COMMENTARY ON LANPHEAR ET AL.

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Pediatric Lead Poisoning: Is There a Threshold?

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A recurrent theme in research on childhood lead poisoning has been the discovery time and again over the past 40 years that lead is toxic to the developing nervous system at levels previously thought to be safe.[1] In the 1960s an elevated pediatric lead level was defined as a concentration in whole blood of ≥60 micrograms per deciliter (μg/dL). The effect of lead on children was viewed at that time as a simple either/or phenomenon: either a child was clinically poisoned, or the child was well. There was no in-between. Then, beginning in the 1970s with the work of Herbert Needleman and others, the recognition grew that lead could reduce children's intelligence and alter behavior at blood lead levels (BLLs) lower than 60 μg/dL, that is, at levels insufficient to produce clinically obvious symptoms.[2–4] Thus was born the concept of "subclinical lead poisoning," based on an understanding that lead produces a spectrum of toxicity in which clinical symptoms such as encephalopathy, renal failure, and anemia have their subclinical counterparts in lowered intelligence, impaired function of the renal tubules, and elevated levels of erythrocyte protoporphyrin.[5]

Continued exploration of subclinical lead poisoning using stronger study designs and sharper analytic tools has continued to show that lead is toxic to children at even lower levels. As these data came in, the US Public Health Service repeatedly reduced the level of lead in blood that defined childhood lead poisoning. Thus in 1971 the level was reduced to 40 μg/dL, in 1978 it was reduced to 30 μg/dL, and in 1985, it was reduced to 25 μg/dL. Most recently, in 1991, the level was reduced to 10 μg/dL.[6] This last reduction followed the demonstration in multiple prospective epidemiologic studies that prenatal exposures to lead could have adverse effects on neurobehavioral development in young children at BLLs as low as 10 μg/dl to 20 μg/dL.[7–10]

Now, in this issue of *Public Health Reports,* the report by Lanphear and colleagues suggests that lead may exert toxicity at concentrations in

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whole blood lower than 5.0 µg/dL.[11] This conclusion is based on an analysis of data from more than 4,800 children ages 6 to 16 years who participated in the Third National Health and Nutrition Examination Survey. Correlations were examined between blood lead concentration and performance on tests of mathematical skills, reading ability, visual-motor skills, and short-term memory. An inverse relationship between blood lead and math and reading scores was noted in children at blood lead concentrations <5.0 µg/dL. The relationship was still evident after adjustment for an extensive series of potential confounding factors.

These are extremely important findings. While they will require replication before they can become the basis for public health action, they most certainly erode any complacency with the notion that a BLL of 10 µg/dL constitutes a bright line below which pediatricians need not worry about lead-induced brain injury in young children.

These findings suggest that it may be necessary to revisit the decision on the part of the Centers for Disease Control and Prevention (CDC) not to require universal blood lead screening of young children in the United States. The findings of Lanphear et al. also call into question the wisdom of deferring public health intervention in children until BLLs reach 20 µg/dL or 25 µg/dL, a practice that has been adopted in many health departments given their limited resources.

The conquest of lead poisoning in the United States over the past 25 years represents a major triumph of pediatrics and public health. The removal of lead from gasoline, the removal of lead from new paint, and the banning of lead from tin cans are actions that have profoundly improved the health of children in this country. From 1976 to 1996, the mean BLL was reduced by more than 90%.[12] However, nearly one million American children still have BLLs of 10 µg/dl and higher, and millions more have levels in the 2.5 µg/dL to 10 µg/dL range.[12] The finding that lead is toxic to children at even exquisitely low levels requires that we retain our vigilance. Lanphear et al.'s findings suggest that there is no safe threshold for the toxicity of lead in the central nervous system.

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