

Podcast: Why Neighborhoods Matter: Brain Development in Children

[Theme music]

Ashley Ahearn (Narrator): You're listening to Environmental Health Chat – a show from the National Institute of Environmental Health Sciences that explores the connections between our health and our world.

I'm Ashley Ahearn.

Where we grow up, and how we grow up, affects how our brains develop.

But, of course, it's a complicated web of factors that play into brain development and cognitive ability.

Megan Herting: I think it's an ongoing, open question, but there's a lot of research suggesting there's various parts of an environmental component, social aspects, like social stressors, education as an environmental factor, the types of schooling and the resources.

AA: Megan Herting has dedicated her career to piecing together the ways in which various factors – social, biological, and environmental – play into how kids' brains develop.

MH: And now we know various pollutants, lead exposure, for example, has been linked to brain health and brain outcomes. So we know there's a lot going on in terms of what we're exposed to outside our own bodies that might matter.

AA: Herting is an assistant professor at the University of Southern California and directs the Herting Neuroimaging Lab at USC.

She lived in several different cities as a kid – Chicago, Albuquerque, El Paso – and that got her thinking about urban environments and how different they can be from one city to another. And even within the same city, there can be big differences between neighborhoods.

MH: So, whether there's parks nearby, whether or not there's factories nearby – you see these kids in different neighborhoods and start to think about what are these environmental contexts and what do these environmental influences mean for a kid who's developing in different regions of the country and/or different parts of one city?

AA: To start analyzing those factors, and understanding what they mean for kids, Herting joined a team of scientists gathering data from more than 11,000 kids in 21 cities across the country. It's called the ABCD study – or Adolescent Brain Cognitive Development Study. It's funded by the National Institutes of Health and it's the largest long-term study of brain development and childhood health in the United States.

MH: So, I am just one very small piece of this magnificent study. And we are really fortunate to have so many children and parents come to us each year, share with us their experiences, let us scan the brain of the developing youth, and learn about how everything from, social and cultural environments, air pollution, and other factors might influence how the brain wires itself.

AA: The ABCD study is providing a wealth of baseline data about children's physical development, their education, their community support systems, their family make-ups – all factors that can contribute to the way their brains develop.

Herting thinks of that kind of data as valuable context for the brain scans – also known as MRI – and cognitive analyses that are also conducted as part of the ABCD study.

MH: We use MRI to study the brain structure and function as a proxy for how it activates and how it's functionally organized. And then we also ask a number of different puzzles and games or tests to try to get at individual differences on how people do with things like paying attention or remembering items, things that are really important for daily functioning for school, and for later on being able to attain jobs and other successful functioning in everyday life.

AA: Herting and her colleagues are five years into the 10-year study. And with this wealth of data, Herting realized she wanted to go deeper. She wanted to look at factors at the hyper-local level and how they might play a role in children's brain development. So, she teamed up with Daniel Hackman, another researcher at the University of Southern California with a background in social work.

MH: And he has a strong background and thinking about more the sociology behind neighborhoods, things like crime or poverty. And so we were very much interested in understanding how community characterization of a neighborhood could relate to child development.

AA: When study participants came in for the ABCD study, they were asked where they lived. That information was used, with their permission, to then map the characteristics around their home using census data.

MH: And what we did is we looked at a couple of different variables in those census tracts, we looked at the percentage of residents with at least a high school diploma, we looked at the median family income, the unemployment rates in those areas, the percentage of families living below federal poverty level, and even the number of single parent households.

AA: Herting and her colleagues were able to assemble a snapshot, if you will, that connected the neighborhoods where these 9-to-10-year-old kids lived with their cognitive scores and brain structure.

MH: And what we found was that the higher these characteristics of neighborhood quote-unquote disadvantage, meaning that there's less people with a high school diploma, lower family income, more families living below the federal poverty level, those were associated with overall poor performance on the summary scores for the cognitive tests we give and those things included things like inhibition and attention – so being able to withhold a response, pay attention to learning new information – as well as things like working memory, which is your ability to hold and manipulate information in your head in order to process the world around us.

AA: Kids from more disadvantaged neighborhoods tended to have lower whole brain cortical surface area. Herting also found some specific patterns of brain size in places like the frontal lobes, the temporal lobes, and the parietal lobes.

MH: And what this means is that we are looking at the overall number of folds in the brain and the size of the brain. And we saw that higher disadvantage was linked to smaller, essentially volumes or surface, of these parts of the brain.

AA: The findings, which showed disparities in children's brain health between affluent and disadvantaged neighborhoods were consistent across the 21 cities where data was collected from more than 8,500 study participants.

Ok, so that's horrifying, when you sit and think about it, right? That the brains of children from disadvantaged neighborhoods look and develop differently from children in more affluent neighborhoods.

But Herting cautioned: It's not that simple. This data represented a snapshot in a child's life, not a long-term assessment. At the individual level, Herting said there were kids from affluent neighborhoods who tested the same or worse than kids from disadvantaged neighborhoods, and vice versa. And...

MH: The effect sizes were small, we're not talking about if you pulled up a brain of someone from a disadvantaged neighborhood versus an affluent neighborhood, that you would be able to tell with the human eye what the difference is. It's not that large of an effect. And so this one snapshot of an association and is not deterministic by any means. But it does say that we should be paying attention to neighborhoods, that neighborhoods matter.

AA: Herting and her colleagues at the Southern California Environmental Health Science Center, which is funded by the NIEHS, have prioritized sharing their findings. They've developed infographics about how various factors might influence brain development and shared them with community groups and other organizations in Los Angeles.

She understands that the findings may be concerning for some parents raising kids in disadvantaged neighborhoods. But for Herting, it's about empowerment. So the team included actionable strategies in the infographic for parents and community members.

MH: We often talk about the environment influencing the brain, but the brain also can choose the environment, right. And so there's a lot to say about being able to take the information about environment and what's there and empower oneself for making the best decisions for themselves and for their families.

AA: Was there a moment or an experience in your research that really made your findings real for you or sort of solidified your commitment to this work?

MH: Yes, I look back at my journey of going from really studying the basic biology of the developing brain to thinking more about the social questions around us, of families and communities around us. And part of that was becoming a member of my current neighborhood. I live in East Los Angeles, and my in-laws and my extended family are from here, third generation Mexican American, and they come from this neighborhood. And when I integrated into their family and came into this neighborhood to be a community member, it was striking how the lack of resources for these very hard working multi-generational families doing the best every day to provide for their families, were not being given the same neighborhood resources as other communities.

AA: Herting hopes her research reaches the ears of policymakers and others focusing on combatting inequality and disparity between neighborhoods across the country.

MH: And that's what I think our work suggests is that we should pay attention so that people who have to make these hard decisions about reinvesting in neighborhoods and also leveling equity in America, can use this to say, well, this is one more really important reason, long term for children's health and outcomes, to be able to put resources into communities in every city that might need more of that.

AA: Do you have kids?

MH: I have one on the way.

AA: Oh, congratulations!

MH: In December. Yes, thank you. So, I too will have a future child to think about and I want the best for them, just as every other parent and grandparent I meet wants the best for their child and grandchild. I'm hoping that we have a way with this research to change the way that we structure our neighborhoods, structure equity, so that just like every parent we leave this world a better place than we found it. But, you know, I think that's always been the case, when you talk to families about their children and about what they want for their children – they want the best possible outcomes. And so here's one way that as policymakers and politicians can look and say, where are we putting our resources? How are we developing equity in our communities? And I think it's worthy of further thought and is really important for everybody to be able to achieve their best self.

AA: Megan Herting and her colleagues will continue this research for the next five years with the hope of mapping long-term potential outcomes – and possible solutions – to protect childhood brain development and health.

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I'm Ashley Ahearn. Thanks for listening to Environmental Health Chat.