

Severe poverty affects brain size, researchers find

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Credit: Anna Langova/public domain

A six-year study by researchers at the University of Wisconsin-Madison has added to the mounting evidence that growing up in severe poverty affects how children's brains develop, potentially putting them at a lifelong disadvantage.

The study - which combined the expertise of neuroscientists and

economists - found that the parts of the brain tied to academic performance were 8 percent to 10 percent smaller for children who grow up in very poor households.

It was based on a relatively large sample of predominantly white children whose mothers were much more educated than the general population. And the results show a biological link between growing up in extreme [poverty](#) and how well children do academically.

"The significance of the study is providing a hard physical link between the experience of growing up in poverty and how well children do on cognitive tests," said Barbara "Bobbi" Wolfe, an economist at UW-Madison and one of the co-authors of the study.

The study, published in *JAMA Pediatrics*, builds on animal studies and other research suggesting that poverty affects the parts of the brain tied to self-control, attention, planning and other traits important for success in school and life.

The children often receive less nurturing from parents and live in environments characterized by increased stress from crowded housing, instability, poor nutrition, limited stimulation and more exposure to violence.

That children who grow up in poverty do less well in school is well documented. But studies increasingly show that at least part of that overall poor performance stems from how their brains grow and work.

The UW study estimated that as much as 20 percent of the gap in test scores could be explained by slower development of two [parts of the brain](#): the [frontal lobe](#) and the [temporal lobe](#).

The frontal lobe is important for controlling attention, inhibition,

emotions and complex learning. The temporal lobe is important for memory and language comprehension, such as identifying and attaching meaning to words.

Both areas of the brain develop through adolescence.

"It provides a brain-based explanation for why children living in poverty are not performing academically as well," said Joan Luby, a professor of child psychiatry and director of the Early Emotional Development Program at Washington University School of Medicine. Luby was not involved in the study.

The UW-Madison study was led by Wolfe and Seth Pollak, a professor of psychology and director of the Child Emotion Lab.

Two former graduate students also were involved in the study and co-authors of the recent article: Nicole Hair, an economist now at the University of Michigan, and Jamie Hanson, a psychologist and neuroscientist now at Duke University.

The study drew on 823 magnetic resonance imaging, or MRI, scans of 389 children, ages 4 to 22, from a National Institutes of Health study done to show normal brain development. The scans were done from November 2001 to August 2007, and the NIH study included complete information on the families' social and economic status.

The design of that study provided additional support for how poverty affects brain development in children.

Here's why:

?? The mothers of the children included in the study were much better educated than the general population - 84.9 percent said they had at least

some college education.

![]? Families were screened for several factors suspected to adversely affect brain development, such as children who were born prematurely or who had other risky neonatal histories, who had low IQs and whose families had a history of psychiatric conditions.

The sample, in other words, was not representative of children growing up in [extreme poverty](#).

"And we still found this drastic difference in brain development," Pollak said.

He suspects that the study's findings would be even stronger for a representative sample of all children living in extreme poverty - households with incomes below the [federal poverty level](#), or \$20,090 for a family of three.

Luby agreed that the effects of poverty found in the study probably were underestimated, given the sample.

Genetics still could be a factor in the slower development of the children's brains.

"But it does provide very, very compelling evidence for another causal change," said Luby, who wrote an accompanying editorial in JAMA Pediatrics.

The study, though, also contained an encouraging nugget: It found no significant difference in the [brain development](#) of children who grew up in so-called near-poor households - those with incomes above 200 percent of the federal poverty threshold, or \$40,180 for a family of three - and those who grew up in middle-class or even upper-middle class

households.

"What that says to me is that humans can actually deal with a quite a lot," Pollak said. "We are not delicate orchids."

The UW-Madison study and similar studies have the potential of changing how people look at poverty and how it affects children.

"A lot of brain science data isn't really saying anything all that different than the behavioral and social science data that we've had for 20 to 30 years," Luby said. "But when you can show tangible brain change, it has a different impact on people and a different meaning. It just provides a level of tangible evidence."

That, too, is Pollak's take on the study.

"What this is doing is reframing the problem," he said. "Since President Johnson declared the War on Poverty, Americans have tended to look at poverty as a policy issue. ... But it also looks like it is a biomedical issue."

He likens the potential effect of poverty on children to lead paint - an environmental hazard that damaged children's brains.

"Now we certainly can begin looking at poverty that way, too," he said.

Research shows that early interventions, such as home visitation programs for families and preschool for children, are effective and have the potential to change lives.

That's because the [brain](#) has more "plasticity" early in life - it responds more quickly to changes in environment.

The studies on how poverty affects the development of children's brains are relatively new. Few existed a decade ago. But now more studies exist, and they are getting more attention in policy circles.

They suggest the need to invest in [children](#), Wolfe said.

If society doesn't, she said, "they are worse off, and we are all worse off."

Pollak, too, stressed the potential long-term costs.

"Americans tend to really like to believe in this narrative that everyone here has a chance," he said. This kind of research suggests that we have some kids entering kindergarten at totally not a level playing field - with environments that are so impoverished and under-stimulated and nonconductive to healthy growth, we've got little 4-year-olds, 5-year-olds starting kindergarten already at an extreme disadvantage.

"So the data really runs counter to the fact that everyone in this country has a fair shot."

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