

Ruth Adewuya, MD (host):

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This episode is part of our Pediatrics Pulse miniseries, and today I will be chatting with Dr. Heidi Feldman on developmental milestones. Dr. Heidi Feldman is the Ballinger-Swindells' endowed professor of Developmental and Behavioral Pediatrics and the Department of Pediatrics at Stanford University. She is board certified in developmental behavioral pediatrics and remains in active clinical service. Her research interests focus on child language, developmental disabilities, and developmental behavioral pediatrics health services. Her recent research studies addresses the neural basis of cognitive and behavioral outcomes of preterm birth. She has served as PI on several federal training grants and has been recognized and honored as a teacher, receiving the Chancellor's Distinguished Teaching Award at the University of Pittsburgh and being selected as an awardee of the National Pediatric Faculty Developments Scholar Program.

Thank you so much for chatting with me today.

Heidi M. Feldman, MD, PhD (guest speaker):

Thank you very much for inviting me.

Ruth Adewuya, MD (host):

Right before we started this recording, Dr. Feldman and I were chatting and we wanted to share with you just the context of some of her responses today.

Heidi M. Feldman, MD, PhD (guest speaker):

It's very common to have conversations with families about developmental milestones. This is a topic that concerns many parents and extended family members, and when I answer the questions, I'm going to try and use terminology that might be useful for the clinician talking to a family member. So I might stick with English as opposed to Latin or Greek terms because those would be far more comprehensible to the family member.

Ruth Adewuya, MD (host):

That's excellent. Thanks for setting the stage for us. Let's start by talking about what are developmental milestones and why are they integral to comprehending a child's growth and development.

Heidi M. Feldman, MD, PhD (guest speaker):

Development is a very complex and interactive and continuous process that really starts from the moment of conception and ends at the last breath. Developmental milestones are activities or skills that most children progress through as they go from childhood to adulthood. So you can think about them like guideposts in this complex process.

Imagine that you're driving from San Francisco to New York City. It might be useful to have in mind what places you're going to go along the way and when will you get to Reno, Nevada, or Des Moines, Iowa, or Chicago, Illinois. And so these developmental milestones are spots along the way. Let's take an example.

The fetus is tightly wrapped in its mother's womb. So from the moment of birth, when that baby is released from that very constricted space, the infant begins to stretch and to move and to build the skills to resist gravity. So that little infant has got to make its way to moving freely throughout the world. One of the milestones along the way is just sitting up against gravity without any support. Another step along the way is taking the first baby steps without anybody's hands. So sitting and walking are reliable guideposts or developmental milestones that we can check for.

Children reach developmental milestones in how they interact in the world in several different domains. It's not just one giant process. And the domains that we care the most about are how they interact with the world, we could call that their social emotional skills, how they speak and understand, we call that their language and communication skills, how they think, which in children includes how they play, how they learn, how they behave, and how they move, both their big muscles, their growth motor skills, and their small muscles in their hands, or fine motor skills.

So in each of those domains of function, there are distinct developmental milestones. So why are they important? Why are they integral, as you said, in comprehending a child's growth in development? We know that most children travel a similar path. San Francisco to New York, it's best to take the I-80. Could do it differently. You could take the I-10 and go up or the I-70, but most cars would go along the same path. And similarly, most children travel similar paths on their road toward maturity. So surveying these developmental milestones that are relatively common across individuals is a strategy to notice, to talk about, and to evaluate the child on that developmental journey.

Surveying developmental milestones can also be helpful for identifying children who are traveling at a slower pace or traveling in an unusual direction, and those children might benefit from some early assessment and interventions. So the milestones can play the role in recognizing, naming, and identifying those children at risk for developmental disorders. We think that in most cases, if we identify the children early and we make modifications in our child-rearing practices and educational practices, that we can make a big difference in that developmental trajectory.

Ruth Adewuya, MD (host):

You talked a bit about developmental milestones as guideposts, and I thought that was really powerful to frame the conversation. You went on to talk about how the milestones are used because if they're guideposts, then they help you along the journey as opposed to there's something wrong and immediately you're thinking for the worst case scenario. Can you talk a little bit about the key developmental milestones that clinicians and parents should observe in infants and toddlers?

Heidi M. Feldman, MD, PhD (guest speaker):

Yeah, we can point out a couple of critical milestones which both parents and the clinicians who care for children can be looking out for. So let's talk about a really important one in social emotional development, and that is that children learn to smile. Children don't smile immediately after birth, and they may have little upward turns of their mouth when they're having a stool or when they're falling asleep. Doesn't count as smiling.

What they learn to do is by about the time they're six weeks of age, respond to something in their environment with a smile, which really seems to reflect pleasure or enjoyment. So that's a key milestone. I have to say, I think it comes at a really important time because if it was a little bit later than that, parents might get really frustrated. Those first few weeks of a child's life are so hard in taking care kids. So when you get that smile, it's a glorious reward.

Ruth Adewuya, MD (host):

I will tell you that as an aunt, I'm pretty sure I claimed a smile before six weeks of age. "That is a smile. She's smiling at me."

Heidi M. Feldman, MD, PhD (guest speaker):

It does occur, and that's a really good point that any given milestone will have a range of ages. So we don't want to suggest that people anticipate the smile at two to four weeks of age because a good portion of children won't have gotten there yet, and that could set up people to worry. What we want to do is pick an age where most children are doing the skill.

I'll give you a few more developmental milestones. Let's talk a little bit about gross motor skills. One of the most important milestones that's very easy to observe, is when children begin taking their first steps independently. And again, what's the age? We used to say it's about 12 months of age. That really runs from about nine months to about 15 months. A big wide range. In fine motor skills, the use of the small muscles of the hands, an interesting milestone, is being able to scribble with a crayon or a pen, and that occurs at about 15 to 18 months of age. And what I find really interesting about that one is this. Before 15 to 18 months of age, closer to 12 months of age, if you give a child a writing implement like a crayon or a pencil, they often put it in their mouths. And so one of the developmental precursors to learning how to scribble and write is often learning to look at the distinctive features of the object rather than to just assimilate the object to the person.

In language skills I want to talk about the milestone that occurs at around two years of age, and that's when children achieve a vocabulary of at least 50 words. And why is that a milestone I choose? Why did I choose 50 words? Well, it turns out that when children can produce 50 words, under most circumstances, they begin to put those words together in short phrases or sentences and they also begin to substitute the adult forms of words for baby forms of words. So instead of "Night," they go to "Goodnight." Instead of "Woof woof," they go to "Doggy," and they make that transition. So though 50 words is the easier one to count, these other shifts are also occurring at the same time. And in thinking and learning skills, children learn to name a color when they're about two and a half years of age, and they learn to draw a circle when they're about three years of age. So those playing and interacting skills are evolving in that timeframe.

Now, I want to talk to you about learning all these milestones. I can tell you having worked with medical trainees for a very long time that people complain, "I can't remember. I can't remember the developmental milestones." And if you're somebody like me who thinks about it all the time, they become automatic. But if you're not somebody who thinks about it all the time, it is hard to remember. There is a terrific resource that I want to tell your audience about. The Centers for Disease Control and Prevention have put out a lot of materials on developmental milestones. The idea with this CDC milestone tracker is that parents are now in control of the information. I love that. And the parents can go online, they can put in what their child can and cannot do. The tracker will give them check marks if things are okay, and will alert them if things are different from the majority of children.

The tracker also has little video clips, so if a parent is uncertain what we mean by a pencil grasp, there will be a little example. And the tracker also has activities. So if you notice, let's say that your 13, 14 month old is not yet walking, there may be recommendations of what kind of activities or games or experiences that child might benefit from to push him over the edge and begin walking. So it's really great, and then the parent can either print out or save the information, take it to a doctor's office or to a well-child visit, and then begin a conversation with the healthcare clinician using that data.

Ruth Adewuya, MD (host):

This is a great segue to talking about, how did you discern between normal developmental variations and potential concerns in early childhood?

Heidi M. Feldman, MD, PhD (guest speaker):

I would say the key here is that we look for patterns. And by using the term patterns, what I'm suggesting is that it's not a single observation and it's not a single point in time. This is a particularly important issue for people who do primary care with children, who have the privilege of seeing children over time with their families under multiple circumstances. So when we think about developmental milestones, patterns across time might look like this.

You might have a child who's maybe not waving bye-bye by at 12 months of age, which is now when that milestone is included in the CDC tracker. But you notice that all the other language and communication milestones at the 12-month time point are being met. The child understands and responds appropriately to "No." That's very good. The child may understand some single words. The child may have a word or two beyond mama and dada. So if they're not waving, bye-bye, and those other milestones are in place, then the pattern is not concerning. If, on the other hand, the child isn't doing any of those 12-month milestones at 12 months and then at [inaudible 00:13:16] months there's still several that are not yet achieved, and at 18 months, then the pattern over time is very concerning. So looking with time as a variable is extremely useful.

The other thing that we sometimes do as developmentalists is look across those domains of function. Let's imagine that we have a 15-month old who is walking very skillfully, so that meets the developmental milestone. That child has no sound production. That's a vast difference between what's happening in one domain and what's happening in another domain. So that pattern concerns us more than if everything is close and not the big gap in abilities. I think the trick in assessing developmental milestones from the clinician perspective is how to respond in a reasonable manner, like not delaying, not waiting and watching too long, but also not leaping to conclusion without adequate data. That's a little bit of the art of assessing developmental milestones.

Ruth Adewuya, MD (host):

That's very helpful, and really honing in on the fact that you have to look at more than one variable in the attempt to understand what is going on. So in a child's progression, how do language and communication skills naturally unfold?

Heidi M. Feldman, MD, PhD (guest speaker):

Thanks for asking that question, Ruth, because when you look at, let's say, early intervention services or early education services for children, the vast majority of children who are enrolled in those programs have delays or differences in their language and communication. So understanding language and communication is really critical.

Right from the get-go, the baby is prepared for language and communication. So a neonate just hours old turns to human voice and turns to human voice over and above other sounds in the environment, and also follows with his or her eyes the human face over and above other stimuli. So children are usually zoned in to the social stimuli from which language and communication emerge. And we think about this development with both understanding or hearing and understanding and producing. I think because it's a complex domain, maybe I'll just give you a few milestones in terms of expressive language.

The first thing the baby starts to do is differentiate crying. There are cries for hunger, there's cries for anger, there are cries for sleepiness, and they're usually not present right at birth, but after birth parents begin to tune in to the cry and that's a great start. When children get to be about two to three months of age they coo, and that cooing is like musical sounds. "Ooh, ah." And the really fun thing you can do with a two to three month old who's cooing is you can set up a proto conversation by imitating the child. So the child goes, "Ooh, ah," and you just go, "Ooh," and you can hand it back and forth a couple of times. And that's setting children up to understand that flow that becomes more meaningful communication as more skills arrive.

Then around six months of age but I think in the new developmental milestones schemes it's a little bit later, comes babbling. And the thing about babbling is that there consonants, just like the word itself. Babble. You can hear this sometimes on an airplane, there'll be a kid who's at this stage and they're going, [inaudible 00:17:07], and they're just going on and on. Sometimes they do it in a social way, and they often just love playing with those sounds. So you can record it sometimes in a baby's crib, this wild inventory of babbles. And then about one year of age, the babbles actually begin to take on a lot of variation and shape an intonation. And it sounds awful lot like actual language until you try and hear the words in there, and they may not be there. Children are getting the kind of rhythms and the flow of language.

I remember one time I was sitting at a birthday party for a 1-year-old. So the 1-year-old was sitting at the head of the table, and you know how adults sit at these tables and adults yak, yak, yak and go [inaudible 00:17:57], and they laugh, and then they yak some more and they go [inaudible 00:18:00], and there was this little pause, and the 1-year-old at the top of the table goes, [inaudible 00:18:07]. Completely mimicking the adult rhythm. So that's all preparatory, and then someplace around the first year of life, the first words come in. And those first words, they're slow to develop, they come and go. So the same word might be there in week one, but not there in week two. They're often baby forms, like "Wawa" for water or "Woof woof," or something like that for dog. And they may not be applied in the same way that adults apply them. So sometimes a dog, the word "Woof woof," could be any kind of animal. It could be a horse, it could be a cat. They don't know that it's a particular animal.

And so in the first wave, children are learning on average about a word a week. So not very quick, but it begins to get faster and faster as that second year of life from 12 to 24 months of age is progressing. And then at some point it goes to a word a day or even more than one word a day, and it's just this rapid logarithmic climb. And that gets called the vocabulary explosion. And that's when kids start learning to put together words. They start normalizing the vocabulary, the meanings begin to align with adult meanings, and then they're able to do so much more with communication.

The one other thing I really want to emphasize is when children are developing normally, typically they use language for lots of different functions, not just their wants and needs. They use a lot to negotiate about the world. They like to point out things that they see in the world. They like to get names for things that they appreciate in the world. So enriching all that function, what people call the joint focus of attention. "It's an airplane. Wow, look, the airplane's going higher and higher up in the sky. Look at that airplane," and not just, "I want cookies."

And children will achieve the real sophistication of language by the time they get to school age, like four to five. So there's really nothing that they can't do that they want to do with language. They may not have full sound maturity until after that. So there's some late developing sounds that can still come in at ages six, seven, and eight. By about eight, the system is really in place and then what the children get are deeper concepts and deeper conversations.

Ruth Adewuya, MD (host):

What are some prevalent misconceptions about developmental milestones?

Heidi M. Feldman, MD, PhD (guest speaker):

One misconception is that a single developmental milestone is a serious issue to consider, whereas as we've spoken before, really it's patterns of development. Another thing is that there are certain parents who think that they need to teach the developmental milestones, and that is really not the case. The developmental milestones are these activities or skills or accomplishments that are going to unfold through interactions in the world. There doesn't have to be any teaching. And in fact, when you sit and try and teach children developmental milestones, you may not exactly get the outcome that you're looking for.

I think these days in this era of artificial intelligence, we're becoming more familiar with this idea that there's lots of data that our machines encounter, but humans encounter too. And learning is what emerges from the data itself. So you don't teach ChatGPT how to answer the question. You feed it general information, and it figures out the information to pull based on probabilities and co-occurrences and things like that. And in human development, I think it's a similar phenomenon that we give the child this vast array of data, experiences, learning, words, and they then find the common features, the co-occurrences, and they create their knowledge de novo from this dataset. So we don't have to teach developmental milestones. What we want to do is enrich the child's life.

Ruth Adewuya, MD (host):

And I love the connection to ChatGPT and that analogy. I'm also curious to hear from you if you have seen ways in which cultural disparities influence the perception of developmental milestones.

Heidi M. Feldman, MD, PhD (guest speaker):

Oh, that's a great question. I have seen a lot of variation in how cultures experience developmental delays and disorders in their children. In some cultures, it is a terrible catastrophe if a child's development is not proceeding as expected. Even if a child is still healthy and moving along the trajectory at a reasonable if not rapid rate, even that sometimes is a source of either disappointment or distress for parents. And I feel like part of my job as a developmental behavioral pediatrician is not only to identify those children whose developmental path is different or at a different rate, it's also to humanize the child and it's also to continue to assure that child experiences respect and compassion, love, understanding, and that child remains welcome in our whole society, in our families, in our schools, in our communities. There's room for the vast diversity of human experience, and we just need to make sure that we make everybody feel welcome at the table.

Ruth Adewuya, MD (host):

Very well said. As you look forward and as we know more about how child development progresses, what are some emerging trends or advancements that you anticipate we will see as it relates to assessing and supporting developmental milestones in children?

Heidi M. Feldman, MD, PhD (guest speaker):

I think that the CDC tracker that I've talked about now a couple of times is an example of democratizing the information about development for the wide public, and that to me is a really important current trend. The more parents have information and family members have information, the more we can support children in their own development.

A second thing is actually invigorating social and community supports for families. So the families can be the early source of education and experience for their children is a really top priority. There are lots of philanthropic organizations that are gearing in that direction, and I think you can even think about that as prevention of mental health disorders as well as enhancement of developmental status. I am really hoping that trend continues.

And the last thing would be, this is one of my pipe dreams, is that families can get early access to supports and services for children if the child's developmental path is altered either in direction or speed or pattern, and that we worry a lot less about the diagnostic category, which right now is the gateway to a lot of those services, and we think more about the function of the child and supporting that child's functioning in all those domains that we've discussed.

And so I'd really like to see, and I think other countries have done a better job of that than the US, broader access to community resources like family centers where you don't need an appointment and you don't need a diagnosis. You can show up. The cost is nothing or minimal, and there are people in the center who can be your peers. "Oh, look, your kid screams like that too when you take away the toy? Your 2-year-old also is poor at sharing? Oh, I had no idea." So there's peer education, and then there can also be some professional peer education, especially for those children who are maybe a bit more challenging or whose development is a little bit off.

And then in that setting, it will become clearer to us if children need more specific or more intensive intervention, and then we can move them through an individual path. I think right now we wait and then all of a sudden it's a panic to get children resources and services that seem appropriate. So I think we need to think about the whole continuum and making a way more available, accessible service for all families in which this invigorating the social and community supports can take place.

Ruth Adewuya, MD (host):

What an excellent future that you've just cast, and my hope is that in the upcoming years there will be an effort to get to this pipe dream that you have, and hopefully it'll no longer be just a pipe dream. But this was excellent. Thank you so much for chatting with me today. I learned a lot. The resources will be available on the website, but this was just incredible.

Heidi M. Feldman, MD, PhD (guest speaker):

Thanks, Ruth. It was really nice.

Ruth Adewuya, MD (host):

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