The poisoning of children by the toxic metal, lead, was first reported in 1892.[1] By 1904 the cause of the poisoning was correctly identified as dust from lead-based paint, which was flaking off the walls inside homes.[1] Today, 100 years later, lead-based paint flaking off the walls of old buildings is still the main cause of childhood lead poisoning.[2]

As early as 1897 -- 107 years ago -- the paint industry acknowledged that its lead-based products were poisonous to children.[3] Today, after more than a century of poisoning children, the paint industry continues to sell lead-based paint, though its use inside homes was restricted in Australia in 1920, in many European countries in 1923-24, and in the U.S. belatedly in 1972.[4]

5-Stage History of Childhood Lead Poisoning

The struggle to prevent the poisoning of children by toxic lead has gone through 4 stages and has now entered a 5th stage.[1]

During stage 1, which lasted from 1892 to about 1914, the medical and public health communities simply refused to accept the mounting evidence that lead could harm children.

During stage two (1914 to 1943), medical authorities acknowledged that childhood lead poisoning was epidemic, but they assumed (incorrectly) that it led to only two possible outcomes: death or complete recovery.

During stage 3 (1944 to 1970), medical authorities acknowledged that children who recovered from gross lead poisoning were permanently affected: they had trouble thinking, concentrating and learning; they performed poorly in school; and they were prone to aggressive, violent behavior and explosive tempers.[1,5,6] However, during this stage, it was assumed that a child had to exhibit gross symptoms before permanent damage could occur. Gross symptoms of lead poisoning includes seizures, palsy, loss of control of the limbs, and impairment of hearing and sight.

Also during this stage, starting in 1950, medical authorities learned that lead was disproportionately harming African-American and Hispanic children and children of the poor. This remains true today, a central issue of environmental justice. See Rachel's #294.[7]

During stage 4 (1970 to 1994), medical authorities began to recognize that children could be permanently poisoned by lead even without showing gross symptoms such as seizures or palsy. The breakthrough study was Herbert Needleman's 1979 report in the New England Journal of Medicine, relating lead in children's baby teeth to diminished mental capacity.[8]

During this fourth stage, numerous studies focused narrowly on loss of mental capacity, especially IQ, confirming that lead permanently damages children's central nervous systems, even at exposure levels that produce no gross symptoms.[9,10,11,12,13] I reviewed many of these studies in Rachel's #529.[14]

In response to these studies, between 1970 and 1991 the U.S. government lowered the official "level of concern" for lead in children's blood from 60 micrograms of lead per deciliter of blood (mcg/deciliter) to 40 then to 30 then to 25 and finally to 10. (A deciliter is 1/10th of a liter and a liter is approximately a quart. There are 28 grams in an ounce and a microgram is one millionth of a gram.)

Among medical authorities, the 10 mcg/deciliter "level of concern" is now widely taken to represent a threshold, a level below which lead is "safe." For example, the New Jersey Department of Environmental Protection says children with 20 mcg/deciliter lead in their blood are "poisoned" and children with more than 10 mcg/deciliter have "elevated" lead -- but below 10 is considered to be of no consequence.[15] Unfortunately, there is now a solid body of medical evidence showing that this assumption is dangerously false. At levels as low as 1 to 3 mcg/deciliter, lead reduces children's IQ, diminishes math and reading skills, and changes behavior for the worse. [9,10,11,12,13] There is no known level of lead that is safe for young children.

If we assume the level of concern should be 5 mcg/deciliter of lead in blood (half the current "official" level of concern), we can see that lead remains an enormous problem among U.S. children.

There are about 19 million children in the U.S. between the ages of 1 and 5. Of these, 4.9 million (25.6%) have blood lead levels of 5 mcg/deciliter or higher. Among African-American children, 46.8% have 5 or more mcg/deciliter. Among Hispanic children, 27.9% have 5 mcg/deciliter or higher. Among whites, 18.7% have 5 mcg/deciliter or higher. These data were published in 2003, but they were gathered during the most recent available survey, 1988-1994.[16,17]

How does the current allowable level of lead in blood compare to natural background levels? The relationship between lead in blood and lead in bone is understood. Careful measurements of the bones of preindustrial humans have revealed that the true "natural background" level of lead in human blood is 0.016 mcg/deciliter. Therefore the U.S. government's current "level of concern," 10 mcg/deciliter, is 625 times as high as the natural background level.[18]

The presence of a potent nerve poison in children at levels 625 times as high as normal (or even 300 times as high as normal) should set off loud alarm bells, but the U.S. government recently reaffirmed that it is keeping the "level of concern" at 10 mcg/deciliter because, "[T]here is no evidence of a threshold below which adverse effects are not experienced. Thus, any decision to establish a new level of concern would be arbitrary..."[19] The Mad hatter himself could not top that logic.

During Stage 4 of the history of lead, many studies showed that children exposed to lead not only had learning problems but also were distractible, disorganized, impulsive and restless --the hallmarks of attention deficit disorder. In short, the mechanism that regulates attention and self-control is damaged by lead. It is now widely recognized that the symptoms of attention deficit hyperactivity disorder (ADHD) are shared by many children exposed to neurotoxicants such as PCBs [polychlorinated biphenyls] and lead.[20,21,22]

In sum, during stage 4 scientists determined that lead, at levels as low as 1 to 3 micrograms of lead in blood diminishes a child's ability to think, concentrate, learn and achieve self-control.

Stage 5 of the struggle to protect children began around 1994 and is ongoing now. During this period, it is slowly dawning on medical authorities that exposing children to toxic lead -- even at levels below 10 mcg per deciliter -- causes some of them to become impulsive, aggressive, antisocial, delinquent and violent. The more lead, the worse the behavior. Herbert L. Needleman has recently suggested that this may turn out to be the most important effect of exposing children to lead.[1]

Violence in the U.S. is a huge problem. Despite a downward trend in recent years, 1.4 million violent crimes were committed during 2000, including 16,765 homicides, in addition to 29,350 suicides.[23]

In 1996 Herbert L. Needleman published a report in JAMA, the Journal of the American Medical Association, revealing a strong link between lead in children's bones and delinquent behavior.[24] Needleman's study was not the first to link lead to antisocial tendencies,[25] but it was one of the most carefully done. Several studies since 1996 have confirmed what Needleman found.[7,26,27,28,29]

Needleman's 1996 findings came as a surprise to many people, but they should not have. As I mentioned earlier, in 1943 Randolph Byers and Elizabeth Lord studied 20 children that had experienced mild lead poisoning during infancy. None of the 20 children had exhibited overt signs of lead poisoning, yet the growth and development of their nervous systems had been "seriously impaired." Among the 20 children examined, only one had progressed satisfactorily in school. Furthermore, many of the children were emotionally impaired as well. Byers and Lord characterized the behavior of many of the children as "unreliable impulsive behavior, cruel impulsive behavior, short attention span, and the like." Three of the 20 children were expelled from school, one for setting fires, another for repeatedly getting up and dancing on the desks, and a third for sticking a fork into another child's face.

In Rachel's #529 (Jan. 16, 1997) we had reported on the Byers and Lord study and on several subsequent studies linking lead exposure to violent and aggressive behavior.[30] Throughout the 1980s studies continued to link lead to violence.

What is different now is the improved quality of the studies, plus much better understanding of brain chemistry. In 2003, the American Chemical Society published a report called "A Recipe for Violence" which described current understanding of the links between brain chemistry, toxic lead, alcohol, and impulsive, unplanned violence.[23]

One key is a chemical in the brain called serotonin (also known as 5-HT), which acts as a brake on impulsiveness. Individuals with normal levels of serotonin show restraint and think things through before they act. They have the ability to foresee the consequences of their actions. On the other hand, people with low serotonin levels are liable to act first and think later, which can get them into trouble.

Serotonin plays the same role in monkeys as it does in humans. Researchers who have spent 25 years studying a colony of 5000 free-ranging rhesus monkeys on an island in South Carolina report that monkeys with low serotonin levels end up with more scars and wounds than monkeys with normal serotonin levels. Human studies confirm the role of serotonin in violent behavior. Among a group of arsonists, those who set fires impulsively were the ones with low serotonin. A study of prisoners who had committed impulsive, violent crimes revealed that low serotonin levels were linked to more frequent aggressive behavior and greater violence.[23]

What's the connection to lead? Lead reduces serotonin levels. The more lead present, the less serotonin. Lead may contribute to aggressive and violent behavior in several ways. Exposure to lead reduces serotonin and simultaneously reduces a child's ability to succeed in school. This in turn leads to low self-esteem, irritability and frustration. People with low levels of serotonin cannot handle frustration as well as people with normal serotonin. Furthermore, when alcohol is available, rats and monkeys with low serotonin levels seek out alcohol more than animals with normal serotonin levels. Alcohol then makes the situation worse in several ways. First, alcohol metabolizes serotonin, further lowering serotonin levels. Simultaneously alcohol clouds an individual’s judgment and relaxes normal restraints on behavior. Among experimentally intoxicated monkeys on the island in South Carolina, the only ones who attack humans (six times their size) are those with the lowest serotonin levels. Among humans, about half of all violent crimes -- whether murders, rapes, or whatever --involve alcohol.

No one believes lead is responsible for all aggressive, violent, or delinquent behavior. Herbert L. Needleman believes lead may explain somewhere between 10% and 40% of such behaviors.[1] Furthermore, no one is arguing that the connection between lead and violence absolves individuals of responsibility for their behavior. People are ultimately responsible for their own actions, but no one can deny that the physical and psychological environment during the formative years can predispose an individual to aggressive and violent behavior.

Studies show that a tendency toward violence can be counteracted by good parenting and sometimes by medical interventions. Children who receive lots of love and nurturing can overcome some of the mental and emotional handicaps created by lead exposure. Some pharmaceutical products may help some people with low serotonin levels (Prozac, Zoloft, lithium, and others).[23] Furthermore, parents who cope with the normal irritations and frustrations of life without

becoming violent themselves-- for example, parents who control their own impulsive anger -- can show children by example that violence is not necessary or desirable.

Still, parents and children should not have to work to overcome the artificial disadvantages created by exposure to lead. This is a matter of simple justice. Lead poisoning is entirely preventable, and numerous studies have shown that preventing it would pay society enormous monetary benefits.

By examining the relationship between lifetime earnings and IQ, and the relationship between IQ and lead in blood, researchers have shown that the current average lead level in the nation's 3.8 million 5-year-olds (2.7 mcg/deciliter) will reduce their cumulative lifetime earnings by $43.4 billion dollars. This will be true of next year's 5-year-olds as well, so lead in blood is costing us about $43 billion each year in lost earnings alone (not to mention the lead-related costs of medical care and violence).[31]

In 2000, the federal government estimated that it costs $9000 to fully remediate an average lead-contaminated home and that complete remediation of all pre-1960 housing would cost the nation $16.6 billion per year for 10 years.[2, pg. 5] With benefits of $43.3 billion each year, investing $16.6 billion per year in lead abatement would provide the nation an enormous gain (extending well beyond 10 years), and would serve our national goal of "justice for all." Unfortunately, President Bush has allocated only $139 million for lead abatement in 2005 -- 20% less than in 2004, and less than 1% of what's needed. At the current rate of federal spending, the lead paint problem will be with us for another 120 shameful years.[32]

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