

Toxic Lead is Still Robbing Our Children of Brain Power

[Rachel's Introduction: The government and the media give the impression that the problem of toxic lead has largely been solved. Unfortunately, this is not the case. Millions of children are still having their IQs reduced by exposure to lead.]

By Peter Montague

In a front-page story June 22, the New York Times reported that a first-born child typically has a 3-point IQ advantage over any brothers or sisters born later.[1] The editors of the Times considered this information so important that they featured it in a second news story,[2] an op-ed commentary,[3] and four letters to the editor.[4]

Here is how the Times initially described the importance of a 3-point IQ advantage:

"Three points on an I.Q. test may not sound like much. But experts say it can be a tipping point for some people -- the difference between a high B average and a low A, for instance. That, in turn, can have a cumulative effect that could mean the difference between admission to an elite private liberal-arts college and a less exclusive public one." [1]

The Times did not mention it, but for some children the loss of 3 IQ points could mean the difference between a high D average and a low C, with a cumulative effect that could mean the difference between staying in school and dropping out.

In other words, a 3-point loss of IQ may be crucially important in every child's life, not just those headed for the Ivy League.

The U.S. Department of Labor says 19 million jobs will be created in the next decade and 12 million of them (63%) will require education beyond high-school.[5] As the globalized economy puts U.S. workers under greater competitive pressure, workers are expected to survive by retraining themselves 2 or 3 times during their working years. In this new world, every IQ point takes on new importance.

Unfortunately, the loss of 4 to 7 IQ points is far more widespread among U.S. children than anyone has so far reported, except in obscure medical journals.

One of the main causes of widespread loss of IQ is the toxic metal, lead, which is a potent neurotoxin. This soft gray metal was widely used in paint, in leaded gasoline, in sealing "tin" cans, and in water pipes throughout most of the 20th century, and the residuals are still taking a toll today in the form of peeling paint, toxic house-dust in older homes, contaminated soil, and a measurable body burden in almost all our children.

The most common units of measurement for lead in blood are micrograms per deciLiter of blood (ug/dL). A microgram is a millionth of a gram and there are 28 grams in an ounce. A deciLiter is

a tenth of a liter and a liter is roughly a quart.[6]

As lead in your blood goes up, your IQ goes down. And paradoxically the first few micrograms of lead are the most damaging.

As a child's lead rises from less than 1 ug/dL up to 10, he or she loses an average of 7 IQ points.[7,8,9,10] If lead continues rising from 10 to 20, another 2 IQ points get shaved off. The first 5 ug/dL reduce a child's IQ by about 4 points.[7,8,9,10]

According to the latest available data, 26 percent of all children in the U.S. between the ages of 1 and 5 have 5 to 10 micrograms of toxic lead in each deciLiter of blood[11] -- which corresponds to a loss of 4 to 7 IQ points.[7,8,9,10] The estimate of lead in blood was published in December 2003, covering the period 1988-1994. Average levels today are probably somewhat lower because the trend for lead in children's blood is downward.

Unfortunately this 26% average for all U.S. children masks a disproportionate effect among non-whites, who tend to live in families with low income and in older homes that may have peeling paint containing toxic lead.

In the 2003 report, nearly half (47%) of non-Hispanic Black children ages 1 to 5 had blood lead levels in the range of 5 to 10 ug/dL, which corresponds to a loss of 4 to 7 IQ points. Nineteen percent of white children and 28% of Hispanic children fell in the same range.[11]

This means that exposure to toxic lead is still a huge problem in the U.S., robbing more than a million children each year of the intellectual potential they were born with.[12]

Unfortunately, there is widespread misunderstanding (and muddled reporting in the media) about this problem, due in no small part to confusing and contradictory policies set by the federal Centers for Disease Control and Prevention (CDC) and U.S. Environmental Protection Agency (EPA). State governments by and large just go along.

Prior to 1971, doctors only treated children for lead poisoning if they had more than 60 ug/dL.[13] At this level many children died, and those who survived had major permanent brain damage. Permanent damage from lead poisoning was well documented at least as early as 1943, but it wasn't until 1971 that the definition of "elevated" lead in children's blood was reduced to 40 ug/dL. By 1978, it was apparent that children were still being brain-damaged at 40 ug/dL, so the definition of "elevated" was reduced to 30. In 1985, the definition of "elevated" was reduced again, to 25, and in 1991 it was reduced again, to 10 ug/dL.[14]

In 2005, the Centers for Disease Control and Prevention (CDC) reaffirmed its 10 ug/dL "level of concern," using tortured logic. CDC first acknowledged that "there is no 'safe' threshold for blood lead levels." [15, pg. ix] In other words, CDC acknowledges that any amount of lead greater than zero causes some harm. CDC then says, "Although there is evidence of adverse health effects in children with blood lead levels below 10 ug/dL, CDC has not changed its level of concern, which remains at levels equal to or greater than 10 ug/dL.... If no threshold level exists for adverse health effects, setting a new BLL [blood lead level] of concern somewhere

below 10 ug/dL would be based on an arbitrary decision," CDC says.[15, pg. ix]

In other words, since any amount of lead in blood greater than zero is harmful to children, then 10 is as good a number as any for defining where the problem begins. It's like saying automobiles are dangerous at any speed above zero, so setting the legal speed limit at 100 mph is as good as any other number.

So this is where it stands today: CDC says children are being harmed at levels below 10, yet CDC retains its official "level of concern" of 10 because picking any number below 10 (except zero) would be arbitrary.[15]

It gets worse: CDC says 10 ug/dL is the "level of concern" but finding 10 ug/dL in a child's blood still does not trigger official attention to that individual child. When a community finds 10 ug/dL in some of its children, it is supposed to take community-wide action to prevent lead exposures -- urging homeowners to wet-mop to reduce household dust, for example. Yes, this will help, but it is an adequate response?

By current CDC guidelines, a child must have 15 ug/dL before the local health department is supposed to initiate "case management," visiting the home, for example, to discuss ways to reduce exposure. If a child has 20 ug/dL or more, then serious intervention may be initiated -- forcing homeowners or landlords to remove sources of lead (such as old paint) from the home, for example.

But here's the worst news: CDC's "level of concern" is widely interpreted as a "safe" level by other government agencies. It was never intended as such. As one lead researcher has written, "Although the CDC's intervention level is not a statement concerning the level of childhood blood lead considered 'safe' or 'acceptable,' it has been interpreted as such by the general public and by federal regulatory agencies." [16] And, we should add, by state agencies as well.

For example, U.S. Environmental Protection Agency (EPA) has never set a "[reference dose](#)" for inorganic lead, as it has for several other neurotoxins about which far less information is available. EPA uses CDC's logic: it cannot find a level of exposure to lead that is "likely to be without deleterious effects during a lifetime" of exposure. So it ignores the problem by refusing to set a reference dose.[16]

As you can probably gather from this description, CDC guidelines do not flag 10 ug/dL as a serious threat to children. And that is the way it is understood across America, as a recent scan of newspapers revealed [with my comments inside square brackets]:

** The Wasau (Wisc.) Daily Herald reported May 27, 2007, that in Marathon County, Wisconsin, 1617 children were tested "with 43 registering levels higher than 10 micrograms per deciliter of blood." [With only 43 out of 1617 affected, the problem doesn't sound very serious, does it?]

** The Arizona Daily Star reported Feb. 4, 2007 that only 1 percent of children in Pima County have "elevated blood-lead levels." [Only 1 percent? Sounds like the problem has been solved,

doesn't it?]

** The Westerly, Rhode Island, Sun reported Feb. 3, 2007 that "In 2005, about two percent of 31,669 children screened in Rhode Island, or 621 children, showed an elevated lead count in their blood..." [Only two percent -- sounds like the problem is small.]

** In Fitchburg, Massachusetts the Sentinel & Enterprise reported Nov. 6, 2006, that childhood lead poisoning has dropped from 8.2 per 1000 children in 1998 to 2.7 per 1000 in 2005 (with "lead poisoning" defined as 20 ug/dL). [Sounds like the problem is small and under control.]

** The Denver Post reported April 29, 2007, "About 38 out of every 100,000 children under the age of 6 tested in Colorado in 2003-04 showed elevated levels of lead." [Only 38 out of 100,000? Sounds like the problem has been solved.]

** The Erie (Pa.) Times-News reported Dec. 3, 2006, "... the U.S. Centers for Disease Control and Prevention estimates that 310,000 children nationwide between the ages of 1 and 5 have blood lead levels of 10 micrograms per deciliter or greater. Ten micrograms per deciliter is the federal threshold for lead poisoning in children that can result in development, learning and behavior problems." [A wonderfully clear statement of the point I'm making -- 10 ug/dL is almost universally reported as a level below which there are no real problems.]

To be fair, several of these news stories quoted one individual or another (often a community activist) saying that levels of lead below 10 can cause problems in children -- but none of the stories mentions the number of children exposed at levels below 10. It's as if levels below 10 don't really matter. All the published numerical estimates are expressed in terms of CDC's official "level of concern" -- and all the published estimates make the problem appear small.

The habit of only reporting 10 ug/dL or more comes directly from CDC itself[17] and from state health departments, many of whom measure, but do not publish, data on lead in blood below 10 ug/dL. For example, here is how the New Jersey state health department presented its summary of lead in N.J. children in 2005 (the latest year for which N.J. data are available):

"While 191,788 (97.7%) children tested in New Jersey in FY 2005 had blood lead levels below the Centers for Disease Control and Prevention (CDC) threshold of 10 ug/dL, there were 4,547 (2.3%) children with a blood lead test result above this level." [18, pg. 7]

So in all of New Jersey, only 2.3% of children rise to the level of concern defined by CDC. This is very different from estimating, for example, that about 140,000 kids younger than 5 in New Jersey have lost 4 to 7 IQ points because they have 5 to 10 ug/dL lead in their blood.[19]

Numerical data on how many children have lead levels below 10 ug/dL seem to be a closely guarded secret. A review of dozens of published reports on lead in children's blood since 1985 uncovered only one report that estimated the proportion of children in the U.S. with 5 to 10 ug/dL.[11] The federal government and many state governments collect this data -- but none of them publish it. They focus instead on the small number of children with more than 10 ug/dL, continuing the illusion that 10 or more is the only amount that matters.

How could a small amount like 5 ug/dL harm anyone?

How could such a small amount of lead -- 5 ug in each deciLiter of blood -- cause brain damage? One way to understand such a question is to ask about the environment in which our species, Homo sapiens, evolved. How much lead are humans accustomed to?

From modern studies, scientists know the relationship of lead in blood to lead in bones. So in 1992, a group of scientists measured lead in the bones of pre-industrial humans, for the purpose of estimating "natural background" (pre-industrial) levels of lead in blood. They concluded that the natural background level of lead in human blood is 0.016 ug/dL -- so 5 ug/dL represents a level 300 times as high as natural background.[20]

A 300-fold increase in a potent nerve poison seems certain to take its toll on humans so exposed, especially if they are exposed during early childhood, when their brains are developing rapidly.

Brain damage is not the only harm caused by lead at levels below 10 ug/dL. In 2004, CDC asked a panel of experts to evaluate and summarize the current scientific literature on adverse health effects associated with blood lead levels less than 10 ug/dL. [See the Appendix in footnote 15.]

They found that intellectual impairment -- brain damage -- was number one, but they also found:

** Reduced height and head circumference as blood lead levels rise above 1 ug/dL.

** Delayed sexual maturation. Two studies observed late puberty in girls with blood lead levels in the range of 2 to 5 ug/dL. This seems to indicate that lead is interfering with the endocrine (hormone) system.

** Dental caries (popularly known as "cavities" in teeth) were more likely to develop as a child's blood lead level rose from 1 to 3 ug/dL.

And a study too recent to have been included in the Appendix has shown that a child is 4 times as likely to have attention deficit hyperactivity disorder (ADHD) when blood lead levels reached 2 ug/dL or greater, compared to children with lead at 1 ug/dL.[21] In the U.S., an estimated 4.4 million children have been diagnosed with ADHD.[22]

So the problem is large -- but the government and the media together have managed to make it appear small. Yes, we have made progress in curbing the very substantial harm done to ourselves and our children by the paint and gasoline corporations during the 20th century. But we've still got a long way to go.

To make any real progress, government agencies need to stop pretending that this problem has been solved. Publishing all the available data on lead in children's blood would be a good start. Yes, parents would find it disturbing and there might be an uproar. That's as it should be.

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[1] Benedict Carey, "Research Finds Firstborns Gain The Higher IQ," New York Times June 22, 2007, pg. A1. <http://tinyurl.com/26nbc4>

[2] Benedict Carey, "Findings on Birth Order and IQ Prompt Debate on Influence of Family Dynamics," New York Times June 25, 2007, pg. A17. <http://tinyurl.com/yofxms>

[3] Benedict Carey, "I Am Worm, Hear Me Roar," New York Times July 1, 2007, Week in Review, pg. 1.

[4] "Mom Always Said You Were Smarter," New York Times June 29, 2007, pg. A28.

[5] Mason M. Bishop, "Promoting U.S. Worker Competitiveness; Statement of Mason M. Bishop, Deputy Assistant Secretary For Employment and Training, U.S. Department of Labor before the Committee on House Ways and Means June 14, 2007." <http://tinyurl.com/yvtwgp>

[6] Occasionally you will see lead in blood reported in micromoles per liter; if you have micromoles per liter and you want ug/dL, multiply by 20.704; conversely, if you have ug/dL and you want micromoles per liter, multiply by 0.0483.

[7] Richard L. Canfield and others, "Intellectual Impairment in Children with Blood lead Concentrations below 10 ug per Deciliter," New England Journal of Medicine Vol. 348, No. 16 (April 17, 2003), [pgs. 1517-1526. <http://tinyurl.com/26l24n> See Figure 2.

[8] Bruce P. Lanphear and others, "Low-level Environmental Lead Exposure and Children's Intellectual Function: An International Pooled Analysis," Environmental Health Perspectives Vol. 113, No. 7 (July 2005), pgs. 894-899. <http://tinyurl.com/2b6yv7> See Figures 3 and 4.

[9] Bruce P. Lanphear and others, "Cognitive Deficits Associated with Blood lead Concentrations <10 ug/dL in US Children and Adolescents," Public Health Reports Vol. 115, No. 6 (Nov/Dec 2000), pgs. 521-529. <http://tinyurl.com/2fn4lp>

[10] David C. Bellinger and others. "Low-Level Lead Exposure, Intelligence, and Academic Achievement: A Long-term Follow-up Study," Pediatrics Vol. 90, No. 6 (December 1992), pgs. 855-861. <http://tinyurl.com/2rmvqq>

[11] Susan M. Bernard and Michael A. McGeehin, "Prevalence of Blood Lead Levels Greater Than or Equal to 5 ug/dL Among US Children 1 to 5 Years of Age and Socioeconomic and Demographic Factors Associated with Blood of Lead Levels 5 to 10 ug/dL, Third National Health and Nutrition Examination Survey, 1988-1994," Pediatrics Vol. 112, No. 6 (December 2003), pgs. 1308-1313. <http://tinyurl.com/3y5arc>

[12] There are about 4 million babies born in the U.S. each year; if 25% have lead between 5 and 10 ug/dL that's a million babies harmed. This number omits some immigrants and children with lead levels above 10 ug/dL.

[13] Walter J. Rogan and James H. Ware, "Exposure to Lead in Children -- How Low is Low Enough?," New England Journal of Medicine Vol. 348, No. 16 (April 17, 2003), pgs. 1515-1516. <http://tinyurl.com/26wx7b>

[14] Centers for Disease Control, Preventing Lead Poisoning in Young Children (Atlanta, Ga.: October 1, 1991). <http://tinyurl.com/2db87t>

[15] Centers for Disease Control, Preventing Lead Poisoning in Young Children; A Statement by the Centers for Disease Control and Prevention (Atlanta, Ga.: August, 2005). [Contains an important Appendix: Work Group of the Advisory Committee on Childhood Lead Poisoning Prevention. A Review of Evidence of Adverse Health Effects Associated with Blood Lead Levels < 10 ug/dL in Children, August 2005.] <http://tinyurl.com/3daf3q>

[16] Susan M. Bernard, "Should the Centers for Disease Control and Prevention's Childhood Lead Poisoning Intervention Level Be Lowered?" American Journal of Public Health Vol. 93, No. 8 (August 2003), pgs. 1253-1260. <http://tinyurl.com/yrk6fl> See also <http://tinyurl.com/2dbyhq>.

[17] "Blood Lead Levels -- United States, 1999-2002," MMWR [Morbidity and Mortality Weekly Report] Vol. 54, No. 20 (May 27, 2005), pgs. 513-516. <http://tinyurl.com/yps0qz>

[18] New Jersey Department of Health and Senior Services. Childhood Lead Poisoning in New Jersey. Trenton, N.J.: New Jersey Department of Health and Senior Services, 2005. [Covers the period July 1, 2004 to June 30, 2005] <http://tinyurl.com/2gmgth>

[19] Even the 4,547 number gives an overly-optimistic impression of the situation in New Jersey in 2005. In July, 2005, there were 563,900 children under age 5 in New Jersey. <http://tinyurl.com/258uoy>. If 2.3% of these have lead levels of at least 10 ug/dL, that's 12,970 kids who have lost at least 7 IQ points. And if one-quarter of the 563,900 have 5 to 10 ug/dL, that's about 140,000 kids who have lost 4 to 7 IQ points to lead.

[20] A. Russell Flegal and others, "Lead Levels in Preindustrial Humans," New England Journal of Medicine Vol. 326, No. 19 (May 7, 1992), pgs. 1293-1294. <http://tinyurl.com/38rnq3>

[21] Joe M. Braun and others, "Exposure to Environmental Toxicants and Attention Deficit Hyperactivity Disorder in U.S. Children," Environmental Health Perspectives Vol. 114, No. 12 (December 2006), pgs. 1904-1909. <http://tinyurl.com/2ohcwf>

[22] "Mental Health in the United States: Prevalence of Diagnosis and Medication Treatment for Attention-Deficit/Hyperactivity Disorder -- United States, 2003." MMWR [Morbidity and Mortality Weekly Report] Vol. 54, No. 34 (September 2, 2005), pgs. 842-847. <http://tinyurl.com/2u38fc>

More Readings on Harm from Blood Lead Levels Below 10 ug/dL

American Academy of Pediatrics, Committee on Environmental Health. "Lead Exposure in

Children: Prevention, Detection, and Management," Pediatrics Vol. 116, No. 4 (October 4, 2005), pgs. 1036-1046. <http://tinyurl.com/2at8fq>

Bellinger, David C. "Lead." Pediatrics Vol. 113, No. 4 (April, 2004), pgs. 1016-1022. <http://tinyurl.com/2k33vv>

Bellinger, David C. and Herbert L. Needleman. "Intellectual Impairment and Blood Lead Levels." New England Journal of Medicine Vol. 349, No. 5 (July 31, 2003), pg. 500. <http://tinyurl.com/2btvj8>

Centers for Disease Control and Prevention, National Center for Environmental Health. "Why not change the blood lead level of concern at this time?" Accessed (and captured as a PDF file) on the CDC web site August 7, 2004; available in PDF at <http://tinyurl.com/2a3vft>

Chen, Aimin, and others. "Lead Exposure, IQ, and Behavior in Urban 5- to 7-Year-Olds: Does Lead Affect Behavior Only by Lowering IQ?" Pediatrics Vol. 119, No. 3 (March 3, 2007), pgs. e650-e658. <http://tinyurl.com/2dq3mo>

Chiodo, Lisa M. and others. "Neurodevelopmental effects of postnatal lead exposure at very low levels." Neurotoxicology and Teratology Vol. 26 (2004), pgs. 359-371. <http://tinyurl.com/2zo7y6>

Committee on Environmental Health, American Academy of Pediatrics. "Policy Statement -- Lead Exposure in Children: Prevention, Detection, and Management." Pediatrics Vol. 116, No. 4 (October 2005), pgs. 1036-1046. <http://tinyurl.com/2at8fq>

Needleman, Herbert L. "Deficits in the Psychologic and Classroom Performance of Children with Elevated Dentine Lead Levels," New England Journal of Medicine Vol. 300, No. 13 (March 29, 1979), pgs. 689-695. <http://tinyurl.com/2wj8l8>

Needleman, Herbert L. "Lead Poisoning," Annual Review of Medicine Vol. 55 (2004), pgs. 209-222. <http://tinyurl.com/2jgw2j>

Needleman, Herbert L., and Philip J. Landrigan, "What Level of Lead in Blood is Toxic for a Child?" American Journal of Public Health Vol. 94, No. 1 (January 2004), pg. 8. <http://tinyurl.com/2dbyhq>

"Neurodevelopment inversely related to blood lead levels <10 mcg/dL," Blood Weekly (Oct. 12, 2006), pg. 73. <http://tinyurl.com/ytzfrx>

Schnaas, Lourdes, and other. "Reduced Intellectual Development in Children with Prenatal Lead Exposure." Environmental Health Perspectives Vol. 114, No. 5 (May 2006), pgs. 791-797. <http://tinyurl.com/2dq3mo>

Schwartz, Joel. "Low-Level Exposures and Children's IQ: A Meta- analysis and Search for a Threshold." Environmental Research Vol. 65 (1994), pgs. 42-55. <http://tinyurl.com/2c63nc>

Shih, Regina A., and others. "Cumulative Lead Dose and Cognitive Function in Adults: A Review of Studies That Measured Both Blood Lead and Bone Lead." *Environmental Health Perspectives* Vol. 115, No. 3 (March 2007), pgs. 483-492. <http://tinyurl.com/2kcvhk>