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Fast Focus

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The Institute for Research on Poverty (IRP) at the University of Wisconsin–Madison hosted a workshop in April of 2016 that brought together researchers working in the area of poverty and developmental neuroscience to discuss the current status of the research and how it can be appropriately and effectively used to inform public policy. The workshop was organized by Seth Pollak, a psychologist, director of the University of Wisconsin Child Emotion Lab, and IRP affiliate; and Barbara Wolfe, a professor of economics, population health sciences, and public affairs, and former director of IRP.

The workshop included national leaders in the neuroscience, poverty, and public policy fields, including Lawrence Berger (University of Wisconsin–Madison), Gary Evans (Cornell University), Martha Farah (University of Pennsylvania), John Gabrieli (MIT), Peter Gianaros (University of Pittsburgh), Charles Homer (US Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation), Pilyoung Kim (University of Denver), Joan Luby (Washington University in St. Louis), Katherine Magnuson (University of Wisconsin–Madison), and Kimberly Noble (Columbia University). The discussion addressed several key challenges, which are summarized in this brief.

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Deepening connections between neuroscience and public policy to understand poverty

Children living in poverty do worse than their more affluent peers on standardized tests, and have lower grades and lower levels of academic attainment than their better-off counterparts. These gaps last into adulthood and translate to lower earnings and worse health. Although this relationship is well-documented, the mechanisms behind it—especially physiological factors—are not well understood. In recent years, however, studies have begun to document that inhibited brain development and functioning in children who are raised in poverty may be an important explanatory factor behind the tie between growing up in poverty and lower educational attainment.

Recent studies analyzing children's brain scans have shown that children from poor and near poor households have smaller volumes of gray matter in their frontal lobes (which are tied to executive functioning) and temporal lobes (which are tied to language skills) compared to children from wealthier households. Low family socioeconomic status (SES) and other early life stresses are also found to be associated with decreased volumes in the hippocampus and amygdala, regions that are important for processing and regulating emotions. Because this is a new area of research, there remains much to be learned about how links between neurobiology and poverty should inform public policy.[1]

What do we need to know about how poverty affects brain development to inform public policy?

The workshop focused on identifying ways that neuroscience research could be used to provide improved insights about the effects of poverty and to develop more effective antipoverty policies in response to these insights. Participants emphasized the need to consider mechanisms such as environmental factors, stress, nutrition, and health to better understand why and how poverty may affect brain development. One key message was that greater specificity is needed when describing particular aspects of poverty that may lead to changes in brain development, with specific implications for cognitive and/or social-emotional functioning. Similarly, there was agreement regarding the importance of improved description and documentation of relations between poverty and neurological outcomes. Although there is growing evidence that experiencing poverty as a child is correlated with delayed brain development, participants cautioned that there is still a great deal to learn, especially relating to the diversity that exists in individual responses to poverty.

There is hope that neurobiological measures may also offer new opportunities in the evaluation of antipoverty interventions. Researchers ultimately want to be able to use neuroscience to assess whether an intervention leads to a particular outcome. By documenting whether an intervention influences key neurological pathways—mechanisms—that are linked to outcomes of interest, brain images might be able to offer more "real time" feedback than behavioral or achievement-based measures. In many cases, behavioral effects are not fully visible or measureable until years after the intervention, whereas brain scans may be able to show results more quickly after implementation of the intervention. For example, the Perry Preschool study and the Moving to Opportunity (MTO) study, two of the oldest and most widely cited antipoverty interventions, suggest that some effects of policies may not be visible until years later. Recent evaluations of Perry Preschool and MTO have found both interventions having effects in young adulthood on those in the treatment groups.[2] It is possible that effects of similar interventions might be captured far earlier using brain scans or other biological measures.

Although neuroscience may offer important insights into antipoverty interventions, implementing interventions in a way that is conducive to evaluating their influences on the brain will likely require additional resources. Researchers at the workshop cautioned that attempts to include biological measures in evaluations without adequate funding to do so in a rigorous manner may be unproductive. Even when adequate funds are provided for evaluation, there remains a lack of consensus regarding what types of evaluation are most effective. Specifically, questions remain about whether EEG, MRI, fMRI, or other types of brain scans can provide results that can be interpreted to indicate whether an intervention was successful.[3]

There are beginning to be efforts to merge brain scan data across studies in order to increase sample sizes and diversity in the samples. Yet, just as there are questions about the comparability of different types of scans, there are also problems with combining scans from different studies. One issue is that functional imaging scans tend to look at very individualized questions and may be of limited usefulness when applied to a different set of questions. Additionally, variations in scanning protocol, machines, and even the calibration of machines raise questions about the comparability of data. On one hand, there is concern that more and better evidence is needed to make strong predictive statements and that more should to be done to determine whether an EEG or MRI scan can actually answer particular types of questions about subsequent development. On the other hand, it was emphasized that this line of research should move beyond focusing on results pertaining only to small, tightly controlled studies and toward more global conclusions. Currently, there are no standard protocols or norms regarding what types of social, economic, and demographic data are collected in brain studies, and how such factors should be measured. (This last issue prompted the organizers to suggest facilitating efforts to standardize these measures.)

What are common challenges in communicating the results of neuroscience research in relation to poverty and its implications for policy?

Researchers participating in the workshop emphasized the importance of appropriately framing discussions of neuroscience research and its application to issues of poverty in order to successfully reach policymakers and the general public. This type of research offers a unique opportunity to help understand the physiological ramifications of growing up in poverty. However, special attention should be paid to accurately relaying and appropriately qualifying findings to nonspecialists. Especially when using these findings to inform policy, it is crucial to make clear what is known about causality and what evidence is sufficient for causal inference. Additionally, some participants worried that these types of findings may be represented as irreversible or as deterministic of a person's life chances. Given these concerns, developing and disseminating strategies for sharing complex findings with policymakers, journalists, and the general public should remain a key component of future efforts in this area of research.

What future directions should neurobiological research about the effects of poverty take in order to be useful to policymakers?

For research to be useful to policymakers, it needs to be timely, relevant, and of high quality. It is also important that it be economical given limited funds available for research efforts. Neuroscience studies focused on socioeconomic questions could offer the advantage of helping policymakers design interventions that are better targeted and more cost effective. It is already accepted that children living in poverty have poorer health and do worse on a number of other measures, but brain scans and other biological measurements may begin to uncover some of the mechanisms behind these outcomes. Similarly, neuroscience may lead to better insights about whether an intervention leads to the intended result. As one way of helping to understand how particular mechanisms or programs work, researchers at the workshop proposed using studies of middle class children to help identify common threads. For example, researchers might compare children in poverty to children in middle class single-parent families since single parenthood is one reason that children in poverty are thought to experience negative outcomes.

Participants at the workshop were focused on finding ways to build the body of evidence in this area to reach the level of certainty needed to put ideas into practice at the policy level. One of the main themes that emerged in discussions was increasing standardization across brain studies by collecting social science data. To do this, participants proposed developing a set of poverty- or SES-relevant questions that could be asked every time a brain scan or other measurement is taken. Such questions could help researchers better understand connections between mechanisms of poverty and improve efforts to identify synergies between mechanisms. Including such measures could greatly expand the amount of data available to researchers with low additional costs. Incorporating a common set of social science-relevant questions would have the added benefit of helping researchers understand how differences in samples could lead to variations in results across studies and would provide a stronger basis for researchers to communicate SES-relevant findings to policymakers.

Bringing new researchers into this field and creating relationships with related areas of research are important steps in building the critical mass needed to make this work useful to policymakers. A proposal was made to develop a workshop to help neuroscience researchers learn how to integrate socioeconomic measures into their own studies. Others suggested expanding relationships with researchers doing work on prenatal stress, the human microbiome, and other areas related to brain development. Workshop participants were optimistic that interest in doing SES-focused neuroscience would continue to increase. Whereas SES used to be treated simply as a control variable in neuroscience work, it is now beginning to be seen as a key area of focus. Attendees expressed great interest in continuing the dialogue as a way to encourage research on the influence of poverty on the brain that might eventually improve policy design and hence opportunities for children growing up in poverty. The Institute for Research on Poverty plans to facilitate additional opportunities to move this discourse forward.■

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[1]For sources and suggested readings, please see:

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G. E. Miller and E. Chen, "The Biological Residue of Childhood Poverty," *Child Development Perspectives* 7, No. 2(2013): 67–73.

S. M. O'Mahony, G. Clarke, T. G. Dinan, J. F. Cryan, "Early-life Adversity and Brain Development: Is the Microbiome a Missing Piece of the Puzzle?" *Neuroscience* (2015).

[2]For Perry Preschool, see J. J. Heckman, S. Hyeok Moon, R. Pinto, P. Savelyev, and A. Yavitz, "A New Cost-Benefit and Rate of Return Analysis for the Perry Preschool Program: A Summary," National Bureau of Economic Research, NBER Working Paper 16180 (July 2010); For Moving to Opportunity, see R. Chetty, N. Hendren, and L. Katz, "The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Project," *American Economic Review* 106, No. 4 (2016): 855–902.

[3]An electroencephalogram (EEG) is a test that detects electrical activity in the brain using electrodes attached to the scalp. Magnetic resonance imaging (MRI) is a technique that uses a magnetic field and radio waves to create detailed images of organs and tissues within the body. Functional magnetic resonance imaging or functional MRI (fMRI) is procedure that uses MRI technology to measure brain activity by detecting changes associated with blood flow.

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