

Low-Level Lead Exposure and Infant Development in the First Year¹

DAVID BELLINGER,² ALAN LEVITON, HERBERT L. NEEDLEMAN, CHRISTINE WATERNAUX AND MICHAEL RABINOWITZ

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BELLINGER, D., A. LEVITON, H. L. NEEDLEMAN, C. WATERNAUX 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

R.L. Isaacson, K.F. Jensen



Low Level Lead Exposure The Clinical Implications Of Current Research:

Low Level Lead Exposure Herbert L. Needleman,1980 *Human Lead Exposure* Herbert L. Needleman,1991-12-07

Human Lead Exposure consists of scientific reviews and important contributions intended to increase the understanding of the legal social and economic forces that have delayed effective prevention of lead toxicity Chapters discuss the history both ancient and recent of lead explore its neurobiology and toxicology review the sources and routes to humans and examine evidence that indicates that lead may affect humans at levels previously thought to be harmless Neurobiologists epidemiologists public health officials and others concerned about the effects of lead on the human population will find a tremendous amount of useful information in this timely volume *Environmental Health Perspectives* ,1993

Reproductive and Developmental Toxicity of Metals Tom Clarkson,2012-12-06 The Permanent Commission and International Association on Occupational Health PCIAOH established in 1969 a Subcommittee on the Toxicology of Metals under the chairmanship of Lars Friberg This committee which later was named the Scientific Committee on the Toxicology of Metals has organized a number of previous meetings that have led to publications in three major areas of metal toxicology a preliminary meeting in Slanchev Bryag Bulgaria in 1971 followed by a meeting in 1972 in Buenos Aires Argentina which produced two reports Dukes and Friberg 1971 Task Group on Metal Accumulation 1973 that discussed the metabolism of metals with special reference to absorption excretion and biological half times The effects and dose response relationships of toxic metals including a discussion of general principles was the second major topic addressed by the Scientific Committee at a meeting in Tokyo in 1974 Nordberg 1976 The philosophy of this conference as well as the previous one in Buenos Aires was based on the concept of a threshold dose for the occurrence of adverse effects In a conference held in Atlanta USA in 1980 the scope of discussion on metal effects was broadened to include the role of metals in carcinogenesis Thus for the first time the Scientific Committee took under consideration the possibility of non threshold relationships Belman and Nordberg 1981 In addition the Scientific Committee on the Toxicology of Metals organized a workshop on metal interactions in Stockholm 1977 Nordberg et al **The Vulnerable Brain and Environmental Risks** R.L. Isaacson,K.F. Jensen,2013-03-07

Contributors to this second volume discuss metal and toxicant toxicity their environmental sources and methods of action and their regulation by courts and agencies **Illness and the Environment** J. Stephen Kroll-Smith,Philip M. Brown,Valerie

Gunter,2000-08 In 25 papers academics and a few environmental scientists activists discuss profound social policy and competing paradigm issues concerning the contested environment disease link in a postnatural world Include discussion questions Kroll Smith is a professor of sociology at the U of New Orleans Annotation copyrighted by Book News Inc Portland OR *Advances in Behavioral Pharmacology* N. Krasnegor,D. B. Gray,T. Thompson,2014-06-03 First published in 1986 This monograph is based on a conference sponsored by the Human Learning and Behavior Branch of the National Institute of Child Health and Human Development NIH The meeting that was held at the Xerox Center in Leesburg Virginia in August

1983 brought together a group of leading researchers for the purpose of providing an overview of the emerging field of developmental behavioral pharmacology. More specifically, as is evidenced by the chapters in this volume, the intent was to put the field into historical perspective, render a working definition, and outline strategies and tactics for conducting behavioral pharmacological research in the developing organism.

The Developmental Neurotoxicity of Lead C. Winder, 2012-12-06

Over the past two millennia, environmental lead levels have risen dramatically. Patterson 1980: Most of this increase has occurred since the beginning of the present century. Murozami et al 1969: and taken into perspective, a typical individual living in the industrialized world sustains a lead burden 500 times that of his prehistoric ancestors. Patterson 1983: Lead is unique in being an environmental pollutant where the levels deemed clinically toxic are less than an order of magnitude from those that are normally encountered in the population. The clinical limit for lead exposure: 70 µg Pb/100 ml blood is about three times the normal value in the range 15-30 µg Pb/100 ml blood. This small difference is remarkable from the toxicological standpoint. The key concept here is control of dispersal. The industrial actions of man bring contact with a wide variety of substances, some of which are poisonous or dangerous. In such cases, protective measures are taken to keep hazardous exposure to a minimum. In the case of lead compounds, stringent regulations on production and distribution are enforced. The exception to this is in the dispersal of lead from vehicle exhausts following purchase from the petrol pump. Perhaps man's long-standing acquaintance with lead in home and industry is responsible for a complacency which until only recently has been unquestioned. Beginning in the late 1960s, evidence began to accumulate suggesting that lead at relatively low levels of exposure might be causing negative effects on neurobiological function.

Cost Increases on Four Watershed Projects of the Soil Conservation Service United States. Congress. Senate. Committee on Environment and Public Works. Subcommittee on Water Resources, 1984

Morbidity and Mortality Weekly Report, 1990-07

MMWR, 1990

Changing Metal Cycles and Human Health J.O. Nriagu, 2012-12-06

of metal interactions with subcellular biochemical systems usually either are metabolites of the system affected (porphyrinurias) or represent some specific function of a cellular system being impaired (proteinurias). One typically finds a continuum of symptoms from the subtle or so-called no-effect biochemical and physiological indicators of exposure to severe clinical disease and death. This continuum is the basis of much of the controversy since many health officials follow the traditional practice of applying the threshold health effect concept in evaluating the problems of environmental exposure to metals. The past decade or so, however, has seen a vast increase in our understanding of the effects of elevated concentrations of toxic metals in local populations and ecosystems. At the same time, there is a growing awareness that the effects of the metals which occur naturally in the environment must be distinguished from those imposed by the pollutant fraction. This point was amply documented in a recent study of cadmium intake and cadmium in a number of human tissues in Sweden, Japan, and the United States, which showed fairly conclusively that the background exposure in Japan was about threefold higher than in

the other two countries 2 One immediate implication is that any health effect studies of cadmium in Japan using control groups within that country are liable to underestimate the difference between the exposed and the control groups simply because of the the high background intake

Lead Contamination United States. Congress. House. Committee on Energy and Commerce. Subcommittee on Health and the Environment,1988

Neurotoxicology Kenneth Blum,L. Manzo,1985-07-30

Lead Exposure and Child Development M. Smith,L. Grant,A.I. Sors,2012-12-06 This book arises out of a workshop on lead exposure and child development which was held at the University of Edinburgh on 8th 12th September 1986 It was organized jointly by the Commission of the European Communities CEC and the US Environmental Protection Agency EPA in association with the UK Department of the Environment and the Scottish Home and Health Department It brought together most of the internationally recognized groups working on the effects of lead exposure on child development including child psychologists psychiatrists neurologists epidemiologists toxicologists statisticians and medical practitioners One of the unique features of the meeting was that it included workers from initially separate fields of lead research in particular those undertaking studies in infants and in older children and those carrying out behavioural research in animals as well as those undertaking biochemical studies on mechanisms of lead effect The structure of this book reflects the main elements of the meeting As such it includes three main sections The first consists of two major state of the art reviews and two invited introductory papers The reviews were prepared for the organizers of the conference by two of the Editors The objectives were to assess critically the state of current knowledge in this field and to provide a scientific basis both for policy decisions and for further research The review prepared by Marjorie Smith for the Commission of the European Communities focusses on methodological and design issues and summarizes our present scientific knowledge in this area

Lead Pollution From Motor Vehicles 1974-1986 P. Farmer,2003-09-02 This bibliography brings together a wide range of material on the problem of environmental lead pollution from motor vehicles published during 1974 1986 It includes research and surveys from a number of countries and covers the effects of exhaust gas lead on humans including children

Neurotoxicity : identifying and controlling poisons of the nervous system : new developments in neuroscience.

, **The Nature and Extent of Lead Poisoning in Children in the United States** ,1988 Hazardous Waste Contamination of Water Resources United States. Congress. House. Committee on Public Works and Transportation. Subcommittee on Investigations and Oversight,1984

Beyond the Individual Abraham Wandersman,Robert Hess,1985

Here is a stimulating volume on the psychological damage caused by our exposures to ills in the environment Topics include case studies from environmental catastrophes Love Canal Three Mile Island and research on how groups respond to and cope with environmental stresses This timely book is aimed at environmental policymakers public health personnel agency staff and mental health personnel all professionals concerned with the impact of the environment on our physical and psychological health

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