LEUKEMIA & LYMPHOMA SOCIETY®

THE BLOODLINE WITH LLS

A PODCAST FOR PATIENTS AND CAREGIVERS

Episode: 'Protecting Patients: COVID and Vaccine Updates'

Description:

Join us as we speak to Dr. Lee Greenberger, the Chief Scientific Officer of The Leukemia & Lymphoma Society, and Dr. Larry Saltzman, the Executive Research Director of the LLS Patient Registry. In this episode, Dr. Greenberger and Dr. Saltzman provide important updates on the continued COVID-19 pandemic, the LLS Antibody Research Study, patients' responses to the COVID vaccines, and additional methods of protection. Be sure to tune in to these important updates as LLS strives to protect patients.

Transcript:

Elissa: Welcome to *The Bloodline with LLS*. I'm Elissa.

Lizette: And I'm Lizette. Thank you so much for joining us on this episode.

Elissa: Today we will be speaking to Dr. Lee Greenberger and Dr. Larry Saltzman on updates with the LLS antibody study, COVID vaccines, and how blood cancer patients can continue to protect themselves during the COVID-19 global pandemic.

Dr. Greenberger is the Chief Scientific Officer of The Leukemia & Lymphoma Society. His responsibilities focus on planning and executing the strategy for all LLS research programs. Dr. Greenberger guides LLS's mission to translate innovative research that ultimately will pave the way for new therapies to treat blood cancers.

Dr. Larry Saltzman is the Executive Research Director for LLS and is also a chronic lymphocytic leukemia, or CLL survivor. Diagnosed with an aggressive form of CLL in 2010, he went through multiple treatments, including CAR T-cell therapy. Dr. Saltzman retired from active clinical practice as a board-certified family physician and was soon retained by LLS to lead the LLS Patient Registry. In this role, he serves as a primary investigator of the LLS Antibody Research Study which was started in February

2021 and has tracked the COVID-19 vaccine response in over 11,000 blood cancer patients throughout the United States. Together, Dr. Greenberger and Dr. Saltzman have worked hard to make sure that blood cancer patients have the accurate and up-to-date information on the varied responses to COVID-19, vaccines, and additional measures of protection.

Welcome Dr. Greenberger and Dr. Saltzman.

Lee Greenberger, MD: Thank you.

Dr. Larry Saltzman, MD: Pleasure to be here.

Elissa: So let's start with the LLS Patient Registry. Why was it started and how does the antibody study fit into the patient registry?

Dr. Saltzman: The patient registry was started as a project many years ago to track the outcomes of treatments of blood cancer patients. Outcomes, meaning positive treatments and side effects of treatments that may not be readily apparent to individual doctors who are treating individual patients.

We have been working on this for many years, and when COVID came into being and the vaccines were released in December of 2020, there was a question as to whether patients who either had a diagnosis of blood cancer or were being treated for a diagnosis of blood cancer would respond to the vaccine. So we enabled our registry to recruit patients who would be interested in allowing us to study their journey in receiving vaccines and whether they responded to them by looking at their antibody levels in response to the vaccine.

Dr. Greenberger: Let me give a little bit more color to what Larry said and why I was motivated to work with Larry. So when the pandemic started in March of 2020, we started getting data that the death rate from COVID-19 in the early phases of the pandemic for blood cancer patients was kind of in the range of 20 to 30% of the patients. Enormous numbers, way higher than the normal population.

And so our Patient Services group was asking patients how they're doing. We kind of knew that there was a problem. And then when the vaccines became online in December of 2020, we said, "Well this is the moment that we really need to step on the gas and do something proactive for our patients." And what Dr. Saltzman had created, the registry now was in the perfect position for us to do that, that we were able to get answers quickly and in large numbers; and that's across all blood cancer patients.

Elissa: That's great. I definitely noticed that there were very high rates; and I think that first data was coming out from China, right, when we were actually looking at patients and survivors. I remember looking at something, I'm an AML survivor myself, and seeing how high the mortality and morbidity rate was for even people years out of treatment.

Dr. Greenberger: Yeah, it was really high. Now we didn't actually get data from Wuhan. We got data from U.S. and that data has been summarized looking at a bunch of publications. And in that early phase of COVID, the death rate was enormously high. It's not nearly as high as it is now, but it's probably in the, somewhere in the 7 to 15% range still, which is much higher than the normal population, which runs about 1 to 2% of patients.

Lizette: Wow. And we had very little data on cancer patients during the COVID clinical trials for the vaccines. What were the side effects like for the blood cancer community?

Dr. Saltzman: During the trials of the vaccines, they were restricted so that any person with a diagnosis of cancer was excluded from the trials. And so it's not only blood cancer patients who were excluded, it was any person with cancer was excluded.

We initially asked our registry participants to let us know what their side effects were, and we accumulated rapidly data on over 3,500 people. And when we looked at their side effects as reported and compared those side effects to the vaccine trial side

effects, we found that they were essentially mirror images. If you look at the main side effect of the vaccine, it was a person having a sore arm or a red arm, and that was the main side effect of the trial.

We believed that they showed a safety profile that was exactly the same or very near the same as what the trial's shown; and we were confident, therefore, in suggesting that every blood cancer patient become vaccinated.

Elissa: Now we started with either one or two doses of a vaccine, depending on which one you had. What was the antibody response to the vaccines in patients?

Dr. Greenberger: So, we have followed the response to multiple vaccines at this point. We initially wanted to understand the response to the FDA emergency authorized vaccines, which are principally the mRNA vaccines. And that's primarily where the data lies even today. Most of the patients we've looked at have had the mRNA vaccines.

We wanted to get data on the second vaccine; and we particularly were asking what is the antibody response to two doses of the mRNA vaccine. Now understand that when the response to a vaccine gets evaluated, you could do it in multiple ways. You could ask, did patients make antibodies? Did patients activate their immune system other ways? And ultimately you really want to know, does it protect against infection, hospitalization, severe infections, and death?

So the antibody response is really a surrogate to figure out if there may be problems down the road, thinking that if you don't make antibodies, that probably means you're going to be less protected.

So, fortunately, there are a few companies. We selected one, that Dr. Saltzman set up. We told patients, "Okay, go get your vaccines. Tell us what the vaccines you got and when you got them, and here is a slip to go to the lab. We're going to sample your blood, and we'll take that blood, send it off to the laboratory, and evaluate for

how much antibody is being made." In particular, how much anti-spike antibody is being made because it's the spike protein on the virus that allows the virus to actually interact with the human cells. And, therefore, if the antibody level is high enough, you should be able to block that interaction.

What we found is after two doses of the vaccine, about 25% of the patients did not make detectable levels. Now let me qualify what I mean by "no detectable level" because this is important. If you look at healthy volunteers, with our analysis system it ranges from essentially a score of 1 to 2,500 units. We know that healthy volunteers generally make about 2,000 to 2,500 units after two vaccines. When I say there's no detectable level of antibody, that means below 1 essentially. So very little antibody being made. There could maybe something there, but it's very low, unusually low. And we think that because the antibody levels are low, those patients might be vulnerable to get infections.

Now furthermore, understand when we got the lab result, the way the clinical trial was designed, would the patients get the same result at that time too? So patients know right away what we know, and we were signaling to patients if you have no antibodies, you may be vulnerable to infections; and, therefore, you need to take protective measures.

Elissa: Now could you do a quick explanation for listeners who may not know what the mRNA vaccine is and how it might be a little different from our traditional vaccines?

Dr. Greenberger: Sure. So mRNA vaccines are brand new. The technology has been developed for 20 years; but this is the first time an mRNA vaccine has been done.

The way it works is there is genetic material, RNA, which is put into a fat vesicle, essentially; and that is injected into the patient. And the idea is that the RNA, which encodes the spike protein, goes into the normal cells and gets expressed. And when it

gets expressed, the immune system wakes up and said, "Hey, wait a minute. This is the spike protein. I've never seen this before. I'm going to make antibodies to it." And it really worked beautifully, much better than we thought.

The way other conventional vaccines work is the material that codes for the spike protein is put into essentially a harmless virus; and the virus or the protein, is just simply injected into patients. The immune system will recognize the protein, either made by the virus or just the protein itself and make antibodies. This is genetic material which encodes for that protein and allows the body to make antibodies to it.

Elissa: Thank you for the explanation.

Now you mentioned that 25% of blood cancer patients did not develop antibodies after the first two doses. Could you tell us what types of blood cancers or types of treatments that may be inhibiting that response and why?

Dr. Saltzman: So essentially when we look at blood cancers, there are different types of white blood cells or blood cells that are reflected in the diagnosis; and the type of white cells that are most effective are what are called B-lymphocytes or B-cells, which are the cells that actually produce the antibodies.

So if one has a B-cell leukemia or lymphoma, as an example, chronic lymphocytic leukemia or follicular lymphoma, as two examples, then the B-cells are somewhat inhibited. And the treatments for those leukemias are meant to knock out those cells because that's where the cancer is. So you want to get rid of those. And if you're getting rid of the cancer B-cells, for better or worse, most likely we're also getting rid of some of the normal B-cells.

So the furnace or the engine doesn't exist to actually produce antibodies. So, again, I gave two examples, CLL or follicular lymphoma. And then for people who are treated for these, if the treatment was, what's called an anti-CD20 treatment, grandaddy of

them all would be called rituximab, another drug is obinutuzumab, those patients are at risk of not producing antibodies because these drugs really knock out the B-cells.

There are other types of treatment for B-cell leukemias called BTK inhibitors, and again the way they work is that they make our systems less likely to produce antibodies of most any kind, that's COVID or anything else.

And so if we look at the pendulum of blood cancers, if those were the diagnosis, and the treatments were for those B-lymphocytes, those people are most at risk.

Lizette: Yeah, and we keep talking about antibodies, right? So can you tell us what the importance of antibodies are, and there's been a lot of talk of protection from vaccines versus natural infection. So how are antibodies different from vaccines and then from the natural infection of COVID?

Dr. Greenberger: Right, so the mRNA viruses strictly encode the spike protein. There is multiple proteins in the virus; and if you get a COVID infection, you will make antibodies to the spike protein, but you could make antibodies to anything else that the virus is actually producing. Turns out that the predominant antibody that's made when you get a COVID infection is an anti-spike antibody.

And so once you've got these antibodies, what they're going to do is the way the virus works is it's just like what it says. The spike protein is sitting at the surface of these viruses. Picture a ball covered with spikes, and these spikes will bind to normal human cells through something called the ACE2 receptor. And so when the spike protein binds to ACE2, it allows the virus to enter the cells. And, of course, once a virus has entered a cell, it's engineered to just make millions and millions of copies, lyse the cell which it was just growing in, and produce millions of more copies of the virus and so you get an infection.

So the name of the game is block that interaction. That's probably the most effective way to block a COVID infection is to get antibodies which will block the ability of the spike protein to bind to the ACE2 receptor.

Dr. Saltzman: I think in the end what we have to understand is that these spike antibodies to COVID really are essentially the same, whether they're produced by the body's response to the vaccine or to the infection. And since we're on the topic of blood cancer patients and their responses, if one person is a blood cancer patient and becomes infected with COVID, potentially one of the reasons that they are sicker than other people is because they don't have the engine or the lymphocytic cells to actually produce the antibodies. That's part of the problem.

So if the vaccine is not going to produce antibodies, it's also likely that a person who's been treated with these drugs, therapies that I just mentioned, they're also not going to be able to produce antibodies. So there's a duality here that we have to really keep in mind.

Lizette: Right, and a lot of our patients are really asking us, what's better for me to get the vaccine or if I get COVID, will my body produce those natural antibodies? So what can you tell our patients?

Dr. Saltzman: Well, look, you noted that I'm a CLL patient and so I'm very clear that I do not want to test my system and go to a chickenpox-like party and get infected with COVID. There is no way I want to do that.

So people should become vaccinated. Our mantra is get vaccinated, act unvaccinated; and I think it's not even thinkable to believe that getting a COVID natural infection in an immune-compromised person is anything that we want to even think about, frankly.

Elissa: And there's also the risk of long COVID, right?

Dr. Greenberger: Yeah, that's true. In fact, some of the variants that have come out actually have been the result of blood cancer patients getting infected. Having a

long-term infection, where a normal individual could resolve an infection in a matter of 10 or 14 days, some of the blood cancer patients, because they are not making antibodies against the COVID infection, will have the viral infection for weeks or months. And that is a perfect breeding ground for viruses to make mutations. That's what viruses do. They're natural evolution. Their ability to survive is based on the ability to change.

And that's where Wuhan variant, Delta variant, Omicron variant, that's what viruses do, they change. And so in a long-term infection, the danger is a variant could appear. We know this has been happened in blood cancer patients. And so it's not only bad for the patient, it's bad for the whole community to have anybody with a long-term infection.

Now long-term COVID could be, even after the infection is cleared, what we're beginning to see is there's long-term consequences of getting an infection. So COVID may be over, but the damage that COVID has caused may go on for many months.

Lizette: Now do we know exactly what antibody levels are needed for protection against COVID?

Dr. Saltzman: No.

Dr. Greenberger: The short answer to that is no. But no antibodies, and when I say 25% have no antibodies, I mean zero. I mean we can't detect it. So those patients are clearly in danger.

What about the patients who have an intermediate level? We really don't know how well protected they are. But the thinking is that there is a certain threshold amount that you really need to have to really have full protection. But the honest answer is we don't know.

There is more work being done, and this will take probably many months or perhaps years to really figure it out. How much antibody and who is at risk and whether it be

amongst normal individuals or blood cancer patients or other organ transplant patients. But no antibody is a definite warning sign. A small amount of antibody should still be of concern.

Dr. Saltzman: And I want to add to that because the federal government scientists, FDA, CDC are not recommending that doctors test antibody levels in patients to let us know whether we have responded or not. And the reason is because nobody knows the right number. If I was to test myself for anemia, there is a set number for my blood counts where a doctor would say I have anemia or I don't.

But with this, there's no set number; and so although LLS has been testing for these antibodies, and we have a sense of, as Lee says, the people who have zero versus the people who have quite a bit, there is no black and white number to let people know when they are safe or when they're not. And I think because of that, it's not recommended to test these on a broad, wide basis and use the numbers as a treatment plan, as we might in other illnesses or diseases like diabetes or anemia or things like that.

Elissa: That seems really good because you could see a pretty robust response and think that I can go out in the world. I can do whatever I want, and I'm perfectly safe because I have antibodies versus, of course, you want to know if you have zero. Because then you definitely want to make sure that you stay protected, and you follow protective measures.

Now we talked about the first two doses. Then during the summer of 2021, a third primary dose was approved for moderately to severely immunocompromised patients, which largely includes the blood cancer community. And, of course, then that was later expanded to the general population. What response did you see from that dose in the study? Did anyone who didn't develop a robust response to the first doses see a response after the third?

Dr. Greenberger: Yeah, we definitely saw responses. So people who were, what we call seronegative, or mean no antibody levels after the second, when given the third dose, about 40% of those patients will start making anti-spike antibodies after the third dose. The amount of antibodies can be quite variable, but they did, what we call seroconvert, start making some antibodies. That does mean that there is still a large portion of patients that still continued to make no antibody and still could be at risk.

I should add another comment to that, just to give the audience some sort of color about how quickly LLS was able to respond. Our program, we started collecting blood, middle of March. By June, we already had our first publication out. Within four months after, we got out data on over 1,000 patients who had blood cancer. So we really were able to use the registry, mobilize it, and get data out really quickly.

We did exactly the same thing with the third dose. By, the third dose started kind of about August.

I mean some patients got it ahead of time. But by September, we had data out on the first 49 patients. And by December, we reported on 750 patients about response to the third dose. So LLS took advantage of the registry to create a very large database and get the data out just about as quickly as anybody else on the planet could have done.

Elissa: That's amazing.

Now many of our patients are now approved for a fourth dose, which is considered a booster, though, versus an additional primary dose. They are now eligible three months after the third dose. Have we seen any increase in antibodies from this dose? And also, how have the antibodies been holding up after the third?

Dr. Saltzman: Well, quite honestly, these recommendations for the booster doses have changed over the last two months very rapidly. At first it was you can have a booster shot, AKA, the fourth dose six months after your third dose; and then it was

five months after your third dose, and then just recently it was three months after your third dose. Because of that, we have not really collected enough data from my perspective, say one way or another how this is going. I think that we have to accumulate the data. And because, frankly, the recommendations change so quickly, patients were getting vaccines before we knew to ask them to go get their blood testing before and after the booster. I think I have to say to hold tight on it.

Dr. Greenberger: I will say we don't have fourth data responses yet. We are anticipating that there will be some increase in anti-spike levels. There are some studies in solid organ transplant patients who are also immunosuppressed showing that there is a response, an increase in antibody levels after the fourth shot.

However, data coming out of Israel suggests, at least in normal patients, that the fourth shot is not going to give you the same kind of boost that you got from the third shot. I think the immune system just says, "Hey, I've seen that before." That's kind of like you turned me on for the max by the third or fourth dose. And so, yeah, you may get some benefit, but you're probably not going to get the same kind of increase in anti-spike or increase in protection that you got from the second and third dose.

Remember that this whole COVID vaccination scheme evolved very quickly. Usually, the development of vaccine happens much more slowly. And so you have the opportunity to really say, "Well, how long should you wait? Should you wait six months or a year before you get the next shot?" We couldn't do that.

And so we were forced to collapse the time frame down without even having all the full data to know how much protection third or fourth or fifth shot, for that matter, might give you.

Elissa: Right. I think that data from Israel had shown that it was really just bringing you back up to a level closer to what you had at your third dose, right, since it tends to decrease over time.

I know for a lot of patients that had their third dose in the summer, I had mine in the end of August. Coming into Omicron, it was very nerve-wracking not knowing if they were really staying up to a decent level. And then having all of those months in between, so I know there was a lot of anxiety there amongst patients like myself.

Dr. Greenberger: Yeah, let me make a couple of comments about Omicron. So this, you know, very typical. The virus sort of turned the tables on us; and there were reports that the vaccinations were not going to be as protective against Omicron. That's true. They do not have the same efficacy. They have some, and it's reduced.

One important thing that the third vaccine has proven, and this has been multiple publications by high quality labs across the world, is in normal healthy individuals, where the second shot doesn't give you antibodies to Omicron, the third vaccine will. And so it's very important that people get the third vaccine, certainly if you're a normal individual and anybody who's capable of making antibodies should get the third vaccine.

Now what should somebody do if they don't have any antibodies after the second vaccine? They should still get the third vaccine. It's safe. It may give you benefit, not only in terms of making antibodies but activating the immune system in other ways and protecting against the Omicron variant.

Lizette: And I think that lends itself to our next question. Really, I wanted to see for those patients who didn't develop any antibody response after even the fourth booster, how can they get protection? I know there's been a lot of talk lately about prophylaxis or really a preexposure treatment called Evusheld, which is an injection to prevent COVID. Can you speak to monoclonal antibody treatments and other treatments that might help our high-risk patients?

Dr. Saltzman: So let me start with a disclaimer if I can, and I'll let Lee get into the science. But the disclaimer is that Evusheld is referred to as a preventative monoclonal antibody. The truth is that we cannot prevent anybody from inhaling the COVID virus,

and we can't really prevent that virus from taking a foothold in somebody's respiratory passages, be it their nose, their throat, or their lungs.

The preventative aspect of this is to keep a person out of the hospital and to keep a person out of a serious, significant infection so that it doesn't hurt them. And I think the idea that we can prevent COVID is really using a phrase that I fear a little bit, because we can't prevent it. We can lessen the effects. We cannot prevent it.

So having said that, yes, there is an injection of these quote "monoclonal antibodies." And the way I look at it from a very simple perspective is that the vaccine is asking our internal furnace, if you will, to create heat. We're challenging our body to respond to a foreign substance and asking our white blood cells to create an antibody towards that foreign substance. So when we see it again, our body will recognize it and will mount the defenses needed to take care of it.

These monoclonal antibodies and Evusheld, since we're discussing that in particular, are really a passive immune protection system, meaning that we're not asking our own body to produce the antibodies. We're just injecting them. And it's an injection into a muscle. It needs to be a bigger muscle, so it's an injection into our rear ends. It's not into our arms as the vaccine shot would be.

And these passive antibodies start floating around virtually immediately. So if we were to be exposed, our bodies' defenses would react as if we responded to the vaccine. That's the idea here. It's not a perfect world. These monoclonal antibodies were developed before we even know Omicron existed. They were developed before we even knew the Delta variant existed. They were developed initially for the first SARS-CoV-2 viruses.

And so they do show protection against these variants, but really, not as 100% good as the viruses they were created to defend against. And so, therefore, very recently, within the last week, the FDA has suggested that patients who receive Evusheld actually need to get a double dose of what they had first suggested. So if a person is

going for their first Evusheld monoclonal injection, the dose they receive is double what those who had it earlier received. And those who had it earlier, who now have received what's considered a half a dose, need to arrange to go back and get the other half.

And so on a very high level, I just want to let people know to still be careful because it's not 100% protection. Just like vaccines are not 100% protection. I mean they give us a sense of security, yes, but they don't protect us absolutely.

Lizette: Yeah, thank you for that discussion. I think that's very important, all the points that you make in regard to not really being able to prevent COVID the way that we probably think that we could.

And the science is evolving so quickly. I didn't know about that recent addition for the Evusheld.

And as Dr. Greenberger said, LLS really has been on the forefront of providing information, really on a daily basis as everything keeps changing. And I want to just thank you for keeping our patients really informed. And I think that's really keeping our patients safer. The more information that they're receiving, the more informed they are, the more that they and we as a whole can protect ourselves.

Elissa: Yes, it's so great that you both have been keeping everybody up to date with information with this podcast and then our coronavirus website, which we'll list at the end of the episode and on the show notes. And then also "Ask the Expert" with Dr. Larry in our [LLS] Community; and we'll also have that in the show notes as well, so you can check that out and he gives updates on what's going on and so it's really great to be able to keep the patients updated because now this is two years long into this pandemic; and it's been really both scary and at times disheartening for the blood cancer community.

At the beginning of the pandemic, patients were the experts at keeping safe, right? Most of us had already had significant experience with protection against infection like mask wearing, social distancing, hand sanitizing. As an AML survivor, I even bought a shirt that said, "Social Distancing – Before It Was Cool." In a way, we felt that sense of bonding with others due to everyone else at the time also taking precautions.

But now as our country is coming down from yet another wave, another variant, mask mandates are being lifted everywhere; and patients, whether they developed a response from the vaccine or not, are now feeling uncertain and anxious again.

I've now had four doses and am several years out of chemotherapy, but my anxiety is building as we get closer to removing all mitigation strategies. What would each of you say to patients and caregivers to give them hope to move forward in this pandemic while still staying safe?

Dr. Greenberger: So clearly blood cancer patients need to be cautious, even with the masks coming off. Certainly, if you know you're not making antibodies, you really need to be very careful. It would be still a good idea to wear a mask, a good idea to do the rapid test. Make sure everybody is vaccinated around you. I think you still have to keep up your guard.

The science is moving very rapidly. We have monoclonal antibodies. We have antivirals, and if President comes through, those antiviral pills will be available and for free for people in the United States.

So the science is improving. We're working on new vaccines that will protect against new variants. So I think there's hope that we'll be able to mitigate this, and hopefully the virus situation will die down all by itself, just as it did in 1917 for the last pandemic. These things have a natural course, and things will hopefully die down.

Counterbalance that, I will say that the Omicron variant BA.2, which is high in some countries, is also beginning to make an appearance in the United States. I heard a

couple weeks ago it was at 3% of the population. Now it's about 8% of the population, and it's doubling. And it continues to increase.

Some of the therapies that we have developed are less effective against BA.2, so, I don't think we're out of the woods yet; and time will tell. But certainly, people have to be on guard if you have a blood cancer. Certainly, if you know that you didn't make antibodies and still be careful.

Dr. Saltzman: Well, I think that things are getting better. Yes, many of us blood cancer patients are still on edge. And the way I'm looking at it now is that we who are treated with chemotherapies or targeted therapies, or bone marrow transplants know that during treatment, prior to COVID, we were all vulnerable to any infections, whether they be a cold or a flu or a food-borne infection. We were susceptible, and most of us under treatment understood that; and I think most everybody took precautions to, not expose themselves to somebody who was, obviously, ill.

And I think the problem then and the problem now is you don't always know who is obviously ill. I mean with the way viruses work in a human body, somebody may be infectious but not show symptoms for two or three days until after those infections have taken hold.

So not to be too cavalier about it, but I think we as blood cancer patients have to go back to all living at a time when, if we were treated, we need to live as if we're under treatment. And what that would mean for a person individually is really up for that person to decide their level of comfort. But I think that's where we're headed, and so for me that means I continue to keep my bottle of Purell® handy at my side. I've become an elbow bumper, not a hand shaker, and I will continue to wear masks in tight indoor public settings or airplanes should I travel, which I haven't, but I would. And I think we just have to be cognizant of the fact that we are special, and we're going to take care of ourselves. And that's what we're going to need to do.

Elissa: Good advice. Well, thank you so much, Dr. Greenberger, Dr. Saltzman for joining us today. We really appreciate you again sharing all of these updates. As we talked about before, the science has changed so rapidly in the past two years, in the past year, in the past few months, and it's really great to make sure that we're keeping our patients updated, especially when it comes to the third and fourth doses and other monoclonal antibody treatments, things like that. And we really, at the end of the day, want to make sure that patients are staying safe.

And so thank you both so much for being here. Again, for our listeners, stayed tuned to the end of the episode. We'll have links available for you so you can make sure you will stay updated with all things COVID and vaccines.

Dr. Greenberger: Thank you so much.

Elissa: And thank you to everyone listening today. *The Bloodline with LLS* is one part of the mission of The Leukemia & Lymphoma Society to improve the quality of lives of patients and their families.

To help us continue to provide the engaging content for all people affected by cancer, we would like to ask you to complete a brief survey that can be found in the show notes or at TheBloodline.org. This is your opportunity to provide feedback and suggested topics that will help so many people.

We would also like to know about you and how we can serve you better. The survey is completely anonymous, and no identifying information will be taken.

We hope this podcast helped you today. Stay tuned for more information on the resources that LLS has for you or your loved ones who have been affected by cancer.

Have you or a loved one been affected by a blood cancer? LLS has many resources available to you – financial support, peer-to-peer connection, nutritional support, and more. We encourage patients and caregivers to contact our Information Specialists at

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1-800-955-4572 or go to LLS.org/PatientSupport. You can find the latest updates on COVID-19 and vaccines at LLS.org/Coronavirus.

The *Ask the Expert* segment mentioned in the episode can be found at LLS.org/Community. All of these links will be found in the show notes or at TheBloodline.org.

Thank you again for listening. Be sure to subscribe to *The Bloodline* so you don't miss an episode. We look forward to having you join us next time.