RCPCH Podcasts transcript

Child health research 1: Digital health technologies

Paul Dimitri (intro)
Digital tools are going to allow us to spot early signals. They're going to help us to tailor interventions and provide personalised guidance in real time. This is going to create a model of care that wraps around the child, adapting as they grow, responds to their change in their condition and offer support in a place where they need it, in home, school and community...

... This is a moment of extraordinary possibility for children's health. We've got technologies that have been developed to help us detect problems earlier, to personalise care and support families in ways that were unimaginable a decade ago. But the real opportunity isn't the technology itself. It's what we choose to do with it...

Nish Talawila
Welcome to this podcast from Royal College of Paediatrics and Child Health. This is the first in a series focusing on child health research. My name is Nish, and I'm the head of research and evidence at the college, and I'm here with Paul Dimitri, our Vice President of science and research. Paul, would you like to tell us a little bit about yourself?

Paul Dimitri
Thanks very much. As you've already said, I'm Vice President for Science and Research at the RCPCH, but I'm based in Sheffield, so I'm a professor of child health technology and a consultant in pediatric endocrinology. I've got quite a strong background in child health technology and innovation, so I've been in this space for about 12 years or so. I'm now the Clinical Director of Technology Innovation at Sheffield children's NHS Foundation Trust, and I'm also the director of the NIHR Health Tech Research Center in pediatric and child health, which is one of 14 Health Tech research centers set up by the NIHR to support the development of technology and the adoption of technology across the NHS, so I head up the only one in pediatric child health, and I'm also the founder of the National Center for

Childhood technology. So I'll tell you a bit more about that during the podcast. But big infrastructure that's about to go live relatively soon.

Nish Talawila
Great. So just to start, What do we mean by child health technology, and why does it matter now?

Paul Dimitri
So child health technology is really thought of as the use of digital tools, data and innovation to improve the health development and life chances of children, young people, and it really matters now, because children's physical and mental health needs are rising. Systems are fragmented, and technology allows us to deliver personalised, preventative and proactive care at scale.

Technology itself in child health now spans an extraordinary range of tools, from everyday digital platforms to highly advanced biomedical systems, and that breadth is one of the biggest opportunities ahead. We're no longer talking about a single category of digital health. We're talking about an ecosystem includes remote monitoring, AI enabled diagnostics and decision support, digital therapeutics, wearables and app-based technologies, or web-based platforms that help families manage conditions day to day.

And then alongside these, sit emerging technologies such as digital twins, which I'll talk about in a short while, virtually augmented reality robotics and even complex assisted devices like exoskeletons and multifunctional prosthetic limbs. And each of these brings different capabilities. So some extend care into the home, some enhance rehabilitation, some support precision diagnostics, and others enable children with disabilities to participate more fully in school and daily life. The real excitement here comes from how these technologies can work together, creating a connected, personalised, child centered model of care that's proactive, empowering, and far more responsive to the realities of childhood.

These children's health systems need solutions now, because the pressures they face are growing faster than their current capacity to respond. As you know, we're seeing rising numbers of children with long term conditions, widening health inequalities and services that are stretched their limits, nowhere more visibly than in mental health and neurodevelopmental pediatrics, the waiting list for autism and ADHD as an example, are

incredibly long, and these families are waiting too long. Clinicians are firefighting and children are missing the window where early intervention makes the biggest difference.

The good news here is that a wave of new technologies is emerging. There are tools that can support triage, accelerate diagnostics and provide personalised support at scale. These range from Ai enable screening to digital therapeutics and remote monitoring. And these innovations are going to help us identify need earlier. They're going to help us reduce these bottlenecks and give children timely and targeted care. But most importantly, this isn't about replacing human expertise. It's about giving overstretched services the intelligent infrastructure that they need to keep pace with the realities of modern child health.

And technology also gives us the chance to move from a system that reacts when children become unwell to one well to one that anticipates their needs and supports them continuously. So instead of waiting for systems to escalate, sorry for symptoms that escalate or families to reach crisis point, digital tools are going to allow us to spot early signals. They're going to help us to tailor interventions and provide personalised guidance in real time. This is going to create a model of care that wraps around the child, adapting as they grow, responds to their change in their condition and offer support in a place where they need it, in home, school and community. So it's a real shift towards truly anticipatory, personalised and continuous care, where technology strengthen strengthens the partnership between families and clinicians rather than replacing it.

Nish Talawila
You told me about what's happening in child health technology, but what infrastructure is there to deliver this in the UK?

Paul Dimitri
So we're really fortunate in the UK. We have world leading child health technology assets. So we've got the National Center for Child Health Technology, which is due to open later this year. We also have the National Institute of Health and Care Research, Health Tech Research Center in pediatrics and child health. And I mentioned that earlier, which is one of 14 NIHR Health Tech Research Centers, but this one's specifically focusing on child health technology development and adoption. And then there are colleagues of mine working in other infrastructures. So we have Alder Hey innovation in Alder Hey Children's Hospital in Liverpool, and the Drive innovation hub, which is the data research innovation and virtual environments Center at Great Ormond Street Hospital, and they have a clinical intelligence

unit, so that's a team of data scientists who use advanced analytics to help their clinical staff make better informed decisions for patient care. There's also a significant focus on child health technology happening in Cambridge and also in Wales as well. And then there's the NHS England clinical Entrepreneurs Program that was set up many years ago, but they have a focus on clinicians developing child health technology, and that's headed up by Tamsin Holland Brown.

And then there's the process to deliver on child health technology. So we have the annual child health technology conference that was started back in 2021, and that's one of the first of its kind. It was definitely one of the first in the UK. And of course, we have the RCPCH digital committee, and we ran our first annual RCPCH digital conference in November last year, and that was really successful. That was a hybrid virtual and in person conference, and what that's led to is a collaboration between the NIHR and the RCPCH to run a two day conference next year on, sorry this year, on technology in pediatric and child health, and that's going to happen on the second and third of December.

So just thinking back to the previous question, this, none of this progress will happen at scale unless we commit to genuine collaboration and coordinated adoption nationally and internationally. And that's what working together across this, these infrastructure about. Children and young people deserve access to the best and most advanced technologies, and that's got to be regardless of where they live or which service they enter. So I'm a great believer in collaboration across these infrastructure, both nationally and internationally.

So when we collaborate across systems or hopefully across nations, what we'll end up doing is accelerating safe adoption. We'll hopefully reduce duplication and ensure that every child benefits from the full potential of digital and AI enabled care.

Nish Talawila
Thanks, Paul, it's interesting to hear about some of the infrastructure that exists to support child health technology development. So how did you get involved in this and how has it developed?

Paul Dimitri
Yeah, it's an interesting journey. Thanks for the question Nish. It started... I've been in this space for about 12 years or so, and it really started when I was working as a regional lead in the medicine for children Research Network when it existed many years ago, and I would attend national meetings, and there would be on the agenda, there would be a space for

digital and technology, and it was very little being discussed about at the time. And so it got me thinking about why child health technology didn't feature in the way that adult technologies were featured around that same time. And so what I did was I managed to get some funding, a small amount of funding, £50,000 from the Yorkshire and Humber academic health science network, which existed at that time. And now the Yorkshire Humber Health Innovation Network, they gave me, gave me £50,000 to set up a network to support child health technology development, and that was the start of the process.

So I set up a network called TITCH: Technology Innovation Transforming Child Health, and I brought on board a programme director who worked with me for about 11 years or so. Then we did our homework. What we essentially did was we needed to understand where the unmet needs and opportunities were. So we ran a series of workshops, bringing together multiple different partners, not just from healthcare, but across many different academic and private sector domains, and also included funders as well, to really understand unmet needs and where we could essentially get the best return on investment.

And two topics dropped out of those discussions. One was about remote monitoring. The other was about self care and independence. And over that subsequent few years, we worked with funders to support a number of different ring fence calls support the development of child health technology, and within a few years, we had leveraged 6.2 million pounds of funding for child health technology. We got pretty busy. Then, you know, it's a successful story to to that date, but then we needed proper infrastructure, so we applied to the NIHR at the time, there was a call for medtech and in vitro diagnostic cooperatives, or mix for short, we were successful. So we started up the NIHR children, young people med tech cooperative. We got a million pounds of funding for that, and we set up a network with seven different partners across the country. They were NHS and academic partners, each of them focusing on a different specialty area, and that we supported child health technology development in those clinical areas.

And over five years, we were incredibly busy. I mean, we worked on over 180 different projects of over 50% of which included an industry partner and within with the when thinking about the tech network and the NIHR children young people MedTech cooperative, we leveraged over £50 million of funding within that eight year period, 27 million of that had been leveraged by industry partners that had gone on, that work with us, that had gone on to get additional funding, but hugely successful for Child Health Technology and, most importantly, children, young people, and we then went on to get additional funding through open competition to form the NIHR children, young people,

men tech, sorry, the NIHR Health Tech Research Center in pediatric and child health, and we got several million pounds of funding. We've kept the same collaborative model where we work across seven different centers. We have a big focus on patient, public involvement and engagement health inequalities as well. And actually we make sure that we focus not only on physical health, but mental health as well.

So we've got thematic areas in early life, which includes preterm babies, neonates and infants. We've got a focus on long term conditions and rare diseases. We've got a theme around transition, the movement of children from pediatric to adult health care. And then we have two cross cutting themes. We have Mind Body integration, which is looking at the interface between mental health and physical health within technology. And then chain the child health Artificial Intelligence Network, which supports the integration of AI within the technologies that develop, and also how we translate AI ai data into real world situations that are informative for clinicians, children, young people and their families.

Now, back in 2016 and around this time, when I was on this journey, I thought about how we bring all this together in a physical infrastructure that was big enough to be able to be able to support collaboration across healthcare professionals, industry partners, universities and academics, but most importantly, working with children and young people. And that was when I had the idea around the National Center for Child Health Technology, and through pretty long journey, but actually has been successful. So far, I've managed with colleagues and with a huge amount of help from a number of different colleagues to to get over 24 million pounds of funding to build the National Center for Child Health technology, we believe, in terms of its size and what it's trying to achieve, one of the first in the world. And it's big. I mean, it's 42,000 square foot and that will bring all those partners together to develop the best and most advanced healthcare technology in the world.

I think just being on that journey, the value to me is the collaboration with the partners. This has been a really fascinating journey for me, but the whole is definitely greater than some of the parts. We need to collaborate, and we do this very well nationally, and I'm hoping that we will continue to do so both nationally and internationally.

And as you know, we've got work going on at the RCPCH as well. So we've got the digital solutions catalogue, which has been established to support our members in identifying technologies which might benefit them in the clinical practice and within their NHS Trust, and then we've also developed the digital skills roadmap. This is about improving digital

capability, competence and literacy. So this is about giving our members, our clinical workforce, the digital skills and capability to deliver healthcare in a technological way.

And we're also entering a new era of bringing our international partners on board. So I work with a number of colleagues across Europe and internationally, but also including in that network investors, that we can look at what's called the opportunity. Rather than just us looking at the unmet needs, knowing where we need to focus funding, we also need to think about what's the opportunities for investors coming in so we can get the appropriate funding to get these technologies to market. And ultimately, we all have the same goal. It's about getting health technology to those that need it most to improve their health and healthcare, which is children and young people.

Nish Talawila
And so what do you think are the biggest opportunities for technology to transform child health?

Paul Dimitri
Yeah, it's a great question. Yeah, there's a number of these, and I think one of the biggest opportunities is going to be the ability to detect problems far earlier than we can today. So we've got artificial intelligence. We use it in our daily life, but there's going to be artificial intelligence supported screening that will be be able to identify problems such as developmental delay, long term condition risk, so, for example, asthma risk, or, you know, to think about something else, early signs of mental health deterioration, long before symptoms become obvious to healthcare professionals. And so we have the opportunity then to analyse patterns of behavior, breathing, for example, sleep, school, attendance or even speech. And what those tools are going to allow us to do is to intervene sooner and to prevent escalation or crises. And this is a real shift. It's a real paradigm shift from waiting for illness to appear to actively predicting and preventing it.

And then thinking about children with long term conditions. So the obvious ones are, asthma, epilepsy, diabetes, remote monitoring is going to be a real game changer here. So there's already existing wearable smart sensors and digital tools that are going to allow families to manage conditions at home with real time support. What that will help us to do is to reduce avoidable admissions and give children more freedom. And this aligns perfectly with the NHS shift from hospital centered care to community based and preventative care. What we'll end up having is a hub and spoke model, where specialty teams support families remotely, while community services are going to provide more

hands on care that could dramatically improve outcomes and reduce the pressure on hospitals.

Then there's another area that I think is really exciting, and I think is relatively early in its evolution, which is the digital twins. And this is going to be, I think one of the most exciting frontiers. So digital twin is a virtual model of a child's physiology. So it's a computer based model of that child's physiology or a condition. And what that will do is allow clinicians to simulate deterioration that can test treatments and personalise care without risk.

So instead of relying on what could potentially be a trial and error base of trying things with children, young people, what we can do is we can model how a child might respond to a medication change or a new therapy, or think about how we can apply a shift in ventilation strategy in a computer based model where we reduce the risk of harm to children. So imagine being able to simulate how a child might respond to a new medication, how you might be able to change a ventilation strategy or take diabetes that you can adjust an insulin dose all without the risk of doing this.

And this is precision pediatrics in its purest and, most importantly, its safest form, we can trial things first to make sure that we have the biggest impact once we use that in a real life situation.

One of the other opportunities is the creation of a single, integrated child health record. And this is really fundamental. This is going to what I hope to see is that it spans health, education and social care. And what we know is that children's needs rarely sit within one system, yet the data does. And what we could do is safely connect these data sets and identify vulnerability earlier. We could then coordinate and implement support more effectively and build proactive early health pathways again at an earlier stage. And what this could do is support everything from developmental and learning needs to safeguarding population health planning. This integrated data approach is going to be the backbone of a modern child health, child centered system.

And then finally, just thinking about streamlining healthcare, this healthcare system itself. So one of the technologies that's already in existence is ambient voice technology, and this is already reducing documentation burden. We can also have other integrated digital systems that will eliminate duplication. We could use federated artificial intelligence that allows us to analyse data across organizations at scale without necessarily moving it into a cloud based structure. So what that means is we get safer data use or safer data use or

analysis, we'll get faster insights, and we'll get more time for clinicians to focus on children rather than the administrative tasks that we're burdened with at the moment.

And these system level efficiencies are going to be essential if we want innovation to translate into real world impact.

Nish Talawila
So you've mentioned artificial intelligence, and this seems to be an area that attracts the most focus in healthcare. How is AI transforming child health?

Paul Dimitri
Yeah, it's fair to say I think AI is transforming health overall. I mean, this is talked about a lot. Artificial Intelligence is a major game changer, and it's opening up a completely new landscape for child health. At its core, AI allows us to bring together information that has traditionally sat in silos. So that's information such as imaging, genomics, electronic health records, wearable sensors, environmental exposures, and even children's own reported experiences. So imagine when we can combine these data streams, and then machine learning systems would be able to spot patterns that clinicians simply can't see unaided. What that will translate to is earlier diagnosis of conditions such as rare diseases, will get better risk prediction and care that adapts as your child grows and develops. And I think that aligns with what I was talking about earlier, about digital twins.

Now there are different types of artificial intelligence that are going to bring different strengths. So take firstly, machine learning, so that will help us predict outcomes and identify hidden subgroups of children with similar symptoms or developmental trajectories. Then we've got deep learning, especially convolutional and transformer based models that are already transforming pediatric imaging, neonatal monitoring and the interpretation of complex time series data like glucose trends or vital signs, and what these symptoms are doing is detecting deterioration earlier and supporting personalised personalised care pathways.

Then there's natural language processing, and this is another major opportunity. What NLP, or natural language processing, can do, can extract clinically relevant information from unstructured notes, referral letters and discharge summaries, turning narrative text into structures, into insights. What it can also do is help capture children's voices. So there's NLP systems that have already been developed that can capture their pain, anxiety or well being, and there's even systems that have been used that have been applied to protecting

adolescent confidentiality. What they're doing is identifying sensitive information before records are shared, to protect the confidentiality of those, those individuals.

Then as computer vision, so computer vision is reshaping diagnostics. What computer vision can do is analyse images such as radiographs, retinal scans, echocardiograms or even facial morphology to support earlier recognition of genetic syndromes. So just thinking about facial morphology, facial recognition analysis has been around for many years, used in industries such as the airline industry, in the retail industry, we've applied that to healthcare now to help detect rare and difficult conditions through facial phenotypic analysis more quickly. Then there are video based systems that can monitor movement behavior and developmental cues in real world environments that will offer new ways to support children with neurodevelopmental conditions.

We're also seeing huge advances in generative AI so that includes generative adversarial networks and large language models. So these are tools that can create synthetic pediatric data sets to overcome data scare data scarcity, or to fill data in where there is essentially a need to join data together in a better way. They can also generate digital twins that simulate disease progression and support research without necessarily exposing identical and identifiable data. And I mentioned this earlier, but digital twins in particular represent a major shift. What they're going to allow us to do is model a child's physiology and test treatments virtually before applying them in real life.

Finally, just thinking about large language models, they bring in new capabilities as well in documentation, summarisation, phenotypic extraction and generating age-appropriate educational materials for families. They can also create synthetic clinical narratives of training and research when real cases are limited and they can be applied across multiple different clinical domains as well.

Nish Talawila
So where do you think that AI is going in paediatrics and child health?

Paul Dimitri
Yes, that's a really interesting question. I think we are just scratching the surface with artificial intelligence. I think the next frontier is going to include multimodal foundation models, which integrate imaging, genomics, laboratory information, vital signs and text into unified diagnostic systems. So that's essentially drawing data from multiple different systems to use that data - so this is multi modal part - to help in diagnosing and supporting

children with rare diseases where meaningful signals are spread across multiple different data types. They're moving us closer to generalist pediatric artificial intelligence. So these will be systems that can reason across tasks, rather than being limited to narrow applications and tasks.

We're also seeing a rise in something called causal AI. So one of the challenges with AI is that it often infers or correlates rather than gives us a reason, a cause, for why something happens. So causal AI will help us to understand not just the correlations, but a true cause and effect situation. So this will allow clinicians to explore the what if scenarios. What if we intervene earlier, what if we change a medication or modify an environmental factor? What is the cause effect relationship with that? And so what that's going to do is support more, provide precise preventative care.

Then looking further ahead, technologies like Quantum Artificial Intelligence or neuromorphic computing and federated learning will really reshape what's possible at the moment. So quantum computing is really about speeding the process up to speeds that are really unthinkable at the moment, and you apply that to artificial intelligence, and what that will allow us to do is take artificial intelligence and do it at ultra fast speed. So for example, enabling ultra fast analysis of genomic and physiological data.

Then there's neuromorphic chips. These are interesting because artificial intelligence is still very much a computer based process, and one of the aspirations is to try and get artificial intelligence to behave more like the human brain. And this is what these neuromorphic chips are. They're going to behave more like a human brain that will allow real time on device learning without relying on data moving in and out of the cloud.

And then there's federated learning. What that will allow us to do is train models on distributed pediatric data sets while keeping the data safely in hospitals. So what you can do there is take the data across systems without moving into a cloud where systems are sharing the data. So essentially, you're providing guardrails for data, not having to leave institutions to be able to do work on multiple different data sets across different institutions.

So the opportunities are really enormous, but what we've also got to remember is so are the responsibilities. This artificial intelligence is a rapidly evolving field, and what we need to do is make sure that it's designed and validated specifically for children. We have to put safeguards in place for privacy, autonomy and equity. If we get this right, AI is not going to

replace clinicians, but it will absolutely augment them, and it's going to reduce inequalities and fundamentally transform the way we care for children and young people.

Nish Talawila
Would you say there are barriers to adopting child health technology in the NHS?

Paul Dimitri
Yeah, it's really interesting. There's no doubt there are, but interestingly, the barriers aren't technological, they're structural, cultural and organisational. So we have to deal with issues such as fragmented data, inconsistent commissioning, limited evaluation capacity, and lack of child specific digital standards.

So take fragmented data as a start. This exists across acute community, mental health, education, social care. There's no doubt, there are real opportunities to bring data sets together to understand children's health and well being in more detail. But these data sets, unfortunately, have been developed in isolation, and the funding to support integration of these data sets and national level is paramount. If we get this right, we will transform healthcare for children and young people.

Then there's procurement and commissioning, and this remains some of the most stubborn structural these. Procurement remains one of the most stubborn structural barriers in child health technology. Unlike adult services, pediatrics really benefits from national scale procurement frameworks or clear commissioning routes, which means that innovative tools often fall into a gap between acute community mental health and education settings, and many promising technologies are struggling to progress because commissioners expect evidence that it's impossible to generate without the adoption acquisition of real world evidence while innovators can't secure adoption without evidence. So essentially, you've got this circular trap that slows progress.

What you also find with procurement processes is that they tend to favor large, established vendors and adult focus solutions. And they leave child specific technologies at a disadvantage. There are fragmented budgets across integrated care systems, schools, local authorities and community services that make it difficult to fund cross sector digital tools, even when they clearly benefit children. So what we need is a commissioning model that recognises children's longitudinal journey, that supports early stage evaluation and enable shared investment across sectors. Without that, the system will continue to reward

incremental adult focused digital upgrades, rather than transformative child health innovation.

One of the major barriers to progress in child health technology is also the lack of pediatric specific evidence. So that's largely because children are so often excluded from clinical trials. What this creates is a vicious cycle, without robust data, technologies will not be validated for children, and without validation, they're not adopted. And what that does is, in turn, limits the generation of new evidence and what we've got to remember, and I'm sure many listening to the podcast will know children will differ from adults in physiology, development, disease trajectories and medication responses, so adult data simply cannot be repurposed safely. The result is that many of the AI tools, digital therapeutics and remote monitoring systems are launched with strong adult evidence, but little understanding of how they perform in infants, adolescents or children with complex needs or healthcare problems. Breaking this cycle requires intentional inclusion of children in research, investment in pediatric data sets and regulatory frameworks that recognize the unique ethical and development considerations of childhood.

Now, I mentioned the digital solutions catalog earlier, and this aligns with a challenge with workforce confidence and digital literacy, which are so critical, because even the best technologies will fail if the people using them don't feel equipped or supported. And across the NHS, there's no doubt that skills and confidence vary widely. Some teams are ready to adopt AI enabled tools and other digital tools today, whilst others are still grappling with basic digital workflows. So that's why national initiatives like the RCPCH, digital solutions catalog and the digital skills roadmap are going to be so important. The catalogue is going to help clinicians and managers identify safe, evidence based tools, rather than navigating what is no doubt a clinic, confusing marketplace, while the skills roadmap is going to provide a structured way to build capability across roles and professions.

But what we also need, and this is really important, is protected time. We also need hands on training and a culture that encourages curiosity rather than fear. So when we invest in our work, sub workforce, not just technology, we're going to create a system where digital tools genuinely enhance care rather than overwhelm it.

And then finally, what we must acknowledge that one of the biggest structural gaps is the lack of pediatric digital standards for safety, interoperability and evaluation.

Paul Dimitri

At the moment, most digital and AI standards in the UK are written for the general population, and assume quite wrongly, that adult physiology, adult consent processes and adult patterns of care would simply translate to children, but they don't account for developmental psychological and anatomical nuances of children, young people. So what this does is create risk, real risk, that tools may be compliant on paper, but actually in reality, they're inappropriate or unsafe in paediatric practice. So earlier this year, I and many others and many of my colleagues responded to an MHRA consultation calling for child specific regulatory standards. These are standards that recognize growth, development, puberty, for example, but also safeguarding parental consent, adolescent confidentiality and the unique trajectories of childhood disease without that pediatric specific regulation, what we're going to continue to do wrongly is to retrofit adult frameworks and technologies onto children. So the time for changes. Now we need to make sure that we focus on child health technology. We start early so that we can change more, but actually we don't use we don't retrofit adult principles onto child health technology. We start from scratch by building child health technologies that are safe and effective for those that we look after.

Nish Talawila
And how do you think we can ensure equity in child health technology?

Paul Dimitri
Yeah, this is, this is a really challenging issue, because one of the the comments that's always played back to me is actually, by using technology or applying digital to health, what we're effectively going with doing is creating a two tier system that those that have access to technology and those that understand technology are going to benefit, where those that don't have those skills or access will will have, will be a disbenefit, and will create, essentially, a digital divide and sub therefore a health care divide. So what we've got to think about is that equity requires designing technology with children and families ensuring access, and that's got to be regardless of socio economic status, and we need to build systems that identify includes close gaps, rather than widen them.

So in terms of that, designing technology with children and families at the NIHR Paediatric Child Health and National Centre for Child Health technology, we have a mantra. We say, “all health technology designed for children with children” that's sometimes played in a different way. The children, young people will say, “no health technology designed for us, without us.” So it's really important that that inclusion starts from the very earliest stages of unmet need and technology design.

What that co-design will do will bring in lived experience into the heart of technology development, and it will make sure that tools reflect the realities of healthcare and of health, disability, neurodiversity, but it will also reflect cultural identity, language and socio economic content, context and when children, families shake, questions, the workflows and the user experience, the resulting technology is much more intuitive. It's undoubtedly more trusted and more likely to be used meaningfully. What this approach will do will prevent the creation of digital tools that work well for some but fail those with the greatest need.

We also got to remember that equity is also impossible if families lack the basic infrastructure to participate. Many children still live in households without reliable devices. They don't have reliable broadband, if at all, or the digital literacy needed to navigate health platforms is lacking within those families. So without addressing that, digital tools risk widening the very inequalities that they aim to reduce, providing devices, subsidising connectivity and hands on digital literacy is going to be hands on digital literacy support through schools, community hubs or clinical teams will ensure that technology becomes an enabler rather than a barrier, and that's the foundation of the minimum digital living standard for children: the minimum standard that we've got to set to ensure that health technology and digital healthcare is received by the most people, or the most children young people.

One of the most powerful roles of artificial intelligence is going to be revealing these patterns of inequality that are otherwise hidden. So essentially, what I'm saying there is that artificial intelligence will help to reveal patterns of inequity so that we can understand and target those groups that are most at need. And this can be done by analyzing multimodal data from healthcare records to environmental exposures, and what AI can then do is highlight where outcomes diverge for different groups of children and pinpoint the drivers for those gaps. This will then allow systems to intervene earlier, target resources more effectively, and design services that respond to real world need, rather than just basing this on assumption. So when we use AI responsibly, data will become a tool for accountability and proactive action, rather than just being applied to situational health care.

Then we've also got to remember that equity depends on the science behind the models. So many artificial intelligence systems fail children because they're trained on adult data sets or pediatric data, and they under represent key groups: infants, adolescents, minority

ethnic groups, children with disabilities or those with rare conditions. So we've got to make sure when we apply artificial intelligence that it's not biased, that it that it's not leading to bias predictions or unsafe recommendations. So when we think about equity, we've got to build representative pediatric data sets and validate models across age, ethnicity and developmental stages to avoid embedding structural inequalities into digital tools.

Paul Dimitri
And then finally, when we think about equity, we have to think about equity that depends on trust family need. Families need to understand how artificial intelligence works, what data it uses and how decisions are made. Transparent communication, explainable models and clear safeguards around privacy and consent are going to be essential for building confidence, especially among communities historically underserved or marginalized by health systems. When children and families feel informed and respected, they are far more likely to engage with digital tools and benefit from them.

Nish Talawila
Thanks, Paul, it's been really interesting. So can you just tell us a bit about what excites you most about the next five years?

Paul Dimitri
Yeah, there's a lot coming in the next five years. And I think this is about the convergence of technologies. So convergence of artificial intelligence, real time, data and digital twins, is going to fundamentally change how we understand and support children's health, moving from a reactive healthcare model to a proactive prediction, prevention and personalised pathway type model.

Another major shift is going to be the rise in technologies that empower families and reduce dependence on hospital-based care. So remote monitoring, smart centres and AI-supported home-based management systems mean that children with long term conditions can be supported where they live, where they learn and where they play. What that's going to do is have an environmental impact. So it will reduce travel. It will also reduce emissions, so impact on hospitals, and also minimise disruption on family life. And what that will do is also, at the same time, improve family life. It will also give parents real-time insight and confidence. What it also does is free up clinicians to focus on children who most need face-to-face care, and it's essentially a move towards a more family-centred model of paediatrics, rather than a more hospital-centric model of paediatrics.

Finally, I think we're going to see the next five years in paediatrics we see it moving decisively towards becoming a learning health system, one where every clinical encounter contributes to new knowledge and where insights flow back into practice, and that will happen in near real time. So with AI, with multimodal data and digital infrastructure, what we'll be able to do is continuously learn from outcomes, refine pathways and adapt services based on what works for children in the real world and also be able to personalise care as well. And what this does is essentially creates a virtuous cycle of improvement that accelerates discovery and reduces unwanted variation, and that, I think is going to be one of the most powerful ways technology is going to transform child health.

Nish Talawila
What message would you give to policy makers and system leaders?

Paul Dimitri
Yeah, really, good question. So there's probably a number of messages I give, but first message is that investing in children delivers the highest return on any health intervention the earlier we are in. And the greater the lifetime impact on health, education, employment and well being, technology is going to accelerate that return by enabling early detection, personalised support and prevention rather than crisis response. When we invest in digital tools for children, we're not funding gadgets. We're investing in healthier adults, stronger communities and a much more sustainable NHS.

Secondly, digital tools are not an optional extra. They are essential infrastructure for modern pediatrics. So remote monitoring, AI supported early warning systems, personalised digital therapeutics, they're going to reduce avoidable admissions, shorten length of stay and improve outcomes for children with long term conditions. Crucially, when they're designed well, technology will narrow inequalities by identifying risk earlier and support families who traditionally struggle to access care. So this is about using innovation to level the playing field, and that level, that level playing field is not just across hospital based healthcare, but also community based healthcare, and also health itself, keeping children healthy for as long as possible.

The next message to policymakers is that national coordination is essential, and I talked about this at the beginning of the podcast. The biggest barrier to progress is fragmentation without national coordination, shared standards, interoperable data infrastructure and consistent evaluation frameworks. Every region ends up reinventing the wheel. So what policy makers need to do is create the conditions for scale, common child health data

standards, safe data sharing environments and clear pathways for evaluating, commissioning pediatric technologies. This is how we're going to move from isolated pilots to system wide transformation.

And then finally, and I swing back to what I said earlier, the UK actually has everything it needs to lead the world in child health technology. We have world class clinicians. We have strong academic partnerships. We have strongly evolving infrastructure, such as the National Center for Child Health Technology, drive Alder Hey innovation, and the Health Tech Research Center in pediatrician child health. And unlike many other health systems, we have a unified national healthcare system. But Leadership isn't guaranteed. Other countries are moving faster in this space, and the window for global leadership in child health technology is becoming narrower. However, if we act decisively now with investment coordination and a clear national mission, the UK can set the global standards for safe, equitable child centered AI and digital healthcare innovation.

Nish Talawila
Is there anything that you might say to families who are worried about technology replacing human care?

Paul Dimitri
Yeah, I think it's fair to say technology will never replace the human relationship, which is really at the heart of Pediatrics. What I think we've got to look at technology doing is strengthening these relationships by freeing clinicians time and giving families better support between appointments. So the first thing I would say to families is that digital tools are designed to extend care, not replace the human relationships that are at the heart of what we do. Technology is there to support us and support children between appointments and also at appointments. And it's also there to support children, young people, in the places where they live, learn and play. What it's also going to do is give clinicians a clearer picture of what's happening day to day. So when families do come in, the conversations are richer and they're more meaningful, but we must remember that the human connection remains central. Technology simply strengthens it.

Families often worry about the fact that technology will make care feel less personal, but in reality, it does the opposite. What it does is by spotting early signs of deterioration or changes, changes in a child's condition, digital tools is going to allow clinicians to intervene sooner, prevent crises and tailor support to each of each child's needs. So instead instead of

waiting for problems to happen, what we can do is act proactively, and that will lead to safer, calmer, more personalised care.

One of the biggest benefits of digital innovations is going to free clinicians from administrative burdens and administrative tasks that takes them away from really working with families. There's already technologies in existence, so automated documentation, so using text such as ambient voice technology, streamlined data capture and AI supported workflows is meaning that clinicians can spend more time listening, examining and supporting children, and that's really the part of the job that matters most. So when I've spoken to colleagues using ambient voice. Technology, albeit that was a little difficult to start to use it. What they've said is not only they like it, but the families, the children. Families like it because clinicians can turn away from computer screens and talk to them, because the computer is doing all the administrative tasks for them. So there's much more human a human centered approach to interacting with children, young people and their families. So it's fair to say that technology is not going to replace human care. It protects it by giving clinicians the time, the space to do what only humans can

Then finally, the message is that technology can empower families with clear information, real time monitoring, personalised guidance. What will happen is parents will gain confidence in managing their child's condition at home. We don't want to bring children in hospital unless absolutely necessary. They need to be at home in a nurturing environment. They need to grow and develop and play in the environments that the that are appropriate for them. Parents and families can then understand what's normal what's not normal, and seek help by using these technology and that sense of control reduces anxiety, and it will strengthen the partnership between families and clinical team. So far from replacing human care, technology is going to help families feel more supported and more connected.

Nish Talawila
Thanks, Paul. It's been really interesting hearing from you today. There's clearly an exciting future ahead. Are there any closing messages from your podcast?

Paul Dimitri
Yeah, I think the message as we look ahead, the message I want to leave with people is quite simple. This is a moment of extraordinary possibility for children's health. We've got

technologies that have been developed to help us detect problems earlier, to personalise care and support families in ways that were unimaginable a decade ago.

But the real opportunity isn't the technology itself. It's what we choose to do with it. If we commit to equity, to collaboration and to designing tools that genuinely work for children young people, what we'll be able to do is build a system that is more proactive, more humane and more effective than anything that we've had before. The next five years is going to define whether we harness these innovations to improve lives or allow gaps to widen. What my hope is is that we act with ambition, compassion, but also urgent, urgency, so that every child benefits from the full potential of child health technology and innovation and AI enabled care.

The final message is, the future is here. Now we need the courage to deliver it.

Nish Talawila
Thanks very much, Paul, and thank you for listening to this episode from RCPCH podcasts. You can find out more about the College's research activities, as well as access our podcasts, on our website at https://www.rcpch.ac.uk and you can find the digital solutions catalogue and digital skills roadmaps that Paul mentioned at hub.rcpch.digital. Thank you very much, and goodbye.