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Lead's societal toll may be high

Exposure linked to intelligence loss, violent behavior in our area

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Scientists have known since the Roman Empire that lead poisons the body. Hundreds of years later, the medical community is only beginning to understand how small doses of lead from exposure to deteriorating lead paint on the walls of old houses can transform a child's brain, reducing intelligence and attention span and increasing violent behavior.

As the scientific evidence builds, many researchers have become convinced that lead poisoning may be linked to juvenile delinquency and even the high homicide rates in aging cities such as Rochester.

"There is a strong and substantial relationship between lead exposure and arrests," said Dr. Bruce Lanphear, director of Cincinnati Children's Environmental Health Center, who has an international reputation for his research into the effects of lead poisoning. Lanphear was in Rochester for a fellowship at the University of Rochester in 1995.

Lanphear has done extensive research on how lead has affected about 250 Rochester children born between July 1994 and January 1995. As these children approach their teens, Lanphear is pursuing funds to investigate possible links between blood lead levels and crime. The project is under way with a group of Cincinnati children and someday could be expanded to include the Rochester group.

The possibility of a connection has been noted by civic leaders including Sen. Hillary Rodham Clinton, D-N.Y., and former Rochester Mayor William A. Johnson, both of whom have linked Rochester's lead poisoning problem to the city's high violent-crime rates.

"People are getting shot because they looked at someone the wrong way," said Derrick Hazle, director of Rochester's Coalition to Prevent Lead Poisoning, who believes that lead is an important and too-often-ignored factor in many of the city's social problems.

"When you start adding all these things up, it contributes to teen pregnancy, dropout rates, crime. ... There's a real domino effect," Hazle said.

Teacher sees the damage

Loretta Rutledge has seen what lead can do to children. That's one of the reasons she retired early from her career as a special-education teacher in city elementary schools, where she was told that most of her difficult students had suffered lead poisoning. "I was burned out," said Rutledge, who lives in northwest Rochester. "The brain damage was so obvious, it was just sad."

The list of ways in which lead is believed to affect behavior — lack of impulse control, distraction, rebellion, a tendency toward violence — reads like a description of Rutledge's students, she said.

"They're so frustrated, they don't know what to do but hit," she said.

Debate over the connection between lead and behavior continues, but anecdotal stories like Rutledge's are common, and suggestive data have been around for years:

- In 1943, an early study linked childhood lead poisoning with school failure.
- A 1954 study conducted by Boston's children's hospital followed 20 children who had suffered severe lead poisoning, at levels rarely seen today. Nineteen failed to graduate from high school; one of them attacked a teacher with a pair of scissors.
- Recent studies in several communities have shown that childhood lead levels portend disciplinary problems in school and that adolescents with high lead levels are more likely than their peers to engage in bullying, vandalism, arson and shoplifting.
- Studies have linked high lead levels with diagnoses of attention deficit-hyperactivity disorder.
- A 1990s study of boys in Pennsylvania found that convicted juvenile delinquents were twice as likely as the general population to have high levels of lead in their bones.
- A mid-1990s analysis of hair samples from adult prison inmates showed that violent offenders were more likely than the general prison population to have high levels of lead and other toxic metals in their bodies.
- A geographic study based on 1990 data compared violent crime frequency with lead levels in the air, adjusted for other variables, and found that the counties most polluted with lead had homicide rates four times higher than the least polluted counties.
- An economist analyzed connections between reductions in the lead content of gasoline and the changes, state by state, in the crime rate and found a statistical link between the shifts, which she believes accounts for at least 13 percent of the nationwide drop in violent crime in the 1990s.

Study to focus on arrests

Lanphear is researching the arrest and conviction records of as many of the original members of the Cincinnati study as possible, comparing the frequency and types of crimes committed with the existing data recording individuals' blood lead levels throughout childhood.

For much of the past 12 years, families in both Cincinnati and Rochester have worked closely with Lanphear and his colleagues, submitting to interviews and examinations, and giving countless blood samples in hopes of understanding how lead affects the body and the brain. His results helped set federal standards permissible for lead levels in homes and were crucial in settling a long-contentious debate about whether small amounts of lead reduced IQ.

The Rochester children with lifetime mean blood lead levels of 10 had IQs that were 7.4 points lower than those with blood lead levels of just 1 microgram per deciliter.

Lanphear won acceptance for his theories by adjusting data for factors such as a mother's IQ and the presence of books in a child's home. For the crime study, he'll also consider whether the child's mother has ever been arrested and will exclude children with a family history of psychiatric illness.

He and his colleagues in Cincinnati are well-respected in the medical community. But because lead is overwhelmingly a problem of poor neighborhoods where countless other social problems are endemic, criticism remains. Some worry that such conclusions will give criminals a biological excuse for their antisocial behavior. Others — familiar with lead poisoning's long history as an ignored disease of poor communities — fear that if the lead-crime theory takes hold, children who already suffer lifelong health and intellectual problems as a result of lead poisoning will be stigmatized as future criminals.

Lead affects everyone differently, and high blood lead levels can't foreshadow the future for any individual, said Dr. Michael McCabe, a professor at the University of Rochester Medical School, who teaches a course about environmental diseases.

"Don't over-interpret the data. High lead levels don't mean that you're going to be working at Burger King and that you're not going to get into medical school. Exposure to lead doesn't necessarily cause violent behavior," McCabe said.

Like any other factor — home life, education, genetics — lead is just one consequence in a lifetime of choices and circumstances that turn someone into a violent criminal, Lanphear said.

"There are a lot of people who live in poverty and don't grow up to live a life of crime," he said.

Lead toxic to children

Lead is a tremendously toxic substance that can harm nearly every biological system, and a substance that wasn't meant to be in the human body, particularly the bodies of children, McCabe said.

Children rather than adults will always be more at risk of exposure to the lead from paint and vehicle exhaust that lingers in dust and soil and makes its way to kids' hands and toys.

"They're out playing in the dirt, (and) that's where the lead is," he said.

Growing children also absorb more lead. The average adult retains about 10 percent of the lead that reaches the digestive tract. In children, however, absorption is much more efficient, ranging from 30 percent to 75 percent.

Once lead makes its way into the body, it settles into bone, where it can remain for decades, leaching into the blood and traveling through the body. Lead in bones stunts children's growth, makes broken bones more difficult to heal, increases the incidence of cavities and often leads to osteoporosis after a child is grown. Lead in blood, which can enter the brain and organs, has been linked to hearing loss, anemia, heart disease, liver and kidney damage, miscarriage and premature birth and low sperm counts.

The presence of lead kills brain cells, but in young children it can also keep neurons from forming, permanently limiting a child's intellectual and emotional capacity. Lead is one of the few pollutants that can enter the brain, and once lead makes its way into brain cells, it damages the system, making it easy for other contaminants to follow in its wake.

Some studies cite the well-established fact that lead impairs the formation of synapses — nerve connections — within the brain.

Others have found evidence that lead interferes with the creation of serotonin and dopamine, chemicals within the brain that are critical to impulse control. Because alcohol and illegal drugs such as cocaine act on these same neurochemicals, some doctors have theorized that lead poisoning predisposes children to later substance abuse. But despite the mountains of data about the harm lead can do, its ability to enter the body remains a mystery. McCabe and many of his fellow researchers believe that lead can sneak into the body by fooling cells into believing it's zinc, iron or calcium.

Scientists, including those who work at UR, are making progress every day, but it will likely be decades before they have any answers to offer, McCabe said.

And so doctors are left with a common and completely preventable disease that they can diagnose but not treat. The only course of action is reducing exposure — which a physician cannot mandate. It's incredibly frustrating, he said.

"You've got this gap. There's a clinical (problem) that you know how to treat, but the treatment is a housing issue," McCabe said.

Rochester's new lead paint law, set to take effect Saturday, is an important step. But nationwide, lead poisoning isn't getting the attention it deserves, researchers said.

Blood lead levels have plummeted nationwide since lead was phased out of gasoline in the 1970s and '80s — but not in every neighborhood, McCabe said.

It's possible for suburban children to have undetectable lead levels. But city children are likely to still have 1 to 3 micrograms of lead per deciliter in their blood because of occurrences such as lead paint dust and chips still

being found in soil, said Dr. Richard Kennedy, a physician at Anthony Jordan Health Center who is heavily involved in the campaign to end lead poisoning.

Nationwide, a million children are believed to have levels in excess of the federal standard of 10 micrograms per deciliter (dL).

In 2005, mandatory blood tests found 675 children in Monroe County with blood lead levels above 10 micrograms/dL.

But Lanphear and his colleagues have shown that lead affects the brain at blood levels of less than 5 micrograms/dL.

"There is not a magic number for safe versus unsafe," McCabe said. "Lead at any level is not good."

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About the series

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Tuesday: Government and public health agencies have failed to move fast enough to guarantee that all children grow up in lead-free homes.

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