Poverty and childhood health

Four panelists addressed the relationship between poverty and childhood health. Anna Aizer discussed the relationship between parental income and childhood health, and the mechanisms through which this relationship may work. She concluded that policy interventions targeting childhood health appear to substantially reduce the intergenerational transmission of inequality. Margot Jackson examined the simultaneous effects of poverty and poor health on children's cognitive achievement. The findings she presented support the idea that poverty is an important early factor in children's development, and also suggest that health investments are a key part of the antipoverty safety net. Rourke O'Brien presented evidence on the effects of the Medicaid expansions of the 1980s and 1990s on intergenerational economic mobility, concluding that early access to health insurance promotes mobility and that local variation in access explains some of the local variation in mobility. Claudia Persico explored whether in utero exposure to pollution helps to explain differences by income in children's cognitive and physical development. She concludes that exposure to pollution appears to cause lower test scores, and an increased likelihood of behavioral problems and cognitive disabilities, and that the "Superfund" cleanup program is associated with significant improvements in long-term cognitive and developmental outcomes for children. This set of articles summarizes their presentations.

How childhood health affects poverty in adulthood

Anna Aizer

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By any measure, there is a large income gradient in child health in the United States, meaning that children born into poorer families have worse child health. This relationship can be observed across a wide range of child health outcomes, including newborn health, infant mortality, and physiological differences in brain structure.[1] The gradient also increases as children age, meaning that a given decrease in income is associated with a larger decline in health for older children.[2] In this article, I explore current knowledge about the effect of parental income on child health and discuss the implications for policy.

The income-health gradient

Birth outcomes, such as the probability of low birth weight (defined as under 2,500 grams, or 5.5 pounds) or infant mortality, illustrate the income gradient in child health. For example, low birth weight occurs in about 10 out of 1,000 births for poor women, compared to six out of 1,000 births to nonpoor women.[3] Similarly, the rate of infant mortality is 14 out of 1,000 births to poor women, compared to eight out of 1,000 births to nonpoor women.

How child health affects future income

There is evidence that health in childhood affects earnings in adulthood, through two mechanisms. First, child health is correlated with adult health, and poor adult health lowers earnings. For example, a sibling study found that those with poor health in childhood had 24 percent lower earnings than their healthier siblings.[4] Second, child health can affect schooling and cognitive achievement, which can in turn affect income. For example, a study of the effects of the eradication of hookworm disease in the American south in the early 1900s found large increases in educational attainment attributable to the health improvement.[5]

Pathways through which family income affects child health

Families with fewer economic resources clearly have less ability to spend money in ways that enhance their children's health, but two additional factors are relevant. First, education matters; those with higher educational attainment are more likely to follow medical treatment plans. Second, poor families tend to have different beliefs about how to keep their children healthy, including being less likely to believe that they can influence their children's cognitive function with their own actions.[6]

There are many different mechanisms through which family income can affect child health. Several of these are discussed in other articles in this issue, such as access to medical care and health insurance (by Rourke O'Brien), exposure to pollution and environment toxins (by Claudia Persico), and violence (by Lawrence Berger). Other potential mechanisms include stress and mental health issues, infectious diseases, and income inequality and relative deprivation.

Stress, and mental health in general, also provide a mechanism through which family income can affect child health. The poor face a greater number of stressful events in their lives and have higher average levels of the stress hormone cortisol relative to their wealthier counterparts.[7] There is some evidence that this relationship is causal;

increases in income from the Earned Income Tax Credit (EITC) have been found to result in lower self-reported levels of stress in mothers.[8] Evidence also suggests a causal relationship between mothers experiencing even relatively mildly stressful events during pregnancy and child outcomes.[9]

Serious parasitic and bacterial diseases are prevalent among the poorest populations in the United States, such as those living in Appalachia and the Mississippi Delta. These diseases exacerbate poverty through effects on pregnancy outcomes, child development, and labor market outcomes.[10]

Research on inequality and relative deprivation indicates that relative income—where one's total income falls relative to other people in the society—more than absolute income, determines mortality in industrialized countries.[11] There is some evidence that high relative deprivation is associated with a higher probability of death for adults, but there is less evidence regarding deprivation and child health.[12]

Public policy, child health, and the intergenerational transmission of income

In a review of research on the effects of public programs for poor children on child health and well-being, Joseph Doyle and I concluded that health interventions were generally the most effective type of policy intervention.[13] In order to test this conclusion, I looked at social spending in Organization for Economic Cooperation and Development (OECD) countries, and identified the type of programs that were funded in each country.[14] I then tried to connect spending changes to changes in mobility and equality. We found that countries that increased their spending on health tended to have larger declines in inequality. This relationship did not hold true for social spending as a whole, or for other categories of social spending. I looked further at how countries spent money on health interventions. I found, for example, that within countries over time, increases in the number of pediatricians per capita and decreases in infant mortality predicted large reductions in both inequality of test scores and intergenerational income mobility 10 to 15 years later. These changes in inequality came entirely from raising test scores for those at the bottom of the distribution, not from lowering test scores for those at the top. While this analysis cannot show that the health spending caused inequality to decrease, it does reinforce the idea that health interventions are a particularly effective way to affect inequality.

Implications

Why are public health investments so productive? It may be that we know much more about how to produce child health than we do about producing other positive outcomes such as high test scores. In the United States, a very large amount of money—18 percent of the Gross Domestic Product—is spent on health, but little of that is spent on children; most is spent on the elderly. Evidence suggests that it may be worthwhile to consider spending more on children's health, where we know these expenditures can be productive in both the short and long run.■

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[2]A. Case, D. Lubotsky, and C. Paxson, "Economic Status and Health in Childhood: The Origins of the Gradient," *The American Economic Review* 92, No. 5 (December 2002): 1308–1334.

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[4]J. P. Smith, "The Impact of Childhood Health on Adult Labor Market Outcomes," *Review of Economics and Statistics* 91, No. 3 (September 2009): 478–489.

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[6]F. Cunha, I. Elo, and J. Culhane, "Eliciting Maternal Beliefs about the Technology of Skill Formation," working paper, November 4, 2015. https://econ.georgetown.edu/sites/econ/files/documents/cunha_elo_culhane_2015.pdf.

[7]A. Steptoe, S. Kunz-Ebrecht, N. Owen, P. J. Feldman, G. Willemsen, C. Kirschbaum, and M. Marmot, "Socioeconomic Status and Stress-Related Biological Responses Over the Working Day," *Psychosomatic Medicine* 65, No. 3 (May 2003): 461–470.

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[9]See, for example, A. Aizer, L. Stroud, and S. Buka, "Maternal Stress and Child Outcomes: Evidence from Siblings," *Journal of Human Resources* 51, No. 3 (August 2016): 523–555.

[10]P. J. Hotez, "The Neglected Tropical Diseases and the Neglected Infections of Poverty: Overview of Their Common Features, Global Disease Burden and Distribution, New Control Tools, and Prospects for Disease Elimination," in *The Causes and Impacts of Neglected Tropical and Zoonotic Diseases: Opportunities for Integrated Intervention Strategies*, Institute of Medicine (Washington, DC: The National Academies Press, 2011). Pp: 221–237.

[11]A. Deaton "What Does The Empirical Evidence Tell Us About the Injustice of Health Inequalities?" in *Inequalities In Health: Concepts, Measures and Ethics*, eds. N. Eyal, S. A. Hurst, O. F. Norheim, and D. Wikler (Oxford, UK: Oxford University Press, 2013). Pp: 263–281.

[12]C. Eibner and W. N. Evans, "Relative Deprivation, Poor Health Habits, and Mortality," *Journal of Human Resources* 40, No. 3 (2005): 591–620.

[13]A. Aizer and J. J. Doyle, Jr., "Economics of Child Well-Being: Measuring Effects of Child Welfare Interventions," in *Handbook of Child Well-Being: Theories, Methods and Policies in Global Perspective Volume 3*, eds. A. Ben-Arieh, F. Casas, I. Frønes, and J. E. Korbin (New York: Springer, 2014). Pp: 1563–1602.

[14]The Organization for Economic Co-operation and Development (OECD) currently includes 35 countries.

Effects of poverty and health on children's cognitive development

Margot Jackson

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It is increasingly clear that poverty and health have a reciprocal relationship, with each affecting the other, and with the two working together to contribute to inequality by socioeconomic status. Health and poverty both vary over time, and each simultaneously obscures, mediates, and moderates the effects of the other. It is difficult to disentangle these intertwined effects, and most research to date has focused only on the effects of health on poverty or the reverse. In the work described in this article, Dohoon Lee and I examine how the reciprocal relationship between poverty and child health during early childhood affects estimates of each circumstance on children's cognitive development, and assess how these effects vary with age and across racial and ethnic groups.[1]

Inequality begins early

As has been discussed in earlier articles, there is a strong association between childhood adversity and inequality later in life. The possibility that the transmission of social inequality begins quite early is receiving increasing attention by both scholars and policymakers. There has also been a shift in how we think about the transmission of social inequality from a fairly static perspective—linking one generation of adults to income or occupational status among the next generation of adults—to a more dynamic perspective. This new perspective acknowledges that sensitive periods of human development structure children's progression through various social institutions, and eventually determine attainment in adulthood. Socioeconomic inequalities in children's health and skill development are present before children enter the school years and play an important role in shaping longer-term prospects for education and socioeconomic attainment.

Poverty and child health

Childhood health is particularly revealing because it is closely intertwined with both biological and social processes, and is strongly influenced by socioeconomic background. Health, independent of socioeconomic circumstances, affects both opportunities for upward mobility in the short-term such as skills acquisition and achievement, and risks of downward mobility in the long-term such as job loss and declining income. This evidence leads us to conclude that health is not merely a proxy for socioeconomic status, but is instead an important determinant of human capital development that operates through both social and biological mechanisms. In researching poverty and health, our hypotheses, and tests of those hypotheses, should not set up the effects of the two factors to be mutually exclusive.

Effects on child cognitive development

Most research on health and inequality looks at longer-term effects among adults. We focus on children not only because childhood is a sensitive period for skill development, but also because child health affects family well-being, not just individual outcomes. In particular, we focus on cognitive development because it is strongly affected by both poverty and child health.

Using data from the Fragile Families and Child Wellbeing Study, we show the effects of poverty and child health on child cognitive skills in Table 1. We find that both poverty and poor health have statistically significant negative effects on children's cognitive skills, but controlling for factors that do not change over time, such as demographic characteristics and socioeconomic status at birth, greatly decreases effect sizes. Using marginal structural models, we also estimated effects that account for time-varying confounding from variables such as family structure, parental employment, number of children, and the reciprocal effects of poverty and child health over time. That is, for poverty estimates, we controlled for child health over time, while for health estimates, we controlled for poverty over time. This approach did not greatly change the estimates of either poverty or poor health on cognitive skills.

As Figure 1 shows, we found different patterns for the effects of poverty and poor health on cognitive skills by age of the child. At age 3, there was little evidence of differences in cognitive development by either poverty or health status.

Table 1
Effects of Poverty and Child Health on Child Cognitive Skills

	No Control Variables	Controlling for Variables that Do Not Change Over Time
Poverty	-0.207	-0.052
Poor Health	-0.065	-0.030

Note: Control variables include: social, economic, demographic characteristics at birth; and maternal, paternal, and child characteristics.

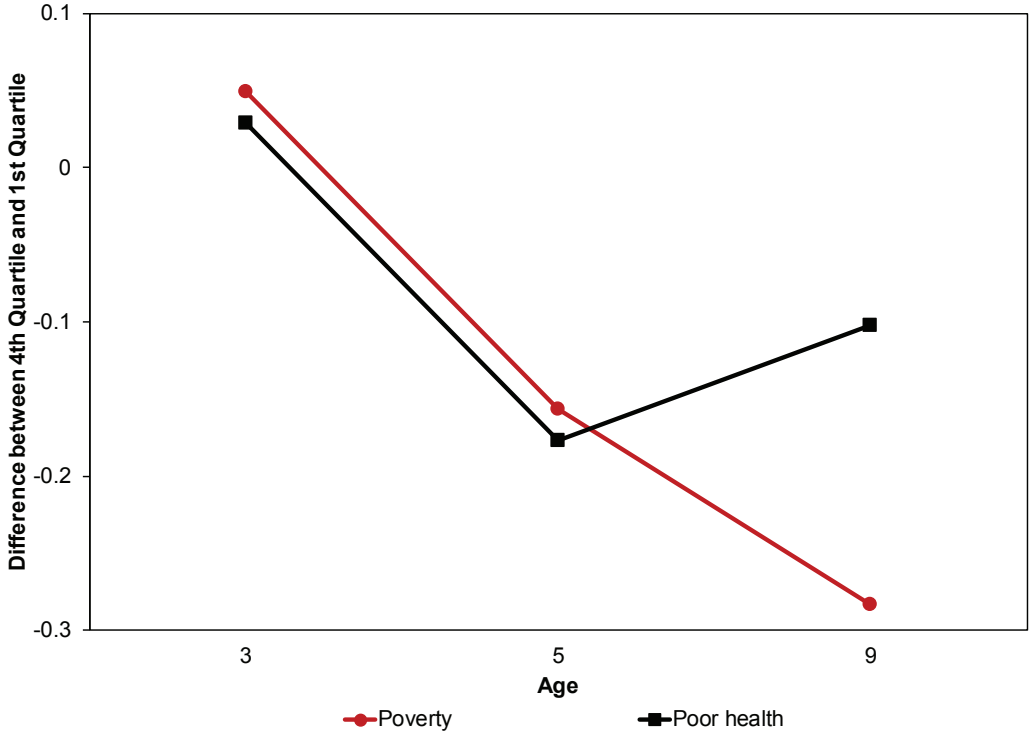

Figure 1. Effects of poverty and poor health on cognitive skills by age.

Notes: Skills differences are calculated between those at the 4th and 1st quartiles of poverty, and those at the 4th and 1st quartiles of poor health. The farther away from zero, the greater the difference.

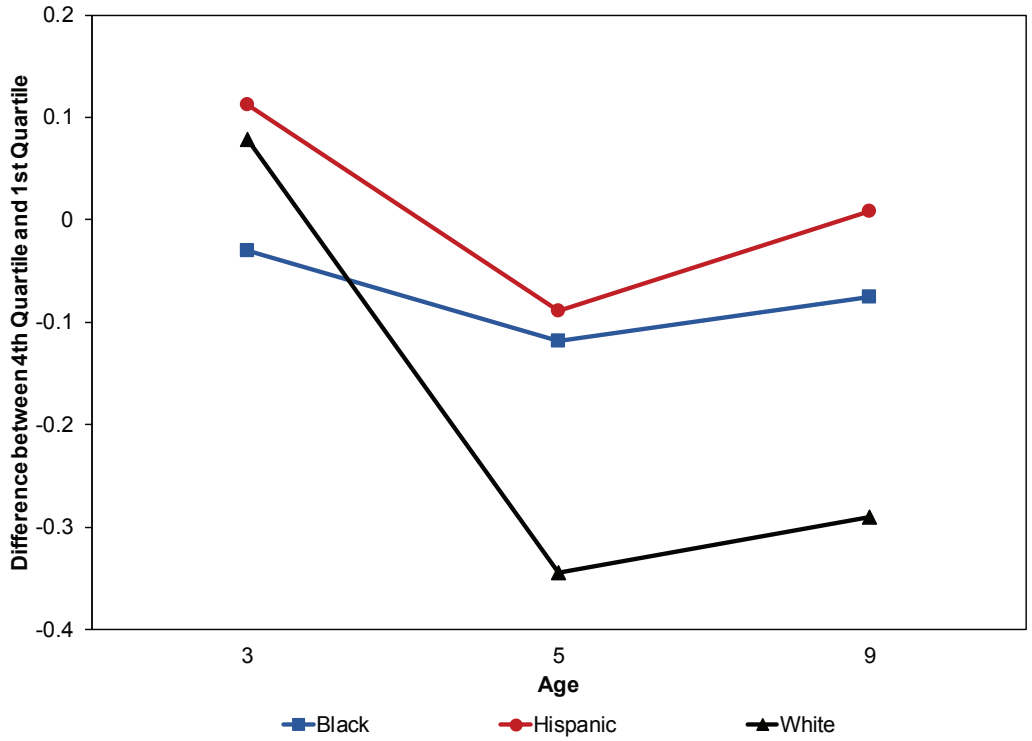

Figure 2. The effects of poor health on cognitive skills by race and ethnicity.

Notes: Skills differences are calculated between those at the 4th and 1st quartiles of poor health. The farther away from zero, the greater the difference.

That is, for example, we found little difference in cognitive skills between children from the wealthiest and poorest families. By age 5, at the start of formal schooling, however, there were significant differences in cognitive skills by both poverty and health status. However, the effects of poverty accumulate, strengthening by age 9, while the effects of health appear to level off after age 5.

While we find little variation by race or ethnicity in the effects of poverty on cognitive skills, as Figure 2 shows, the negative effects of poor health are largely driven by the effects on white children, rather than on black or Hispanic children. This finding is consistent with findings from other studies.[2] In work I did on the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), I found that among all eligible children, white children were the least likely to be in families receiving WIC benefits.[3] This finding, combined with the results from the study described here, suggests that in some cases, populations who may benefit most from interventions are the least likely to receive assistance.

Implications

These results confirm that poverty and poor health work simultaneously to shape children's cognitive development. Our findings are consistent with the idea that poverty is a "fundamental cause" of children's cognitive development, that appears quite early in life. In addition, our findings also suggest that health investments are a key part of the antipoverty safety net, given their effects on development independent of the effects of poverty.■

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[2]See, for example, M. I. Jackson, "Understanding Links between Adolescent Health and Educational Attainment," *Demography* 46, No. 4 (2009): 671–694.

[3]M. Jackson and G. Schwartz, "Is WIC Reaching Those in Need? Children's Participation in Nutritional Policy during the Great Recession," IRP Discussion Paper No. 1423-14, Institute for Research on Poverty: Madison, WI, 2014.

Medicaid and intergenerational economic mobility

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Research has shown that there is geographic variation in levels of economic mobility (change in economic status), but the reasons for this variation are not well understood. One potential cause is differential access to health insurance. Whereas studies have shown that health insurance coverage may reduce the transmission of economic disadvantage from parents to children, to date there has been no direct assessment of the effect of expanding insurance coverage on intergenerational economic mobility in the United States. In this article, I describe work done with Cassandra Robertson to explore whether the Medicaid expansions of the 1980s and 1990s had an effect on intergenerational economic mobility.[1]

Medicaid expansions of the 1980s and 1990s

The Medicaid program was established in 1965 to help states provide health care to low-income people by providing health insurance coverage. In the 1980s and 1990s, federal and state changes to Medicaid greatly expanded the number of low-income infants and pregnant women eligible to receive this coverage. This expansion was associated with a number of positive changes, including sizable reductions in infant mortality and the incidence of low birth weight.[2] Among school-aged children, health disparities by income level were reduced, and there is evidence that these improved health outcomes continue as children become adults.[3] Medicaid expansions have also been associated with positive outcomes for low-income children in areas other than health, such as improved educational achievement and attainment including high school completion, college attendance, and college completion.[4] Finally, expanded coverage in early life has been associated with increased employment, higher wages, and reduced reliance on public assistance in adulthood.[5] Overall, the expansion of Medicaid coverage has been linked to improved health, education, and labor market outcomes, all of which provide important pathways for economic mobility.

Economic mobility

To directly assess the effects of the Medicaid expansions in the 1980s and 1990s on economic mobility, I use new county-level mobility estimates published by the Equality of Opportunity Project generated using Internal Revenue Service data.[6] Raj Chetty and colleagues compared the income rank of children at age 26 to their parents' income rank years earlier. They found that the possibility of upward mobility for children in poor families varied greatly depending on where they grew up.[7]

Before the Medicaid expansions began, there was a wide range of eligibility by state; when the expansions occurred, there were also very different implementation timelines across states. Over the time period of the expansions, while the average increase in the proportion of the population eligible for Medicaid throughout the United States was 63 percent, the increase in eligibility in individual states ranged from 4 percent to 264 percent. Because the within-state trends in the percentage eligible for assistance reflects both changing policy and changes in underlying demographics, we separate out only the change attributable to policy. We then make use of the policy-dependent variation in Medicaid coverage across states and over time to isolate the effects of Medicaid expansion on economic mobility.

We found small but statistically significant improvements in a child's income rank associated with increases in Medicaid eligibility. Because the mean increase in Medicaid eligibility between 1980 and 1993 (the years for which data is available) is 20 percentage points, we frame our findings in terms of those associated with that size increase. For example, we find that for children whose parents were at the 10th percentile of the income distribution, a 20 percentage point change in Medicaid eligibility is associated with a 1.8 percentage point increase in their mean income rank. Thus, a child who at age 26 who would have been in the 13th income percentile would instead be near the 15th income percentile as a result of Medicaid expansion. For children whose parents were at the 25th percentile of the income distribution, the increase in mean income rank is slightly lower at 1.6 percentage points, and the effect continues to shrink as we move up the parental income distribution.

In addition to looking at children's rank in the income distribution as adults, we also looked at college attendance. Here we also find evidence suggesting that expanding Medicaid eligibility increased mobility, in this case by reducing the extent to which parental income predicted college attendance. So, for example, for children of parents at the 10th percentile of the income distribution, a 20 percentage point increase in Medicaid eligibility is associated with a 1.4 percentage point increase in college attendance. Again, this effect decreases as parental income rank increases.

Policy implications

Our findings suggest that expansions in Medicaid coverage for low-income pregnant women and infants in the 1980s

and 1990s improved the life chances of low-income children, by small but statistically significant amounts, and help explain variations in mobility by location and by when a child was born. Although there is still more work to be done in exploring all of the pathways through which Medicaid expansion may improve mobility outcomes, including birth weight, educational attainment, and incidence of teenage pregnancy, policies that increase early access to health insurance appear to hold promise for increasing intergenerational income mobility.■

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[1]R. L. O'Brien and C. L. Robertson, "Medicaid and Intergenerational Economic Mobility," working paper Harvard School of Public Health, Harvard University, 2017.

[2]J. Currie and J. Gruber, "Health Insurance Eligibility, Utilization of Medical Care, and Child Health," *The Quarterly Journal of Economics* 111, No. 2 (May 1996): 431–466.

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[4]S. R. Cohodes, D. S. Grossman, S. A. Kleiner, and M. F. Lovenheim, "The Effect of Child Health Insurance Access on Schooling: Evidence from Public Insurance Expansions," *Journal of Human Resources* 51, No. 3 (August 1, 2016): 727–759.

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[7]R. Chetty, N. Hendren, P. Kline, and E. Saez, "Where is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States," *The Quarterly Journal of Economics* 129, No. 4 (2014): 1553–1623.

Inequality before birth: Effects of in utero pollution exposure on children's development

Claudia Persico

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Pollution is extremely widespread in the United States, as shown in Figure 1, which maps the location of two types of toxic waste sites in the United States in 2015. The blue dots show the location of Toxic Release Inventory sites, which are factories that are required to report their emissions to the Environmental Protection Agency (EPA) because they are using certain EPA-identified toxic chemicals. The red dots show the location of "Superfund" sites, which are the most contaminated federal toxic waste sites. Superfund sites are generally no longer operating, and the EPA is in the process of cleaning them up. Although we do not currently have comprehensive evidence on which pollutants are harmful and what type of exposure causes negative health effects, the evidence we do have is worrisome and suggests a source of inequality that has not yet been explored in depth. Namely, since African American, Hispanic, and low-income families are more likely to live in close proximity to toxic waste sites, where housing is less expensive, it is possible that exposure to pollution—which more affluent families can avoid because they can afford more costly housing—is one mechanism through which poverty produces negative cognitive and health outcomes over time. In the study described in this article, David Figlio, Jeffrey Roth and I examine whether prenatal proximity to Superfund sites is associated with negative cognitive and developmental effects through childhood and into adulthood .[1] These effects can have long-term consequences on socioeconomic outcomes such as academic achievement and adult income, as noted in several other articles in this issue including those by Ariel Kalil and Helena Duch in this section, and by Anna Aizer and Margot Jackson in the section on poverty and parenting young children.

What are the consequences of exposure to commonly encountered pollution levels?

As illustrated in Figure 1, toxic waste exists in every major U.S. city. The Comprehensive Environmental Response, Compensation, and Liability Act, known as Superfund, is the largest and most expensive federal program to clean up toxic waste in the United States. Eighty million people, or 1 in 4 Americans, live within three miles of a Superfund site, and about 11 million Americans, including 4 million children, live within one mile of a Superfund site. There is a large literature establishing associations between mothers who are exposed to pollution during pregnancy and negative birth outcomes. For example, Janet Currie, Michael Greenstone, and Enrico Moretti found that the cleanup of Superfund sites was associated with a 20 to 25 percent reduction in the risk of congenital anomalies in infants.[2] However, less is known about the long-term consequences of prenatal exposure to commonly-encountered levels of pollution. It is possible that pollution affects brain development, causing negative consequences in addition to, or even in the absence of, birth outcomes.

One challenge in assessing the effects of pollution is that toxic waste sites lower nearby housing values, so low-income people are more likely to live in close proximity to these sites than are people who have higher incomes and can afford to spend more on housing. Thus, a simple comparison of people who live near Superfund sites to those who do not may capture not only the effects of pollution, but also some effects of being low-income. In our study, we are able to account for this by comparing siblings in families living within two miles of a Florida Superfund site where at least one sibling was conceived before or during cleanup of the site, and the other sibling or siblings were conceived after site cleanup was completed. The Florida data combines birth and school records to provide information on children born between 1994 and 2002.

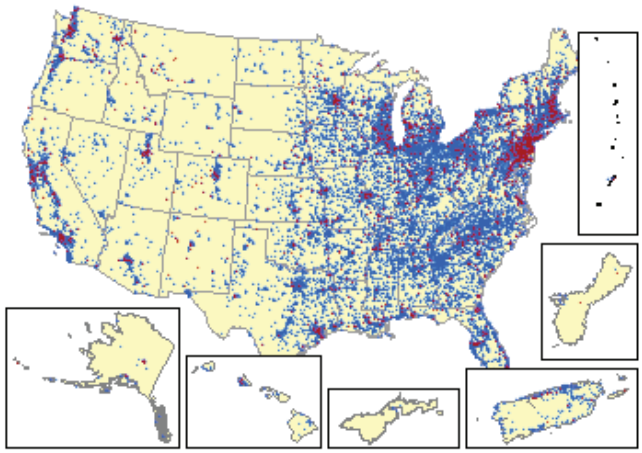

Figure 1. Locations of Toxic Release Inventory and Superfund sites in the United States in 2015.

Note: Toxic Release Inventory facilities are shown in blue and sites on the Superfund National Priorities List are shown in red.

Source: National Institutes of Health, Department of Health and Human Services. https://toxmap.nlm.nih.gov/toxmap/

In addition to replicating effects on birth outcomes, such as health at birth and the likelihood of low birth weight, that were identified in earlier work, we find a significant effect of proximity to a Superfund site before cleanup on school outcomes. For families living within two miles of a site, siblings conceived prior to the completion of cleanup were 7.4 percentage points more likely than siblings conceived after cleanup to repeat a grade, and 6.6 percentage points more likely to be suspended from school. Closer proximity was associated with even larger effects; children conceived within one mile of a Superfund site prior to cleanup had a 12.5 percentage point increase in the likelihood of repeating a grade, and notably, a 10 percentage point increase in the likelihood of cognitive disabilities, compared to their siblings who were born after cleanup (and therefore not exposed to the pollution). Prenatal exposure to Superfund site toxins was also associated with test scores that were lower by between 0.06 and 0.12 of a standard deviation compared to a sibling who was not exposed to the pollution.

The large size of these effects is particularly notable given several factors that could result in underestimation. First, parents tend to invest more in earlier-born children than later-born children, so in this study those additional investments would have favored the siblings born prior to site cleanup. Later-born children could also have experienced some effects of pollution from the Superfund sites, since toxins would tend to accumulate in the bodies of mothers over time; they could also have been exposed to other sources of pollution. Finally, it is possible that parents took steps to reduce their own and their children's exposure to pollutants.

Policy implications

This study is the first to investigate the long-term effects on children of prenatal exposure to commonly encountered levels of pollution. These findings show that exposure to pollution has detrimental effects on children's development. Further, the results suggest that cleanup of Superfund sites can have significant positive effects on a variety of long-term cognitive and developmental outcomes for children. Because disadvantaged families are more likely to live near Superfund sites, both the negative effects of pollution and the benefits of cleanup are more likely accrue to low-income, black, and Hispanic children.

Given public debate over whether the Superfund program should be continued, it is important to understand the true costs of pollution and the benefits of cleaning up toxic waste sites. For example, since the cost of providing special education in public schools is very high, it is likely that the Superfund program could pay for itself in a fairly short period of time simply by reducing the incidence of cognitive disabilities. Furthermore, cleanup of Superfund sites located in areas with particularly high population density could result in particularly large cost savings, since more children would reap the benefits.■

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