that the J&J vaccine, one of the things that differentiates it from the Pfizer and the Moderna, and the AstraZeneca vaccine is it's a single-dose vaccination. There isn't a second dose you have to take.

GG deFiebre: [00:18:36] Thank you for that. And so if someone gets one of these vaccines now in the US, these three different potential options, and has a worsening of symptoms, which, which might happen without having a new attack, what should they do? At what point should they contact their provider if, if needed or is, you know, is there a timeframe, you know, that symptoms might happen where they should then contact their provider after a certain amount of time?

Dr. Ben Greenberg: [00:18:58] Yeah, this happens all, all the time. And you're right, GG, by noting that there's this phenomenon. It was originally described in multiple sclerosis patients 150 years ago called Uhthoff's phenomenon, where anything that stresses out the body - it can be a low-grade fever, it can be a vaccine, it can be a bad night's sleep, it can be a fight with your significant other, all sorts of things that

can physiologically stress out the body - can lead to a reemergence or worsening of old symptoms. Very well-described phenomenon that when we have studied it left and right, is not associated with new damage from the immune system.

[00:19:35] And so, in the setting of the vaccination where it's pretty common to run a low-grade fever, that's your immune system getting activated. And we actually are thrilled when we hear about a low-grade fever because the vaccine is kicking the immune system into gear. If it's in the setting of a low-grade fever and somebody is experiencing a re-emergence of old symptoms -something they've had in the past - so, let's say you have transverse myelitis and you have weakness of your left leg and you got over it. But after a vaccine with low grade fever, the next day, your left leg is weak again. Well, what I would tell my patients is "if it's the exact same as what you've had in the past, take Tylenol, hydrate, cool off, rest. And if it's going on for more than 24 hours, let us know and we'll individualize our recommendations". A lot of times we'll just keep watching. Sometimes, if there's something funny about it, we may do an MRI, but we would not treat it as a relapse unless we get conclusive proof of new inflammation.

[00:20:27] If after a vaccine or frankly after COVID infection or anything, if you ever develop a symptom that you've never had before? So let's say you're a transverse myelitis patient, and you had your event years ago, and now all of a sudden, you're having blurred vision in your right eye that lasts an entire day - not 20 minutes, not an hour, but a whole day. For new symptoms, you definitely want to talk to your practitioners and discuss getting imaging done to see if you're having inflammation in the part of your body separate from where you had damage previously.

GG deFiebre: [00:21:01] Okay. Thank you. And, you know, there's several people, you know, people in our community are on potentially other medications. Are there any issues with the vaccines interacting with other drugs, like blood thinners or diabetes medications, heart medications, drugs, for example, for multiple sclerosis?

Dr. Ben Greenberg: [00:21:17] Yeah. To our knowledge, from a safety perspective, no. Efficacy goes back to the immunosuppression. So, if somebody is on immunosuppressive regimens then they can have a lower efficacy of the vaccine, but there's no safety concern with mixing the two.

[00:21:32] In terms of health issues, there still is the warning that if you have multiple food allergies or medication allergies, you're somebody who walks around with an epi pen because you've had anaphylactic type reactions in the past, then you definitely want to have a longer monitoring period after vaccination to make sure you don't have an unusual allergic reaction. But there's not a known drug, drug interaction.

GG deFiebre: [00:21:54] Okay. And then we've also talked in previous videos about the medications that are used most frequently for neuromyelitis optica. And so there are some new medications that have come out in the past year or two. Are there any recommendations regarding timing of those and then also some of them might require vaccinations before receiving your first dose, any recommendations in terms of timing of that with the COVID vaccines?

Dr. Ben Greenberg: [00:22:16] Yeah. So we're getting this question a lot, and I want to break down my answer in two parts.

[00:22:20] So you reference one of the newly released FDA-approved medications for neuromyelitis optica known as eculizumab. And this therapy requires people to get a meningococcal vaccine prior to starting drug because the drug will specifically put people at risk from meningococcal meningitis. So the vaccine requirement and ahead of time was not relative to a reduced efficacy later. It was specifically, there's a known

safety risk with the drug, and we're trying to mitigate the chance of somebody getting meningitis after they start the drug.

[00:22:54] Now, if you flip to any of the immunosuppressant regimens - whether they be for neuromyelitis optica or multiple sclerosis or anti-MOG associated disorder, or a lot of the conditions that, that our community gets treated for - there has been a large discussion amongst neuroimmunologists on should we try to get the vaccines in before somebody starts immunosuppression or if they're on an immunosuppression that's dosed episodically, should we time the vaccination at a certain point? And the answer is complicated.

[00:23:28] So ideally, and I stress the word ideally, we would get vaccines in before starting immunosuppression. And ideally if somebody was on immunosuppression that was dosed twice a year, we'd get the vaccine in the latter half of that six-month period before their next dose.

[00:23:47] But that's under ideal circumstances. And what I've been telling my patients is the notion of, you know, perfect can't be the enemy of good. That even if we're not going to get the ideal, we should get vaccinated. I'm worried about people losing their opportunity to get vaccinated if we're dealing with supply chain issues while waiting for the most ideal time to get vaccinated.

[00:24:07] So ideally, we'd get it before immunosuppression, but if you can't, it's hard for me to recommend delaying a necessary treatment while waiting for the vaccine.

[00:24:17] It's definitely worth discussions with your clinician, because not all conditions are created equal. Somebody with anti-MOG associated disorders, they might be able to wait more than somebody with an aquaporin-4 mediated neuromyelitis optica.

[00:24:31] So this is going to be very individualized, but in general, I say, do the best you can.

GG deFiebre: [00:24:36] Yeah, I think that's a great point, especially how difficult it has been I think for several people to get the vaccines, you kind of just get it when it's available to you, based on luck of, you know, how quickly you're able to get it. So yeah, I think that, that makes sense.

[00:24:50] And so we did also get a question that there were a group of people who received doses of the Moderna vaccine, that it wasn't stored at the correct temperature. And this was specifically in Sweden. So is the, you know, is the effectiveness of the vaccine potentially not guaranteed and what about the side effects if something like that happens?

Dr. Ben Greenberg: [00:25:08] Yeah, so for the Moderna and the Pfizer, and the recommendations have been evolving over time. But the key is not having it out at room temperature or at less than frozen temperatures for too long a period of time because then the efficacy declines, the molecule degrades.

[00:25:25] If something is stored at too cold, we don't think it would change the efficacy. But if it's stored too warm, then basically we would count it as not getting vaccinated and would repeat the series. Now, if you can do the appropriate anti-spike protein antibody test and measure you had a response, then you're fine.

[00:25:46] From a safety perspective, it shouldn't change the safety. It's, it's purely around the efficacy and whether or not it's going to induce a response.

GG deFiebre: [00:25:55] Thanks. And then there's been a lot of discussion too about Guillain–Barré syndrome and then transverse myelitis and kind of the difference between Guillain–Barré and these rare neuroimmune

disorders. So if you just talk a little bit about kind of the difference, because there were some kind of conflicting recommendations that came out, that people with a history of Guillain–Barré shouldn't get the vaccine and then people getting concerned that that impacted those with rare neuroimmune disorders. So yeah, if you mind just kind of an overview of how they're, they're different and if we've seen any sort of issues with that with any of these vaccines.

Dr. Ben Greenberg: [00:26:24] Yeah. So what led to this concern... Dr. Fauci gave an interview on, on television where he stated that individuals who had had Guillain–Barré in the past should avoid the COVID vaccine.

[00:26:36] And he talked about the, the concern from the '76, '77 swine flu era. He got called out on that comment both privately and publicly. There was actually an open letter written by a group of neuromuscular physicians who specialize in Guillain–Barré from the US and from overseas going through all the data and noting that to date, there have been no cases of Guillain–Barré associated with the COVID vaccine, but recognizing that the number of subjects in the clinical trials at that point in time were pretty small to detect something that would have an event rate of, you know, one in a million. And so he actually addressed that statement back in January and indicated that there was no excess risk for neurologic events from COVID-19 vaccines and, and clarified the statement, saying that he agreed they were not seeing cases of Guillain–Barré or something called CIDP, which is another neuromuscular disorder. And as we've mounted now, tens of millions of doses being given in a very short period of time, if we were going to see a spike in Guillain–Barré cases, we're expecting that we should be seeing it now, or even just before now, and so far it hasn't been reported. And so in general, we're not seeing a Guillain–Barré risk, a measurable risk, with the COVID vaccine.

GG deFiebre: [00:28:00] Thanks. And then in terms of just, you know, what Guillain–Barré is versus something like transverse myelitis in terms of where it affects the central nervous system. Do you mind just giving a brief overview of that? Because I know there's sometimes confusion about the relationship between them.

Dr. Ben Greenberg: [00:28:12] Yeah, there's confusion, not just for our patients, families, but sometimes for clinicians, we run into this all the time. And the way I explain it is by reminding people of the anatomy of how we move.

[00:28:23] So I'm just going to talk about the motor side. I'm going to, I'm going to leave off sensation for a moment, but it's similar. So, when I want to move my right thumb up and down, there are two wires that are important for that. So wire number one goes from my brain to my spinal cord. Wire number two goes from my spinal cord to the muscle.

[00:28:40] So, if we think about a stereo system and the stereo is connected to a speaker, imagine splicing two speaker wires together in the middle. So wire number one and wire number two. If I were to cut either wire, you would hear no music in the stereo. So the symptom of the damage is exactly the same, depending on, no matter which wire I cut.

[00:29:02] But they're two very different injuries. Same thing in the nervous system. So I could damage wire number one or wire number two, and I would have weakness. Guillain–Barré is a disease of wire number two, transverse myelitis is classically described as a disease of wire number one.

[00:29:19] Now, in the world we live in where we've re-introduced the notion of acute flaccid myelitis, we've learned that sometimes you can get damage to both wire number one and wire number two. So there are different patterns. But the classic Guillain–Barré is purely a wire number two outside of the spinal cord pathology.

GG deFiebre: [00:29:38] Great. Thank you. That's, that's really helpful. And then, is there anything else that you want to mention about these vaccines and in our community before we end?

Dr. Ben Greenberg: [00:29:46] So the one thing that I want to address with the release of the J&J vaccine that we're starting to get questions on is, people are reading in, in the literature and in the lay press about the published efficacy results and this perception of a difference in efficacy between the Moderna/Pfizer, which reported efficacy rates in the high nineties percent efficacy versus the J&J, which was reporting in the sixties or seventies. And people are saying, well, why wouldn't I take just the Pfizer or Moderna if it's more efficacious. And it's incredibly important to recognize the very different circumstances that these vaccines were studied under. The J&J vaccine was a very large international trial, including South Africa and some places where variants of the COVID virus were already underway that we weren't seeing in the US, whereas Pfizer and Moderna was very much a US trial.

[00:30:35] And so, what we may be seeing in the efficacy rate differences is the impact of those variant viruses. And in fact, the efficacy of the Pfizer/Moderna may be below the nineties, as we get more of these variant viruses in. And so what I'm telling folks is, whichever one you get offered, take it. There, there, I can't yet say for certain that you have absolutely have to take one versus the other.

[00:31:00] And again, we live in a world where supply is going to dictate a lot of what we do for this year. And I think it's better to get a vaccine in than to wait for one versus the other. Because in the end, the efficacy might be pretty close to each other. And it's important to recognize, again, we are all in this fight together.

[00:31:18] The more of us who get any vaccine in us whatsoever, we really start to change the shape of the curve. We really start to change the number of people who are a target for the virus, and we will all get back to life as normal a lot sooner. And so, if offered the vaccine and you and your physician decide there isn't a specific contraindication, take it. It will help us turn the corner.

GG deFiebre: [00:31:44] That's a great point. Thank you. And yeah. And the Johnson and Johnson vaccine, for example, too, as the efficacy is pretty comparable to the mRNA vaccines for death, for example, from COVID or very severe disease. So, you know, looking beyond just that, that 66% versus the 94, 95.

[00:32:01] So yeah, so thank you so much for taking the time again, I'm sure we'll do another one in the future as we learn more, but we really appreciate you taking the time to do this.

Dr. Ben Greenberg: [00:32:09] Looking forward to it. Thanks so much.

GG deFiebre: [00:32:11] Alright, thank you.