Dr. Mariam Hanna

Hello, I'm Dr. Mariam Hanna. And this is the Allergist, a show that separates myth from medicine, deciphering allergies and understanding the immune system. We're used to thinking of artificial intelligence as just another tool, something that helps us move faster, sift through complexity, and make better decisions. But what if it's doing more than that? What if it's quietly reshaping how we think? How we define disease, interpret risk, and even decide what matters?

Think about the last time you used GPS. You got exactly where you needed to go, but could you retrace the route on your own? I don't know if we remember maps as well as we used to. Now bring that into clinic. A patient sits in front of you, complex history, multiple sensitization, and uncertain trajectory. You synthesize what you can. But imagine an AI tool alongside, processing thousands of similar cases, offering even a risk score, suggesting a path forward. Do you follow it? Do you question it? Or does it start to reshape your decision before you even realize it?

In allergy and immunology AI is already here, touching diagnosis, prediction, and the promise of precision care. It's in other parts of medicine as well. We'll talk soon about whether we're late to the game or early. The question isn't whether we'll use it, it's how we use it, and how we stay in control.

To help us unpack this, I'm joined today by a wizard nonetheless, Merlijn van Breugel, who will walk us through what AI is truly adding value, where the pitfalls lie, and what this means for clinicians on the ground. And yes, this intro was entirely AI generated. Who knew?

Merlijn van Breugel has a background in data science and philosophy. He started doing medical research in search for purpose, like many of us, but he started applying machine learning algorithms on epigenetics data to predict allergy in children. This led to an evening hours PhD track, which I can't even fathom at this point, in the Netherlands, with a focus on AI in allergy and immunology. In his professional career he's implemented AI solutions across industry and was board member and trainer of an AI training school for medical professionals. That's cool.

Since 2024, he founded Ditto, a Dutch tech startup that built an app that helps patients and their loved ones understand their healthcare better. With Ditto, patients can record medical conversations, and then it makes a plain language summary that you can share with your loved ones, or hey, your partner at home that didn't come to the appointment and will have a million questions for me at the end of the consult. So that's brilliant. Merlijn, thank you so much for joining us, and welcome to the podcast.

Merlijn van Breugel

Thanks, Mariam, thanks for having me.

Dr. Mariam Hanna

I love that we were able to connect on this topic because this is something that now has been showing up in my algorithm left, right, and center as I research how to take care of AI and incorporating it in my life and in my career.

Now, when I think of tools that interpret, the earliest example I saw of it was like EKGs and ECGs where they had that interpretation of the tracing there, and they interpreted it. Most of the time in all my clinical rotations, the first thing the physician would tell me was ignore that. Is it getting any better there?

Merlijn van Breugel

Why are they ignoring that?

Dr. Mariam Hanna

Because of the accuracy and because, well, the need to learn the process.

Merlijn van Breugel

Yeah, no, and that's definitely has been part of, I would say, quite early days algorithms that were also used in clinical practice as decision support and I think if you look back, the first real progress and large breakthroughs were, I think, more in image technology.

So I think radiology is one of the fields that was fastest in really applying it in clinical practice because the nuances of imagery and then being able to basically crunch through, well, how many images can a radiologist see in a lifetime? And then if you multiply that by a thousand, that's what an AI model can process.

So I think there you saw like the biggest gains where it started to outperform clinicians, where I think the really interesting part is, I think it also links to your introduction, is that generally what is seen is that clinicians that use AI not to replace them, but basically to augment their decision-making, they outperform either the computer alone or the clinician alone. So I think there's a more symbiotic relationship possible.

Dr. Mariam Hanna

Okay. All right. And in that symbiotic relationship, are allergists and immunologists now adopting AI, and were we considered like early to the game or late to this playing field that radiologists have been on and others have been on for some time?

Merlijn van Breugel

I think definitely not early. Maybe a bit more on the late side.

Dr. Mariam Hanna

You're so polite. Definitely not early. Okay.

Merlijn van Breugel

No, not definitely not early. But I think it has to do with the domain itself. So not with the people, but some of the like structural characteristics that just made it also harder to, let's say, jump on the train right from the start.

So as said, the domains that use a lot of image data, there you saw that algorithms were just advancing so fast that it was like an easier match. And I think, well, what is different in allergy and immunology is all the very heterogeneous data, complex environmental effects, less availability of enormous cohorts that you can easily analyze.

And if you look at the numbers, so last year I also wrote a review article where we went through all the FDA approved software as a medical device tooling, and there you also saw that, for example, radiology was really ahead and back then there weren't any specific allergy and immunology applications approved yet. But who knows what happened last year, I haven't checked the FDA website recently.

Dr. Mariam Hanna

The space is exploding on a minute-to-minute basis, it would seem.

Merlijn van Breugel

Definitely.

Dr. Mariam Hanna

Okay. So where does AI outperform or meaningfully assist allergists today? Is there any practical applications that are there today that you can see?

Merlijn van Breugel

Yeah, so I would say that there are a few domains where a lot is happening. I think very promising research happening, with also some truly promising results that I think are really on the assistant side.

So one is, for example, on phenotyping and subtyping, so where with different clustering algorithms it's possible to, let's say, subtype asthma or eczema. And I think that's really helpful where large data sets with a lot of maybe different data modalities can be used to reveal also new subtypes or phenotypes. I think that's one domain that's very promising.

And another one is on the diagnostic side or prediction side, where with, for example, machine learning algorithms, it's possible to come up with new predictive models or diagnostic models, for example, for asthma and personally I've been involved in research that did that for very young children, where we saw that especially when children are very young, certain lung function tests, for example, cannot yet be applied. And then in a search for new methods to still come up with a like supported diagnosis, I think that's very promising. I would say that those are most still in really in the research phase. So, I think there's still quite some steps to take till that's kind of common in clinical practice.

Dr. Mariam Hanna

That's fantastic. And, you know, there's this fear that some of us have about like hallucinations that AI has when it helps us or where it's a little bit misleading. And if we overtrust it, then we

can be led down the wrong path. Can we speak to that a little bit? What's going on when that happens?

Merlijn van Breugel

I think it's very good to take some time to discuss that because it's a serious issue that does occur. And I think underlying it, what you mostly see this in is what you call large language models. So AI is this big umbrella term, and then you have all these subclasses, and large language models are kind of the algorithms that power tools like ChatGPT and Claude and Gemini.

And the way they are set up is underlying they are basically, well, based on certain input and based on certain instructions, they give you certain output. And they want to make you happy, basically. So they want to give you the best possible output, but that does not necessarily mean that this is always the most reliable or accurate output. And I think that's where hallucinations come in, where they actually make up certain answers that seem very realistic, but they're not.

And I think you've seen that actually also with some quite painful cases where, for example, in academic research that certain references were completely made up. And it just wants it thinks, well, it's great to have a reference here, I don't know which one, so well, I'll just come up with a name and then it fills it in. So I think that's pretty serious and especially if that has to do with, well, decisions that might, well, change the course of treatment, for example.

So that's something that does occur. So, I think especially with these toolings, or these tools, it's really key to remain critical and to not take every word or every output that you get for granted, even though it might sound very poetic or realistic.

Dr. Mariam Hanna

Yes, but it's actually it's quite challenging because when when you get a couple good answers out of AI, you kind of start to become dependent, like subconsciously, you're starting to just assign a lot of credibility to the response that you're getting back. So I mean, one of the big like philosophical questions, and I love that you went into philosophy before this, is are we really creating better clinicians at the end of the day if this technology is still prone to hallucinations making us happy and not and not being like the difficult surgeon that we all rotated with that grilled you until you got the right answer?

Merlijn van Breugel

So I would say that there is a big responsibility towards any user of AI, but especially clinicians that use it, to remain critical. At the same time, the developers, there's a responsibility to do really thorough validation and the proper governance, where there's now also some more regulations coming into place to, let's say, to guide that.

And especially in a clinical setting to ensure that it is trained on a representative patient population, that there are certain guardrails in place that avoid or minimize the risk of mistakes to even be served, let's say, to the user or clinician that needs to digest and interpret that output.

And one other thing, so the topic of hallucinations is a very hot topic in relation to, let's say, language models. In more traditional machine learning techniques, which are often about predicting a certain outcome, there hallucinations are not so much a thing. It's at most uncertainty of where the prediction precisely is or what the risk score precisely is, but not in a very different way than what we've seen and been using for decades in traditional statistics. So there there's actually the same reasoning and thoroughness that we applied on statistical predictions also apply to machine learning models.

Dr. Mariam Hanna

What about this liability and this legal portion that you kind of mentioned? I've seen that discussed a little bit to say like if hallucination occurs with a large language model and if a clinician were to take that and lead to the wrong diagnosis or the wrong differential, who's fault Who's at fault?

Merlijn van Breugel

Well, there's probably a legal answer that I don't know, but I would say that in the end, it's the clinician that provides the care and decision support systems, well, it's in the name, they should support your decisions and they are not leading in that sense. They should guide it. So I think for now, the accountability is still on the human side.

I think underlying this, there is, of course, this enormous debate of what happens with our sense of responsibility and accountability when more decisions are being guided by or even made by AI systems. As I think one of the earliest, well, very clear examples on that is on the self-driving cars, right? There you have also the same debate going on of whose fault is it when there is a mistake there.

The flip side of that, which I think is often overlooked in these discussions, is the upside. I think it's a really important question. At the same time, humans also make mistakes. And I think the net effect of a lot of these applications is that it will reduce mistakes made by clinicians and it will actually help make better decisions. Still, the more ethical question, okay, whose responsibility is it if the AI fails, but I think it's also good to look at the upside, and I think currently with self-driving cars, they are safer. It's the human the other humans on the road that are a bit tricky to deal with.

Dr. Mariam Hanna

Yes. Yes. And that's great perspective. Will, however, future physicians, and let's be specific, future allergists start to think differently than previously when we were trained to? I mean, I'm excited to hear the application of phenotyping in asthma because this is something that we've tried to impart but has been really hard to adopt actually from us not being able to synthesize all these different phenotype clusters that we are seeing or that we are learning about. Will that fundamentally change future allergists to think differently altogether?

Merlijn van Breugel

I don't think that will change altogether. I think a large part of the discipline and the role, some things will shift, but mostly because there are new opportunities and new possibilities.

And I think what you will see is with the increased availability of more data and the technology to analyze that in novel ways, I think there will be a shift towards thinking in and leveraging more of that also in clinical practice, and that there will just be more and more accurate, for example, decision support systems or new ways to do research where vastly different data modalities can be combined from, for example, genetics data in combination with environmental data and maybe wearable data at the same time.

And I think in the past that was very difficult with some of the traditional bioinformatics technologies, and I think now this will open up new research avenues, and with that, hopefully also more changes in clinical practice.

One other thing that will change, I think really for the better, is the more, well, operational AI which just smooths and streamlines things in clinical practice from doing the paperwork and writing discharge letters, answering patient questions in a better or faster way, reimbursement, like I think there you see the fastest uptake, I think also in clinical practice, and the US is really moving extremely fast there. So with that, it will also create more time, I think, for what allergists are best at.

Dr. Mariam Hanna

Absolutely. Yes, and this is the portion that clinicians take on but really don't need to take on and can be delegated, and would love that in any clinic. But what happens like when we try to deploy AI in a real clinic? Let's talk about the different struggles or hurdles that people have in incorporating AI to an established workflow.

Merlijn van Breugel

Yeah, there I think a lot of sides to this question. There's the part more on the technology side that I've been through in different settings is going from a prototype to something that's like truly production ready and safe and validated, even before kind of you can talk about adoption or clinicians starting to work with this technology in a significant way.

But I think more on the clinician side changing behavior is difficult. And that applies to all parts of life. So, I think it's also a matter of more the human side of adoption rather than the technology side where, well, suddenly there's this new tool, whether it's for administration or whether it is for decision making, that wants to guide you, but it's also humans that still need to take certain actions or follow up on that. So I think that human side or almost change management side of deploying this in real clinics is one thing.

A second is that AI technology or algorithms they might have been developed in a certain environment, a certain patient population, and I think in deploying it in a new setting, there's always a question like how reproducible or generalizable is this technology, and or do we serve a certain subpopulation that just behaves differently or has different demographic

characteristics, and that means that the quality or reliability might actually be different from the same, let's say, testing environment.

And one of the things that I've seen really helpful here, and I think also research shows that, is that this idea of multi-functional collaboration where you bring different disciplines together to really have different perspectives but also different expertises, both in the development but also deployment, is really key. So, just some nerds like myself that would develop an algorithm and say, "Well, now, best of luck, trust me, it's good," and then, "Start using it," that's generally not what is the way forward.

Dr. Mariam Hanna

Fair. Is there anything that would happen during the the process of development of an AI tool that you would say like, "This is no good"?

Merlijn van Breugel

Yeah. Well, one of the things that I've noticed is especially on the research side, that it's fancy new technology and different like it opens up new possibilities, but sometimes then the tendency is to just apply it to either solved problems. So some problems that basically where clinical practice is just working really well, and there are great protocols in place that are accurate enough, or there are other traditional methods that actually are hard to beat, and then you come up with this really powerful hammer of an AI model that wants to do it better, but then actually often it doesn't.

So, I think I would avoid applications where it feels like overkill or that there's actually not a problem to solve. And another one that is just generally hard by being able to leverage more data and to crunch through enormous data sets, you still see that a lot of data sets are biased in where they have been generated, what type of ethnicities are included, and I think there there's again that ethical question, like if you develop a new algorithm that is heavily biased, for example, to predict better for certain ethnicities than for others, that brings, I think, some serious, well, can bring serious harm and there I think already in development process is really important to at least take that into account and do whatever you can to mitigate that risk.

Dr. Mariam Hanna

Okay. That's really helpful. Okay, this whole space is changing exponentially. What skills will become more important for a clinician and then the reverse, what will matter kind of less?

Merlijn van Breugel

I think is just raw memorization of building, like your brain is capable of immense things that AI really cannot do. Storing information is not one of those things. I think computers or technology is better in just raw storage and processing large part of data, so I think also synthesizing or analyzing large data sets is something where we already use computers and interpreting certain signals, for example, there I think there's the domain expertise and being very critical, I think that's where you still have kind of the human edge to a large extent.

I think another thing a skill that will help is data and AI literacy. So with this new technology progressing fast, I would say that it is really key to also educate yourself in this, so I think data and AI literacy is something where a skill that needs to be fostered. And what we were discussing, right? Being able to still remain critical in your appraisal of AI. And that will become, I think, more and more important the more we start relying on it as well.

Dr. Mariam Hanna

Fantastic. And if you can give us kind of one one pearl for allergists specifically using AI um at this stage in the game, what would it be?

Merlijn van Breugel

I would start looking at some of the problems that are significant and underserved so far, and then look at what are the specific what are the use cases where AI is of particular value? And I think that has to do with novel large data sets that are heterogeneous and multimodal, and I think identifying those problems and then seeing how can AI help in really making a leap here that wasn't possible maybe five years ago, I think that is a very exciting domain to be in. Applying it on things that were basically already solved just out of curiosity is, I think, not so helpful.

And I would say be open to adopting this and putting in the effort to change your own way of working. I'm really forcing myself on a daily basis to change my own day-to-day way of working, whether it has to do with how I interact with my computer, which I stop typing, I'm only speaking to my computer because it's faster, like those things, it requires some curiosity and some investment upfront, but I think it really pays off. At least it does for me. Yeah.

Dr. Mariam Hanna

Each of us I have nothing to say. No, brilliant. All right, time to wrap up and ask Merlijn van Breugel for his top three key messages to impart to patients and physicians on today's topic, AI in allergy. All right, over to you.

Merlijn van Breugel

I would say one is that AI might feel like magic at times, but mostly it's just powerful technology, and with any technology, it's a tool. So, by having this tool in your toolkit, it can really augment and support your work. It doesn't replace you, but it will likely shift some of your activities. That's one.

Then going to two is, although AI is powerful, it's definitely not a silver bullet. It's not a solution to either problem you have or every problem you have. And domain expertise is still invaluable. And sometimes AI is too powerful of a technology and actually more well, old-school technology like or old-school techniques like statistics is working even better.

And the third would be that the field is really moving at a daunting pace, and the best way to keep up is by being curious, by daring to experiment a bit yourself, and by educating yourself in

data and AI literacy to know what the fundamentals are, how it is useful, what the pitfalls are, such as you can, well, unlock the potential while also mitigating some of the risks.

Dr. Mariam Hanna

Thank you, Merlijn, for being a magician on this entire podcast. We really appreciate it.

Merlijn van Breugel

Thank you, Mariam. It really was a pleasure.

Dr. Mariam Hanna

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