

# Low-Level Lead Exposure and Infant Development in the First Year<sup>1</sup>

DAVID BELLINGER,<sup>2</sup> ALAN LEVITON, HERBERT L. NEEDLEMAN, CHRISTINE WATRNAUX AND MICHAEL RABINOWITZ

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BELLINGER, D., A. LEVITON, H. L. NEEDLEMAN, C. WATRNAUX AND M. RABINOWITZ. Low level lead exposure and infant development in the first year. *NEUROBEHAVIORAL TOXICOL TERATOL* 8(2): 151-161, 1986. The developmental impact of prenatal and early postnatal low-level lead exposure was assessed in a prospective study of 249 middle and upper-middle class infants with umbilical cord blood lead levels in the range currently considered "normal." Infants were classified into three exposure groups: "low" ( $<3 \mu\text{g/dl}$ ), "mid" (6 to 7  $\mu\text{g/dl}$ ), and "high" ( $>10 \mu\text{g/dl}$ ). At 6 and 12 months, the lead concentration of capillary blood was measured, and the Bayley Scales of Infant Development administered. At both ages, Mental Development Index scores, adjusted for confounding, were inversely related to infants' umbilical cord blood lead levels. The difference between the mean adjusted scores of the infants in the low and high cord blood lead groups was 5.8 points at 6 months and 7.3 points at 12 months. At neither age were scores significantly related to postnatal blood lead levels. Prenatal exposure to lead levels relatively common among urban populations appear to be associated with less favorable development through the first year of life.

Human studies

Prenatal and postnatal lead studies

Infant development

WE previously reported an inverse relationship between infants' umbilical cord blood lead concentrations and their scores at 6 months of age on the Mental Development Index (MDI) of the Bayley Scales of Infant Development [2,3]. This relationship was dose-dependent over 0 to 25  $\mu\text{g/dl}$ , the range of lead levels observed in our sample. The difference between the adjusted MDI scores of the infants in the "low" ( $<3 \mu\text{g/dl}$ ) and "high" ( $\geq 10 \mu\text{g/dl}$ ) exposure groups was approximately 6 points (0.4 SD).

Although this finding suggests that lead has adverse effects at blood concentrations prevalent among young children [12], its implications for regulatory policy depend on the magnitude of the association and its stability over time. Among the relevant questions are the following. Do the performance differences between exposure groups persist beyond 6 months of age? Does the lower mean performance of infants with "high" cord blood lead levels reflect the enhanced susceptibility of a subgroup of these infants or does the effect extend to most of them? Does level of postnatal exposure alter the relationship between cord blood lead concentration and MDI? In this report we address these and related issues by including follow-up assessments of the infants at age 12 months in a re-examination of the association between pre- and postnatal lead exposure and performance on the Bayley Scales in the first year of life.

## Sample Selection

The infants enrolled in this study were selected from a

Population of 11,837 infants whose umbilical cord blood lead concentration was measured. These infants represent approximately 97% of the births at the Brigham and Women's Hospital in Boston, MA, between April 1979 and April 1981. The mean cord blood lead level of this population was 6.6  $\mu\text{g/dl}$  (SD=3.2, range=0-37) (16).

Our goal was to select three groups of infants for study: those with cord blood lead levels in the lowest tenth percentile for the population of births at this hospital (the "low" lead group), those with levels very close to the mean (the "mid" lead group), and those with levels exceeding the ninetieth percentile (the "high" lead group). The distribution of cord blood lead levels for the approximately 2,500 infants born in the first 4.5 months of blood sample collections was used to establish criteria for eligibility in these three groups ( $<3.6$  to 7, and  $\geq 10 \mu\text{g/dl}$  for the low, mid, and high lead groups, respectively). The study sample was chosen from the 9,489 infants born between August 10, 1979 and April 30, 1981.

Not all eligible infants and families were invited to participate. Infants were excluded because of a serious medical condition evident at birth or in the early postnatal period (e.g. Down's syndrome, gestational age less than 34 weeks, cleft palate), location of residence (greater than 12 miles from the Children's Hospital or in an area judged unsafe for home visitors), language barrier, failure to seek or obtain consent, an intention to relocate out of the immediate region, or our inability to locate them (Table I). Additional details about the sample selection process and ascertainment bias are presented elsewhere [3].

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# Low Level Lead Exposure The Clinical Implications Of Current Research

**Kenneth Blum,L. Manzo**



## **Low Level Lead Exposure The Clinical Implications Of Current Research:**

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