

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

Claudia Persico

Claudio Persico is Assistant Professor of Educational Leadership and Policy Analysis at the University of Wisconsin—Madison and an IRP Affiliate.

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.

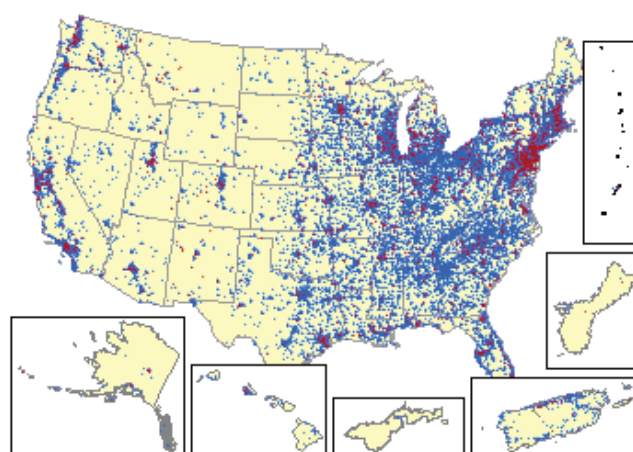


Figure 1. Locations of Toxic Release Inventory and Superfund sites in the United States in 2015.

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 to 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.■

¹C. Persico, D. Figlio, and J. Roth, "Inequality Before Birth: The Developmental Consequences of Environmental Toxicants," NBER Working Paper No. 22263, National Bureau of Economic Research, May 2016.

²J. Currie, M. Greenstone, and E. Moretti, "Superfund Cleanups and Infant Health," NBER Working Paper No. 16844, National Bureau of Economic Research, March 2011.