The Charles A. Dana Award
for Pioneering Achievement in Health
1989

The Quiet Epidemic:
Low Dose Lead Toxicity in Children

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I am deeply grateful to the Dana Foundation for the honor conferred upon me with this most significant health award. It is a source of profound pride to be listed with the previous awardees, whose accomplishments have contributed so much to reducing death and suffering and enhancing human welfare.

The effects of lead at high dose in children were recognized almost a century ago in Brisbane, Australia. For fifty years it was widely believed that if a child did not die of the disease, the child was left untouched. It was thought that there were no sequelae, and that there was no such thing as silent lead intoxication. The search for low level lead effects in childhood began with Randolph Kuhnhardt Byers, one of America’s first pediatric neurologists. Fifty years ago, Byers asked how many cases of school failure or behavior disorder were due to undiagnosed lead poisoning. Randy Byers was a naturalist and had a naturalist’s eye for subtle clues. He also had a curious, creative and joyful mind that continued to generate new ideas until his death in 1988 at the age of 92.

In accepting this honor, I want to single out for particular mention two colleagues, among the many who have helped me in the study of this disease. Alan Leviton, a neurologist and epidemiologist, took my raw notions and gave them rigor and focus. Dave Bellinger, a psychologist and epidemiologist, joined our group in 1979, and applied his formidable skills in child development and data analysis to the question of prenatal lead effects. Working with these two men has meant a steady career of enrichment, stimulation and friendship that has continued over time and distance.

The study of lead and children’s health draws one rapidly into many unfamiliar terrains. When I began this work I had some knowledge of child development and pediatrics, and I expected to learn about epidemiology and toxicology. I did not know that I would be forced to become involved with economics, politics, the sociology of science, and the behavior of institutions. I had treated lead poisoning as a pediatric resident at the Children’s Hospital of Philadelphia. Later, in community psychiatry in the inner city, I began to wonder how many of the children attending school across from my office in northeast Philadelphia were doing poorly because they had unrecognized lead in their brains. I wanted to go into a first grade classroom and measure the students’ lead exposure and then test their IQ. But lead in the blood is cleared fairly rapidly and if exposure occurred when the child was three years old, his blood could well be normal when he entered first grade. Lead goes to bone. But you can’t go around sticking needles into bones. It occurred to me that there was a spontaneous biopsy available to the investigator—the baby tooth. I started collecting baby teeth, and found that the tooth was indeed a good storage system for lead.

That brought me to Harvard and the Boston Children’s Hospital to study whether small amounts of lead were neurotoxic. There, a kind fate placed me in the same institution as Randy Byers, who had become an elder statesman in pediatric neurology, and in an office in the Mental Retardation Research...
time before the age of eighteen with Alan and Irm. When
my first grant application was disapproved, I had the
wit to consult Alan. Our eighteen-year collaboration and
my past-post-graduate education began. Dr. Overs
became a member of the advisory committee on my
research project, and was available to me any time I
needed his vision or counsel.

The new field of low dose lead toxicity in chil-
dren was both controversial and chaotic. I examin-
ed all the studies that had been conducted and saw
that they suffered from four design flaws: they used
an inadequate measure of lead exposure; they used
insensitive measures of psychological perform-
ance; they did not control for other factors which
could be confounders; and they did not evaluate
sampling bias. Alan and I designed a study that was
a conscious effort to deal with these issues. We used,
for the first time in outcome studies, dentine lead as
the exposure marker; we measured IQ and other
behaviors by a number of sensitive tests; we con-
trolled for 39 factors that could confound; and we
selected our sample in an unbiased fashion. We
found that having more lead in one's teeth, in the
absence of recognizable illness, was associated with
lower IQ, speech and language handicaps, and poor
attention. Teachers, blind to the children's lead
levels, supplied information on classroom behavior;
as lead went up, bad classroom behavior became
more common. This study was published in the
New England Journal of Medicine at the time the
Environmental Protection Agency was struggling
with writing an air lead standard, and was used by the
administrator in reducing lead in the atmosphere and
in gasoline.

A neonatologist, Jack Scanlon, had shown in 1972
that lead crosses the placenta. This raised for
the first time the question of intrauterine exposure
and its consequences. Once more, after many appli-
cations for support, we were funded to study a cohort
of 12,000 births at the Boston Hospital for Women.

The same group of investigators who had begun to
the first time the question of intrauterine exposure
have focused on. There is no good reason for this.

Significant to regain its competitive edge,
core costs of living are affecting the society to
increase in the risk of reading disability. The social
increase in the risk of reading disability is a high
risk for reading disability, and a risk
that
children with high lead levels and more need
those children without high lead levels. We found
that children from high-exposure homes who
were more than two years old had
higher levels of lead exposure was significantly
lower. Scores measured by school-based tests, were
tested
for remediation and behavioral consultation.

In order to maintain the same level of services for
special services such as speech therapy, reading
remediation, and phonological and phonemic con-
sciousness, the education level is critical. In
the children from high-exposure homes, we
found
several, measured at the same time in children
who had
no obvious signs of developmental delay.

We have continued to follow them into their adolescence,
and have continued to follow their development. We
hope to be able
to continue to follow, and we hope to be able
to learn from the experiences of these children. These
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stein report that criminality is constitutional in nature, and die the following findings in support of this claim: criminality can be diagnosed early in childhood; it is more common in males; it is more common in blacks; it is more common in urban areas; and criminals have lower IQ's, possess a history of hyperactivity, and come from disorganized homes. All of these are risk factors associated with lead exposure. This is not to say that lead is responsible for all crime; life is more complex than that. But it is a reasonable hypothesis that some of the disordered behavior of criminals results from disordered brain function, and that some of this disorder in the brain is neurotoxicity from lead exposure that begins at blood levels as low as 10-15 μg/dl. This means that one American child in six has toxic amounts of lead in his or her blood, and that 400,000 newborns are delivered bearing toxic levels each year. Lead is not a problem for poor inner city minorities alone. But like many of the assaults upon decent living, the poor receive an unfair dose. For black children in poverty, the rate of blood lead levels over 15 μg/dl is 55 percent! This datum, one of the most outrageous and frightening public health statistics, has received only passing attention since the ATSDR report was issued. It means that lead exposure is among the most serious American public health problem.

One is forced to ask why lead poisoning, long known is not nearly as complex as AIDS or cancer, has not been remedied. There are three reasons: First, it is generally believed that lead poisoning is a disease of the poor, and that inferior child care is at the root. Once the victim has been blamed, public and professional consciences can rest. Second, removing lead from gasoline, from water, and from housing costs money, and proposing such removal arouses vested interests. These include lead additive companies, the paint industry, and homeowners who have invested in leaded surfaces. These groups know how to pluck the strings of power. The lead industry has worked mightily to obscure the effects of lead at low dose, often using individuals from the academic world in this effort. Finally, lead is a low technology disease, it does not enjoy the cachet of lasers, molecular biology or liver transplants. It is not at the center of the medical drama, and many pediatricians believe that with the removal of lead from gasoline and the passage of the lead paint act, the problem has been solved. Many academic pediatric centers have stopped testing for lead, and many pediatric trainees no longer consider it in making a differential diagnosis of developmental failure.

The distribution of risk here is strikingly disequilibrium. If one were to map the areas where lead is to be found in excess, and then map where decent housing is in short supply and where decent housing is in excess, and then map where decent jobs are scarce, the three maps would be isomorphic. What could be done to rationalize this imbalance? One simple solution would be to train unemployed people from high lead areas in safe deleading and housing rehabilitation, and to pay them a living wage. This would reduce unemployment and crime, and would reduce exposure to lead. Where could this be done? There are 2 million homes in the U.S. with severe exposure; there are 7 million homes in the U.S. with moderate exposure; and there are 10 million homes in the U.S. with low exposure. What could be done to map these risks?

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inner city and multiply by creating demand for groceries, laundry, and other goods and services. This may strike some as a Utopian phantasy. It is instructive to realize that the cost of constructing one new prison bed is $30,000 and that maintaining one prison inmate costs $20,000-130,000 per year. You can pay now or pay later, as the man in the oil filter ad says.

A recent front page story in The New York Times told of deeply troubled CEO's who are unable to find qualified employees to operate their modern, demanding production lines. Modern industrial workers increasingly need to be literate, and competent in mathematics and problem solving. Management is having difficulty recruiting workers who meet the present day criteria, and project that if this situation is not remedied, the United States will become less and less competitive. We risk becoming an underdeveloped nation.

Most of the attention given to this problem has focused on the school curricula; little thought is given to the status of the cognitive equipment students are bringing into the classroom. One of the identifiable causes of school failure and reading disabilities is lead poisoning.

To study an environmental health question is to be unavoidably confronted with a clear vision of how complex and tightly interrelated are the mechanics of our ecosystem. We are beginning to recognize that just as the future climate in New York City is linked to the rate of rain forest destruction in Brazil, the welfare of children of highest privilege is tied to the health and future of babies born in the poorest neighborhoods of the United States.

The most important form of capital is human capital: the health, vigor, creativity and imaginative power of the brain cells of our offspring. To allow this human capital to be compromised in any way is immoral.

Lead poisoning is no mystery; the toxin's whereabouts, its effects, and the steps to removing it forever are plainly prescribed. What is needed is the same kind of vision displayed by the first Dana award winner, Dr. Donald Henderson. He was honored by the Foundation for his work in eradicating smallpox from the earth. The eradication of lead poisoning, this quiet epidemic, from the face of the earth is entirely possible and worthy of the same sort of dedication and resolve. Herbert L. Needleman was nominated by Philip H. Landrigan, M.D., Director, Division of Environmental Medicine, New York School of Medicine. The New York Times reported that he is working on this Foundation for his work in eradicating smallpox from the earth. The eradication of lead poisoning, this quiet epidemic, from the face of the earth is entirely possible and worthy of the same sort of dedication and resolve.