

THE BLOODLINE WITH LLS

A PODCAST FOR PATIENTS AND CAREGIVERS

Episode: 'Providing Hope for AML Patients'

Description:

Join us as we speak to Dr. Courtney DiNardo from MD Anderson Cancer Center in Houston, TX. about the recent advancements in AML treatment. Dr. DiNardo is an academic clinical researcher who has participated in clinical trials resulting in three new AML therapies since 2017. In this episode, we dive into the new treatments that are showing great promise, as well as discuss how AML can be hereditary. With recent results of the Beat AML Master Clinical Trial, the increasing potential of immunotherapy and other new treatments, this episode is sure to give hope for current and future AML patients and caregivers.

Transcript:

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

Edith: I'm Edith.

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

Elissa: Today we will be speaking to Dr. Courtney DiNardo. Dr. DiNardo is an academic clinical researcher at MD Anderson Cancer Center in Houston, Texas. Her research interests focus on individualized therapy and precision oncology for myeloid malignancies and the clinical evaluation of targeted therapeutics for acute myeloid leukemia or AML.

Dr. DiNardo has served an integral role in several highly influential trials which have led to the FDA approval of three therapies in AML since 2017. In addition, Dr. DiNardo's clinical and research focus led to the development of the MD Anderson Hereditary Hematologic Malignancy Clinic which now provides clinical and research-based evaluations of underlying cancer predispositions and hereditary cancer syndromes in leukemia patients. Welcome, Dr. DiNardo.

Dr. DiNardo: Thank you so much. I'm so happy to be here.

Elissa: So now before we get into today's topic on acute myeloid leukemia, we want to know a little bit about our speaker; and we definitely like for our listeners to get to know them as well. So, what brought you to the field of medicine?

Courtney DiNardo, MD: You know, there are just so many things that happen, in your life that you probably don't appreciate at the time but that really do help shape kind of where, where your life leads. And so, both in middle school and in high school there were classmates of mine that had acute leukemia, that were battling acute leukemia during the school year. And that definitely left an impression on me during that kind of more formative years. And then when I was in college, my grandmother who I was incredibly close with developed a blood cancer and I loved science from the beginning; and so I was already thinking about, medical school and wanting to be involved as a physician in some way I remember feeling so incredibly kind of helpless and just frustrated that the standard of care wasn't helping her and it really helped solidify for me that moving into blood cancers and trying to improve upon the standard of care was what I wanted to do with my life.

Elissa: Is that why you chose to focus on AML in particular?

Dr. DiNardo: Yes, I think so.

Elissa: Very nice. So, could you tell us a little bit about what AML is?

Dr. DiNardo: So, it stands for acute myeloid leukemia. It is a blood cancer; and so, it's a cancer that is essentially of your immune system where your immune system, your neutrophils in particular are some of your best infection fighting cells. And so instead of developing appropriately, they get stuck in this precursor phase. We call them the blast cells, B-L-A-S-T. And, when they get stuck in that place as blasts, they proliferate and fail to turn into the immune system cells they're supposed to. And then that kind of fills up the bone marrow and prevents the normal things your bone

marrow's supposed to make, like your immune system but also, your hemoglobin, your red blood cells, as well as your platelets which are your clotting factors.

So, it's different in many ways as solid tumors that I think people are more accustomed to kind of understanding. But it's a cancer-specifically of your bone marrow and your immune system.

Elissa: Now I'm an AML survivor myself and have the inv (16) mutation. I'd love for you to tell us about gene mutations in AML. What do the different ones mean and how do they relate to the prognosis?

Dr. DiNardo: So, it has been since the '70s or '80s that we've known about some of the genetic changes in AML. Like, you said, you have an inv (16). There are 8 translocations of chromosome 8 and 21. And these are what we call the favorable risk leukemias. These ones are ones that are incredibly sensitive and responsive to kind of some of the more standard intensive chemotherapy agents that we've had. And patients with these, what we call core binding factor or favorable risk genomics frequently don't need a transplant for their curative treatment program.

And then there are many other genomic changes and more that we've learned about just in the past ten years or so that we've been doing molecular sequencing, since this era of next-generation sequencing has come upon us in addition to kind of the structural chromosome changes like inv (16)s and 8;21s. We now know about specific point mutations in genes that are also abnormal and associated with AML. So, some of the more common ones are FLT3, which is important because we now have FLT3 inhibitors to add to our regimens when people have FLT3 mutations. There's another one called NPM1 mutations which are one of the more common in AML and, and tend to be more associated with a good prognosis also.

And then there are other mutations that don't necessarily have a specific what we call prognostic importance, meaning that, whether you do or do not have this mutation isn't as important in terms of how well you do. But it's important because we now

have targeted therapies for the IDH1 and the IDH2 mutations, for example. So, we now screen for these mutations and we test for them, not because in and of itself that is impacting the outcome of our patient but because we have specific targeted therapies to offer these patients as well.

Elissa: You focus a lot of your research on IDH1 and IDH2, so how did you get to that specific focus?

Dr. DiNardo: It is, a story of just being in the right place at the right time, I suppose. So, when I was in my fellowship, I was at the University of Pennsylvania, and that was back in 2009, which is right when, the era of sequencing was upon us. And we realized that IDH mutations even were recurrent in AML, that was first identified in 2009; and that's right when I was doing my fellowship.

And my thesis project for the master's program I was participating in during my fellowship was looking at the specific metabolite that IDH-mutant cells will create. And so it was just because I was kind of involved in kind of the nitty gritty development of kind of the story of IDH inhibitors and the fact that they make this metabolite called 2HG got me very involved so that, just a couple years later, when I was now faculty at MD Anderson, and they had IDH inhibitors that were developed and they were looking for people who were both clinicians but who also understood the world of IDH mutations. They looked to me since I had been involved from the beginning in that story.

Lizzette: And I know that you just, we're talking about mutations and here at LLS we do have our Beat AML Master Trial which does speak to the new innovative ways we can treat AML patients at this juncture. Especially since there wasn't much movement with treatment protocols in the past 30 years?

Dr. DiNardo: Yup, no, that's exactly right. And that's why I think, there are so many leukemia researchers and scientists that are kind of so excited to be involved in the field right now because things are just changing so quickly after, as you said, a 30-year

period of what was really kind of a binary treatment decision. We would see a patient with leukemia, and we would say, "Are they appropriate for intensive chemotherapy?" And if they were, then we would give them that standard, what we call 7 + 3-based chemotherapy which works for a subset of people.

You know, there's someone on the call right now that probably benefitted from that.

Elissa: Yes

Dr. DiNardo: But there are many people that, that's not the best treatment for. So, we had the option of that standard 7 + 3 or if we had people who, really weren't what we call fit. Really, not appropriate for intensive chemotherapy because they're older or they have underlying, organ dysfunction, underlying heart disease, you know, things that would make it just not a great idea to tolerate the intensity of intensive therapy that the risks of that therapy actually outweigh the benefit.

Then we had lower intensity strategies like azacitidine or decitabine to offer, which isn't a bad option. But just the responses with that are under 30%. The average survival for that is under a year. So those were two options which are certainly better than no options at all but not great for every patient, right?

Lizette: Right.

Dr. DiNardo: And so that's what's been so amazing is that in the past like three years, we've had 8 to 10 new approvals in AML. So all of a sudden we've gone from 2 options to a dozen plus options when you think about, combinations of the different approved agents which are dramatically changing the outcomes for many leukemia patients that wouldn't have had a good option with either of those two prior treatments.

Elissa: That's just amazing.

Dr. DiNardo: Yeah.

Lizette: Yeah, definitely. Which treatments are you the most excited about right now?

Dr. DiNardo: Well we talked a little bit about the IDH inhibitors. I've been involved in that story from the beginning. So those are very, very near and dear to my heart for sure.

I think one of the most kind of transformative new approvals is venetoclax, the combinations of venetoclax with azacitidine in particular has really kind of rapidly become the new standard of care for the average older AML patient who is diagnosed and who otherwise would have probably gotten azacitidine or decitabine alone.

And there was a large Phase III confirmatory trial that just read out a couple months ago that confirmed, you know, not only are remissions better but the remissions last longer. People are becoming transfusion independent. Survival is improved. And so, this really is a very important new combination for many of our older AML patients.

Elissa: AML survival rate still remains pretty low. After so many decades of kind of a one-size-fits-all treatment, followed by so many exciting advancements and FDA approvals since 2017, how do you see the survival rate improving in the next few years?

Dr. DiNardo: I think it will. Unfortunately, or fortunately, we have to weigh the years to see that improvement in the five-year or the ten-year overall survival. So even, we have all these approvals, I think you can't just look at the current SEER (The Surveillance, Epidemiology, and End Results) database and say like, "We still only have a five-year overall survival of 28% because that is lagging behind what our new therapies are going to do."

So, my hope certainly is that we're improving upon those numbers; and I think we are. Although I think we're still not curing the majority of patients yet. All of these approvals are super important; but I think the story isn't, done yet. And some of the

things that myself and many other translational scientists are involved in are trying to figure out kind of even within these new approvals, which patient is the best for which agent; and also, it is very rare for cancers around the spectrum, right, that just one drug is going to fix everything.

So what we need to do now is figure out whether to do combinations or sequence agents in a way similar to, think about multiple myeloma, how they've gone from, one line of therapy to like four to five lines of therapy. And each one has various different combinations, and they have kind of moved that needle from an average, survival of just a couple years to now, more than a decade. And that's I think, where leukemia is going.

Elissa: That's great news.

Lizette: Sure. And the more personalized medicine, the individualized medicine. So, a lot of these newer medications or newer treatments are more for your specific mutation. So, if you have a specific mutation and there is a treatment for it, isn't the odds that treatment will work for the person, isn't it much better as well as for possible long-term and late effects? Because aren't people getting like a less toxic regimen than the usual 7+3?

Dr. DiNardo: Yeah, I mean think about a perfect example for that is gilteritinib which is approved for patients with FLT3-mutated disease in the relapse setting. And that's a single therapy. It's a pill that you take every day. So, you're an outpatient.

So, even if that Phase III study had been done where you were looking at what we would call a noninferiority design, meaning that, if you're giving standard chemotherapy or standard azacytidine. If gilteritinib was just as good as that, that for me would be a win because you have your patient now home taking a pill instead of being in the hospital or chained to an infusion bed.

But not only was it not inferior, it actually was superior. So now we know, that if you have a FLT3 mutation, in the relapse setting, gilteritinib is better than, intensive chemotherapy with less side effects and better quality of life. So, absolutely, that is kind of the hope and the realization of this new personalized medicine.

Lizette: Definitely. And I know that Elissa will of course comment to this, but the long-term and late effects, the possibility for getting such an intense treatment for an acute leukemia, an aggressive leukemia. So basically, that's good news hopefully for the long-term and late effects of treatment.

Elissa: Yeah, particularly for the younger generation, for the children, for young adults that still have decades left to live. And, these side effects that come along, whether it's just chronic fatigue or digestive issues or GVHD for getting that transplant. Do you see that definitely or hopefully improving as we continue this targeted treatment?

Dr. DiNardo: I do. I think, also, something that we haven't talked about yet but that is kind of tangentially along these lines is the discussion of what we call MRD. So that's minimal residual disease; and that's where we have given whatever treatment that we're giving and then you check the bone marrow and the bone marrow is not only showing you a remission morphologically, meaning that we are looking and we see a remission; but we can get really deep levels now where our tests are able to detect whether there is still leukemia below the limits of detection based on the eyeball test of our hematopathologist.

And so, I think the future is also going to be using these approved therapies, using our standard therapies, and then trying to figure out, is four cycles the right amount? Is six cycles the right amount? Monitoring, making sure your patient becomes MRD-negative with therapy, which is linked to the duration of that first response and hopefully that forever cure from their leukemia.

As well as now that we have kind of maintenance strategies and we have the decision of transplant in our younger patient. So trying to do a better job based on these new technologies in this MRD assessment that we have can help us identify who is going to benefit from a transplant, and who doesn't need the toxicity of a transplant. And the same thing with the standard therapy, trying to, again just, even using standard therapies, personalize them to that person's response because some people are going to respond faster than others, for instance.

Elissa: So, when you're looking under that detectable level, so you're also looking to see, you know, what that chance of relapse is. So, if there's still those blasts hanging around there that may be under those detectable levels?

Dr. DiNardo: Yeah, so think about inv(16), for example so when we have a patient at MD Anderson when an inv(16), we're giving them a, standard intensive chemotherapy regimen with the addition of a drug called gemtuzumab, one of those approvals now which, works particularly well in people with inv(16)s and 8;21s. And so, we follow those levels of that, that specific inv (16) or 8;21, so we know their leukemia's in a remission. But then we're checking what's called a PCR for that inv(16) or a PCR for that 8;21. And so you're looking, not for a blast percentage of under 5%; but you're looking for a PCR that's negative to point, 0.001%. Right, like you are getting to incredibly low levels. And so, when that happens, you can feel much more confident that that person is not going to relapse.

Elissa: Oh, that's great.

Lizette: And do you think that these newer treatments are going to take the place of transplant in the future?

Dr. DiNardo: Well that I don't know. So, I think transplant is always, or at least for the foreseeable future is going to play a very important role. I think, what a stem cell transplant does is really harness a donor's immune system, right, to go in; and, and if there is any leukemia below the limits of our detection when you're going into a

transplant in a remission taking care of that. And so, it's providing that immune surveillance that for whatever reason, the individual dealing with leukemia, their immune system isn't able to effectively get rid of those remaining leukemia cells.

And so, there's also the hope of immune therapy in AML moving forward. Is there going to be a way to kind of augment the immune system through various different strategies under various different trials now that can do that role without, needing to undergo a transplant? We're certainly not there yet, but I think, you know, hopefully, in my lifetime we will be.

Elissa: Do you see with the immunotherapy having that potentially as a first-line treatment for AML?

Dr. DiNardo: There's still a lot more work to be done in that regard. So, it is definitely true that, the more lines of therapy someone has had, the more exhausted their immune system is. And so there are these different ways that we can detect, the status of a person's immune system; and there's this kind of phenotype, this kind of characteristic that's called immune exhaustion that happens kind of along the way. So, absolutely, I think immune strategies are going to be more effective when you're using them at the beginning or earlier on in the disease course when that person's immune system hasn't been so beat up with all the treatments.

Elissa: So, doing all these checks for checking of below this detectable level and checking the immune system, how are you doing that? Are you doing that just through blood tests or is it all through bone marrow biopsies?

Dr. DiNardo: It's primarily done through bone marrow biopsies right now, which is not, the easiest thing on our patients, I know. But right now, it is still primarily bone marrow assessments.

I think you raised a good point, and we are trying to figure out how accurate some of the peripheral blood testing can be to look for some of these low levels of disease.

And certainly, that is also an area where kind of the advances in technology really are benefiting patients because, again, I'm using the inversion 16 as an example. That PCR test is validated, and we can do on peripheral blood. And so, rather than having a patient in a remission, a year later be getting bone marrows every, you know, every three months, you can do those peripheral blood tests for that, PCR level and feel confident, in that level is staying low. So, yes-

Edith: Oh, that's great.

Dr. DiNardo: -that is something that is more and more becoming a reality.

Lizette: And I don't want to take you totally in a different direction, but I do want to hear about the Hereditary Hematologic Malignancy Clinic, especially since I don't hear a lot about hereditary and AML together, so I'm really interested in hearing more about that.

Dr. DiNardo: Yeah, you're right, it is something that even three to five years ago we weren't talking about in our field really at all. And, as physicians, as providers, as patients and caregivers, we know a lot about like breast and ovarian cancer syndrome. The BRCA genes are something that has kind of made it into the lay press, and so people know about some of the what we call the hereditary cancer syndromes but primarily due to the risk of like breast and ovarian cancer, some of the colon cancer genes in families, but it just really hasn't, hasn't been widely kind of understood that there are some families that have hereditary blood cancers. And there are.

I came here to MD Anderson and we are definitely a referral center for unusual cases. So I think, you know, MD Anderson tends to be enriched in some of those things, which is how it became kind of the more obvious thing for me that like, hey, we're definitely seeing some families here where there are three generations that have had MDS or AML. There's, you know, there's something here. And so, it ends up, you know, being a minority, but maybe like 5 to up to 10% sometimes of patients with blood cancers; MDS in particular but also AML can have a hereditary component. And

there's a whole list now of about a dozen genes that you can actually have been inherited, a gene copy that doesn't work that well that puts you at an increased risk of a blood cancer in your lifetime. So, it is something that we are building up, and I think attention is kind of more and more being raised that this is a real thing.

Elissa: With looking at that, do we see potentially in the future of being able to do the testing like we do with the BRCA and having that test to see if there might be a chance in the future that you could get a blood cancer?

Dr. DiNardo: Yes. So that, that exists now. The issue is that we don't have preventative options in the same way that people with solid cancers do, right. So, if you have a predisposition to colon cancer, you can have frequent colonoscopies and you can have actually a colectomy to remove that part of your colon to decrease that risk. If you have breast and ovarian cancer gene, you can actually undergo prophylactic mastectomies and oophorectomies to decrease the risk. We're not really to the point, nor do I think it's appropriate, to be talking about like preventative transplants for people that have an inherited predisposition. So, it's just one of those things where right now it's very much a personal decision.

Some people feel very empowered with knowledge, right, and so if they are in a family like that, knowing whether they do or do not have a, a predisposition to a blood cancer is really informative and important to them, and I offer them surveillance in my clinic once or twice a year, you know, following counts, doing bone marrows to see if we can identify any early changes that would suggest something was, was brewing.

Other people say, "You know what, that information is not something- You know, if there's nothing you can do to prevent it, I really don't want to know that information." And that's not the wrong decision either for sure. So, it's just kind of that discussion and trying to decide what's right for any particular person.

The one position I do make, 'cause I think it really makes a difference, is if I am treating a patient who has an inherited predisposition, if I'm using a family member as

their donor for a transplant, you really need to make sure that that family member has been tested to make sure they don't have that gene 'cause otherwise you're just transplanting back in that same predisposition risk. So that's the one instance where it really is quite important to know.

Elissa: So if somebody does, potentially find a gene that can be inherited and lead to blood cancer, are they then recommended at least to, you know, maybe go in for regular blood tests, whether it's once a year or something?

Dr. DiNardo: Yup, there are now kind of expert opinion guidelines. There's many clinics around the country that are now offering evaluation and following patients with inherited blood cancers. University of Chicago Lucy Godley has been there and there are many others, but she's kind of been actually a mentor for me in developing my clinic 'cause she's really was the one who brought this story to light at least for me.

But, yes, we recommend blood work about twice a year, at least an annual visit. There's currently no specific recommendation to have routine bone marrow evaluations, but several of us have different kind of research programs in place where people who are willing to do that, we're learning kind of what is it in this person that's hopefully preventing and protecting them from going on to develop a blood cancer; or if they do go on to develop, what are those steps that we can identify it and try to arrest it in the future?

Elissa: Do you see with twice-yearly blood tests that you do have a greater possibility of catching it early? For instance, I was diagnosed at 20% blast, which is very early for being diagnosed with AML. And so, do you see with these more regular blood tests to potentially catch it early even though AML is so fast-growing?

Dr. DiNardo: It's a great question. So typically, the type of blood cancers that develop in people with hereditary predispositions are not the kind of very proliferative, dramatic what we call *de novo* AML. So a lot of times they are associated with MDS or, you know, a blast percentage that is slowly increasing counts that are slowly

dropping and so it does end up being kind of a not quite as dramatic as an event as what you are describing.

Typically, patients when they do develop a blood cancer, there are absolutely those cases where it hits you like a ton of bricks and it just happens. A lot of times though it'll be, an infection, an upper respiratory infection that you have a course or two of antibiotics and it just doesn't really get better. And then it's another infection and you're like, "Hey, this is weird. I should go see my primary care doctor." Half the time they'll do a blood test and they'll identify it and sometimes they don't and then it's another month or two later that they go to the Urgent Care because now they have this funny rash and then that's how they end up being diagnosed.

So, there are definitely patients who present very quickly and then there are other people that it's definitely I think a surprisingly slower process. Not all AMLs are medical emergencies as we learned about in medical school.

Elissa: Is there anything that patients can look for or primary care physicians as we're looking to get those diagnosed earlier?

Dr. DiNardo: So, I am very biased, right, as a blood cancer doctor, but I am always shocked at the number of times people see primary care physicians and don't ever have bloodwork done. And so, I am looking at it from a very skewed viewpoint, but if I have a patient who, you know, has an infection that's just taking a really long time to get better or recurrent bronchitis or for me I think bloodwork, a CBC looking at, you know, the immune system, the white count, the platelets is helpful, and that would be kind of what I would encourage the primary care physicians to consider.

Edith: Doctor, so there are some patients that may feel a bit hesitant when talking to a doctor thinking that they're too busy, my question's a little bit silly. So how important is it for patients to have an open communication with their doctor?

Dr. DiNardo: I think it's really important. I think that patient/physician relationship is just one that has to be kind of mutual understanding and respect. And there are definitely cases of patients that have come to me as a second or third opinion that have decided to transition care and be treated here at MD Anderson, not necessarily because there's a specific clinical trial we have to offer, but just because they felt like they were able to have, you know, an open communication with me and my team. I mean my clinic team is fantastic. I have a nurse and a nurse practitioner and a scheduler and we all kind of are incorporated together. And so, I think it's really important to make sure that you feel comfortable with your team that's caring for you.

Edith: Thank you. And what are common questions you hear from patients and their families when told they have AML?

Dr. DiNardo: One of the most common questions I get is, you know, "What stage is it and did I catch it early?" Which is hard because it's different than solid tumors, right. It's not like a breast cancer that's in the breast and then it's in the lymph nodes and then it's, you know, metastatic because blood cancers are circulating kind of everywhere to begin with. So, we just, you can't really stage it in the same way. You either really kind of have leukemia or, or you don't. And so, I get that question a lot, because their family members always want to know like, "Did, you know, did we catch it early?" And, it's, you know, it's, "Yes, because you're here in my clinic, you know, we caught it early and, and we'll treat you" So that's kind of one I hear a lot.

You know, people, I think, imagine leukemia therapy to be horrible. To just be this like absolutely almost untenable situation where they're barely going to survive the, the leukemia therapy. And I think even with our intensive therapies, that's not the case anymore. It's not a walk in the park. People don't sign up for fun for this for sure, but we have really good supportive care like anti-nausea medicine for whatever it is, whatever side effects, you know, that a person is dealing with from their therapy. And everyone's a little bit different, but we really have good supportive care medicines to help people get through their treatment. And so, I have found that it is an intensive

usually like six months or so. So I typically tell people like, "Expect the next six months to be really challenging, but we will, you know, get you through and we'll take you through it each step of the way."

Elissa: That's definitely what I appreciated about my own treatment was that any symptoms that would come up, they're like, "Hey, we've got medication for them. We don't want you to be so nauseous, and we don't want this to happen." And it really made the treatment go so much better than I ever expected in the beginning because you do expect, you do expect the worst because you just don't know. And everybody seems to react to the chemo very differently.

Dr. DiNardo: For sure.

Elissa: So, to wrap up, many of our listeners today could either be AML patients or have a loved one with AML. In some cases, treatment may still be limited. So, what would you say to these patients and caregivers about the potential future of AML treatments and how they can remain hopeful?

Dr. DiNardo: There are people in my clinic that I am seeing tomorrow and last week that would not be here if they had been diagnosed four or five years ago, right. I mean things really are changing and that's based on some of the, you know, amazing translational work that is bringing discoveries to treatments for our patients. And so, things have definitely improved, but, you're right, we're not where we want to be yet and things are continuing to, improve and there are new therapies that are really exciting available in clinical trials right now.

So I guess I would say that, you know, if you have had a more standard therapeutic approach and it hasn't worked for you, unfortunately, then, you know, talk to your doctor and seek out an academic center that has different clinical trials available because, that's absolutely how we are kind of moving our field forward and, bringing new therapies to light because things really are getting better, and people are doing better. And it's just been such an exciting thing to be part of over the past few years.

Elissa: Yes. It's great to remain hopeful for patients and also know that, you know, maybe there's not something for you right now, but maybe there could be a year down the road or two years down the road and, you know, things are looking up. And there's been such exciting advancements in AML treatment and I'm excited to see the future. I'm excited to see survival rates increase, hopefully, in the next few years, and-

Dr. DiNardo: Yeah.

Elissa: -yeah. It's a great time to be in AML research and just see all these advancements coming.

Dr. DiNardo: Absolutely. Well thank you so much. This was fun. I enjoyed it.

Elissa: Thank you, Dr. DiNardo, for joining us today and sharing your expertise and experience with us and our listeners. And thank you to everyone listening today. *The Bloodline with LLS* is just 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.

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specific to precision medicine for AML at [LLS.org/BeatAML](https://lls.org/BeatAML). All of these links will be found in the show notes or at TheBloodline.org.

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