



UNLEADED

When a Natural Element Has Unnatural Consequences

By Alison Main

Lead exposure weaves an intricate web, affecting individuals and societies from almost every possible angle: cultural, economic, environmental, political, biological, psychological, and criminal.

In 2015, Flint, Michigan, and its contaminated water made headlines, bringing mass awareness to lead as a health hazard. You might be thinking, *I don't live in Flint, so I'm ok, right?* But lead poisoning is hardly confined to that singular midwestern city, nor to its unfortunate residents. Flint remains a warning beacon, a worst-case scenario. But from the ancient Romans to those embarking on home renovations today, lead was—and still is—an omnipresent, serious public health concern. With wide-reaching ramifications for our brains, bodies, and communities, it's worth learning how to protect yourself (and your children) from lead poisoning.

THERE IS NO SAFE LEVEL OF LEAD

Plain and simple, lead is a neurotoxin, causing damage to the brain and central nervous system.^{1,2,9,12} Even low levels of childhood exposure can result in irreversible, lifelong health effects, including behavior and learning problems, hearing and speech problems, and slowed growth and development.^{1,12} These effects, in turn, can lead to lower IQ, attention deficit and hyperactivity, and underperformance in school.^{10,11}

Regulatory and public health agencies have continued to evaluate (and then re-evaluate) what is considered a “safe” level of lead, both in our blood and in our environment. According to the American Academy of Pediatrics, “Very high blood lead concentrations (i.e., over 100 µg/dL) can cause significant overt symptoms, such as protracted vomiting and encephalopathy, and even death. Low-level lead exposure, even at blood concentrations below 5 µg/dL (50 ppb), is a causal risk factor for diminished intellectual and academic abilities, higher rates of neurobehavioral disorders such as hyperactivity and attention deficits, and lower birth weight in children. No effective treatments ameliorate the permanent developmental effects of lead toxicity.”^{9,12} In 2012, the Advisory Committee on Childhood Lead Poisoning Prevention of the CDC concluded that **there is no safe level of lead exposure** and adopted the use of a reference value of greater than or equal to 5 µg/dL (50 ppb).²

And it's not just the brain that is affected. A 2018 study by Lanphear, et al., concluded that low-level environmental lead exposure is an important but largely overlooked risk factor for cardiovascular disease mortality in the U.S.³

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So where's all this lead coming from? And how is it getting into our bodies? According to the EPA, there are multiple sources for potential lead exposure in the home,¹¹ but of primary concern today are:


- 1 Homes built before 1978:** Lead from paint remains one of the most common causes of lead poisoning. In 1978, the U.S. Consumer Product Safety Commission restricted the content of lead in residential paint to 600 ppm; it was lowered to 90 ppm in 2008.
- 2 Household dust:** Lead dust can form when lead-based paint is scraped, sanded, or heated during home renovations. Lead chips and dust can attach to accessible surfaces and objects in your home. Vacuuming and dust sweeping can also kick up more dust into the home's atmosphere.
- 3 Painted toys, furniture, and toy jewelry:** From old antique dolls and rocking chairs to contemporary toys and jewelry (e.g., Mardi Gras beads), some of the most common items around your house may contain lead-based paint or materials.
- 4 Cosmetics:** The U.S. Food and Drug Administration recommends¹³ that cosmetic products contain no more than 10 ppm of lead as an impurity. Although most cosmetics on the market in the United States meet this requirement, a small number unfortunately do not, including products imported from other countries.
- 5 Containers for food or liquids:** Lead crystal or lead-glazed pottery and porcelain can leach lead into the foods and beverages stored inside.
- 6 Drinking water:** Lead can enter drinking water through corrosion of plumbing materials, including old water-supply lead pipes used into the 1920s or lead solder.
- 7 Jobs and hobbies:** If you work with lead and/or lead-based paint (e.g., renovating and painting, mining, smelting, battery recycling, refinishing old furniture, autobody work, shooting ranges), or if your hobby uses lead-based materials (e.g., hunting, fishing, stained glass, stock cars, making pottery), you could be contaminating your home.
- 8 Folk remedies:** Some folk remedies such as greta and azarcon (to treat upset stomach) and nzu, poto, and calabash chalk (to treat morning sickness) contain dangerous levels of lead.

There's potentially poisonous lead in your drinking water, on your windowsill, or on your kid's favorite toy truck. Awesome. But before you move to a straw hut in the middle of the rainforest, don't panic. There are many actionable steps you can take to determine 1) Are you at risk? and if so, 2) What you can do about it.

WHO'S AT RISK?

Technically, lead is a toxic concern for everyone of all ages, races, locations, and socio-economic backgrounds. But whether you're living in a well-groomed mansion or an inner-city tenement, babies and children are at the highest risk.

Children are especially susceptible to lead exposure because their bodies absorb metals at higher rates than the average adult. Children younger than six are most at risk due to their rapid rate of growth. According to the AAP, blood lead concentrations of children who live in lead-contaminated environments typically increase rapidly between 6 and 12 months of age, peak between 18 and 36 months of age, and then gradually decrease.²



As for adults, high lead levels have been linked to increased blood pressure. Pregnant women and their fetuses are also especially vulnerable to lead exposure since lead can significantly harm the fetus, causing lower birth weight and slowing normal mental and physical development.¹⁵

The neuropsychiatrist Herbert Needleman developed a study that showed that children from both impoverished and affluent backgrounds equally experienced lead poisoning. His work also revealed that the greater the amount of lead in baby teeth, the more poorly the children performed in school and the lower their IQ. Even relatively small amounts of lead were associated with significant cognitive and behavioral problems.^{1,4,12}

Other populations at risk include those living near lead-based industries, such as smelters and battery manufacturing plants. When lead is airborne, it eventually falls to the earth, becoming a soil contaminant for adjacent communities.¹² In 2004, four waste treatment plants were among the 20 largest dischargers of lead that were submitting data to the Toxics Release Inventory of the U.S. EPA.



WHAT'S ON TAP?

In March 2013, the City Council of Flint, Michigan, decided to change their water source, a seemingly innocuous move with disastrous consequences. Instead of continuing to buy water from the Detroit Water and Sewerage Department, Flint switched their intake to Lake Huron. While the new pipeline was in development, the city temporarily acquired their water from the Flint River. Immediately after the switch, residents started vocalizing concerns about their water's smell, taste, and color.

A research team from Virginia Tech led by Marc Edwards, the Charles Lunsford Professor of Civil and Environmental Engineering, came on board for testing and analysis, finding dangerous levels of lead in residents' tap water. The state was found to be in violation of federal law for not treating the Flint River water with an essential anti-corrosive agent that would have prevented exactly this problem. Untreated, the water eroded the iron water mains, and with half the service lines to homes in Flint still made of lead, these pipes, too, became

corroded, leaching a tremendous amount of lead into Flint's water. And people got sick. A lot of people. Particularly children.

Of the 30 water samples Edwards tested in his lab at Virginia Tech, the lowest lead level was 300 parts per billion. The average was 2,000 ppb, and the highest was over 13,000 ppb.¹⁴ The EPA's Lead & Copper Rule considers a level of 15 ppb "actionable," meaning that utilities must take certain prescribed steps to correct the problem and notify citizens. Recall that the CDC states that, "No safe blood level has been identified and all sources of lead exposure for children should be controlled or eliminated."¹⁰ Over 100,000 residents of Flint (including 9,000 children) were exposed to these astronomical levels of lead over the course of 18 months.¹⁴

Flint is not alone in its aging public-infrastructure crisis, although it's certainly an example of corrupt politics and financial interests run amok to the detriment of its own citizens. The 1974 Safe Drinking Water Act granted the EPA regulatory oversight of public drinking water (i.e., tap water). If a water system does not meet the EPA's Lead Action Level, it is required to be replaced, yet the lead service line is often the responsibility of both the utility and the homeowner.¹¹ Today, an estimated 3 to 6 million miles of lead pipes¹² are used for drinking water in towns and cities across the U.S., so strict adherence to federal rules and guidelines is essential to prevent this crisis from happening elsewhere.

CRIME AND PUNISHMENT

Across the United States, violent crime peaked in the early 1990s and then began a steady decline in the decades thereafter. While many factors may be at play in explaining this improvement, there also exists the "lead-crime" theory, which has to do with gasoline.

When you hit up a gas station to refill your tank, you're typically met with three choices: Regular. Plus. Premium. But what about the word underneath each option? *Unleaded*. There was a time, not too long ago, when that gas was very much *leaded*. And this change *could* be the smoking gun in our country's crime statistics.

In the late 1920s in the United States, lead was first added to gasoline to boost engine power. Gasoline's lead content rose throughout the mid-century, remaining high until the 1970s' Clear Air Act, when the EPA mandated a timetable for the reduction of lead in gasoline from 2.0 grams per total gallon to a maximum of 0.5 grams per total gallon by 1979. Lead in gasoline subsequently dropped by 99 percent between 1975 and 1990.⁵

So why was leaded gasoline such a problem? We certainly weren't drinking or bathing ourselves in gas directly from the pump. Rather, the culprit was the omnipresent leaded gasoline exhaust that was released into the atmosphere . . . everywhere. The denser the area (i.e., in cities with more vehicles), the more leaded exhaust people were breathing (potentially a reason crime rates were higher in more populous urban areas). Lead deposits from the exhaust also accumulated on sidewalks, lawns, and in the soil, an easy point of contact, particularly for children who played outside or for those who tracked soil into their homes.⁵

A plethora of research studies point to the connection between childhood lead exposure, neuropsychological effects, and criminal and aggressive behavior. A peer-reviewed study by Rick Nevin in 2000 showed that lead

emissions from automobiles from 1941 to 1964 could explain 90 percent of the violent crime in America from 1960 to 1998.⁶ In 2007, researchers Howard Mielke and Sammy Zahran published a paper correlating lead and crime at the city level, analyzing crime data and lead data in six U.S. cities dating back to the 50s. Their findings showed that when you overlap the “crime map” with the “lead map,” even at the neighborhood level, they are nearly identical.⁸ That same year, Nevin published a follow-up paper looking at crime trends around the world. He found that an overlapping lead curve and crime curve was not a phenomenon unique to the United States—it was replicated in other countries, including Australia, Canada, Great Britain, Finland, and France.⁷ Does this mean our world will soon see a crime-free utopia, given the elimination of lead in gasoline? Not so fast. Experts point to lead paint in older homes and buildings as an ongoing and primary source of childhood lead poisoning today. But that raises the question: Could preventing childhood lead exposure from old paint right now generate reduced violent crime in 20 years?

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HIDE AND SEEK

There's a difference between the “presence” of lead-based paint in a home and childhood exposure to a “lead paint hazard.”¹⁵ The U.S. Department of Housing and Urban Development defines lead-based paint as an XRF reading of equal to or greater than 1 µg/cm or 5,000 ppm of lead in a paint chip. Hopefully, you won't get that lead inside your body. A lead paint hazard, on the other hand, is defined by the EPA as “any condition that causes exposure to lead from contaminated dust, lead-contaminated soil, or lead-contaminated paint that is deteriorated, or the presence of accessible (or chewable) surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects.”²

Doug Dalsing, environmental consultant and co-owner of Testudo, LLC, a lead inspection firm in Madison, Wisconsin, says, “A lot of people hope they'll get a risk assessment report with ‘safe’ or ‘unsafe’ starkly depicted on the front page. But that's not really the case when it comes to lead-based paint.” It depends on a variety of factors, particularly on the occupants and their habits and hygiene. Dalsing explains, “You can live safely with lead-based paint in your home, as long as the paint is intact, you don't have young children, you're not renovating, and you follow good house hygiene. But if you have a home with lead-based paint, and you have kids crawling around on the floor, then it can be hazardous. I always like to tell people you have to up your game when it comes to keeping floors and windowsills clean.”

In 2010, a federal law went into effect that requires all renovation, repair, and painting firms working in housing or facilities built before 1978 where children are routinely present to be certified, and that at least one certified renovator be assigned to each lead-disturbing job. Dalsing advises, “Homeowners should be vigilant and communicative with their remodelers, and specifically ask if their remodeler is certified in this.”

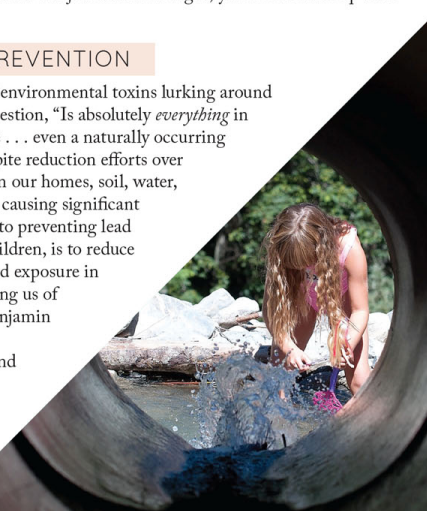
Dalsing further advises, “My number-one recommendation to homeowners is: work with a trained and certified renovation professional. I don't recommend that homeowners DIY their own lead-paint projects. Get someone trained who knows what they're doing. Because if the job isn't done right, you could wind up with a much bigger problem.”

AN OUNCE OF PREVENTION

Given the multitude of environmental toxins lurking around every corner, it's fair to question, “Is absolutely *everything* in the world going to kill me . . . even a naturally occurring element?” The fact is, despite reduction efforts over time, lead is still present in our homes, soil, water, and products, and it's still causing significant health problems. The key to preventing lead toxicity, particularly in children, is to reduce or eliminate sources of lead exposure in the environment, reminding us of the immortal words of Benjamin Franklin: “An ounce of prevention is worth a pound of cure.”

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