S3 E4_ Research Roundup on Early Diagnosis

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SPEAKERS

Jocelyn Cohen, Dr. Marie McNeely

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** 00:24

And today, we're happy to share our first Research Roundup episode. These are shorter episodes that highlight recent and ongoing research focused on different CP-related themes or topics to help you stay up to date on what's new in the field. The studies featured in today's episode and future Research Roundups represent interesting, innovative work happening in the CP research space that's not funded by CPARF, unless we specifically say so. In this episode, I'm going to talk about four new research papers related to diagnosing CP and other conditions, as well as predicting outcomes.

D **Dr. Marie McNeely** 01:00

Now the study in the first paper that we'll cover today was led by Saeed Montazeri and colleagues at the University of Helsinki and Helsinki University Hospital in Finland. In a previous study published in 2022, this research group developed a fully automated, continuous quantitative measure of electroencephalogram, or EEG background, which was based on deep learning artificial intelligence.

D **Dr. Marie McNeely** 01:27

Now to break that down a little, EEG measures electrical activity in the brain and background EEG is thought to reflect the overall health of a person's brain. However, interpreting EEG can be pretty tricky because there's a lot of data and the patterns can be quite complex, so the

methods that this team developed to use deep learning AI to make sense of this large amount of complex data to generate a quantitative score that can be tracked then over time and used to make important clinical decisions quickly, even by clinical team members who don't have extensive training with interpreting EEG.

D Dr. Marie McNeely 02:08

Now they call this quantitative score the brain state of the newborn, or BSN, and they monitored the BSN data over time to measure BSN trends. In their latest paper, the authors monitored EEG data and the calculated BSN trends from 80 newborns during their first days of life, and then they looked at how that data related to four clinical outcomes at four years of age. The outcomes were categorized as favorable, a CP, diagnosis, CP, with epilepsy or death. The BSN trends were accurate in predicting outcomes from six to 48 hours of age, and they could serve as an automated, objective and continuous measure of brain activity in newborns. So very exciting findings there.

D Dr. Marie McNeely 02:59

Now the next two papers on our list for today are from Drs. Colleen Peyton and Theresa Sukal Moulton at Northwestern University. Their studies are related, so I'm going to talk about these two papers together. This research group studies movement in babies and is interested in understanding how early movement patterns in infants are related to and may predict development of cerebral palsy or other conditions. In one of their two new research papers, they described the development of an innovative new way to measure a pattern of movement in infants called spontaneous, independent joint motion. This kind of movement pattern is also known as selective voluntary motor control. They included a sample of 75 participants in the study who had gross motor function data at two years old, and also a diagnosis of spastic CP, or no Cp at two years old. In spastic CP, individuals experienced tightness, stiffness andor spasms in their muscles. And with this sample, they looked back at a video taken earlier at three months of corrected age, and scored it with their new Baby Observational Selective Control Appraisal â€" BabyOSCAR test. Now corrected age takes into account any difference between due date and when a baby was born. So for example, a 10-week-old baby that was born eight weeks early would have a corrected age of two weeks. They found that infants with spastic CP had a lower BabyOSCAR score than those without CP. Also, BabyOSCAR scores correlated or were related to motor function and the asymmetry subscore of the test specifically was higher in participants with unilateral CP. Now this really showed that BabyOSCAR scores were a valid and reliable measure of spontaneous, independent joint motion, and in their next study, the group assessed whether this BabyOSCAR score at three months of corrected age could then be used to accurately predict functional ability and cerebral palsy diagnosis at two years of age. So with a sample of 75 participants, the results showed that the total BabyOSCAR score could strongly predict diagnosis of spastic CP with high specificity and sensitivity. It could also distinguish between levels of motor function at two years of age, and the asymmetry score was predictive of unilateral CP. So again, very promising results in this study as well regarding a test that can potentially diagnose CP earlier.

D Dr. Marie McNeely 05:36

And in our final study that we'll talk about today, researchers from the University of Western

Brittany and France, led by Dr Sylvain Brochard, are interested in developing a diagnostic tool, more generally, for gait or walking disorders in children, including kids with CP, neuromuscular disease, toe-walker syndrome or other conditions. And we know 3-D analysis of gait is often used for evaluation or assessment purposes, but is rarely used as a diagnostic tool. The research team in this study examined whether characteristics or the kinematics, in this case, of gait from 3-D gait analysis could be combined with deep learning artificial intelligence models to create a new tool to accurately diagnose gait disorders in children.

D **Dr. Marie McNeely** 06:23

With data from 371 children, the results showed that the gait analysis plus deep learning approach had good to excellent accuracy for one, distinguishing between children with CP and children without CP. Two, distinguishing between children with CP and children with either neuromuscular disease or toe-walker syndrome. And three, distinguishing between children who had a stroke before the age of two or after the age of two, giving some insight into the timing of a brain injury. And these results really support that 3-D gait analysis combined with deep learning could be a useful and objective tool for diagnosing gait conditions that wouldn't necessarily require the user or the operator to have any clinical expertise in this area.

D **Dr. Marie McNeely** 07:11

So listeners, I know we've covered a lot of ground in a short time talking about new diagnostic approaches being developed using EEG to monitor the brain state of the newborn, or BSN, spontaneous independent joint motion using the baby observational, selective control appraisal, or BabyOSCAR, and gait analysis plus deep learning. And I'm really excited now to welcome Jocelyn Cohen, CPARF's Vice President of Education, back to the show to talk about why these studies are important and what the findings can mean for people with CP or other disabilities.

J **Jocelyn Cohen** 07:49

Thanks, Marie. So these studies are all incredibly interesting in their own right, and they highlight some important points. We know that an early cerebral palsy diagnosis gives babies the best possible start because it leads to early interventions when the brain is most neuroplastic and open to changing. The tools you described earlier make these innovations possible and potentially personalized down the line. We also know that the strength, stamina, and abilities established in childhood will influence the way someone with CP moves throughout their adolescence, and this shapes how they'll move as an adult. Gathering this information and these tools has a far-reaching impact beyond the first weeks, months, and years of life, and it's quite heartening to learn about these scientific advances.

D **Dr. Marie McNeely** 08:33

Well, Jocelyn, thank you so much for joining us and sharing your perspective today.

J Jocelyn Cohen 08:38

Thanks so much for having me.

D Dr. Marie McNeely 08:40

And listeners, thank you for joining us as well. You can find links to the abstracts for the papers we talked about today with the notes for this episode on CPARF's website. And now I'd like to take a moment to tell you about 3forCP, CPARF's grassroots fundraising initiative for cerebral palsy research and disability innovation. Whether you level up a read-a-thon, a sip-and-paint event, a comedy show or something else that you love. Three for CP gives you the chance to make a difference in your own signature way. Head to 3forcp.org, to get started. That's the number 3, F , O, R, C, P, dot O R, G, and we look forward to connecting with you again in our next episode of Changing What's Possible.