The Lead in Peds

Transcript: Season 1, Episode 4 - Future Ready: AI's Role in Revolutionizing Pediatric Care

Host: Dr. Nathan Kuppermann

Guest: Dr. Marius Linguraru

Dr. Nathan Kuppermann (00:00):
What if the key to unlocking lifesaving treatments for pediatric diseases wasn't in a lab, but in a computer algorithm? When resources are scarce and every second counts, how can artificial intelligence or AI bridge the gap between sick kids and the care they need? The future of medicine is here and it includes AI. Welcome to The Lead in Peds. I'm Dr. Nathan Kupperman, Chair of Pediatrics and Chief Academic Officer at Children's National in Washington DC. AI is revolutionizing medicine - including pediatric medicine. From predicting disease before symptoms appear to personalizing treatments in ways we never thought possible, AI is the game changer, bringing innovation straight to the bedside. For today's episode, I want to welcome Dr. Marius Linguraru, Connor Family Professor and Chair of Research and Innovation at Children's National. Marius is a computer scientist and also happens to be the son of a pediatric nurse. Before we dive in, Marius, first I want to know something. How do I know that you're real? How do I know that you're not a deep fake? Maybe some 3D holographic hallucination like we hear about in AI. In fact, before we start chattering, I would like to check with ChatGPT to see if you are in fact real. So let me just,

Dr. Marius Linguraru (01:22):
Ready Nathan,

Dr. Nathan Kuppermann (01:22):
Let me, okay, so I'm just going to open the app here. My ChatGPT, and I'm just putting in is Marius Linguraru real? Okay, this is what ChatGPT says, yes, Marius Linguraru is a real person. He's a researcher and scientist known for his work in medical imaging and computational diagnostics, particularly in pediatric healthcare. Let me know if you're looking for specific information about him. So… thoughts?

Dr. Marius Linguraru (01:50):
I was hoping it was going to say that I'm married to Taylor Swift as well, which would've been a lot more interesting, and then I'm very, very handsome. But if that was not enough, I can pinch.

Dr. Nathan Kuppermann (02:02):
Okay, so now I'm feeling a little bit more comfortable that you are real. So let's get started with the episode. So you've been involved with AI for a long time. Obviously now over the past few years, AI has really sort of taken over in medicine and it's a real tool that we're using as best we can, still trying to figure it out. You've been involved with AI for many years, so why don't you

give us a little bit of background in how you got into AI and sort of the trajectory that you've followed?

Dr. Marius Linguraru (02:34):
AI is at an extraordinary time right now where it's really changing not just medicine, but everything that lives and works around us. But some years ago when I started to get into this field, I was fasciNathand really about the human eye because I thought the eye is really the key to how we interpret images and data. Of course, I learned that the eye is the mirror or also the window into the brain, and if a brain can process information well, an artificial brain can do it even more because something that we as humans are not so well equipped with doing is to interpret vast, vast of massive information of different types, multimodal information like we have in healthcare. So in time, I started working into this field at the time, as you were saying, when AI wasn't cool, so we were calling it sometimes neural networks, but support vector machines, random forests. We were using nomenclature that was keeping the word artificial out and also because using artificial next to intelligence was getting people nervous, I think became a lot more comfortable with the concept now, and we are ready to have it around us because we use it every day. We use it on the phones that we have right now next to us.

Dr. Nathan Kuppermann (03:51):
Yeah, it's interesting, Marius, I'm going to bring up an experience that I had. As you know, I use a bit of AI in my research, but it's really, I do sort of predictive algorithms that use sometimes machine learning, sometimes just big statistical software and whatnot. And one day when I was driving on the freeway on NPR, I heard them talking about medical algorithms and prediction modeling. So I pulled on the side of the freeway, I needed to listen and there was a gentleman, his name is Berkeley Dietvorst. At the time, he was a graduate student at the Wharton School of Business and he studies predictive algorithms, computers in prediction. He's actually now a professor at the University of Chicago. But he was saying that us humans were scared of computers and algorithms and he actually had a term for it. I don't know if he developed it or he coined it from someone else. It's called, he called it algorithmic aversion. And the interesting thing is that the computer can be right a thousand times in a row, a million times in a row, and then one time there's an error happens and we humans say, see, the problem was the computer. Meanwhile, if we don't use computers, humans, we're making errors all the time, but we make excuses for ourselves. Oh, they were sleepy or this, that and the other. But in fact, there is something about humans having to overcome their algorithmic aversion or now it's fear of AI.

Dr. Marius Linguraru (05:24):
It is. And if you remember in the nineties when Kasparov played against Deep Blue and Deep Blue won, that was a shock.

(05:33):

Nobody was expecting, right? The machine to get smarter than that. But yes, we are adverse to the unknown and there is a lot of unknown in ai. And AI can be used for good or for bad. We're using it for good, just to be clear from the very beginning. But it's also a matter of messaging that we're doing and training. And sometimes we give the wrong message about what AI is going to do in the future. It'll replace us, we'll become obsolete and we'll become secondary to machines. Just yesterday, right, a controversy arose in an interview with Bill Gates when he said that in the next 10 years, AI will probably replace doctors and teachers. And I think there was a nuance there. It'll replace some of the work that doctors are doing and teachers things that you probably don't like to do every day. Right? And AI can do and help you with that. So there's a very good role for AI there and it'll redefine our jobs, but I'm also hoping for a better job.

Dr. Nathan Kuppermann (06:27):
It's interesting, we'll get to the work that you're doing with AI, but I'd like to comment on that because it's super important because it also bleeds into the topic of, in general, communication around science. How do we communicate to people because we need people to understand and not be fearful of science. And what I always say with the predictive algorithms, that is the basis of my research, is that I say that this algorithm, it brings the evidence to empower you, not to replace you. And certainly that's the case for the foreseeable future. Okay, Marius. Now I actually want to get into the work that you've been doing, and I know you've been doing lots of different types of AI domestically, globally, with lots of different conditions. But I want to start with rheumatic heart disease. And the reason I want to start with that is first of all, I know it's something that you've been doing for quite some time and it poses an interesting problem because rheumatic heart disease, it's greatly a disease, although we certainly have this in the United States and resource countries, but it's greatly a disease of under-resourced countries where they don't have the technology as available as we do, like the ultrasound or echocardiogram, and they don't have as much expertise in interpreting the echocardiogram.

(07:42):
So do you want to just talk about the research studies and the programs you've been involved with with rheumatic heart disease?

Dr. Marius Linguraru (07:49):
I'd love to. And first I would like to paraphrase you a little bit about how AI can shorten the distance between the patient and the provider. Because at Children's National, we have some of the top level cardiologists that specialize in rheumatic heart disease in the world. Although as you said, this is not a condition that it's of big concern to our patient population. So with AI, we started to look at how to bring that kind of level of knowledge that we have at Children's National and use it to benefit kids that don't have access to the same level of care. But first, maybe I can say briefly, what is rheumatic heart disease? Right? For our listeners,

(08:25):
It's a complication that comes from strep throat, right? You had strep throat, I had it plenty of times. Got penicillin, fixed. But penicillin is not administered so easily to kids that live in areas with limited resources. So when the strep throat stays in the body, it starts to impact the heart and other parts of the body over time. And complications actually can lead to death. There are actually about 55 million people in the world who live with rheumatic disease, and this condition is endemic in lower and middle income countries where it kills more than 350,000 individuals every year, many young. So this brings me to the type of technology that we use there, and this is something that I know you love dearly as well. Ultrasound imaging, cheap, portable, noninvasive, safe. So you take a portable ultrasound machine, which is probably about the size of my phone here, and we acquire data from kids who may be at risk for rheumatic heart disease, where we train healthcare providers who are not cardiologists, they're not experts, but they can learn in a few days how to acquire an image of high quality that is of diagnostic quality.

(09:39):
Then, that image needs to be interpreted. And I've worked with medical imaging for a quarter century, and if you put an ultrasound image in front of me it is like looking at a painting of Jackson Pollock and making a diagnosis on it. So, this is where the algorithm comes in. So, our AI algorithm looks at those patterns that are very complex, very noisy to the untrained eye that can actually make a determination of rheumatic heart disease in less than one minute on a laptop. So small resources to run there without wifi because we use Bluetooth technology to make it communicate and then indicate when a child is at risk and require further examination.

Dr. Nathan Kuppermann (10:21):
That's fabulous. And in what countries have you been using that technology? That technology that is the combination of ultrasound with AI?

Dr. Marius Linguraru (10:29):
Our great partnership there is with the Uganda Heart Institute, where actually some of our cardiologists have returned from a trip just a couple of months ago where we did a feasibility study and we got great excitement. People are ready to embrace the level of technology because they know what they're missing in the level of expertise. So is a conversation we had earlier as well, Nathan, about we need more pediatric experts. We need niche experts trained to take care of kids, pediatricians take care of kids differently than your general practitioner that looks at you as an adult. Therefore, AI needs to learn how to look at kids differently as well. And this is what we do at Children's National. We have a team that understands how to work with conditions that impact kids and only kids with data that comes from kids and only kids, but to do something that would be beneficial for that child, for the lifespan.

Dr. Nathan Kuppermann (11:20):

Marius, I'm going to give an analogy that, I mean, first of all, one of the great things is we're talking about very sophisticated technology where perhaps some of the greatest use is in under-resourced countries. But the interesting issue, and this is a problem not only in under-resourced countries, but even in the United States, there are not enough pediatric subspecialists here. We were just talking about it before the show that we don't have enough pediatric subspecialists. So how do we get pediatric expertise where it's not available? Of course, the biggest concern or the most challenging might be in Africa or other under-resourced parts of the world, but even in the United States, I'm a pediatric emergency physician, but only about 10% of children in the United States who seek emergency care come to the great meccas like Children's National, 90% go to general emergency departments. I'm not saying that they're bad, but they frequently don't have the same pediatric resources to diagnose and treat children.

(12:16):
So our approach has been, we've been using telemedicine to try to bring expertise from the high expertise emergency department to the lower expertise one. But I'll give you another example of something very similar to what you're doing with rheumatic heart disease. I'm a traumatologist, so I study pediatric trauma and ultrasound just like you're using for the heart. We use ultrasound to diagnose bleeding in the body after trauma. And we know when the child is critically ill and has a low blood pressure. It's standard of care, you have to use the ultrasound and emergency physicians are trained how to read it. But we don't know for children after trauma when they're stable, that is their blood pressure is normal, whatnot, if ultrasound is a value or not. But the problem is to try to figure out if it's a value, one of the big problems is that we don't know if it's the technology or the reader.

(13:11):
If the reader is great and the technology is great, maybe it's useful for everybody, but if one or the other are not great, maybe it's not useful. So I'm working with a mentee of mine who's really driving this. He's Dr. Aaron Kornblith, he's at UCSF. He's a pediatric and general emergency physician who studies ultrasound, but with an AI algorithm, so that when you use ultrasound with an AI algorithm to interpret, maybe that's the way to really make it useful. So I guess I'm highlighting the stuff that you've been doing internationally, which is super important. The United States, our own country here, could also greatly benefit from these merger of technologies between AI and imaging modalities.

Dr. Marius Linguraru (13:54):
Absolutely. And we get patients that come from the DMV area, right to Children's National because this is the tertiary hospital. This is the place to be. When something serious happens, we are the best and the worst place to go to. Right? Exactly when something serious happens. But if you come from southern Virginia, there is a five hour long drive to come with a sick kid after you wait for a while to get an appointment. If we can take the doctor into the pocket, whether

this is a smartphone app or a tablet or somebody's computer with telemedicine and take it home where the kid is, I think that will be greatly appreciated by everyone starting with our patients, the kids, our other patients, their parents, and also doctors who can help more patients from their office.

Dr. Nathan Kuppermann (14:37):
So now we're going to move to a different condition, a different disease shall we say, that you do AI work with. So we're going to talk now about genetic screening of newborns. And we know as pediatricians, that it's critically important to identify some congenital genetic abnormalities early so we can make the diagnosis and start treatment early. But again, it's a problem of lack of expertise around the world, even around the United States. So I know that you've been working with an app or a tool called mGene to facilitate diagnosis of rare genetic conditions for similar reasons that you've been working in the rheumatic heart disease space. But why don't you tell us a little bit about mGene?

Dr. Marius Linguraru (15:20):
Yes, thank you for bringing that up. And actually I can start again with a bit of an anecdote. You're talking about genetic conditions. They are generally very rare, so they affect few people. So we know little about this. So we get little data, something that usually AI doesn't like. AI loves, loves lots of data, but we have to make tools that work with the rare data as well because this is what's impacting kids. So what I wanted to say is that one of these genetic conditions that we know better in the society is Down syndrome because we all know somebody who has Down syndrome. Not so much,some years ago in the 1960s, if a child was born with Down syndrome in the United States, the median age for the child to survive was somewhere between one to two years. And right now, individuals with Down syndrome live a productive life into their seventies.

(16:14):
And it's not because we eradicated the disease, it's because of preventive care. Just like you said earlier, we diagnose earlier, we do something earlier. For instance, treat their hearts because they're at a high risk to have congenital heart conditions. And there are more than 8 million kids in the world who are born with congenital anomalies. So these kids require immediate care if we recognize them, and maybe we recognize Down syndrome a little better. Not always easy in spite of what we think, but there are more than 7,000 rare diseases in the world. And one in three kids born with a rare disease won't live to see their fifth birthday. So it's really impactful to do this early. And what we do, we take pictures of these newborns and we look if they have patterns on their faces that may correlate with the risk of a genetic condition. So therefore later on you can send them to a specialist, a geneticist if a geneticist exists. But they're very rare, therefore, we packaged one into this phone and with the risk of dismantling our studio here. Nathan, can I show you how mGene works?

Dr. Nathan Kuppermann (17:22):
Yeah, sure. Come on over. Yeah,

Dr. Marius Linguraru (17:25):
Come and look at this. So I'm pulling my mGene up and you'll have to look at me.

Dr. Nathan Kuppermann (17:32):
Oh no, I'm scared.

Dr. Marius Linguraru (17:32):
And not smile. Oh, sorry about that. And I'm not touching anything. And during this time, we're getting your photo and all your facial biometrics done automatically.

Dr. Nathan Kuppermann (17:47):
Amazing. Hey, good looking guy. High iq. I love it. Yeah,

Dr. Marius Linguraru (17:51):
I confirm. I confirmed. Yeah. So in a split second, without any kind of expertise with this app, we captured your facial biometrics, which can be indicative of a condition and also your photograph. Then we can send to our AI algorithm to see if you're at risk or not and no comments.

Dr. Nathan Kuppermann (18:10):
Yeah, I was going to say, what does it say there about my IQ and the size of my nose, but maybe it doesn't do that.

Dr. Marius Linguraru (18:17):
The first one is exceptional. The second one is unnoticeable.

Dr. Nathan Kuppermann (18:21):
No, no comment on the second one. By the way, it's interesting that these are the Venn diagrams of our worlds. Obviously you're very sophisticated in AI. I use sophisticated statistical software, but we both share the love of global health. I also happen to have a sister with Down syndrome. She's a healthy 58-year-old, but because of the availability of good care, good screening, the preventive stuff that is available in certain centers and certain locations in the world. So again, this is that power of bringing technology to where it is most needed.

Dr. Marius Linguraru (18:58):
And I grew up in Romania when I was a kid. I didn't know anyone with Down syndrome because there are no kids with Down syndrome, nor adults. Right now, you start seeing them there. And

what we are doing, we are actually doing now newborn screening in Kinshasa in the Congo where there are no clinical geneticists to see how we can improve the thing there too. The same, the future of these kids depends on the early detection, but we look at other things as well. We look at sickle cell anemia and how that impacts the physiognomy and what we can learn from that and maybe risks of severity or how will a child, again, that is impacted by one of these conditions is going to do in the future if identification is done earlier. Plus that this reduces the resources on medical resources. It's really expensive to take care of a child that is getting sicker and sicker versus one that is going to thrive because we acted early.

Dr. Nathan Kuppermann (19:53):
Yeah. So Marius there's just one last kind of area that you're involved with that I'd like to speak with on this episode. And this involves ultra-low-field MRI. And I'll let you afterwards explain it, but as you know, imaging in medicine is fundamental for diagnosis. I mean imaging we're talking about from the chest to the body, to the brain, et cetera. But MRI is interesting in a few ways. First of all, it is super high fidelity technology, great technology, but it's very expensive. And again, low resource countries typically do not have the technology widely available. So I know you've been working on this ultra-low-field MRI that would be available for under-resourced countries, again paired with AI, I think it's been funded by the Bill and Melinda Gates Foundation. Why don't you tell us a little bit about that project?

Dr. Marius Linguraru (20:44):
I'm glad you bring this up, Nathan. And if you've seen our ultra-low-field MRI, which since our colleague Katie called it R2D2 two has stuck to me with that name. So this is an emerging technology that is actually fascinating for multiple reasons. First of all, one in three people in the world doesn't have access to any kind of medical imaging. And we're talking any basic level of medical imaging. When it comes to MRI, this is maybe one of the most expensive, most sophisticated, hardest to use the technology. And this new machine, the R2D2, is 10 times cheaper, 10 times lighter than a typical MRI machine. It uses the same amount of electricity or energy as your coffee maker and it's portable. So you can take it with you, you move it with a joystick and you move it around the hospital wherever it's needed.

(21:39):
However, all these fantastic things come at a cost as well. And that cost is in the image quality of this machine. So what we've been doing and working with sites funded through the Unity Consortium by the Gates Foundation, we have sites in Africa, multiple in South Asia. Now, some are starting to be set up in Latin America. We work with them to basically increase the image quality of this machine so it has better diagnosis and clinical value as well. And what we do for that, and I didn't mention this in any of the earlier examples, we use deep learning. Deep learning is our AI friend here, right? We talked a lot about AI, but what we really do, we build these massive neural networks with very sophisticated technology inside them that create value from

noisy low resolution MRI images such as the ones acquired with the ultra-low-field MRI, but which can be acquired in spaces and in areas where no other machine can go, not the ones that we used to use in our hospital. And therefore bridge the difference between image quality of what's happening when resources are limited versus what's happening in elite healthcare systems like ours.

Dr. Nathan Kuppermann (22:53):
And where have you used that technology and where have you been studying?

Dr. Marius Linguraru (22:57):
Two weeks ago I was in South Africa and Malawi. And actually in Malawi what was really interesting, it was the end of a cyclone. It was cyclone Jude that came from the Indian Ocean. And so there was a massive tropical storm. Everything was wet and dripping, and the hospital was under serious distress because of the weather. And one thing that was running without interruption was R2D2. And I have a good story without AI actually for this. We are looking at a patient that was scanned, a child with cerebral malaria who was in coma and was being scanned. And it was a very sad episode being there next to the child and next to his father who was desperately watching his kid. While there was also a clinical trial for this condition that is run with our colleagues from Children's National. And while we were requiring the data and we're talking about our AI approach to help better interpret the data, the child woke up the next day.

Dr. Nathan Kuppermann (23:58):
Wow. Amazing.

Dr. Marius Linguraru (24:00):
Yes, AI had its role there, but good doctors were equally important. And this is something that I think we need to have in the future as well. Good doctors with good tools.

Dr. Nathan Kuppermann (24:10):
That's actually a perfect segue as we come to closing to the end of this episode. Just give me your thoughts about, you've described a lot of good uses of AI, where we've come from. What do you predict for the next, shall we say, five to 10 years where AI is going? And I'd love your thoughts about this issue of appropriate use, but also safe use. Recently, I saw an article that you were involved with. It was, I think, a consensus conference around the appropriate and safe use of AI in healthcare. What do you think is coming in the next five to 10 years?

Dr. Marius Linguraru (24:44):
Absolutely. And this brings it back to something very important that you mentioned earlier in our discussion. The adversity to technology, the adversity to AI, the fact that we are naturally scared about what may happen in the future if we don't control it well. AI can be good and AI can be

bad if we don't use it appropriately, but we want our clinicians and the society in general to use AI for a good reason and to use it well. And I think in the future, we'll train kids in schools how to use AI. We'll train our fellows in a medical school how to use AI because they'll have to work with it. Actually, as somebody said very well, doctors with AI will replace doctors who don't use AI rather than AI replacing the doctors. But for that, we are going through a cultural shock and not just in medicine in everything else, because this technology is impactful.

(25:35):
And it's here to stay, we had AI coming first, then we had ChatGPT as an example, coming afterwards, like revolution within a revolution, things are moving so fast and we are just learning how to deal with it. So we have to address these cultural differences that we have between humans and technology working together well. And the paper that we published recently in the BMJ, it's actually called Future AI. And this is very specific to healthcare, and it's a consensus from specialists from more than a hundred specialists from all over the world. I mean, I'm one of them where we came up with what should be addressed well for AI to be trustworthy in healthcare in the future. And there are really good examples in these papers that I'm not going to speak about now, but why is it called Future AI? So future AI stands for six letters that are important for trustworthy AI in healthcare. F stands for fairness, U for universality, T traceability, U usability, R robustness and E for explainability. So with these six concepts together, we teach people how to trust the AI tools in healthcare practice.

Dr. Nathan Kuppermann (26:44):
Fabulous. Love it. So I love really where the potential of AI is. It really is an equity builder. It's helping us diagnose conditions. As we've discussed on this episode, we're learning how to do it safely as we discussed. We are needing it and using it in the United States as we're using it in under-resourced countries. So that really is a grand sort of equalizer of healthcare around the world. The other takeaway points that I have from what we've spoken about is that we as humans have to get comfortable with the technology. It has to be trained to our medical students and our residents and trainees. We do, and we are still learning how to use it safely. And the technology does have to get better to avoid the deep fakes and the hallucinations and all those things that we opened with. But the future really is now. It is happening now, and we really need to just put our arms around it, embrace it, and learn how to use it wisely. Marius, thank you for this incredible conversation.

Dr. Marius Linguraru (27:40):
Thank you very much, Nathan. And yes, I think AI is the greatest tool we have to bring better care to kids that don't have access to elite systems like we have here in Washington DC.

Dr. Nathan Kuppermann (27:51):

Today, we explored how AI is not just a futuristic concept, but a real tangible force transforming pediatric healthcare. From detecting rheumatic heart disease in remote villages to using a smartphone for newborn genetic screening, AI is breaking down barriers to care. Please subscribe to our show wherever you get your podcasts and learn about what we're doing to raise the bar of care for all children here at Children's National and around the world.

** This podcast has been edited for clarity. Some content may have been altered to enhance the listening experience.**