

Monitoring Movements for Earli...gnosis With Dr. Colleen Peyton

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SPEAKERS

Dr. Marie McNeely, Dr. Colleen Peyton

D Dr. Marie McNeely 00:01

Hello and welcome to Changing What's Possible: The Disability innovation podcast brought to you by Cerebral Palsy Alliance Research Foundation or CPARF. I'm your host, Dr Marie McNeely, and this season, we are excited to bring you cutting-edge stories and insights on research, technology and innovation for people with CP and other disabilities.

D Dr. Marie McNeely 00:23

Today, we have with us, Dr Colleen Peyton, listeners. Colleen is an assistant professor in the Department of Physical Therapy and human movement sciences and the Department of Pediatrics at the Northwestern University Feinberg School of Medicine. She is also a tutor in the general movements assessment, where she teaches the general movements assessment to clinicians and researchers, and today, we are going to focus our conversation on Colleen's research, including projects funded by CPARF looking at early movements in babies and their later outcomes, including the development of cerebral palsy. So Colleen, thank you so much for joining us today. How are you?

D Dr. Colleen Peyton 01:00

I'm good. Thank you. The sun is shining here in Chicago.

D Dr. Marie McNeely 01:04

Well, we are so excited to have you with us today. The sun is shining here in St Louis as well. So it's an auspicious day. Can you start by giving me and our listeners a little bit more information about yourself?



01:15

Sure. Yeah. So I am a physical therapist. I specialized in pediatrics, and I began as a clinician. My first job was at University of Chicago, and there I worked in the neonatal intensive care unit, so we were taking care of babies who were born early or who needed specialized medical services shortly after birth. And then I also worked in the outpatient follow up clinic, so I would see these babies develop over time. And I really didn't start out with the intention to have a career in research, but a lot of clinical questions kept arising that I didn't feel like I had the answer for. And so one particular question that was vexing me was these babies would pass through the NICU, and we know as related to so we're talking about cerebral palsy today, that babies who go through the NICU have an increased likelihood of developing cerebral palsy, but not all of them for sure, and it was really hard to figure out which ones would develop a diagnosis of cerebral palsy. And the reason that was important to me was because we wanted to make sure that those babies had services earlier. And so that's sort of what launched me into this career. Because I found this tool through some literature searching that told me that I could just by looking at the way that babies move, you can learn a lot about their brain. And I thought, oh my gosh, I've already been looking at these babies. I must be missing something. What am I missing? And there's so much to learn. So that's sort of how I moved into research, by starting as a clinician and then moving into my academic job at Northwestern in 2016.




Dr. Marie McNeely 02:56

I think that's wonderful, and I think bringing this clinical perspective to the research is really important, and I'm sure helps you in what you're doing. But maybe, to give us some background, can you describe how cerebral palsy is typically diagnosed today, and maybe what some of the benefits and limitations are of this current diagnostic approach?



03:13

Yeah, so cerebral palsy, it's diagnosis made based on, if possible, a combination of both clinical and neuroimaging findings. If neuroimaging, like an MRI, is something that is accessible to providers, but it's not like they can do a blood test and find cerebral palsy, so it's a diagnosis that's made based on the physical examination of a baby, and in 2017 several researchers from the Cerebral Palsy Alliance and a group of other people came up with some guidelines for earlier detection of cerebral palsy and earlier diagnosis, so a diagnosis can be made using a motor assessment, and the one that I'm particularly interested in in my research and work is called the general movement assessment. So that's sort of recommended in babies under five months that you can look at the way that they're moving in this systematic way and decide if they have the marker. We can talk more about this. But if they don't have something called fidgety movements at a certain time point in their development, and then they have MRI findings that indicate whether or not they're likely to have cerebral palsy. An early diagnosis can be made in infants under the age of five months, but a lot of times, and I think what happens still is that is sort of the gold standard. If we could all do that, that would be great. But what I think a lot of babies are still in the US, at least diagnosed at the age of two, or between one and two when they're getting closer to the age when to when most babies are walking. So that is why I think it's been a wait and see approach traditionally, but using this sort of new guideline published in 2017 we can make that diagnosis a lot younger. I think that's

 Dr. Marie McNeely 04:57


I think that's wonderful. And as you sort of hinted at, there's some research that supports that there are two types of markers, or general movement patterns, that can reliably then predict the development of cerebral palsy. So, Colleen, can you go into some detail in describing what each of these movement patterns looks like?

 05:12

Sure, this is a special challenge, I think, on a podcast format, but I'll try for the listener here to describe. So these fidgety movements are probably the best predictor. And actually, if the child does have fidgety movements, which I'll try to describe here, then we don't think that they're likely to develop cerebral palsy.

 Dr. Colleen Peyton 05:34


And these movements appear between nine and 16 weeks corrected age, or after their expected due date. And the movements can occur in the wrists, shoulders, neck, hip and ankle, and these are all joints that can move in multiple directions. So fidgety movements are small movements that occur in all directions. So almost like if you were wearing a shiny ring with facets, and you were trying to catch the light. I don't know if anyone's had this experience.

 Dr. Marie McNeely 06:07

Oh yes, I love it.

 Dr. Colleen Peyton 06:08

yeah, with like, a reflector. Actually, someone in one of my classes mentioned this, and you're sort of moving it around so that you can catch the light, or something like that. If you're wearing a piece of jewelry, let's say on your middle finger, or something like that, something reflective, or a shirt or something that you're trying to move in multiple directions so that you can see the shiny lines appearing, these small movements that sort of move in all directions are fidgety movements. So we expect those to be present in babies. And I would say like the safest window is between 10 and 16 weeks. So that's about two and a half to four months of age that most babies have these movements in their joints when they're awake and active, and this is part of the movements that they produce. So babies are constantly producing motion. Unlike me, where, if I'm at rest and awake, I can sit in front of the TV and watch a show and not hardly move at all. But babies at this age, as their nervous systems are developing, and all babies do this, so babies who have CP, babies don't have CP, they're constantly moving, and babies who don't have CP have these fidgety movements.

 Dr. Colleen Peyton 07:17

Babies who have CP, they also are moving, but they do not somehow generate these fidgety movements, or as much of these fidgety movements in the different joints of their body, so they don't move their joints in these tiny little ways. So it's actually probably hard to understand over a podcast for the listener, but it is present, and there are probably some that like to learn it. You can watch videos and recognize this in babies.

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Dr. Colleen Peyton 07:41

The other movement happens a little bit younger in development, so babies who are born preterm or term age after they've experienced a brain injury, there's a movement called cramp-synchronized general movements, and this is where we see stiffness in the limbs and the trunk, which occur simultaneously. Again, these babies are also moving a lot, about every 15 minutes, or in a term age baby, they're moving when they're awake and active. And in these babies, we sometimes will see the whole body, including the trunk, or like the chest and the neck and the limbs move together and with a stiff quality. So that's what cramp-synchronized is, and that one also is related to cerebral palsy. But in general, when we're making a diagnosis or classifying someone, we use this fidgety movements at three months because it's more predictive at a consistent time point. So that's sort of the time point that we check. Is this two and a half to four month time point for these fidgety movements. So hopefully the listener can envision this somewhat over a podcast. But otherwise, the ways to learn these things are through looking at videos of examples.

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Dr. Marie McNeely 08:57

Absolutely. Well, Colleen, I think you did a phenomenal job of describing these movement patterns, and you mentioned, of course, that you are focusing on these fidgety movements. Can you talk about how the absence of these kinds of movements might be linked, then, to differences in the baby's brain structure or brain development?



09:13

I have to credit all of the people that have done this work for 30 years before myself, and especially one of my colleagues from Austria, Christa Einspieler. She is a physiologist, and she as she was doing her training, and they were learning more about this, as I mentioned before, babies are producing so many different movement patterns, and at different ages, they produce different types of patterns. And Professor Einspieler, realized that these fidgety movements were related to children who didn't develop CP, and that the babies who didn't develop fidgety movements were the ones who ended up with CP. And what's amazing is that they were able to discover this. I think it's one of the most amazing discoveries, because if you watch babies. Babies. You can see them moving all the time. So to pick out this one thing is quite remarkable, I think, and has been, I think, useful for a lot of families, infants and clinicians that are trying to narrow in on the babies, like I was as a clinician at the beginning, question to direct services to those families and supports to the families who receive a diagnosis of CP.

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Dr. Colleen Peyton 10:20

And so we are still learning now through different studies looking at MRI. or there's other ways

that we can sort of study the activity of the nervous system, EEG, or there's some other methods as well, what is involved in generating fidgety movements, and what the timing of fidgety movements also correlate, if we think about the brain in sort of two parts, like our older brain or the reptilian brain, and then the newer brain, the cortex, at this time point, when we start to see fidgety movements developing. At this two and a half to four month time point, we're really starting to see the cortex, or our newer brain, becoming more active, and that's when we see fidgety movement. So we do think that this is probably related to the integration of these new cortical pathways with the older part of the brain, although we can only really at this point, make some guesses about where and how fidgety movement is generated, but it probably takes the motor structures of both the cortex and the sub cortex, the older and the newer parts of the brain that are responsible for motor behavior, to produce fidgety movement. So if there is a lesion in either one of those parts of the brain, then fidgety movements may not be produced or may be produced in only one side of the body depending on where the lesion in the brain is located.

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Dr. Marie McNeely 10:21


Absolutely. I think that makes perfect sense, and we've really emphasized that these fidgety movements are then linked to the potential diagnosis or development of cerebral palsy. But can you explain why an early diagnosis of cerebral palsy is so important, and then how an early diagnosis could potentially change the trajectory of treatment as well as outcomes for young children and their families.

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12:05

So in neuroscience, there's these windows of time that the young brain is especially sensitive to certain environmental stimuli where the different parts of the brain are growing most often. So for instance, the motor critical period is in the first year of life. So if we think about a newborn baby who's born and as we know now, they move a lot, but they're really not able to yet roll over or hold up their head or pick up a cheerio or crawl, but by the end of the first year of life. Most babies who have no injury in their nervous system are able to do those things. They're able to roll over and point and pick up food and feed themselves, and perhaps crawl and stand. And some babies may even be able to take some steps by the end of the first year of life. So from going to not being able to do any of those things, to be able to do so many things, the motor system is really refining itself. And if we think about, for instance, the critical period of language development, we know we start to really learn language in that two to three year age window with some give or take on either side. And so if we want to learn a language, like, for instance, if I wanted to go learn Mandarin, now, I could go and do that. But if I had a two year old and we both went and learned Mandarin together and were immersed in a culture that spoke Mandarin, the two year old child would be able to produce the sounds and the language much better than I, because that two year old is in their critical window. So taking that now to the I could still learn it as a person of my age as an adult, but I definitely won't learn the same way and the same tone to be able to capitalize on this critical period of motor ability, motor plasticity, or the critical motor period when we're really learning our motor skills, and that bringing is really growing so much in the motor pathways earlier intervention allows us to sort of enrich babies motor experiences during a time when they're putting all those connections together in their brain. So of course, babies can always learn, and anyone can always learn a new skill at any time. But there's certain windows of time in which we can sort of maximize our


learning, or maybe be more efficient in our learning, because our brain is sort of built to sort of focus on that brain development period. And so that's why a lot of centers, for instance, in the US, they may not diagnose cerebral palsy until two years of age. And that, again, those babies are also able to learn motor skills. But if they had perhaps had more focused intervention on motor skills in the first year of life, that would have allowed them to maximize, perhaps that window of opportunity where the brain is most able to learn new motor skills. So we can always learn at any time. It's never too late. But if we can diagnose earlier and begin earlier intervention during that important window of time, the thought is that we can maximize our potential.

 Dr. Marie McNeely 15:09

Absolutely and give kids a better head start it sounds like in terms of motor development.

 Dr. Colleen Peyton 15:13

Yes.

 Dr. Marie McNeely 15:14

Wonderful. Well, it's been great to hear a little bit more about the diagnosis side, and I'd love to dive into the research and talk a little bit more about your work specifically. So I know Colleen, you've been collaborating with Dr Alicia Spittle over there in Melbourne, Australia, using an innovative smartphone app called the baby moves app, and you're using this to assess general movement in babies. So can you tell us a little bit more about this app, as well as the benefits of using this approach for data collection and research, and how you've been able to use the app as a research tool for your work?

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And again, I just want to say that my very smart colleagues in Australia have come up with this tool. Alicia Spittle and Amanda Kwong have come up with this solution that I think is wonderful, and I give them the credit for designing this app and putting it all together, and I've been really lucky to be able to use it. But what it is is parents can download this app. The baby moves app if they're part of a research study already, and they can enter in their baby's expected date of delivery and the research study they're a part of. And this app will give a little outline of where the baby should be positioned. And it also goes through and gives some instructions to the parents on how to collect video data. So in order to collect data on this general movement assessment, all we really need is to watch the baby moving without any sort of other stimulation. We're just watching what they can produce on their own.

 Dr. Colleen Peyton 16:38

So essentially, the parents put them down on the floor or in their crib, and they just film them overhead with their smartphones using this app, and they record them for three minutes, and then the app will send the video securely to research servers where we can look at the video. So

then the app will send the video securely to research server where we can look at the video. So it sounds sort of simple, but the reason that it's so wonderful for us is because in this era of data security, we know that this is securely transferred and is loaded to a place where we can safely view it without sacrificing their privacy. So that's why it's good for us as researchers. But why it's beneficial for families is because this makes a lot of sense to families. They know how to use their smartphones to take pictures and videos of their babies, and they're probably doing that already all the time. So this is not something that's so tricky for them to do. Their babies are always moving. And one benefit is that they can take that at their convenience. So we give them sort of a week time frame, and so when they traditionally would come into clinic or, you know, for a research visit, we're putting them on our schedule. And babies have, you know their own times when they are happiest and in the best mood to be filmed for three minutes, and sometimes that's not in a new place at a certain time, like maybe they're want to take a nap, or they're fussy. So the parents can decide what's the best time and the best place, and they know their baby the best, so they know when they're in the best mood for a video, and then it's a little bit more convenient for the family. They don't have to travel to another location. And we've been able to get some really great data that's been filmed by parents. And it's relatively easy for the parents to do, and I think it's a lot easier for them than coming into a clinic setting and bringing their baby in.

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Dr. Marie McNeely 18:25

absolutely and I think this convenience factor is huge, particularly for parents with a young infant, who may have other kids in the family, who might be working with disabilities themselves, or have other limitations to their travel or their ability to get to the clinic or the lab for these different visits. So are you seeing this sort of expand access to participation in research studies?



18:46

Definitely. Actually, Alicia had put this app together before the pandemic, and had been using it for several years, and we actually began our study before the covid pandemic. And I think that now this is, of course, there's been a lot of work that's been done on telehealth, and I think our society has changed a bit, and a lot more people working from home, and we're, you know, meeting on Zoom and things like that, but this does allow more access. So recently, we did a study in Chicago where we looked at four different hospital sites and families may have more difficulty coming to the clinic during daytime hours, because perhaps they work during the day, or they work at night, or it costs money to go into a clinic visit and transportation may be difficult. And there's a lot of different factors as to why people may have more difficulty coming into a clinic. So allowing the families to choose a time that's convenient to them, and also, I think we have not come across too many people at this point who don't have access to a smartphone. Most people do, at least in the US. Most people are smartphone users. So yeah, it has expanded our access, both geographically and people from different socioeconomic backgrounds are able to participate in this work. So that's been really great for us.

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Dr. Marie McNeely 20:00

Absolutely. And I'd love to dive into some of the details of this study that you mentioned, you and your colleagues recently published a study examining the feasibility of using this baby

moves app to study general movement in babies in the Chicago area where you are after their NICU stay. So I think importantly, you were looking at feasibility for families living across a spectrum of what you termed areas of low childhood opportunity to areas of higher childhood opportunity. So maybe, as a first step, can you define what these areas of childhood opportunity are and how they are defined?



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Yes, sure. We use a metric called the childhood opportunity index, and we use the 2.0 so this is a system that has been designed by others. And it's a tool that I think it's diversity data kids that develop this tool, and it has three different domains, and it combines data from 29 neighborhood level indicators. And the three domains are education, health and environment and social and economic, so based on their zip code, or their geo code, or these smaller regions of zip codes, they can define and break down these different components into childhood opportunity index score, and this education is what is the access to quality early childhood education, quality of elementary and secondary schools and social resources to educational achievement. And then the Health and Environment domain reflects healthy environments, access to healthy food and green space and things that are less healthy, such as pollution from industry and exposure to extreme heat. And then the social and economic domain is measuring access to employment and neighborhood social and economic resources. So those all combined together sort of define these different places based on where the patient's address is at the time of birth. Is how we use it to this childhood opportunity index. And then there's very low, low, moderate, high and very high levels of childhood opportunity so that is an indicator of all these access issues that children have. So what we did was we looked at our participants and where they were from, group by childhood opportunity index, using the address that they had at their time of birth to see who was able to use this app, and from what parts of the city we have a very diverse population in Chicago of all different levels of childhood opportunity.



Dr. Marie McNeely 22:29

Very interesting. And then what did you see when you looked at the feasibility and how that may have differed based on where families lived? Yeah.



22:36

So at this time, we asked families to send us two videos. So this was actually work that we had done prior to the first cparf study that we looked at as a group, which we can talk about later. But these two time points, we asked families to film for us, and what we found was we were able to recruit from so my previous work at University of Chicago and then my current work at Northwestern two different parts of the city and different patient populations that they serve with different areas of childhood opportunities. So that gave us a good, diverse sample set, and what we found was families were able to return video recordings of their babies, and we were really excited about that. So we had a diverse sample, and I think 43% of our sample was from low or very low areas of childhood opportunity, which is great that we were able to have so many families participate in our sample. And we also found, though, that the children who were

from low or very low areas of childhood opportunity, they were more likely to return one instead of two videos to us, but a lot of people were able to access and use the app, so we were pretty excited about that.

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Dr. Marie McNeely 23:45

Absolutely. It seems like this is something that could serve a broad range of different populations, like you said there, in the Chicago era specifically, and I imagine that that would translate relatively well, not only across the US, but around the world as well. What are your thoughts in terms of sort of the potential applications or implications of these findings?

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24:01

So actually, in Melbourne, Australia, where they came up with the app, they did this even before us, and they had similar findings in in Melbourne, where families maybe needed some more support or use the app slightly less from lower socioeconomic status families, but they were also able to recruit from a broad area. But it was this initial work that led us to our first study where we could collect data in multiple parts of the world, and because the app uses the same sort of format and we all have the same research database, that was great, because we can use this to collect data from multiple parts of the world. So we do think it has a broad applicability, and we're studying that now.

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Dr. Marie McNeely 24:40

That's wonderful, and I love to talk about this work funded by CPARF next. So you mentioned that you're studying using this baby moves app to study the timing of the emergence, in this case, of fidgety movements, in collaboration with investigators in Australia as well as Italy. So Colleen, can you talk a little bit more about the purpose of this study and give us a status update of where you're at right now?

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25:00

Yeah, so from this original two studies we did, we decided to expand this and include also the sites in Italy and another site in Australia, so Melbourne, Sydney, Pisa and Chicago. And we translated the app into Spanish, Italian, Arabic. And I think that was it for the study. I think it has also been translated into other languages, which serve sort of all the different populations that we see in our different settings. And what we're looking at in this study is we're collecting data at six time points. So traditionally, when we have the previous work before sort of this study and others, we had a lot of videos of babies who were in the NICU at multiple time points, and maybe one or two videos after they left the hospital. And I think that was because it was more difficult for families to come back in once they had just taken their baby home from the hospital, and we didn't have this ability. But this study allows us, because the parents can film them and at their convenience, and send the video securely, allows us to see this sort of trajectory of fidgety movement development between 10 and 20 weeks, to see over time, how does fidgety movement develop in these different countries, but also in different populations of babies. So when we first began this work, and we use the Royal we, this was before my time,

they were really looking at babies with the highest likelihood of having cerebral palsy, and sometimes that included babies with non brain injury and babies without brain injury. And as this work has expanded over time, and more NICU centers are using this, there's other conditions which we come across that weren't maybe originally studied and we didn't know so much about.

 Dr. Colleen Peyton 26:38

So for instance, congenital heart disease or congenital anomalies that require surgery has not been something that's been traditionally looked at, but we're looking at that. So how do fidgety movements develop in that population? And babies who have a chronic lung disease and diagnosed with something called bronchopulmonary dysplasia, we're also looking at that condition because clinicians have pointed out that these fidgety movements may be more difficult to interpret in babies who require longer term oxygen use. So some of this has been provided to us as feedback from our clinical work ourselves and other questions that other clinicians have shared with us about you know, does this develop differently in different populations. So this tool and the ability to study this in a larger sample and over time, allowed us to sort of answer the question. So the status update is, we're still collecting data, so we haven't cracked the data yet. There's still one group collecting data, but we've completed most of our data collection, and we're beginning now, and I hope this is okay to the next phase, if I talk about that, to following these kids until they're two years of age to see how did their early movements relate to their outcomes at age two.

 Dr. Marie McNeely 27:55

I think this is fascinating. And I think this approach that you're taking of really being able to monitor the babies over time is really powerful, and I'd love to talk about this second study. So in a second grant from CPARF, you are looking, as we mentioned, at some of the outcomes at age two and how they relate to these movement patterns that these babies demonstrated early in life. So Colleen, I'd love you to go into some detail if you can, about the kinds of outcomes that you're studying, then at age two, maybe the kinds of relationships that you think you might see, and how identifying these relationships between those early movements and then these later outcomes at age two could potentially inform clinical care.

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So the questions that a lot of clinicians have are like, for instance, if we don't see fidgety until later on in development, which is something that clinicians often discuss, like, I didn't see them now, but maybe I saw them a little bit later. Is there meaning to that? Or is this just individual variability, like anything in childhood development, where some kids, for instance, walk at 12 months and some kids walk at 16 months, but this shorter window of time doesn't have any meaning, and so at two years of age, we're collecting data on a motor ability, cognitive ability and language ability using sort of like the standard NICU follow up test. It's called the Bailey scales of infant and toddler development. We're using the fourth version of this test. So we're going to look at how these motor behaviors relate to later language motor and cognitive outcomes. And then we're also looking at infant, toddler quality of life measures. So that's something that's obviously pulled up by the parents, because the babies are not able even a

two year old, even though we consider that old isn't able to really report on their own quality of life. And then we're also capturing data about their behavior, so at age two, we can sort of identify some behaviors that may lead to later diagnoses of internalizing or externalizing mental health issues. And that is not my area of expertise, but I'm learning more about it, but it's related to the behavioral domain, so that's interesting as well. So we're trying to establish the relation. Between this first group of when the fidgety develop and if the time course is altered. Is there any relationship at age two, and does this vary by diagnostic grouping? So this could potentially help clinicians who are perhaps looking at infants, let's say, with congenital heart disease by understanding what is the trajectory and what is the relationship with two year outcomes that might help them either to plan their treatment care or to decide when is the best time to film these babies.

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Dr. Marie McNeely 30:32

Very interesting. So at this point, Colleen, do you have any hypotheses or guesses of what kinds of relationships you think you might see in the data? I know it's early and it's not all been collected yet.

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My personal hypothesis, and this is just speaking for myself, is that fidgety movement is an indicator of sort of brain connectivity in some ways, or these other behaviors which we can talk about later. And so if we see this behavior developing later in development, it might be telling us that the pathways that produce fidgety movements are perhaps taking a little bit longer to develop, and that may also be the case for other pathways in the brain. So how fast are the nerves making connections, and how fast are those connections forming is all related to the brain development. So if those are perhaps slower to develop, so we see them later in the time course of development, we may also see a relationship between delays and these other domains, which domains, I'm not sure, but I would expect that there is a relationship between delayed development perhaps later on in the time course, at two years old, that we may see continue on, and also that this may be seen, perhaps in these behavioral domains as well.

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Dr. Marie McNeely 31:47

Well. Colleen, I am excited to see the results of this study come out as you continue to work on it, and I'd love to touch on a third CPARF-funded project that you're working on as well. This one is actually taking a detailed look at some of the movement data to identify some other potential important movement patterns that may be present and relate those to outcomes as well. So Colleen, can you tell us a little bit more about this third project and how you're approaching this very detailed analysis?

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32:14

So I wanted to say this also, which is we think that most clinicians who are using the general movements assessment, they're looking for the presence or absence of fidgety movements. But like I mentioned before, babies are moving in so many ways and producing so many

different types of movement behaviors, and not all of these babies, in fact, will end up with a diagnosis of CP, but a lot of babies who were following have gone through a NICU course, there is a higher likelihood that they may develop other conditions like a motor coordination issue or maybe Autism Spectrum Disorder or perhaps language issues, and those are all very common, more common than cerebral palsy coming out of the NICU and perhaps some of these Other behaviors are related to those outcomes. So for instance, we might see that a baby is fidgeting, and I've tried to describe that before. Maybe easier to picture for the listener is when the baby starts to bring their hands together and starts to play with their hands. Is one behavior that we could look at, or the same for their feet, or they bring their hand to their mouth. These types of behaviors are also appearing over this time course that we're studying. And there's more than that. Those are just the easiest to visually, I think, picture to the listener. These other behaviors, do they have any relationship to the later outcomes? So by looking at this detailed assessment of motor behavior which is used, we could delineate not only the babies which most likely to have CP, but perhaps the babies that are most likely to have other conditions that are seen in the NICU, and we're going to look to see if any of those motor patterns are related to those later outcomes that we're studying. So we're pretty excited about that.

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Dr. Marie McNeely 34:01

I think this is really cool. And I'm curious how many different kinds of detailed movements are you looking at? I know it can be difficult. You know, babies are moving all the time. How do you put a bucket together in terms of, is this a separate movement? Is this an interesting movement? How do you make those decisions?

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34:16

Our colleagues, who are also in the general movement trust, Arend boss, is a neonatologist from Groningen, and I mentioned Christa Einspieler from Austria. They have come up with this by studying these movements as they were originally finding fidgety movements. They were documenting all these different types of movement patterns from the beginning, and it was only later that they discovered that fidgety movements were related to CP, and that was their main outcome of interest with CP. But in the meantime, they categorized and defined all these other movements that they observed babies to be doing, as well as some others that people had discovered in the literature.

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Dr. Colleen Peyton 34:53


There's a score that we use from five to 28 and within this score we see of these behaviors. How many do the babies produce? And there are probably, I would say, about 25 maybe 30 different behaviors that we look for. We don't expect that all babies do all of these things all the time. So that's what's a little bit tricky in studying this. Is there's a lot of variability in what babies are able to do and at different time points, but perhaps there are some other additional links that we can make with this data set. So just by filming a baby for three minutes, we actually get a continuous output of brain activity, because the brain is what produces all of these behaviors, movement and otherwise, so by understanding what they're producing in this early time point of brain activity, we can sort of begin to understand how the brain is connected, and how is that related to longer term outcomes.

 Dr. Marie McNeely 35:48

Definitely. And Colleen, I think this is a fascinating area of research. What are some of the next steps for you and your colleagues?

 35:56

I think that it's based on all of these still unanswered questions, based on what we find, we'll incorporate that into our teaching, and perhaps if there are some deviations in different conditions and the way that they present, we may update guidelines or look for specific other patterns as a result of this research study. Yeah, so I think those are the sort of the next steps is based on what we find, will, of course, update the audience and try to implement our findings into practice, or at least in our teaching in the general movement instruction courses.

 Dr. Marie McNeely 36:29

Very interesting. And you mentioned, of course, that there are many unanswered questions in the field, and I'd love to talk about some of these. So what do you see Colleen as some of the biggest unanswered questions, or maybe the biggest areas of opportunity in your field of research?

 36:42

I think that we still have a lot to learn about early intervention. We have some really great evidence so far into what are the early interventions that work best, especially in children with unilateral cerebral palsy, and some really promising work in babies that have cerebral palsy that affects both sides of the body, or bilateral cerebral palsy. I should explain unilateral cerebral palsy is when one side of the body is more involved in movement and posture differences than the other side of the body, whereas both sides of the body are involved in bilateral cerebral palsy.

 Dr. Colleen Peyton 37:18

I think that we are learning more about how to intervene in cases of bilateral cerebral palsy earlier, and also looking more into interventions for babies with dyskinetic CP, where it's not spastic type cp, but where there's extra movements, besides movements that are sort of related to spasticity or to certain types of movement patterns, that would be a really interesting field to study. I think we would love to know more about how parents feel about the different interventions and how they want to invest their time in these early interventions. What is the best delivery model for different types of families? I think we still need to know a lot about dosing. What is the right dose that's effective, and what's not only effective, but what's possible for families to do, and how does that vary by family? So there's a lot of unique circumstances. And how do we sort of tailor these interventions to families and kids with their individual needs and differences to maximize their function and their fun? Right? I also think another big question is around who are the best responders to intervention, and so sort of

tailoring intervention to the people that respond best to certain types of intervention versus other types of intervention. And all of these topics I'm talking about are behavioral interventions. But I think it's also exciting to think about some of the work that's on the medical side of things, and I know some of the Cerebral Palsy Alliance Research Foundation is looking into work in stem cells and in relationships, also to neurotransmitters and genetics that may be involved in who may be the best responders, or maybe what we can do to help maximize response to treatment. So those are some topics that I think are really interesting to be explored.

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Dr. Marie McNeely 39:07

Absolutely. I think these are all phenomenal questions, and I like that you really emphasize the importance of identifying sort of the best treatment, or perhaps the potentially most successful treatment, for individual people. I think this area of research is tremendously important. And I know you spent years as a clinician, and I think this can really impact research. So can you talk a little bit about how you're working to incorporate findings from your research to improve clinical practice?

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Dr. Colleen Peyton 39:34

I think I have a understanding coming from a clinical space of how much clinicians can be pressed for time and resources, and how difficult it can be to change your practice. Because, you know, clinicians have a lot of demands and a lot of different factors that are coming their way with time and resources. So trying to make these changes in a way that, like any sort of research, how does this relate to what they're doing? How can they make some changes in a way that they're thinking about things that are feasible for them in their current context, and thinking about ways to do that in a way that makes sense?

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Dr. Colleen Peyton 40:15

So for instance, getting clinicians to implement new research into practice has traditionally taken 17 to 21 years.

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Dr. Marie McNeely 40:23

Oh, wow.

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Dr. Colleen Peyton 40:24

This is across all different medical practices. So how do we do that sooner and get the evidence to people faster? And I think there's a lot of different ways that people can learn new information. Of course, they can take courses or go to conferences. They can read literature, but I think the podcasts like this one or YouTube videos like the also the type that your organization puts out is another way people will also use social media, which has some pitfalls, but also its benefits. But yeah, I think that we also need to consider, as researchers, how to

make our research tangible and usable to clinicians in a way that they can understand and provide guidelines like some of the ones that have come out previously, that are clear and easy to follow and to help support clinicians and making transitions into something new. So I think we need to come up with practical, easy to implement solutions in a way that's translatable and understandable to clinicians. And personally, I try to do that when I teach and also participating in different ways of dissemination, through channels like this and through different conferences and any sort of way we can get to clinicians and give them some practical guidelines. I think can help.

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Dr. Marie McNeely 41:38

Definitely. And I think, like you said, a really important point to be able to provide those resources so that the clinicians can maximize the time that they're spending with their patients, with the babies that are coming in during their clinical visit, but also to maximize the opportunity of being able to intervene during these critical windows that you mentioned for motor development, for example. So wonderful points that you made there. If listeners want to learn more about your research and more about you and your work. What is the best way for them to do so?

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Dr. Colleen Peyton 42:06

Well, they can check out my faculty profile page at Northwestern University. If they just put my name in there, they should be able to find some of the work that I've done, and also access to my email in case they have any questions and want to contact me directly. And I've also done a YouTube video that you can find where I show demonstrations of some of the movements I discussed today, so you can get a visual picture of that.

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Dr. Marie McNeely 42:30

Perfect. Well, listeners, definitely check out a webinar on CPARF's YouTube channel if you want to see some of the movements that we talked about today and learn even more about Colleen's work and Colleen, it's been such a pleasure to chat with you today. Thank you so much for sharing your insights and expertise.

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Dr. Colleen Peyton 42:45

Thank you so much for having me, and thanks for all the important work you do, and CPARF does as well.

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Dr. Marie McNeely 42:50

We appreciate it. And listeners, it's been great to have you here with us as well. When you have a moment, please subscribe and leave a rating or review on your favorite podcast platform to let us know what you think of the show, and we look forward to connecting with you again in our next episode of Changing What's Possible.

