

Lead Poisoning

DISCLAIMER: the following is not meant to treat anyone with advice or tell you what you should do, such as relative to use of medication, exercise, or changing your diet. The information in this handout is merely offering what has been published in the research literature, as well as based on my professional experience. Talk to a doctor or other appropriate professionals as to what is best for your own specific needs.

It should also be appreciated that everyone has their own perspective on how to improve health. Nutritionists do it through food. Physicians do it through medicine. Psychologists do it through changing thoughts, feelings, and behaviors. Consequently, what is offered here is a reflection of my own bias and perspective.

“...You will see by it, that the opinion of this mischievous effect from lead, is at least above sixty years old; and you observe with concern how long a useful truth may be known, and exist, before it is generally received and practiced on.”

Benjamin Franklin

July 31, 1786

There is an agency of the federal government, (Agency for Toxic Substances and Disease Registry, ATSDR) that ranks 275 toxic substances as to which poses the greatest threat to human health based on frequency, toxicity, and potential for exposure to people. Lead is #2 (as of 2022. Arsenic is #1, mercury #3).

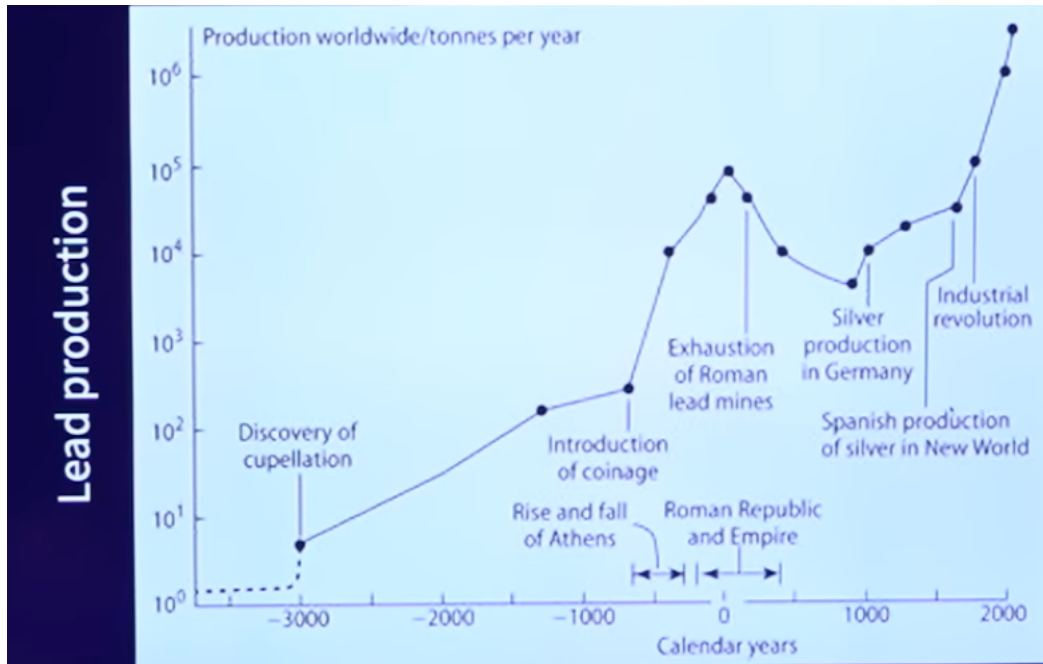
The oldest known lead mine, found in Turkey, dates back to 6,000 B.C. Lead has been recognized as poisoning people as far back as ancient Rome, including Dioscorides (a physician from the time of Nero) who said that ‘Lead makes the mind give way.’ There are some who say that ‘the fall of the Roman Empire’ was partially due to lead. The Romans had lead water pipes, lead cooking pots, lead added to wine to make it sweeter, and some of their storage containers were made of lead. And lead poisoning, without known attribution to that metal, is said to have been noticed as far back as 6,000 years; Egyptian hieroglyphs had a character for lead. Skip ahead to today and UNICEF now says that 1 of 3 kids around the world – up to 800 million – have lead poisoning (5 mcg/dl or higher; [unicef.org/press-releases/third-worlds-children-poisoned-lead-new-groundbreaking-analysis-says](https://www.unicef.org/press-releases/third-worlds-children-poisoned-lead-new-groundbreaking-analysis-says)). Lead poisoning then or now can cause infertility, memory impairment, and loss of various cognitive abilities. It also poisons every organ of the body.

An analysis of EPA data shows that between January 1, 2018 – December 31, 2020 186 million people in the U.S. – 56% of the population – drank from water systems with lead exceeding the 1 ppb level the American Academy of Pediatrics recommends as to protecting kids from lead contaminating water. Moreover, 61 million people drank from water above the 5 ppb set by the FDA for bottled water. Seven million people had water supplies above 15 ppb which is the level the EPA sets for water systems taking action to ‘get the lead out’ quite literally. (<https://www.nrdc.org/resources/millions-served-water-systems-detecting-lead>)

Leaded gasoline was a major culprit of poisoning our environment and ourselves for decades in that it was spewed into the air and then falling back to earth and into our water supply. Remarkably, the lead spewed out from tailpipes is still with us today. A study done in London from 2014-2018 estimated that 45 kg of lead stored in soil and 800 kg in road dust continues to circulate in the city's air every year. (Proceedings of the National Academy of Sciences, "Strong evidence for the continued contribution of lead deposited during the 20th century to the atmospheric environment in London of today" Eléonore Resongles et al, 6/12/21). Perhaps equally bizarre and unexpected is that the little lead weights that are clipped on to tires to balance them can fall off and then be crunched into lead dust by cars driving over them. The EPA estimates that 13% of these weights fall off each year, leading up to 2,000 tons of lead being put into the environment in the U.S. according to the U.S. Geological Survey. In 2009 the EPA considered banning such weights. As of 2024 the weights are still being used and the EPA is still looking at the issue. (epa.gov/chemicals-under-tsca/epa-seeks-input-lead-exposure-lead-wheel-weights).

Leaded house paint also took a toll. One estimate is that 170 million Americans who are alive today, meaning a bit more than half of the entire population, were exposed to high lead levels (>5 mcg/dl) in early childhood leading potentially to lower IQ by about 3 points, and lead-related health problems down the road including cardiovascular as adults along with increased likelihood of mental illness. (Proceedings of the National Academy of Sciences, "Half of US population exposed to adverse lead levels in early childhood" Michael McFarland et al, 3/7/2022, which is based on a nationally representative sample of US kids and NHANES data from 1976-1980 and 2015-2016). The study found that those born between 1966-1975 100% of the U.S. population had childhood blood lead levels above 5 mcg/dl. For those born between 1951-1980 90%-100% of the U.S. population had blood levels at over 5 mcg/dl. A few months before this study came out the CDC revised the number down to 3.5 mcg/dl where 'clinical concern' is raised. The CDC came up with this figure as of 2021 not by saying 'This is okay for a child to have.' Instead, they worked backwards, by saying 'What blood level do 2.5% of kids ages 1-5 have and that's the level we'll set clinical concern at.' So 3.5 mcg/dl is it as of now so they might "receive prompt actions [and] help mitigate health effects and remove or control exposure sources." www.cdc.gov/lead-prevention/php/news-features/updates-blood-lead-reference-value.html?CDC_AAref_Val=https://www.cdc.gov/nceh/lead/news/cdc-updates-blood-lead-reference-value.html But the study also notes that around 10 million people alive in 2015 had childhood blood lead levels above 25 mcg/dl, five times the level of concern previously and now seven times that level.

Kids ages 0-4 have the highest percentage of elevated lead levels according to some research. Young adults have lower levels, and older individuals see the lead levels rise again as it comes out of bones from aging, including among menopausal women. Lead impacts the brain, nervous system, kidneys, liver, pancreas, bone marrow, immune system and collagen synthesis.



(Lead and silver are often found together in ore, as to the comment about silver production in Germany and Spain.)

“Lead: a toxic legacy” Dr. Ian Mudway,

<https://www.youtube.com/watch?v=k9ssNZiLUdc&list=PLU3TaPgchJtQAB6YnYMKuniIt3rkM6dJH&index=71>

There has been a massive increase in lead levels in people over preindustrial times. Estimates vary but it is thought that people currently have 50-1,000 times more lead than such earlier generations. The primary reason for the massive increase was the use of leaded gasoline during the 20th century which spewed it into the air worldwide so that it ended up in the soil and waterways. Its use peaked in 1973 when about 200,000 tons of lead were added to gasoline that year alone in the U.S. One estimate is that 5 million metric tons of lead was put into the air from the use of leaded gasoline (<https://nutritionfacts.org/video/normal-blood-lead-levels-can-be-toxic/>). The last country to ban leaded gas, Algeria, did so in 2021. Leaded gas is still used to this day in small private planes. Spew lead into the air from plane engines and the result is the same – it comes back to earth, gets into the soil and water supply, and exposes us to its toxic effects. Back in the days of leaded gas for cars the legal limit was 0.1 grams/gallon. Aviation gas today has a legal limit of 2.1 g/gallon. “The EPA estimates that people living within 1 km of airports are at risk of being exposed to lead from [aviation gas with lead], and 3 million children attend school within 1 km of these airports.” (*Environmental Health Perspectives*, “A geospatial analysis of the effects of aviation gasoline on childhood blood levels” Marie Miranda et al, Oct. 2011). A study commissioned by Santa Clara County in California looked at kids downwind vs. upwind from one airport. It found that downwind they had an increase of 0.40 mcg/dl of blood vs. those upwind. People exposed to lead in Flint, MI from contaminated water pipes had between a 0.35-0.45 mg/dl increase. (“Leaded aviation gasoline exposure risk at Reid-Hillview airport in Santa Clara county, California” 8/3/2021). Flint, MI is hardly the only city in America with a lead problem. A Reuters article identified 3,810 neighborhoods across the country with childhood lead poisonings rates at least double those of Flint’s, and 1,300 had hot spots with blood levels at least four times higher than Flint’s. (www.reuters.com/article/idUSKBN1DE1H2/). Since leaded gas for cars got banned leaded aviation fuel for 170,000 piston aircraft is said to have become the largest source of lead emissions, accounting for two-thirds in the nation.

The other major source of lead was in house paint. In 1897 lead-free paint was available at least in England as to people starting to recognizing the leaded form being hazardous. It was learned over 100 years ago that kids could be poisoned by ingesting lead paint. By 1926 lead poisoning in kids was frequent. But its use in house paint was not banned until 1978. A number of countries in Europe banned it as early as 1909. (<https://nutritionfacts.org/video/how-the-lead-paint-industry-got-away-with-it/>)

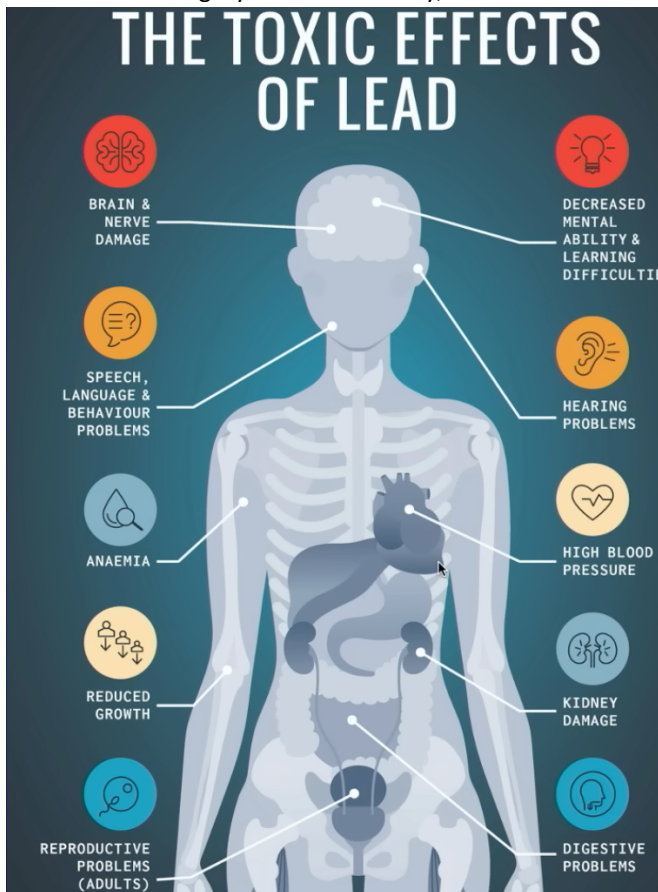
According to the EPA leaded house paint was used in

- ❖ 87% of houses built before 1940
- ❖ 69% of houses built between 1940-1959
- ❖ 24% of houses built between 1960-1977

Leaded house paint can create problems by contaminated dust being made such as through opening and closing windows and doors with friction on the paint turning it into fine dust that can be inhaled. The risk is greatest when it is peeling, chipping, chalking, or cracking. Removing leaded paint such as by scraping or blowtorches also creates lots of opportunity for it to get into the air and then contaminate the soil and subsequently waterways. So, although the leaded gasoline and paint period is in the past the leftover effects of lead contamination are still with us. One study that came out in 2021 ([JAMA Pediatrics](#), "Individual- and community-level factors associated with detectable and elevated blood lead levels in US Children - results from a national clinical laboratory" Marissa Hauptman et al, 9/27/2021) looked at over 1.1 million kids under the age of 6 in all 50 states and Washington, D.C. between 2018-2020. Just over 50% had levels over 1 mcg/dl, and 2% had 5.0 mcg/dl or more. The odds of such lead levels increased the most with those living in housing built before 1950, and those living in poverty.

How it harms us includes from the fact that on a chemical level it has a positive charge and so attracts negatively charged molecules which includes proteins. So lead tends to bind to protein which causes a lot of its toxicity as to impairing how protein then functions. One of the most

“Lead: a toxic legacy” Dr. Ian Mudway,



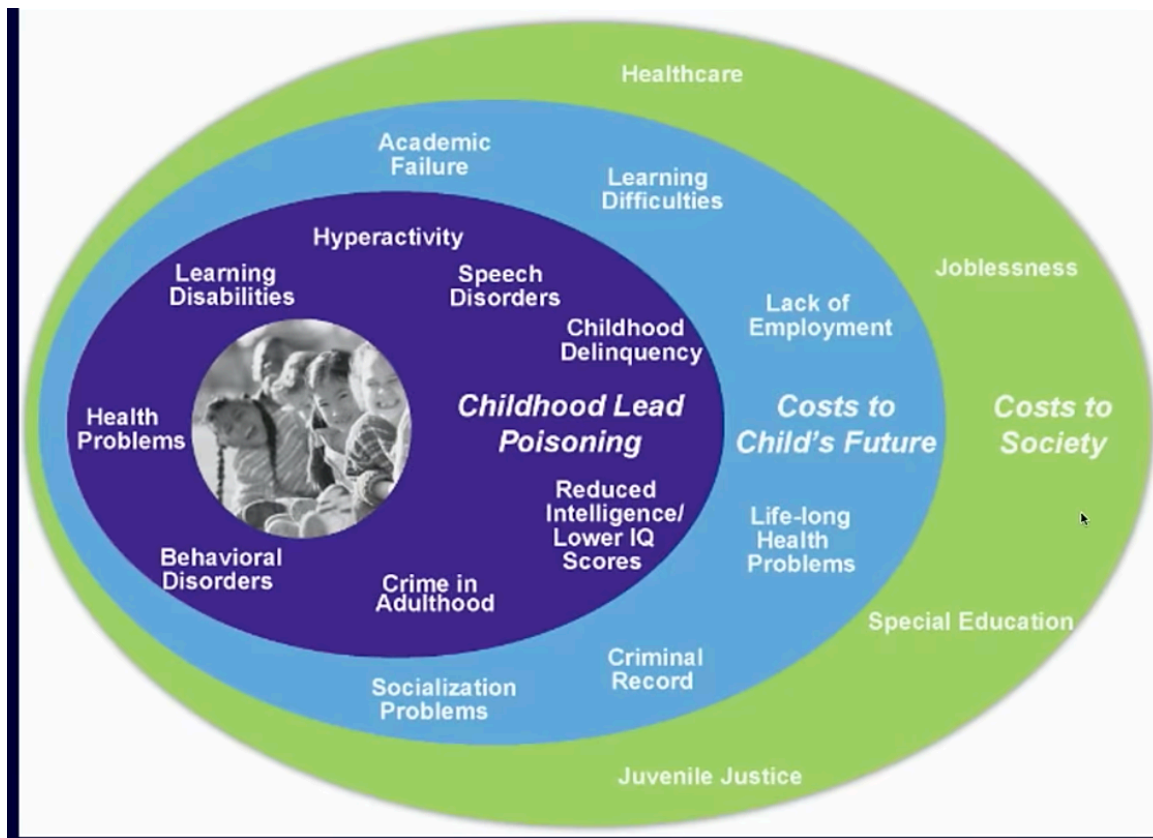
common symptoms of lead poisoning is anemia (low red blood cells, which are what carry oxygen). Lead blocks an enzyme (a protein) that blocks synthesis of hemoglobin – the transport molecule for oxygen. No hemoglobin=no red blood cells=anemia. Lead also impairs kidney function by causing direct damage to them.

The kidneys are involved with blood pressure regulation. Blood flow to the kidneys is reduced from the effects of lead, and blood pressure is raised by them through hormonal effects as a compensatory mechanism.

“Lead: a toxic legacy” Dr. Ian Mudway,

Yet another way lead is harmful to us is that on a chemical level it has some similarities to calcium, and so can compete with calcium which obviously includes bones. So lead can deposit in bones and joints and also disrupt the synthesis of bones which then can lead to osteopenia or osteoporosis. Lead also can cross membranes including the placenta during pregnancy, as well as the blood brain barrier leading to interference with our nervous system such as having peripheral neuropathy, foot- or wrist drop (where they can no longer be flexed). In severe cases it can lead to paralysis.

It can also interfere with the development of the nervous system, meaning in infants and children. It kills brain cells and interferes with myelin, the insulation around brain nerve cells and so hinders the brain from functioning effectively as it should. If lead is ingested by adults roughly 10% of lead taken by mouth or mucous membranes is absorbed in the GI tract. If inhaled (such as through cigarette or marijuana smoke) the figure is about 40% absorption through the lungs. The CDC estimates that kids absorb about 50% of ingested lead after a meal, and up to 100% on an empty stomach. Their blood brain barrier is not yet fully formed and so more lead can get into that which then causes increased damage. Exposure risk is probably greatest before the age of 2 such as from so much stuff being put into their mouth then. Kids who seem healthy can still have elevated levels of lead in their bodies. Early life exposure to lead can persist into adulthood and is a possible contributor to Alzheimer’s developing.



"Lead: a toxic legacy" Dr. Ian Mudway,

This graphic captures the many 'costs' to individuals and society that lead causes on children throughout their lives.

But kids are not the only ones who have lead poisoning. One study ([JAMA](#), "The decline in blood lead levels in the U.S.: the NHANES surveys" JL Pinkle et al, 1994) estimated that "at least 1.7 million people in the U.S. have blood lead levels of at least 20 mcg/dl." Blood lead levels of 10-19 mcg/dl were associated with a significant 17% increase in mortality from all causes and 46% increase in mortality from cancer, compared to levels <10 mcg/dl. (Blood lead levels of 20-29 mcg/dl were associated with a 39% increase in all-cause mortality, 46% increase from cardiovascular diseases, and 68% increase in cancer-related death.)

A study published online in [Circulation](#) ("A prospective study of bone lead concentration and death from all causes, cardiovascular diseases, and cancer in the VA Normative Aging Study" Marc Weisskopf et al, Sept. 2009) looked at 868 people and assessed for blood lead levels as well as that stored in bone. Risk from death due to cardiovascular disease was almost six times higher for those with the most amount of lead stored in the bones compared to those men with the lowest such levels. Such risk was independent of age, smoking, education, race, alcohol, physical activity, BMI, HDL or total cholesterol levels, high blood pressure, or diabetes.

Lead is still being heavily used in the U.S. to this day, most notably in making lead-acid car batteries. It can also be found in

- ❖ ashwagandha root powder (one survey of over 200 samples of it in the US found that 21% had toxic levels of lead, mercury or arsenic despite 75% claiming 'good manufacturing practices' certification).
- ❖ baby food. One study found detectable levels of lead in 20% of 2,164 baby food items sampled. Consumer Reports magazine did tests on baby food in 2018 and then again in 2023. Some improved, some got worse, some stayed the same as to heavy metals such as lead. Rice and sweet potatoes remain risky they say. ("Are there still heavy metals in baby food?" Kevin Loria, 6/27/23). "An occasional serving of even one of the foods with the highest levels [of heavy metals] is generally okay. [But] long-term intake of heavy metals may increase the risk of a variety of health and developmental problems in young children, including a lower IQ and behavioral issues, as well as ADHD, autism, and other issues. Early development is a really sensitive period of time. Organ systems are developing and are particularly vulnerable."

The above studies are the 'good news.' The 'bad news' is that Healthy Babies Bright Future did a study on 168 baby foods involving 61 different brands and 95% of them contained heavy metals. Some of the brands were organic ones including Plum Organics, Beech Nut and Earth's Best. Findings were that among the brands

- 94% contained lead
- 75% contained cadmium
- 73% contained arsenic
- 32% contained mercury

Plus

- 26% contained all four toxic metals
- 40% contained three of them
- 21% contained two of them
- 8% contained one metal
- 5% (only 9) contained zero heavy metals.

Fifteen foods accounted for over half of the heavy metal in baby food risk and choosing organic does not necessarily lower the risk. The most dangerous foods were:

- Rice-based foods (e.g. cereal, rice dishes, rice-based snacks)
- Apple juice
- Grape juice
- Fruit juice blend (100% juice)
- Cheerios and oat ring cereals
- Mac and cheese
- Puff snacks and teething biscuits
- Soft cereal bars
- Oatmeal cookies
- Fruit yogurt
- Sweet potato baby food

But wait, there's more! Food is not lead-free once a person passes out of infancy or toddler years. Older kids and adults are still exposed to food contaminated with lead and other heavy metals. One non-profit group, 'Moms Across America' did research on the Top 20 fast-food restaurants in the country. The primary finding: Of all the samples purchased at 21 locations nationwide, 100% were contaminated with lead and cadmium. Some were in trace amounts. The highest was 912% above the limit set by the EPA for lead in drinking water, from a cheeseburger at a Sonic Drive-In. (https://www.momsacrossamerica.com/fast_food_heavy_metals)

- ❖ bone broth. (One study looked at organic chicken broth being made in three different ways: using the bones, using cooked chicken meat without bones, and using chicken skin and cartilage without the bones after the chicken had been cooked. All exceeded the maximum allowed limits with the skin and cartilage worst by exceeding the allowable amount by 475%, and the bones second worst. Medical Hypotheses, "The risk of lead contamination in bone broth diets" J.A. Monro et al, April 2013.)
- ❖ calcium supplements
- ❖ candy (especially imported from Mexico, Malaysia, China, and India and made with tamarind, chili powder or certain salts).
- ❖ cannabis
- ❖ canned food. Canned baby food such as evaporated milk may have as much as 200 mcg of lead per liter. Canned juices may contain up to 100 mcg/L.
- ❖ carrageenan (it is widely used in the food industry as a thickener and stabilizer, especially in dairy and meat products. The FDA has done testing on it and found that there are very wide differences between how much arsenic, cadmium and lead are in any one brand much less across brands. FDA testing found that
 - arsenic levels ranged from 75-2,011 ppb. The standard is 3,000 ppb.
 - cadmium ranged from 35-1,292 ppb. The standard is 2,000 ppb.
 - lead ranged from 38- 1,065 ppb. The standard is 5,000 ppb. The concern is that such heavy metals are cumulative and difficult to eliminate from the body. And they can take an especially bad toll on kids. The standards are viewed as being outdated in that they were based on the ability to measure these substances in 2002 and not based on health risks posed by them. The ability to measure such substances has improved greatly since then such as being able to measure lead down to 10 ppb.
- ❖ chili peppers/powder/hot sauce
- ❖ chocolate
- ❖ cocoa
- ❖ cookies. Among baby cookies, 64% of arrowroot, 47% of teething biscuits, and 19% of zwieback toast had lead.
- ❖ echinacea
- ❖ eyeliner
- ❖ eye shadow
- ❖ fruit juice. In baby food samples, lead was found in 89% of grape, 67% of mixed fruit, 55% of apple, and 45% of pear juices.
- ❖ ginger

- ❖ gluten-free diets. National research (NHANES, 2009-2012) looked at those on a gluten-free diet and those who were not. People who were gluten-free had significantly higher urine levels of arsenic, and blood levels of mercury, cadmium, and lead vs. those not on such a diet. (Clinical Gastroenterology & Hepatology, “Accumulation of heavy metals in people on a gluten-free diet” Stephanie Raehsler et al, 2018)

Below is a table showing lead and cadmium levels of various chocolate products.

	Lead mcg/serving	Cadmium mcg/serving
NOW healthy foods certified organic cocoa powder 100 pure	7.5	10.8
Whole Foods 365 Everyday value organic dark chocolate coconut 56 cacao	6.0	16.3
Theo organic fair trade almond coconut 65 dark chocolate limited edition spring collection	4.5	10.7
Trader Joe’s passport Tanzania 73	4.4	6.8
Endangered species chocolate natural dark chocolate with 88 cocoa	3.4	2.1
Godiva chocolatier 85 cacao extra dark Santo Domingo chocolate	3.0	6.8
Lindt Excellence 85 cacao extra dark chocolate bar	2.8	5.2
Whole Foods 365 Everyday value organic dark chocolate 56 cacao	1.8	10.3
Newman’s Own organics the second generation super dark chocolate premium organic chocolate 70 cocoa	1.8	33.1
Cadbury Royal Dark Chocolate Indulgent Semisweet	1.0	0.9
Godiva chocolatier 50 cacao dark chocolate sea salt	1.0	2.1
Hershey’s Special Dark Mildly Sweet chocolate bar	1.0	3.8
Equal Exchange chocolate organic fairly traded dark chocolate very dark 71 cacao	1.0	8.1
M&M’s dark chocolate	0.9	Not available
Toblerone of Switzerland dark chocolate with honey and almond nugat	0.9	1.1
Swiss Miss premium cocoa dark chocolate hot cocoa mix	0.7	0.7
Ghirardelli chocolate premium baking cocoa 100 unsweetened cocoa	0.7	0.6
Whole Foods 365 Everyday value organic hot cocoa rich chocolate flavor mix	0.7	4.5
Dove silky smooth dark chocolate bar	0.7	5.5
Nestle rich milk chocolate flavor hot cocoa mix	0.6	0.3
Baker’s unsweetened baking chocolate bar	0.6	4.6
Hershey’s kisses milk chocolate	0.5	0.6
Whitman’s sampler solid milk chocolate rabbit	0.5	0.6
Hershey’s cocoa 100 cacao natural unsweetened	0.4	4.0
Reeses milk chocolate peanut butter cups	0.1	0.6
Snickers bar	None detected	0.6

A more complete listing can be found at <https://www.asyousow.org/environmental-health/toxic-enforcement/toxic-chocolate>

A simpler breakdown of chocolate with high levels:

HIGH IN LEAD

Chocolate bars that are high in lead include:

Brand	Chocolate Type	Cacao %	Lead	Cadmium
Tony's	Chocolonely Dark Chocolate	70%	134%	28%
Lily's	Extra Dark Chocolate	70%	144%	42%
Godiva	Signature Dark Chocolate	72%	146%	25%
Chocolove	Strong Dark Chocolate	70%	152%	60%
Lindt	Excellence Dark Chocolate	85%	166%	80%
Endangered Species	Bold + Silky Dark Chocolate	72%	181%	31%
Trader Joe's	Dark Chocolate	72%	192%	36%
Hu	Organic Simple Dark Chocolate	70%	210%	56%
Chocolove	Extreme Dark Chocolate	88%	240%	83%
Hershey's	Special Dark Mildly Sweet Chocolate	-	265%	30%

82
Pb
Lead
207.2

This graphic is based around the heavy metals found by Consumer Reports (CR) that appeared in Feb 2023. To determine the risk posed by the chocolates in CR's test, they used California's maximum allowable dose level (MADL) for lead (0.5 micrograms) and cadmium (4.1mcg)

DRJOCKERS
SUPERCHARGE YOUR HEALTH!

"Heavy metals in chocolate: what you need to know? Dr.Jockers.com

HIGH IN CADMIUM

Chocolate bars that are high in cadmium include:

Brand	Product	Lead %	Cadmium %
Beyond Good	Organic Pure Dark Chocolate 70% Cacao	42%	112%
Beyond Good	Organic Pure Dark Chocolate 80% Cacao	42%	138%
Equal Exchange	Organic Extra Dark Chocolate 80% Cacao	45%	120%
Scharffen Berger	Extra Dark Chocolate 82% Cacao	49%	136%
Alter Eco	Organic Dark Chocolate Classic Blackout 85% Cacao	49%	204%
Pascha	Organic Very Dark Dark Chocolate 85% Cacao	68%	253%
Dove	Promises Deeper Dark Chocolate 70% Cacao	74%	112%
Lindt	Excellence Dark Chocolate 70% Cacao	48%	118%

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To determine the risk posed by the chocolates in CR's test, they used California's maximum allowable dose level (MADL) for lead (0.5 micrograms) and cadmium (4.1mcg)

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HIGH IN LEAD AND CADMIUM

Chocolate bars that are high in both lead and cadmium include:

Brand	Product	Lead %	Cadmium %
Theo	Organic Pure Dark Chocolate 70% Cacao	120%	142%
Trader Joe's	The Dark Chocolate Lover's Chocolate 85% Cacao	127%	229%
Theo	Organic Extra Dark Pure Dark Chocolate 85% Cacao	140%	189%
Lily's	Extremely Dark Chocolate 85% Cacao	143%	101%
Green & Black's	Organic Dark Chocolate 70% Cacao	143%	181%

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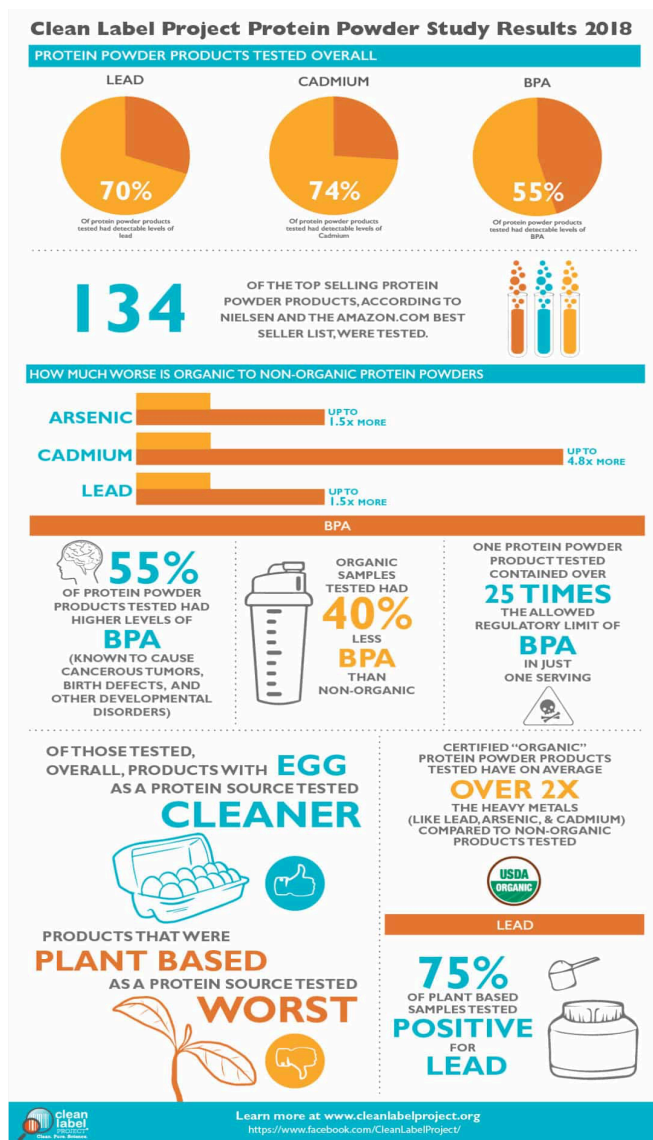
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Chocolate is known for its being contaminated with cadmium as well. If you want to avoid both, here are some to steer clear of.



- ❖ leafy greens (e.g. lettuce, spinach).
- ❖ lipstick/lip gloss (as of 2023 about 70% of lipstick sold in the U.S. still contain lead)
- ❖ paprika
- ❖ pea protein (especially if processed in China)
- ❖ protein powders (e.g. hemp, soy. One study done by the Clean Label Project in 2018, "New Study of Protein Powders from Clean Label Project finds elevated levels of heavy metals and BPA in 53 leading brands" <https://cleanlabelproject.org/blog-post/new-study-of-protein-powders-from-clean-label-project-finds-elevated-levels-of-heavy-metals-and-bpa-in-53-leading-brands/>) found that about 75% of such powders had measurable levels of lead. The powders also contained detectable levels of arsenic (83.5%), cadmium (73.7%), mercury (28.6%), and BPA (55%). Certified organic products averaged twice as much of the heavy metals. Plant-based protein powders contained more heavy metals than the non-plant based ones. Based on a serving size of 35 grams none of the samples exceeded reasonable safety limits for arsenic or mercury. However, 10 were over the limit for cadmium and three were for

lead. Higher cadmium levels are often found in products made with chocolate (cocoa powder).



<https://cleanlabelproject.org/protein-powder-infographic/>

Consumerlab.com has evaluated several protein powders and they failed Ancient Nutrition Plant Protein+Vanilla due to "lead contamination, excess fat, sodium and calories."

- ❖ root vegetables. In baby food samples 86% of sweet potatoes and 43% of carrots had lead. But as was true with juices, some samples had no detectable lead.
- ❖ tamarind
- ❖ turmeric
- ❖ tea (especially from China such as oolong and black teas)
- ❖ balsamic vinegar (a study of 58 brands found 70% exceeded California's maximum level. Some red wine vinegars also contain lead. White wine vinegars do not contain lead.)
- ❖ wild game (shot with lead bullets/shotgun pellets). There was one study (PLoS 1, "Lead bullet fragments in venison from rifle-killed deer: potential for human dietary exposure" W. Grainger Hunt et al, 4/24/09) that looked at deer killed with copper jacketed lead bullets. "All carcasses showed metal fragments (mean=136 fragments, range=15-409) and widespread fragment dispersion. ...We conclude that people risk exposure to bioavailable





lead from bullet fragments when they eat venison... At risk in the U.S. are some 10 million hunters, their families, and low-income beneficiaries of venison donations.”

- ❖ water (from pipes made of lead, or older pipes that were soldered with lead)
- ❖ wine

Consumer Reports magazine did research which it published (“Your herbs and spices might contain arsenic, cadmium and lead” Lisa Gill, 11/9/21). About a third “had high enough levels of arsenic, lead and cadmium combined, on average, to pose a health concern for children when regularly consumed in typical serving sizes. Most raised concerns for adults, too. For two herbs, thyme and oregano, all the products we tested had levels that CR experts say are concerning.” They also noted that brand names, being packed in the U.S., or being organic made a difference. Some of their findings are offered below.

CR's Herb and Spice Test Results

CONSUMER REPORTS tested 126 herbs and spices from 38 brands for arsenic, cadmium, and lead. (We did not test spices that tend to be used in baking, such as cinnamon and nutmeg.) We tested two or three samples from different lots of each product. Our findings are a spot check of the market and cannot be used to draw definitive conclusions about brands. The products are organized alphabetically by type. Within each group, the products are listed according to the degree of concern. Regularly consuming ¼ teaspoon or more daily of a product in one of the concerning categories could, over time, pose a health risk to children as a result of the combined levels of the three heavy metals. Unless noted, they could also pose a risk to adults. The more red boxes next to a product, the higher the concern.

 No Concern	 Some Concern	 Moderate Concern	 High Concern
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BASIL



Simply Organic Basil	✔
365 Whole Foods Market Basil	●
Great Value (Walmart) Basil Leave	●
McCormick Culinary Ground Basil (Albahaca Molida)	●
Sausage Maker Ground Basil	●
Litehouse Freeze Dried Basil	●
Morton & Bassett Basil*	●
Spice Islands Sweet Basil	●●

BLACK PEPPER



Tone's Ground Black Pepper	✔
El Guapo Black Pepper Ground (Pimienta Negra Molida)	✔
Badia Ground Black Pepper (Pimienta Negra Molida)	✔
Casablanca Ground Black Pepper (Pimienta Negra)	✔
Trader Joe's Organic Ground Black Pepper	✔
Kirkland Signature (Costco) Fine Ground Black Pepper	✔
Simply Organic Black Pepper	✔
Penzeys Spices Tellicherry Black Pepper Fine Shaker Grind	✔
Great Value (Walmart) Ground Black Pepper	✔
McCormick Pure Ground Black Pepper	✔

CHILI POWDER



Morton & Bassett Chili Powder	✓
Spice Islands Chili Powder	✓
Simply Organic Chili Powder	✓
Badia Polvo de Chili Powder	✓
Swad Chilli Powder	✓
Good & Gather (Target) Chili Powder	✓
Gebhardt Chili Powder	✓
El Guapo Ground California Chili (Chile California Molido)	✓
McCormick Dark Chili Powder	✓
Great Value (Walmart) Chili Powder*	●

CORIANDER



Simply Organic Coriander	✓
Happy Belly (Amazon) Ground Coriander	✓
Badia Ground Coriander (Culantro Molido)	✓
Great Value (Walmart) Organic Ground Coriander	✓
Spice Islands Ground Coriander	✓
Morton & Bassett Ground Coriander	✓
Laxmi Brand Corriander Powder	✓
Penzeys Spices Coriander Ground	✓

CUMIN



Spice Islands Ground Cumin Seed	✓
Simply Organic Ground Cumin	✓
El Guapo Cumin (Comino)	✓
Morton & Bassett Ground Cumin	✓
McCormick Ground Cumin	✓
365 Whole Foods Market Cumin Ground	✓
Bolner's Fiesta Ground Comino (Cumin)*	●
Badia Ground Cumin (Comino Molido)*	●
Great Value (Walmart) Ground Cumin*	●
Trader Joe's Organic Ground Cumin	●

CURRY POWDER



Simply Organic Curry Powder	✓
Great Value (Walmart) Organic Curry Powder	✓
Morton & Bassett Curry	✓
Spice Islands Curry Powder	✓
Jamaican Choice Jamaican Curry Powder	✓
McCormick Curry Powder	✓
Happy Belly (Amazon) Curry Powder	✓
Caribbean Rhythms Mild Curry Powder	✓
Badia Jamaican Style Curry Powder	✓

GARLIC POWDER



365 Whole Foods Market Organic Garlic Powder	✓
Lawry's Casero Garlic Powder (Ajo en Polvo)	✓
McCormick Garlic Powder	✓
Simply Organic Garlic Powder	✓
Bolner's Fiesta Garlic Powder	✓
Kirkland Signature (Costco) Granulated California Garlic	✓
Great Value (Walmart) Granulated Garlic	✓
La Flor Garlic Powder (Ajo en Polvo)	✓
Badia Garlic Powder (Ajo en Polvo)	✓
Spice Supreme Garlic Powder	✓

GINGER



Simply Organic Ginger	✓
365 Whole Foods Market Ground Ginger	●
Great Value (Walmart) Organic Ground Ginger	●
La Flor Ground Ginger (Jenjibre)	●
Tone's Ground Ginger	●
Badia Ground Ginger (Jengibre Molido)	●
Spice Islands Ground Ginger	●
Morton & Bassett Ground Ginger	●
McCormick Ground Ginger	●

OREGANO



Simply Organic Oregano	●
McCormick Ground Oregano	●
Penzeys Spices Oregano Turkish	●
Spice Islands Oregano	●
Badia Ground Oregano (Molido)	●
Sadaf Oregano Leaves (Origan)	●
La Flor Ground Oregano	● ● ●

PAPRIKA



Morton & Bassett Paprika	✓
Simply Organic Paprika	✓
Spice Islands Paprika	✓
365 Whole Foods Market Paprika	✓
Great Value (Walmart) Organic Paprika*	●
Badia Paprika (Pimenton)*	●
Pride of Szeged Sweet Hungarian Style Paprika	●
McCormick Paprika	●

SAFFRON



Pacific Plaza Imports Full Thread Spanish Saffron	✓
Krokos Kozanis Organic Greek Red Saffron in Filaments	✓
Vigo Imported Saffron	✓
Badia Pure Selected Saffron (Azafran)	✓
McCormick Gourmet All Natural Spanish Saffron	✓
Sadaf Pure, Premium Saffron Thread	✓

SESAME SEED



Sincerely Nuts Sesame Hulled	✓
Woodstock Organic Sesame Tahini Unsalted	✓
Al Wadi Al Akhdar Tahina 100% Ground Sesame	✓
Grain Brain Organic Hulled Sesame Seeds	✓
Bob's Red Mill Premium Hulled White Sesame Seeds	✓
Penzeys Spices Sesame Seeds White Hulled	✓
Roland Tahini Pure Ground Sesame Seed	✓
JFC Premium Roasted White Sesame Seed	✓
Sadaf Sesame Seed Raw	✓

THYME



Spice Islands Ground Thyme	●
Morton & Bassett Ground Thyme	●
McCormick Ground Thyme	●
Tone's Ground Thyme	● ●
Happy Belly (Amazon) Ground Thyme	● ● ●

TURMERIC



Laxmi Brand Turmeric Powder	✓
Spice Islands Turmeric	✓
Sadaf Turmeric Powder (Curcuma)	✓
Simply Organic Turmeric	✓
Badia Ground Turmeric (Curcuma Molida)	✓
Kirkland Signature (Costco) Ground Turmeric	●
Morton & Bassett Turmeric	●
McCormick Ground Turmeric	●
La Flor Ground Turmeric	● ● ●

Kids between the ages of 1-2 years old absorb 40-50% of lead they ingest such as from food, while adults only absorb 10-15%. The amount absorbed also increases in people who have a poor diet such as being deficient in iron, calcium, phosphorous, or zinc in particular which is one of the most well studied metals for the alleviation of heavy metal toxicity. i.e. Foods rich in these minerals help prevent lead from being absorbed in the body.

The FDA has regulation for bottled water as to it containing no more than 5 parts per billion (ppb). The American Academy of Pediatrics recommends that drinking water at schools have less than 1 ppb. Other foods' lead levels are not regulated by law but has limits. They include:

- ❖ fruit juices and nectars: 30 ppb
- ❖ berry juice and other small fruits: 50 ppb
- ❖ candy consumed by small kids: 100 ppb
- ❖ dried fruits (e.g. raisins): 100 ppb

Lead can also be found in toys, such as plastic or wooden play items that babies all too often put into their mouth. It can also be in hair dye and jewelry.

For adults the primary source of lead exposure is through jobs such as

- ❖ ammunition manufacturing
- ❖ battery manufacturing and recycling
- ❖ construction (especially restoration and retrofitting)
- ❖ scraping and sanding lead-based paint
- ❖ crystal and glass manufacturing
- ❖ firing range instruction
- ❖ lead smelting
- ❖ lead weight manufacturing
- ❖ mining
- ❖ pewter manufacturing
- ❖ plumbing and radiator repair
- ❖ pottery making
- ❖ shipbuilding
- ❖ stain glass making
- ❖ welding
- ❖ being shot with a lead bullet and having it remain in the body. (The CDC says there are an estimated 115,000 gunshot injuries/year in the U.S., with ~70% being nonfatal. Surgeons often do not remove a bullet from someone who has been shot if the damage in doing so is greater than leaving it in the body. The body will encapsulate a bullet as a foreign object and at least in theory that helps prevent it from causing lead poisoning. There are some who say that bony fractures resulting from a bullet wound, or a bullet that has fragmented rather than remaining whole pose a greater risk for causing lead poisoning and that the patient should have blood lead levels monitored every three months for the first year. Retained bullet fragments (RBF's) leading to elevated blood levels are said to occur infrequently but a small number can reach very high levels such as above 80 mcg/dl or

rarely even over 300 mcg/dl. The time span between being shot and the first symptoms of lead poisoning arise have had reports range between 2 days and 40 years.)

The initial sign of lead poisoning is usually anemia, which can lead to fatigue, fainting, pain, thirst, and weak or rapid pulse.

Hobbies also expose one to lead contamination. Among non-industrial exposure the #1 risk is shooting firearms (CDC, Morbidity & Mortality Weekly Report, "Adult blood lead epidemiology and surveillance, U.S. 2008-2009, 7/1/2011). Another study reported on by the CDC (Morbidity & Mortality Weekly Report, "Indoor firing ranges and elevated blood levels – U.S. 2002-2013" 4/25/2014) concluded that there is "serious lead exposure from indoor firing ranges. ...Firing range customers and family members of firing range employees, in addition to employees themselves, can be exposed to hazardous amounts of lead. There are an estimated 19 million active target shooters in the U.S." This study also found that about 37% of recreational target shooters had blood levels at 25 mcg/dl or higher, and about 38% had levels between 10-24 mcg/dl.

One study found that employees at a California firing range had lead levels of 20-40 micrograms/deciliter (mcg/dl). Another study looked at police cadets and found that blood lead levels went from 6 mcg to 15+ mcg/dl after five days of training. As to how fast lead levels dropped, sixty-nine days after training was completed levels were on average still at 9 mcg/dl. It is estimated that 1 million police officers train with guns at indoor ranges.

Another study (Journal of Occupational Medicine, "Lead exposure at uncovered outdoor firing ranges" R.L. Goldberg, et al, June 1991) found that "substantial air lead contamination can occur at high-volume, uncovered outdoor shooting ranges despite 'natural ventilation. ...We discovered a blood level of 65 mcg/dl in a police officer who 'moonlighted' only 2 days per month as an instructor on a private outdoor range. We advised him to find a safer way to supplement his income, and his blood level subsequently dropped to 15 mcg/dl within several months."

Another study by NIOSH (National Institute for Occupational Safety & Health, part of the CDC; "Reducing exposure to lead and noise at outdoor firing ranges") noted that outdoor ranges have natural ventilation and so there is more dispersal of lead. However, the "personal breathing zone lead levels can exceed the NIOSH recommended exposure" limits. At one firing range in California the highest lead exposure was on the range's instructor. In wiping down surfaces, the highest lead contamination was found on firearms. But lead was also found on picnic tables where employees ate.

The city of Los Angeles did a study of full-time shooting instructors ("Lead exposure at uncovered outdoor firing ranges" Robert Goldberg, et al) who worked at uncovered outdoor ranges. Air monitoring and blood lead levels were measured. What they found was significant lead exposure and absorption occurred. Use of copper-jacketed ammo may decrease the amount of lead in the air and the lead absorption by instructors. In 2014 OSHA inspected only 201 of over 16,000 shooting ranges in the country.

Other hobbies with potential lead exposure include painting, remodeling and renovation, and molding bullets and fishing weights.

Other forms of paint such as for boats, cars and bridges can still contain lead and use of those may lead to exposure. Ayurvedic medicine can be contaminated with lead. Some products that were marketed to pregnant women exceeded standards by as much as 4 million percent. (Morbidity & Mortality Weekly Report, “Lead poisoning in pregnant women who used Ayurvedic medications from India, New York City 2011-2012” 8/24/12). Heavy metals are intentionally added to several Ayurvedic supplements.

As of 2018 the FDA set the maximum daily lead intake from food for kids at 3 mcg; over a million kids get more than 6 mcg/day. The limit for adults is 12.5 mcg. California’s Prop. 65 law limits the maximum allowable daily level of lead for any product causing exposure greater than 0.5 mcg. The U.S. Federal government now recognizes that *NO* level of lead exposure is safe. The average blood lead level of adults in the U.S. is 1.2 mcg/dl, and kids are around 1.0-1.4 mcg/dl. The CDC considers anything above 5 mcg/dl to be ‘elevated.’ Using a standard of 5 mcg/dl an estimated 500K children age 1-5 years are above it, according to the CDC. Other research (offered in Pediatrics, April 2017) found that there was an underreporting of lead contamination in kids and estimated that 1.2 million kids between the age of 1-5 years old (during 1999-2010) had elevated blood levels. This obviously does not include kids under the age of 1, nor those age 5-17. One estimate is that kids in about 4 million households in the U.S. are exposed to high levels of lead (Family & Community Health, “Inequitable chronic lead exposure – a dual legacy of social and environmental injustice” Tamara Leech et al, Sept. 2016). Firm numbers of how many kids of all ages have lead poisoning are hard to come by but is clearly well into the millions.

However, such numbers are based on a standard of 5 mcg/dl. One study found that the typical level of lead around 1.2 mcg/dl in adults is associated with an increased prevalence of gout leading them to conclude that “very low levels of lead may still be associated with health risks.” A study in The Lancet (4/1/2018) looked at a nationally representative sample of 14,289 Americans who were 20 years or older and who were part of the NHANES 3 study (National Health & Nutritional Examination Survey). It ran between 1988-1994 and follow-up lasted until the end of 2011. The average lead level was 2.71 mcg/dl. By their calculations and extrapolating to the entire country their findings included

blood lead levels higher than 1 mcg/dl are responsible for around 412,000 deaths in the U.S. each year. Of these, around 256,000 are from cardiovascular disease. These results remained after accounting for a number of possible confounding factors, including participants’ age, sex, body mass index (BMI), diet, smoking status, and alcohol intake.” (Cited in Medical News Today, “Over 400,000 U.S. deaths per year caused by lead exposure).

i.e. The CDC is using a standard of 5 mcg/dl being elevated and it had been assumed that only concentrations of 5 mcg/dl or higher would take a toll on health. This research found lower ones to be having an impact, such as contributing to the deaths of hundreds of thousands of adults every year.

There was another study that looked at people born between 1979-1984 which found a strong, inverse dose response curve between childhood blood lead levels and brain volume in adults. Brain tissue in the prefrontal cortex (the area that ‘makes us human’ and differentiates us from ‘lower order animals’ and gives us decision making and executive skills) was significantly smaller with lead poisoning. Plus, lead has been found to impact some genes that control dopamine receptors that are involved with executive judgment. Conclusions of the research included that there was a loss of mathematical reasoning and reading comprehension in adults with a dose-response curve (i.e. higher blood lead levels in childhood equals greater intellectual losses in adulthood). Plus, there was a risk of more people being of lower intellectual caliber overall and lower chance of adults being of higher intellectual caliber based on blood lead levels in childhood. (“Long reach of lead: early childhood lead exposure and cognitive ability in later-in-life” Christopher Keyes et al, 5/10/23).

Then there is research on kidney disease. A researcher at Beth Israel Deaconess hospital in Boston analyzed health information on almost 598,000 patients with chronic kidney disease in the US who started dialysis between 2005-2017, as well as official data on lead concentrations in city water supplies in the five years leading up to the dialysis. What was found was that levels below the 5 mcg/dl level were associated with worse health in such patients. Even at 1.5 mcg/dl, the trend was observed.

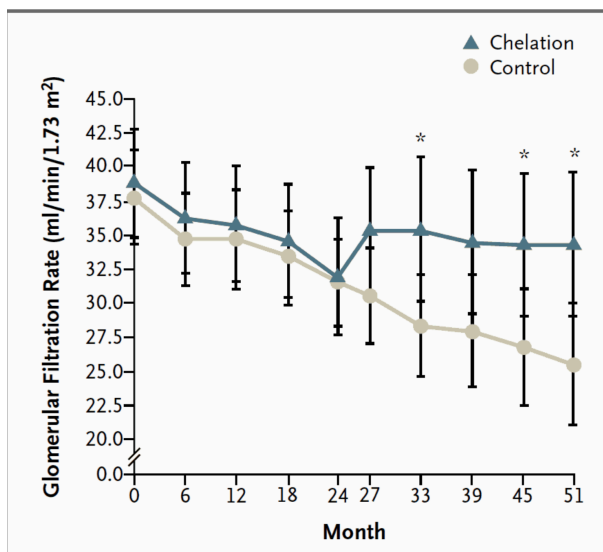


Figure 2. Estimated Mean (± 2 SE) Glomerular Filtration Rate According to Time in the Chelation Group (N=31) and the Control Group (N=30) during the Observation and Intervention Periods.

The patients in the chelation group received chelation therapy from month 24 to month 51. The asterisks indicate $P < 0.05$ by Student's t-test.

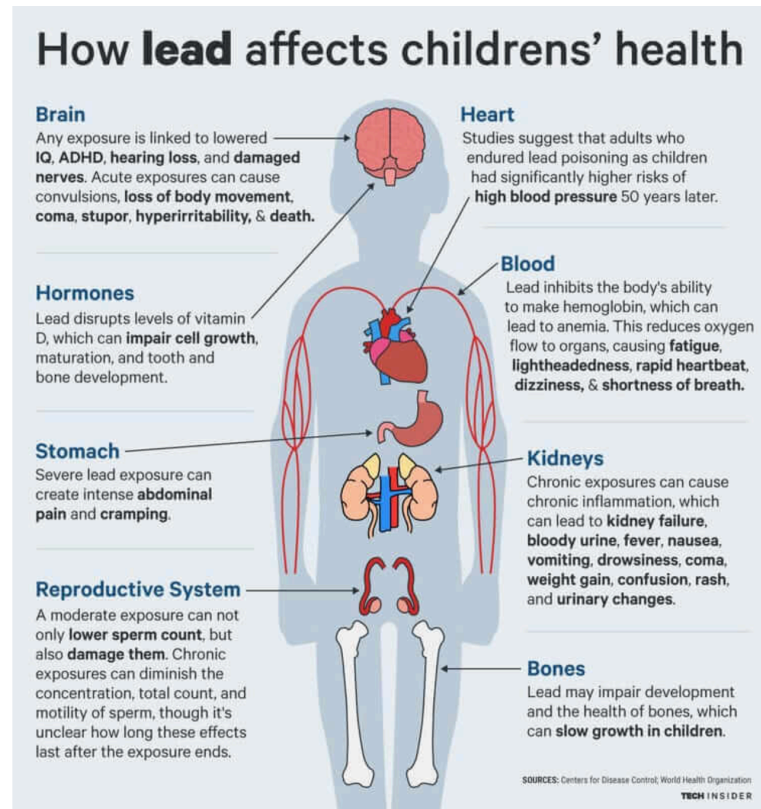
There was also a study published in the New England Journal of Medicine looking at 64 patients with low-level lead induced renal toxicity who were followed for four years. They initially just monitored the kidney function for two years and both groups slid down as to declining kidney function. Then half received EDTA chelation therapy and their kidney function did not decline over the next 27 months while the control group continued their slide toward increased dialysis and death.

(<https://davidhaasemd.com/2018/09/25/how-much-lead-detrimental-health/>)

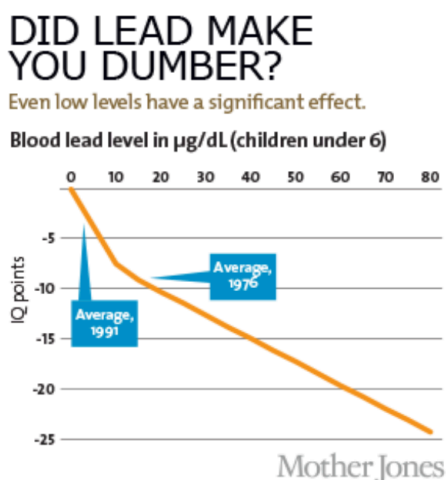
Kids are more sensitive to the effects of lead poisoning than adults due to their brains being in the early stages of development. If 1 mcg/dl is harmful for adults, it certainly must be so for kids. Consequently, if the average childhood level is 1.0 mcg/dl or higher, as already stated, then the vast majority of kids in this country are suffering some deleterious effects from it.

<https://zegofoods.com/how-do-you-avoid-lead-exposure-lead-in-food-part-1/>

Lead also crosses the placenta, so babies can be exposed to it.



Below is a graphic showing just one effect of lead as to lowering IQ (Mother Jones, "Lead: America's real criminal element" Kevin Drum, Feb. 2013) with the biggest effect between 1-10 mcg/dl. More than 10% of inner-city and poor kids have lead exposure levels over 10 mcg/dl.



Another study (PLOS Medicine, "Decreased brain volume in adults with childhood lead exposure", Kim Cecil et al, 5/27/2008) found that high exposure to lead in childhood was linked to a permanent loss of brain tissue, especially in males. It occurred primarily in what is called the prefrontal cortex (i.e. right behind the forehead, and the region that 'makes us human' and separates us from 'lower animals'). This part of the brain controls executive functions which is involved with skills such as emotional regulation, impulse control, attention, verbal reasoning, and mental flexibility.

Another study on kids (BMC, "The effect of lead exposure on IQ test scores in children under 12 years: a systematic review and meta-analysis of case-control studies" Serve Heidari et al, May 2022) looked at 3,316 kids across eight studies. They found that higher vs. lower concentrations of lead in a child, being more or less than 10 mcg was one factor. But another was how long children had such concentrations in their bodies as to longer or shorter than 4.5 years. The mean

difference of IQ points for longer than 4.5 years was almost 23 points vs. 3 ½ points for shorter than 4.5 years.

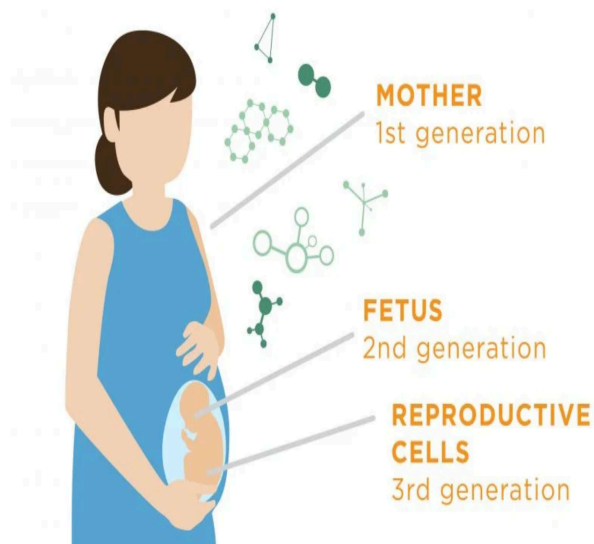
Another study ([Environmental Health Perspectives](#), Dec. 2006) also found evidence that small amounts of lead exposure in kids can cause problems. Adjusting for a number of factors (age, sex, race/ethnicity, preschool attendance, prenatal exposure to tobacco smoke, smoker in the house, insurance status, and serum ferritin levels) having the 'typical' level of lead doubled the risk of ADHD vs. having a blood lead level below 0.8 mcg/dl. Having a lead level of 2.0 mcg/dl or greater quadrupled the risk of ADHD. Research in 2016 offered in [Psychological Science](#) found that there is a gene mutation (HFE C282Y) in about 10% of American kids. For those with the mutation there is "a heightened association between lead exposure and ADHD symptoms- particularly hyperactivity-impulsivity" and more so in boys. The gene helps control the effects of lead in the body. Those without the mutation "showed amplified symptoms as lead exposure increased, but not as consistently."

Lead likes to get stored in bone and 95% of it is found there. While it is stored in the bone it is not seen as a problem. But it does not always stay there. There is something called 'bone turnover' which involves the breakdown and replacement of it as part of a normal bodily process. Lead is released back into the bloodstream during this process. Certain states such as pregnancy, menopause, breast feeding, hyperthyroidism, and hypermetabolic states can increase bone turnover and as a result blood lead levels.

The half-life of lead in the blood from a single (i.e. not a chronic and ongoing exposure such as described above in various groups of people) is about a month. That means over three months the blood level of it will be reduced by roughly 90%. But where is it going? Into your bones.

How long does it take to get out of your bones? Estimates vary widely, from about 10 - 50 years to remove half of it from bone. What's the problem with that? Bone is not like steel girders in a building, permanent and unchanging. Bone turnover is such that every 10-12 years you are said to have a new skeleton. Plus, if you lose a lot of weight your bones do not need to be as strong and bulked up, and some of the calcium - and lead - in them is released back into the blood. Then there are factors like osteoporosis. One study on about 3,000 postmenopausal women found that there was a significant increase in lead levels after they lost their periods. Then there is pregnancy and breastfeeding. Most of the extra calcium needed during those events comes from the body being able to absorb more calcium from the foods eaten. But if it is not capable of getting all that it needs for pregnancy or breastfeeding it dips into the calcium stored in bones - and the lead is pulled out in the process. And over a month, such as after breastfeeding ends, calcium gets redeposited back into the bones. But in the process do you want your fetus or newborn to be exposed to lead, at the worst possible time as to the rapid development of the brain that is occurring? One study found that taking a calcium supplement during breastfeeding did limit an increase in lead being released from less bone needing to be taken. But the best advice for limiting lead exposure at such times: not getting the lead into your body in the first place. i.e. Strive for an ounce of prevention, not a pound of cure.

But wait, there's more! If you eat food like an apple, its calories and nutrients get used up in some period of time and it is gone. If you ingest lead through some means you can get rid of it through detox, or sweating, or through stool. But otherwise it is not being used up or consumed. Lead persists.



For women their blood and bone lead levels can be transferred to a fetus through the umbilical cord and placenta as well as through breast milk. And for a daughter she can then pass the lead her mother has transferred to her to her own future offspring. And this can persist for generations to come. Human research into this issue is nonexistent as far as I have been able to see, because to do 2-3 generations could take 50-100 years to accomplish. Some research on the transgenerational effects of toxins being passed along has been done on rats and fruit flies which have a short life span so it is easier to see that multiple generations are impacted.

<https://www.ewg.org/research/how-toxic-pollutants-can-harm-future-unexposed-generations>

Effects of lead poisoning according to some may be most noticeable when blood lead levels are ≥ 60 mcg/dl. They can include:

- ❖ abdominal pain
- ❖ aggressiveness
- ❖ anemia
- ❖ attention span being shortened
- ❖ behavioral problems

- ❖ blood pressure (There was a study done in American Journal of Epidemiology, “The

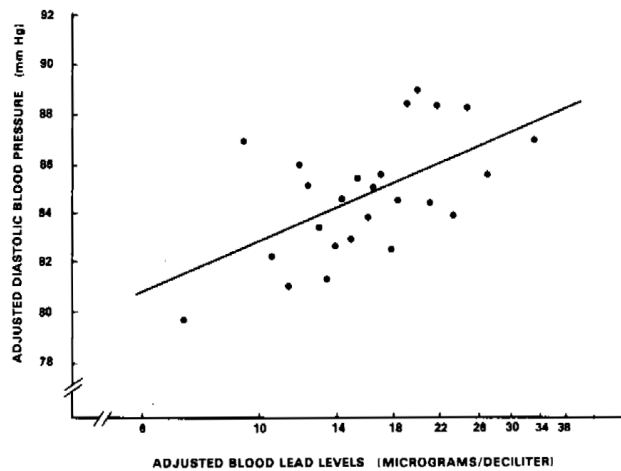


FIGURE 1. Adjusted diastolic blood pressure and adjusted blood lead levels for white males aged 40–59 years, NHANES II. Both blood pressure and blood lead have been adjusted by regression for the effects of age, age-squared, body mass index, and all other variables significant at the 5 per cent level (see table 2). The 564 observations have been reduced to 25 points for illustration. Each point is the mean blood pressure and mean blood lead of 22 or 23 consecutive observations, ordered by increasing blood lead levels. However, the plotted regression line reflects the slope coefficient obtained from the multiple regression analysis of all 564 points.

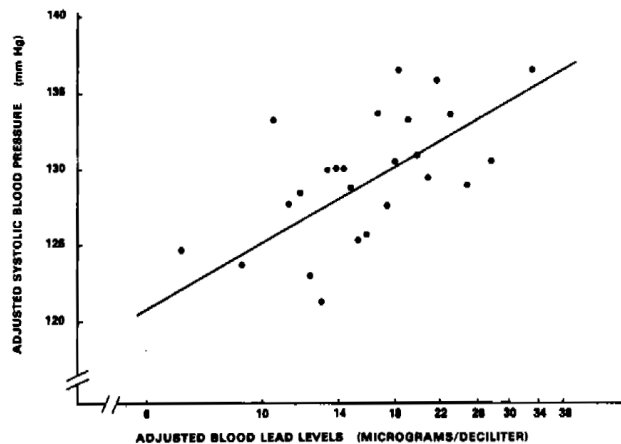


FIGURE 2. Adjusted systolic blood pressure and adjusted blood lead levels for white males aged 40–59 years, NHANES II. Both blood pressure and blood lead have been adjusted by regression for the effects of age, age-squared, body mass index, and all other variables significant at the 5 per cent level (see table 2). The 543 observations have been reduced to 25 points for illustration. Each point is the mean blood pressure and mean blood lead of 21 or 22 consecutive observations, ordered by increasing blood lead levels. However, the plotted regression line reflects the slope coefficient obtained from the multiple regression analysis of all 543 points.

relationship between blood lead levels and blood pressure and its cardiovascular risk implications” James Pirkle et al, 1985, taken from a NHANES study. It basically found a linear relationship between higher blood lead levels and systolic and diastolic blood pressure going up.

Another study found that the three significant risk factors for bone and blood lead increasing risk of high blood pressure were BMI, family history of high blood pressure, and bone lead concentration in the tibia. (JAMA, “The relationship of bone and blood lead to hypertension. The Normative Aging Study” H Hu et al, April 1996 involving 30 years). They

concluded that “long-term lead accumulation, as reflected by lead levels of lead in bone [as reflects long-term lead accumulation vs. blood which reflects recent lead exposure], may be an independent risk factor for developing hypertension in men in the general population.

- ❖ cancer
- ❖ cardiovascular mortality (There was research done in Environmental Health Perspectives, “Blood lead levels and death from all causes, cardiovascular disease and cancer: resulted from the NHANES III mortality study” Susan Schober et al, Oct. 2006. It was a nationally representative study involving 9,757 people who were 40 years or older, and followed for

twelve years. Relative risk of cardiovascular mortality based on blood lead levels were found as shown below:

Blood lead levels (mcg/dl)	Risk of mortality
<5	1.0
5-9	1.2
≥10	1.55

Their conclusions included that “blood lead levels as low as 5-9 mcg/dl were associated with an increased risk of death from all causes, cardiovascular disease, and cancer.”

If you think there is safety in low levels of blood lead here is some more research to consider. It also was taken from the NHANES III study and looked at low doses of blood lead levels and the increased risk from heart attack, stroke and cancer, based on 13,946 people 17 years or older. Comparing those in the bottom tercile to the top tercile

	Blood lead ≤1.93 mcg/dl hazard ratio	Blood lead ≥3.63 mcg/dl hazard ratio
Heart attack	1.0	1.89
Stroke	1.0	2.51
Cancer	1.0	1.10

They controlled for age, race-ethnicity, sex, diabetes, BMI, current/former smoking, alcohol, physical activity, income, C-reactive protein, cholesterol, education, urban, menopause, hypertension, and renal function. The difference in cancer was not significant. ([Circulation](#), “Blood lead below 10 mcg/dl and mortality among US adults” Andy Menke et al, Sept. 2006

- ❖ concentration difficulties
- ❖ constipation
- ❖ damage to the brain and nervous system
- ❖ digestive problems
- ❖ dyslexia
- ❖ fatigue
- ❖ footdrop, wrist drop
- ❖ gout
- ❖ headaches
- ❖ hearing problems (said to occur at concentrations of ≥2 mcg/dl. One third of adolescents with such a blood lead level had >15 decibel hearing loss. Lead has not been proven to be the cause of hearing loss and for now it is just an association.
- ❖ high blood pressure (which can occur at blood lead levels ≥10 mcg/dl)
- ❖ hyperactivity
- ❖ irritability
- ❖ joint and muscle pain
- ❖ kidney damage (decreased renal function can occur at blood lead levels <5 mcg/dl according to the CDC)
- ❖ lethargy
- ❖ loss of appetite, weight
- ❖ lower IQ in kids

- ❖ memory impairment
- ❖ miscarriage, premature birth, still birth. (There was research that found that as blood lead levels climbed the rate of spontaneous abortion did too. The levels shown below are lower than occupational standards allow. American Journal of Epidemiology, “Blood lead levels measured prospectively and risk of spontaneous abortion” Victor Borja-Aburto et al, Jan. 1999. Risk factors for there is so much increased risk includes from the father as to lead being passed through semen to the mother. Or the father’s work clothes, equipment, hands are a source of exposure to the mother. Or lead alters his sperm. For the mother risk may include impaired hormonal environment needed to maintain the pregnancy and/or direct teratogenic effects on the fetus from the lead.)

Blood lead levels (mcg/dl)	Odds ratio of miscarriage
<5	1.0
5-9	2.3
10-14	5.4
≥15	12.2

- ❖ mood disorders
- ❖ multiple sclerosis
- ❖ pain in the extremities
- ❖ seizures
- ❖ sleep disturbances
- ❖ slowed physical growth
- ❖ tingling in the hands or feet
- ❖ death

There was a S. African study that found that aggression scores are significantly higher in people who use firearms and have blood lead levels ≥ 5 mcg/dl vs. those using archery ranges. Out of 87 shooters assessed just shy of 80% had blood lead levels ≥ 5 mcg/dl, and those with blood lead levels ≥ 10 mcg/dl were more hostile. Frequency of use of shooting ranges was significantly associated with higher blood lead levels as well as aggression in shooters. Aggression and anti-social behavior in kids and adolescents has been associated with elevated blood lead levels too. (International Journal of Environmental Research & Public Health, “Is there a relationship between lead exposure and aggressive behavior in shooters?” Nisha Naicker et al, July 2018).

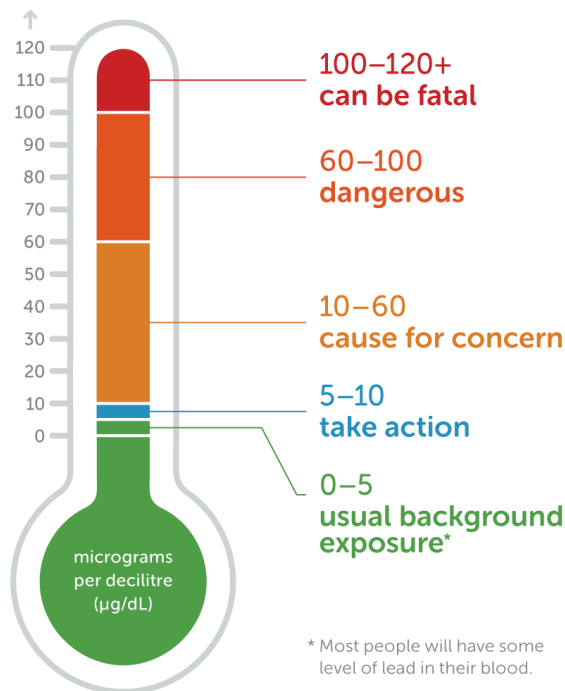
There is also some research based on people and animals suggesting that exposure to lead in childhood can cause problems in adulthood including anxiety, depression, obsessive-compulsive disorder (OCD), ADHD, autism, and Tourette’s syndrome. Lead can cause a calcium loss or interfere with zinc, copper or iron metabolism all of which are needed for energy production and hence their absence can lead to depression. However, there is also research that found that no symptoms of lead poisoning may be apparent even with elevated levels of it in the body.

There was also a fifteen year long study done on adults exposed to lead and its effects on them over time. It looked at over 3,000 adults in the U.S. and Korea who had industrial exposure to lead. They concluded “that a significant proportion of what is considered ‘normal’ age-related cognitive decline may, in fact, be due to past exposure to neurotoxicants such as lead.” (American

Journal of Industrial Medicine, “Effects of lead on the adult brain: a 15-year exploration” Walter Stewart et al, Oct. 2007).

Having laid out all the ways one can suffer contamination from lead and its effects on our health, what can be done about it? The best advice is to eliminate the sources of exposure which may be easier said than done.

Blood lead level indicator



<https://leadsmart.nsw.gov.au/effects-of-lead/>
“How lead affects people”

When should you be concerned as to a blood lead level and what should you do at different levels of it? Opinions are far from unanimous. Fetuses, infants, and young children have the greatest risk of damage being done, and so the actionable level for them is much lower. For adolescents or adults maybe there should be a different level for them.

This graphic offers one set of recommendations as to how much concern one should have with various blood lead levels.

A BLL of $\geq 45 \mu\text{g/dL}$ is not a threshold for chelation, but a guideline. Professional judgment should guide the decision to chelate a child or adult, based on their individual clinical considerations. In some instances, a patient may need to be chelated at somewhat lower BLLs.

This table comes from the CDC as to what they advise for kids based on various blood lead levels (BLL).

Table 8: ACCLPP Recommended Actions Based on BLL [ACCLPP 2012]

< Reference Value	\geq Reference Value of 5 – $\leq 45 \mu\text{g/dL}$	$\geq 45 - \leq 69 \mu\text{g/dL}$
Lead education -Dietary -Environmental Environmental assessment* for pre-1978 housing	>Lead education -Dietary -Environmental Follow-up blood lead monitoring Complete history and physical exam Lab work: – Iron status Consider Hemoglobin or hematocrit Environmental investigation Lead hazard reduction Neuro developmental monitoring Abdominal X-ray (if particulate lead ingestion is suspected) with bowel decontamination if indicated	Lead education -Dietary -Environmental Follow-up blood lead monitoring Complete history and physical exam Lab work: - Iron status-Free erythrocyte protoporphyrin Environmental investigation Lead hazard reduction Neuro development al monitoring abdominal X-ray with bowel decontamination if indicated Oral chelation therapy Consider hospitalization if lead-safe environment cannot be assured

https://www.atsdr.cdc.gov/csem/leadtoxicity/patient_treatment.html



HEALTH-BASED GUIDELINES FOR BLOOD LEAD LEVELS IN ADULTS

These guidelines are for the care of adults aged 18 and older and adolescents exposed to lead at work. The mean blood lead level (BLL) for U.S. adults is less than 1 µg/dL, and the 97.5 percentile for BLL is 3.5 µg/dL (CDC, CSTE 2021¹); thus, CDPH recommends clinical action and follow-up for adult BLLs 3.5 µg/dL and greater. Chronic adverse health effects have no threshold, so clinicians should monitor patients with elevated BLL until below 3.5 µg/dL. For occupational lead exposure, these CDPH guidelines are more stringent and health protective than the current Cal/OSHA or federal OSHA lead standards.

Identification and removal from lead exposure is the primary treatment of elevated BLL and most cases of symptomatic lead toxicity. Chelation therapy is reserved for patients with severe symptoms of toxicity, which typically occur at BLL greater than 80 µg/dL, or in any patient with an extremely high BLL (e.g. > 100 µg/dL). Consult with a specialist experienced in treating lead toxicity for symptomatic patients.

Blood Lead Level	Action Needed	Timing of recheck BLL	CLINICAL EVALUATION
3.5–9 µg/dL	Obtain history on lead exposure and minimize contact.	Repeat BLL every 3 months until < 3.5 µg/dL.	Obtain history on potential sources of lead exposure at work and home at all BLLs ≥ 3.5 µg/dL and minimize lead contact. A venous blood lead sample should be used for diagnosis and monitoring. Testing of hair, urine, or capillary blood and provocation testing are not recommended.
10–19 µg/dL	Check baseline labs if none in past 12 months.	Repeat BLL every 2 months until < 10 µg/dL.	Laboratory tests (CBC, BUN/Cr, and urinalysis) should be obtained within two weeks of a BLL result > 30 µg/dL and urgently if > 80 µg/dL. Consider labs at BLL ≥ 10 µg/dL if no baseline results are available from the past 12 months. Monitor blood pressure at least annually for lead-exposed adults.
20–29 µg/dL	Conduct physical exam and labs if not done in prior 12 months.	Repeat BLL monthly until < 10 µg/dL.	IF OCCUPATIONAL EXPOSURE Remove from work or reassign to job duties that do not involve lead if the last two BLLs are ≥ 20 µg/dL or if the average of all BLLs in the last 6 months is ≥ 20 µg/dL.
30+ µg/dL	Conduct physical exam and labs within 2 weeks of BLL result.	Repeat BLL monthly until < 10 µg/dL.	Remove from work or reassign to job duties that do not involve lead if one BLL is ≥ 30 µg/dL.
80+ µg/dL	Prompt physical exam, labs, and consultation with an occupational medicine specialist or toxicologist.		
In pregnancy, BLL should be as low as possible to protect the fetus. Identify and stop lead exposure, remove from work at BLL ≥ 3.5 µg/dL, and repeat BLL at least every 4 weeks until < 3.5 µg/dL. Refer to the American College of Obstetricians and Gynecologists guidelines and CDC guidelines on lead in pregnancy and lactation for additional recommendations.			

https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/OLPPP/CDPH%20Document%20Library/BLL_Adult_Mgmt_Guidelines_Revised_Jan_10_2022.pdf

This table comes from the California Dept. of Public Health as to advice they offer for adults with lead exposure at work. Other States' governmental agencies websites that I have seen offer comparable advice.

My take on the two tables above is you not follow the advice of such bureaucrats with an attitude of 'You're being poisoned by lead, do nothing about it but sit around and see if it gets better over time.' Instead, be proactive and detoxify your body through appropriate means.

What is offered below are a different approach to consider when lead levels have elevated.

I am not a medical doctor and will not delve into medical treatments of it. Ask your doctor for advice on that score. Two comments I will make here is that EDTA, a chelating agent, is only used for very high levels of lead in the blood, such as at maybe 60-70 mcg/dl, and not for lesser amounts. However, some say that kids should be chelated down around 45 mcg/dl. EDTA also has numerous side effects which can be serious. The other statement to be made about EDTA is that it has its dangers such as being toxic to the kidneys, and healthy minerals like zinc, iron and manganese can be excreted out with it too.

There are simple approaches to consider that are over the counter in nature that may be of interest. Much of the research that has been done in this area has used rats, and there is always uncertainty if such results will then apply to humans.

There was one study done in 2012 (Basic and Clinical Pharmacology & Toxicology, "Comparison of therapeutic effects of garlic and D-Penicillamine in patients with chronic occupational lead poisoning" Sina Kianoush et al) that took 117 workers who had lead exposure from the car battery industry. One group was given medical chelation therapy involving a drug called D-penicillamine. Another group got the equivalent of two cloves of fresh garlic using the powder form compressed into a tablet. Both groups saw blood lead levels drop by about 20%, and the garlic had fewer side effects. What was more amazing is that the garlic group had significantly less irritability and fewer headaches, plus their deep tendon reflex and systolic blood pressure improved. The drug group did not benefit in such a manner. So, the garlic was safer and more effective. Their conclusion included that "garlic can be recommended for the treatment of mild-to-moderate lead poisoning." However, you should also consider that 80% of the raw garlic sold in the US is grown in China. Chinese soil is beyond contaminated with toxic chemicals including lead. Raw garlic is not labeled as to country of origin. But, Chinese garlic has the roots cut off the bottom of the bulb and the paper skin is bleached so it is very white. Finding garlic without the bleached skin and roots intact does not necessarily mean it was grown in the US, and it might still have been grown in contaminated soil of some other country. Powdered dehydrated garlic is sometimes identified as to country of origin. Kyolic (garlic in capsules) also sometimes shows its country of origin.

Another study (Journal of the American College of Nutrition, "The effect of ascorbic acid supplementation on the blood lead levels of smokers" Earl Dawson et al, 1999) took 75 males ages 20-30 and who were smoking at least a pack per day. In one week of using 1,000 mg of vitamin C there was an "81% decrease in blood-lead levels... possibly by reducing the intestinal absorption of lead." However, another study on 52 adult males found that supplementing with vitamin C for three months at 500 or 1000 mg had no effect on lead levels in the blood or hair. (Annals of the NY Academy of Sciences, "The effects of vitamin C supplementation on blood and hair levels of cadmium, lead, and mercury" Edward Calabrese et al, July 1987).

There is also research that vitamins B6 (pyridoxine) and B1 (thiamine) can help alleviate health problems due to lead poisoning. B1 affects how much is absorbed and may cause an increase in lead excretion. B6 may reduce the accumulation of lead in tissues. Vitamin C also is "unsurpassed in its ability to bind to and remove lead [and so therefore is] highly effective at alleviating lead toxicity." (Annals of Occupational Environmental Medicine, "Evaluation and management of lead

exposure” Hwan-Cheol Kim, et al, 12/15/2015). They go on to note that “Quercetin is effective in alleviating lead-induced liver, kidney, and brain damage... by being able to bind to some of the lead accumulated in the hippocampus” which is a key brain structure involved with memory. “Though the optimal dosage has not been settled, the oral ingestion of quercetin is known to cause no particular side effects.”

This does not mean you should start gulping down such vitamins in supplement form. Nature likes everything in balance, to be at ‘Goldilocks’ levels – not too much, not too little, but just right. If you increase your intake of some vitamin it can have impacts on other minerals and vitamins and not just lead. Consider lab testing to see where such vitamins are at in your body if you have lead poisoning, and then consult with an appropriate professional if supplements or an increase from your diet is needed.

Still other approaches that some have offered ([Medical News Today](#), “What is a heavy metal detox?” Natalie Olsen, 12/16/2019) for people to consider include

- ❖ dietary fiber
- ❖ chlorella (a form of seaweed available in capsule form)
- ❖ foods rich in sulfur (e.g. broccoli)
- ❖ modified citrus pectin (using a commercially available product called PectaSol which might help reduce lead in the body). There was a small study done ([Alternative Therapeutic Health Medicine](#), “The role of modified citrus pectin as an effective chelator of lead in children hospitalized with toxic lead levels” July-Aug. 2008, Zheng Yan Zhao et al) that used modified citrus pectin (MCP; PectaSol). Results “showed a dramatic decrease in blood serum levels of lead, (161% average change) and a dramatic increase in 24-hour urine collection (132% average change). The need for a gentle, safe heavy metal-chelating agent, especially for children with high environmental exposure, is great. The dramatic results and no observed adverse effects in this pilot study along with previous report of the safe and effective use of MCP in adults indicate that MCP could be such an agent.” However, the product also has California’s Prop. 65 warning on it due to it containing a small amount of lead.

Others ([Nutrients](#), “Dietary strategies for the treatment of cadmium and lead toxicity” Qixiao Zhai et al, Jan. 2015) offer that green tea, tomatoes, and ginseng can be helpful. Some probiotics in the lactobacillus family have been found able to bind lead based on mice studies. Sodium alginate (another pill form of seaweed) also has been used for chelation of lead (“If it’s not food, don’t put it in your mouth” Becky Plotner, www.nourishingplot.com/2014/06/23/chelating-heavy-metals-naturally/). There also has been research that following a lactovegetarian diet for a year resulted in reduced levels of lead, along with mercury and cadmium.

There is some research saying that there are a number of minerals that are antagonistic to lead – and it is a two-way street as to lead being adverse to them (other than for chromium which is only one-way as to lead being damaging). Such minerals include calcium, chromium, copper, iron, magnesium, manganese, selenium, sulfur, and zinc. The same warning applies here as to vitamins, as to not gulping down handfuls because there is a need to maintain Goldilocks levels.

'Test, don't guess' as to where your levels are before supplementing. Garlic, ginger and onion have some protective properties against lead. Garlic is said to be good because of its antioxidant qualities, plus chelating ability due to sulfur-containing amino acids that promote the excretion of lead. Ginger and onion are similar to garlic in their effects. Green tea and tomato are also said to be helpful at least based on rat research. Green tea is good for its antioxidants and chelating ability. Tomato is a chelator as well and helps reduce the accumulation of heavy metals (lead, cadmium, and mercury) in the liver of rats.

Testing of blood is not generally going to tell you much about 'total body burden.' Lead does not stay in the blood for more than a month and then it gets put into tissue including the brain and the bone. Consequently, blood tests will tell you about an acute exposure that occurred recently. Analyzing hair samples can capture a longer time frame such as 1-3 months. Hair testing has been shown by the EPA to be a good method of testing for lead poisoning. Several hair tests may be necessary before elevated lead levels are revealed. Quality labs such as Trace Elements and Analytical Research Labs can offer such measurements of lead. Plus, there is some evidence that the ratio between calcium and phosphorous on such a hair test can determine whether the body has enough energy to detoxify from lead contamination. Too low a ratio and it will not happen. Seeing what other minerals are being impacted by lead can also give one a better understanding of what needs to be brought up to the Goldilocks level. EDTA challenge testing will detect what is in the blood, and reveal little about what is stored in body tissues.

Another approach that has some research behind it is sweating through use of a steam or infrared sauna. Such sweating was found to be good in helping to eliminate heavy metals including lead, cadmium, and aluminum, along with others such as nickel (Archives of Environmental Contamination & Toxicology, "Blood, urine and sweat (BUS) study: monitoring and elimination of bioaccumulated toxic elements" Stephen Genius, et al, Nov. 2010). You should have appropriate cardiovascular health before making use of a sauna and should talk to your doctor if you are unsure about this issue. You need to drink water before or after sauna use as to dehydration as well as consider replenishing electrolytes that are lost to sweating too.

Some experts voice concern that if you try to flush out toxic elements like lead too fast, what might happen is that it goes from being locked up in your body to suddenly flushed into your blood stream and hits you with a more serious and acute poisoning. Consequently, they recommend that you first strengthen yourself nutritionally such as by looking at mineral and vitamin levels and getting them up to snuff, before you flush anything out of your system.

There is all manner of advice on how to remove lead contamination from clothing. One article that offers some is <https://www.displaycloths.com/can-you-wash-lead-out-of-clothes/>. There are also specialized soaps and detergents that some say are better at facilitating its removal.