

Bodgen, J. D., Oleske, J. M., & Louria, D. B. (1997). Lead poisoning-one approach to a problem that won't go away. Environmental Health Perspectives, 105 (12), 1284-1287.

**Keywords:** Bone, calcium, nutrition, lead, toxicity

**Objective:** To evaluate the potential benefits of fortification of a variety of foods with low levels of calcium as a way to reduce the morbidity resulting from widespread lead exposure.

**Overview:** Skeletal lead concentrations increase inevitably with age. For children with concentrations of 45  $\mu\text{g}/\text{dl}$  or greater, chelation therapy is the treatment of choice. However, chelating agents are nonspecific, bind and promote the excretion not only of lead but also of essential metals such as zinc and copper. They also have the potential for nephrotoxicity. Dietary intakes of calcium for most Americans fall well below the Dietary Reference Intakes and the National Institutes of Health consensus statement guidelines. A simple increase in dietary calcium ingestion can prevent and even reverse accumulation of lead in critical tissues and body reservoirs. While dietary calcium cannot correct irreversible damage to the central nervous system or other organs caused by previous lead ingestion or inhalation, it can help prevent adverse effects from additional exogenous and continuous endogenous lead exposure.

**Conclusion:**

The recommendation to increase dietary calcium intakes is not an alternative to proper abatement of the lead in millions of homes, but an additional approach to be used with other preventive strategies. It is not known what the ideal amount of dietary calcium would be to achieve this objective. Further studies are needed such as dose-response studies.

Castiglia, P. (1995). Lead poisoning. Journal of Pediatric Health Care, 9, 134-135.

**Keywords:** lead poisoning, screening guidelines, CDC recommendation, treatment

**Objective:** To provide an overview on lead poisoning. It details the history of lead poisoning.

**Overview:** Lead poisoning or plumbism is not a new problem. Today, one in six children is at risk for lead poisoning. Lead poisoning, while more common in low income, urban areas, is a threat to all children. The Centers for Disease Control and Prevention (CDC) recommends screening of children six months to 6 years. Recommendations also state that children should be tested once before 12 months of age and tested again at 24 months. Some symptoms of lead poisoning are nausea, vomiting, sleep disturbances, headaches, and diarrhea. Lead poisoning is related to behavior and attention problems and irreversible brain damage. Treatment varies according to the lead level. Treatment can include rescreening, counseling on prevention and nutrition, environmental risk assessment, and in extreme cases chelation therapy.

**Results/Conclusion:**

Prevention should be the focus with lead poisoning.

Hotz, M., Kniepmann, K., & Kohn, L. (1997). Occupational Therapy in Pediatric Lead Exposure Prevention. The American Journal of Occupational Therapy, 52 (1), 53-59.

**Keywords:** Lead poisoning, public health, health promotion, occupational therapy

**Objective:** To review lead sources and effects in children, and the role occupational therapists can play in preventing childhood lead exposure at the child, family and community levels

**Overview:** This article lists in detail the major sources of lead and the effects of lead exposure during childhood, particularly the effects that lead has on overall CNS development and function. Prevention is the key. Occupational therapists are in a unique position to use lead prevention strategies in their roles through treatment provision, monitoring, and consultation. The article goes on to list prevention strategies that begin at the individual child level and expand to the family and community level.

**Conclusion:** Occupational therapists can play an active role in efforts to safeguard the health of children who are at risk for lead poisoning and can become involved in community programming and prevention.

Jones, T. F., Moore, W. L., Craig, A. S., Reasons, R. L. & Schaffner, W. (1999). Hidden Threats: Lead Poisoning from Unusual Sources. Pediatrics, 104 (5), 1223-1225.

**Keywords:** Blood lead levels, US Consumer Product Safety Commission (CPSC)

**Objective:** To alert health care providers to new or unusual sources of potential lead exposure in children

**Overview:** Two case reports involving unusual sources of lead in children were examined. A routine examination of a 2-year-old child showed a blood lead level of 43  $\mu\text{g}/\text{dl}$ . The physical examination was normal and the history indicated no obvious risk factors. The child, however, was noted by the mother to have been playing with a new necklace purchased 10 weeks prior that the child frequently put in his mouth. The necklace had been imported from China and upon testing was found to have 20,200 mg/kg of lead (The CPSC regulations require paint to contain < 600 mg/kg of lead.) Upon removal of the necklace, the child's blood lead level dropped to 24  $\mu\text{g}/\text{dl}$  in three weeks without treatment.

An 11-month-old child was found to have a blood lead level of 43  $\mu\text{g}/\text{dl}$  on routine examination. The parents revealed that a substance called "Surma" had been applied to the child's eyes daily for 5 months to "strengthen them." Surma, a fine powder that resembles mascara, is applied to the conjunctival surface of the eyelid in many Asian countries. Testing of the powder revealed 252,000 mg/kg of lead. The child's blood lead level dropped to 23  $\mu\text{g}/\text{dl}$  within 8 weeks after the product was discontinued.

**Conclusion:** These cases serve as examples of the importance of thorough investigation of any possible causes of lead poisoning.

Norman, E. H., Bordley, C., Hertz-Picciotto, I., & Newton, D. A. (1994). Rural-Urban Blood Lead Differences in North Carolina Children. Pediatrics, 94, 59-64.

**Keywords:** rural, urban, screening guidelines

**Objective:** To compare the differences in elevated blood lead levels of children living in rural and urban regions of North Carolina.

**Overview:** North Carolina has a large, low-income, rural population living in older homes. Screening previously has been concentrated in the urban, inner city areas where poverty and housing conditions put young children at risk for lead poisoning. Through this study, blood lead levels and risk factors associated with lead poisoning was evaluated in children living in rural and urban settings.

**Results/Conclusions:**

In this study, all children living in rural North Carolina, regardless of race were at an increased risk for lead poisoning compared to children in urban areas of North Carolina. In a comparison study done through the NHANES II survey, African American children living in rural areas were at an increased risk for lead poisoning compared to African American children in urban areas. However, in the NHANES II study, fewer Caucasian children living in rural areas of America had elevated blood lead levels compared to Caucasian children living in urban areas.

Finkelstein, Y., Markowitz, M., & Rosen, J. (1998). Low-level lead-induced neurotoxicity in children: An update on central nervous system effects. Brain Research Reviews, 27, 168-176.

**Keywords:** neurotoxicity, young children, low-levels

**Objectives:** To examine the affect of low-level lead exposure on the central nervous system.

**Overview:** The article describes the effects of lead on neuroanatomy in relation to how the CNS functions. The physiological effects in regards to children with elevated lead levels include hearing loss, decrease posture and balance.

**Results:** The results of the two studies found a causal association between low-levels of lead and deficiencies in neurobehavior and cognitive abilities. It also showed a decrease in IQ levels in children. The study also found that at any level, lead is toxic to the central nervous system.

Mendelsohn, A., Dreyer, B., Fierman, A., Rosen, C. M., Legano, L. A., Kruger, H. A., Lim, S. W., & Courtlandt, C. D. (1998, March). Low-level lead exposure and behavior in early childhood. Pediatrics [On-line serial], 101(10). Available FTP: Hostname: [www.Pediatrics.org/egi/content/abs](http://www.Pediatrics.org/egi/content/abs).

**Keywords:** young children, behavior, low level lead exposure

**Objective:** Evaluate the relation between low level lead exposure and behavior in children 12 to 36 months of age.

**Overview:** During routine well child exams, all children at a large urban hospital pediatric medical center in New York were screened (capillary) based on CDC recommendations. The study used the Behavior Rating Scale (Bayley Scales of Infant Development) for behavior measurement.

This study had an exposed and a nonexposed group for control. Confounding factors, demographic factors, socioeconomic status, maternal depression, home-based cognitive stimulation, hematocrit level, and mean corpuscular volume to determine iron deficiency were collected for each child in the study.

**Results:** Children in the lead exposed group had a significantly lower BRS behavior score than children in the non-exposed group.

Needleman, H. L., Riess, J. A., Tobin, M. J., Biesecker, G. E., & Greenhouse, J. B. (1996). Bone Lead Levels and Delinquent Behavior. Journal of the American Medical Association, 275 (5), 363-370.

**Keywords:** delinquency, antisocial behavior, bone lead measurements, young children

**Objective:** To study the relationship between bone lead levels and delinquency and antisocial behavior.

**Overview:** A sample of 301 boys in the first grade in the Pittsburgh, Pennsylvania public schools was selected based on a risk scale for antisocial behavior. The bone lead concentrations were measured by in vivo x-ray fluorescence, a measure of cumulative exposure. The relationship of bone lead burden was examined along with reports of antisocial behavior from three separate sources: parents, teachers, and the subjects themselves. Attention function, neurobehavioral and academic performance in relation to lead were also evaluated. The subjects were evaluated at seven and 11 years of age.

**Conclusion:**

Parents of subjects at seven years of age reported no significant lead-related difficulties. Teachers reported borderline associations at seven years between lead and somatic complaints, social problems and delinquent, aggressive and externalizing behaviors. At the age of eleven, parents and teachers of high-lead subjects reported significantly more somatic complaints, delinquency and aggressiveness. Lead exposure is associated with increased risk for antisocial and delinquent behavior. The effects demonstrated in this study follow a developmental curve.

Pocock, S., Smith, M., Baghurst, P. (1994). Environmental lead and children's intelligence: a systematic review of the epidemiological evidence. British Medical Journal, 309, 1189-1197.

**Keywords:** Lead burden, IQ, cross sectional, epidemiological studies, tooth lead, birth cohorts, public health

**Overview:** To provide a review of twenty-six epidemiological studies to associate lead burden in early childhood with a decrease in intellectual ability based on IQ scores. The article divided the studies into three categories 1) birth cohorts 2) cross sectional studies of lead in the blood and 3) cross sectional studies of lead in teeth. The study controlled for confounders when possible.

**Results:** The analysis of the twenty-six epidemiological studies revealed that there is an inverse association between body lead burden and child IQ levels. Therefore, having even a low level of lead can cause small deficits in IQ. Five public health implications were described in the study, as follows 1) Neonatal lead exposures does not affect child IQ. 2) Blood and tooth lead measures during the first two or three years of life have an inverse association with IQ at age five and older 3) Doubling in elevated blood lead levels (from 5 to 10ug/dL) could result in a loss of 1 to 2 IQ points 4) observational studies such as those analyzed in this study raised the debate about whether a relationship can be made between lead burden and IQ. 5) once an association has been established between IQ and lead, there will be a need for alteration of public health policy.

Tong, S., Baghurst, P., Sawyer, M. Declining blood lead levels and changes in cognitive function during childhood: The Port Pirie cohort study. *Journal of the American Medical Association*. 1998;280:1915-1919.

**Keywords:** cognitive function, declining blood lead levels

**Objective:** To examine whether cognitive abilities vary following the reversal of lead exposure. This was assessed by testing cognitive function as blood lead levels decreased.

**Overview:** In this long-term study, children born to women living near Port Pirie, South Australia, the largest lead smelting facility in the southern hemisphere, were studied for developmental status at ages 2, 4, 7, and 11-13 years. Blood samples for lead exposure were taken to compare the blood lead level with the cognitive development scores. The study determined the possibility of confounding factors between lead exposure and development in all age groups.

**Results/Conclusions:**

The results revealed an inverse association between blood lead levels and cognitive development in all the age groups.

Chaisson, C., & Glotzer, D. (1996). Counseling to prevent childhood lead poisoning. Journal of the National Medical Association, 88, 489-492.

**Keywords:** parental knowledge, counseling, lead poisoning

**Objective:** To assess the time and level of counseling or anticipatory guidance that parents received regarding their child and lead poisoning.

**Overview:** Parents of children with elevated blood lead levels of 0.48umol/L or higher were visited by an outreach worker from the Boston Childhood Lead Poisoning Prevention Program. During the visit, a verbal survey was conducted on the counseling that parents received in regards to childhood lead poisoning from their health care providers.

**Results/Conclusions:**

Only 12% of parents received counseling on preventative measures for childhood lead poisoning before the actual screening (prior visit). Fifty-one percent of parents first learned that their child had an elevated blood lead level during the outreach site visit. Seventy-one percent of parents did not recall receiving any preventative counseling regarding lead poisoning prior to the outreach visits. Parents of children with elevated blood lead levels are not receiving preventative counseling in an appropriate and timely manner.

Jackson, R. J., Cummins, S. K., Tips, N. M. & Rosenblum, L. S. (1998). Preventing childhood lead poisoning: The challenge of change. American Journal Preventative Medicine, 14, 84-86.

**Keywords:** prevention, lead poisoning, managed care/insurance

**Objective:** To review the multitude of issues related to childhood lead poisoning such as health effects and environmental sources.

**Overview:** Topics discussed include screening protocols, follow-up care for children with elevated blood lead levels, and the role of managed care organizations. The change in screening requirements from universal to allowing individual states to determine screening guidelines based on demographics was addressed. The need for a team or multidisciplinary approach in follow-up for children with elevated blood lead levels was outlined and discussed. The roles for each team member were discussed. The examination of the role of managed care organizations revealed that most provide better prevention and early intervention through routine screening efforts than most other insurance providers.

Mehta, S., & Binns, H. (1998). What do Parents Know About Lead Poisoning? Archives of Pediatric Adolescent Medicine, 152, 1213-1218.

**Keywords:** parental knowledge, lead poisoning prevention

**Objective:** To test the effectiveness of lead poisoning prevention strategies and programs.

**Overview:** The focus of the article is on parental knowledge of lead poisoning as an evaluation of lead poisoning prevention programs. A total of 2225 surveys were received from parents of children from birth to six years of age. Surveys were completed in pediatric practices and one family practice throughout suburban Chicago. Ninety percent of respondents were mothers with a mean age of 32.9 years, 80% were home owners, 49% were college graduates, and 36% had homes built before 1950 that were undergoing or had undergone renovation within the past six months.

**Results:** Most general knowledge questions (e.g., Lead paint chips can be poisonous when eaten) on the survey were answered correctly more often than the lead prevention (e.g., Lead in water can be removed by boiling), or nutrition questions (e.g., A diet with enough calcium helps prevent lead poisoning). The test score mean was 12.7 out of 24 correct answers. In addition, results show that only 34% of those surveyed remembered receiving lead information from their healthcare provider.

**Conclusions:**

Parents do not have a knowledge base for preventing lead poisoning and the important nutritional component related to lead poisoning.

Binns, H. J., LeBailly, S. A., Fingar, A. R., & Saunders, S. (1996). Evaluation of risk assessment questions used to target blood lead screening. Pediatrics, 103, 100-106.

**Keywords:** risk assessment, low-risk

**Objective:** To evaluate the sensitivity and specificity of an Illinois risk assessment questionnaire similar to the Centers for Disease Control and Prevention recommended risk assessment questionnaire.

**Overview:** Parents of children seen at thirteen private pediatric practices and five health departments completed a lead poisoning risk assessment questionnaire. Each child was screened for lead exposure during a routine pediatric visit. Of the children studied, 738 lived either in a high risk zip code area (n=282) or a low risk zip code area (n=456).

**Results:** The sensitivity and specificity for both the low risk and high risk zip code area were similar. The Illinois risk assessment questionnaire identified most children with elevated blood lead levels. The study did suggest that the questionnaire may need to be refined to limit the number of low risk children it deems necessary to test.

Campbell, J., Paris, M., Schaffer, S. (1996). A comparison of screening strategies for elevated blood lead levels. Archives of Pediatric Adolescent Medicine, 150, 1205-1208.

**Keywords:** screening, risk assessment, cost

**Objective:** To compare cost of five various screening strategies to determine lead exposure.

**Overview:** The study compared five strategies of screening for lead exposure in children. The first includes conducting a risk assessment via a questionnaire and screening only high risk children by venipuncture and low risk by capillary. The second strategy includes screening all children using the capillary method regardless of risk. The third strategy is to screen all children by venipuncture. The fourth strategy was to assess risk using a questionnaire and then screen high risk children by venipuncture. The final strategy was to assess risk using the risk questionnaire and test by capillary method only high risk children. All elevated capillary tests were confirmed by the venous method.

**Results:** The costs of strategies one through five was \$9.07, \$8.16, \$10, \$4.13, and \$5.04, respectively.

**Conclusion:**

Practices that have a patient population with a prevalence of elevated blood lead levels will have the lowest costs when using the capillary screening method.

Campbell, J., Schaffer, S., Szilagyi, P., O'Connor, K.G., Briss, P., Weitzman, M. (1996). Blood lead screening practices among US pediatricians. Pediatrics, 98, 372-377.

**Keywords:** screening practices, pediatricians

**Objective:** To assess the practices among pediatricians in the United States on Lead Poisoning.

**Overview:** The article discussed the revised guidelines set by the Centers for Disease Control and Prevention (CDC) in 1991 for assessing and screening children for lead poisoning. In relation to the CDC guidelines, pediatricians were surveyed on their practices regarding anticipatory guidance and screening, general information on lead poisoning, and demographic background such as number of years practicing medicine.

The survey divided the population of physicians into three categories providers that 1) screen universally, 2) screen selectively, and 3) those who do not screen. The study also assessed whether capillary or venous screenings were performed.

**Results/Conclusion:**

Universal screeners were female, had urban practices, and were more recent graduates of medical school, while select screeners had to be prompted by certain patient characteristics, and those who did not screen felt that the prevalence of children with concerning elevated blood lead levels were low. However, less than half of physicians who fell into the universal or select screener categories used the risk assessment questionnaire before screening.

Committee on Environmental Health. (1998). Screening for Elevated Blood Lead Levels. Pediatrics, 101, 1072-1078.

**Keyword:** elevated blood lead levels, new standards and recommendations, prevention

**Objective:** To examine the role of pediatricians in identifying, treating, and eventually eradicating lead poisoning.

**Overview:** While, the number of children with elevated blood lead levels has declined sharply in part due to legislation that removed lead from paint and gasoline, lead poisoning still affects approximately 890,000 of children nationwide. The Centers for Disease Control and Prevention (CDC) in 1991 established new guidelines for elevated blood lead levels and screening criteria. While any level of lead above 0ug/dL is a concern, blood lead levels  $\geq 10\text{ug/dL}$  are considered elevated. Screening guidelines suggest that all children living in high risk areas or deemed high risk for other reasons have their blood tested for lead, while in other areas that have low prevalence or risk for elevated blood lead levels, uses a targeted screening method.

The AAP stresses the importance and encourages physicians to engage in anticipatory guidance. Physicians should inform parents on sources of lead, prevention, and nutritional issues. The article outlines the risk assessment and screening guidelines. It details the questions that physicians should ask on the risk assessment questionnaire and the zip code areas that are tracked for high risk.

**Conclusion:**

All pediatricians should be implementing the CDC guidelines in an effort to eradicate childhood lead poisoning.

Flaherty, E. G. (1995). Risk of Lead Poisoning in Abused and Neglected Children. Clinical Pediatrics 128-133.

**Keywords:** Abused and neglected children, screening, risk assessment

**Objective:** To evaluate the importance of performing lead screening in any child with a history of abuse or neglect if environmental risk factors cannot be assessed.

**Overview:** A total of 746 children between the ages of 6 months and 6 years were taken into protective custody because of reports of abuse or neglect. Blood lead levels were performed on 79% of these children. Eighty-eight percent were African-American, 6% Caucasian and 5% were Hispanic. All blood measurements were performed on venous blood.

**Results:** Of the children tested, 64.7% had blood concentrations of 10  $\mu\text{g}/\text{dl}$  or higher. The mean lead level for these children was 12.23  $\mu\text{g}/\text{dl}$  with concentrations ranging from 1-61  $\mu\text{g}/\text{dl}$ .

**Conclusion:**

Abused and neglected children have a high prevalence of lead poisoning. These children should be screened for lead poisoning whenever environmental risk factors indicate or cannot be assessed.

Lanphear, B. P., Byrd, R. S., Avinger, P. & Schaffer, S. J. (1998). Community Characteristics Associated With Elevated Blood Lead Levels in Children. Pediatrics, 101 (2), 264-271.

**Keywords:** screening, community characteristics, census, prevention, young children

**Objective:** To identify community characteristics associated with children having blood lead levels  $\geq 10$   $\mu\text{g}/\text{dl}$  and examine these characteristics for use in identifying children with elevated blood lead levels.

**Overview:** A total of 20,296 children, less than 6 years old, had blood lead testing over a 12 month period in Monroe County, New York. The results were compared to community characteristics obtained from census data. The following community variables were associated with an increased risk of elevated blood lead levels in the children: residence within the city; block groups with higher proportions of individuals of Black race; higher screening rate; lower housing value; housing built before 1950; higher population density; higher rates of poverty; lower percentage of high school graduates, and lower rates of owner occupied housing.

**Results:** Of the 20,296 children, 5531 (27%) had blood lead levels of 10  $\mu\text{g}/\text{dl}$  or higher, 1042 (5%) had a blood lead level of 20  $\mu\text{g}/\text{dl}$  and 81 (0.4%) had a blood lead level of 40  $\mu\text{g}/\text{dl}$  or higher. More than 95% of all the children with elevated blood lead levels lived in the city. Only 237 (4%) of the children tested who lived outside the city of Rochester, NY had an elevated blood lead level.

**Conclusion:** Several essential community characteristics that can be used to predict elevated blood lead levels in children. They include percentage of the population who are within the black race, level of poverty, high population density, living in older housing, low housing value, low rate of owner occupied housing, low education levels and living in the city.

Schaffer, S. J., Campbell, J. R., Szilagyi, P. G., & Weitzman, M. (1998). Lead screening practices of pediatric residents. Archives of Pediatric and Adolescent Medicine, 152, 185-189.

**Keywords:** screening, pediatrics, elevated blood lead levels

**Objective:** To determine the extent to which pediatric residents screen patients for elevated blood lead levels and evaluate for possible lead exposure.

**Overview:** The American Academy of Pediatrics (AAP) 28<sup>th</sup> Periodic Survey of Fellows evaluated pediatrician practices and opinions regarding lead screening. This study focuses on the response of 143 participants who were pediatric residents at the time of the survey. The questionnaire was made up of three sections: demographic and practice setting characteristics; screening and educational practices and opinions regarding issues related to elevated blood lead levels.

**Conclusion:** Seventy-five percent of the respondents reported screening all patients younger than six for elevated blood lead levels, 21% reported screening some patients and 4% reported screening none. Pediatric residents in the Northeast were more likely to screen universally. Most pediatric residents seemed to be screening young children for elevated blood lead levels in compliance with the guidelines of the CDC and the AAP. Those that screened selectively based their decision on risk factors similar to those recommended by the CDC and AAP.

Committee on Drugs, American Academy of Pediatrics. (1995). Treatment guidelines for lead exposure in children. Pediatrics, 96(1), 155-160.

**Keywords:** chelating agents, blood lead concentrations

**Objective:** To review the pharmacology of currently available chelating agents to treat elevated blood lead levels.

**Overview:** The four leading chelating agents used to mobilize lead from various sites in the body are discussed. They are Dimercaprol, Calcium Disodium EDTA, Succimer and D-Penicillamine. The pharmacology and toxicology of each is discussed as well as recommended doses and length of treatment. Elevated blood lead levels are considered and recommended treatment guidelines are given based on the blood lead results.

**Conclusion:**

Chelation therapy is indicated in patients with blood lead levels between 45 and 70  $\mu\text{g}/\text{dl}$  and greater. The pharmacology and toxicology of each chelating agent must be considered before one of the agents can be effectively administered.

Markowitz, M., Rosen, J., & Clemente, I. (1999). Clinician follow-up of children screened for lead poisoning. American Journal of Public Health, 89, 1088-1089.

**Keywords:** Follow-up care, screening guidelines, prevention

**Objectives:** To determine compliance with the Centers for Disease Control and Prevention (CDC) recommendations for follow-up of all children with initial blood lead levels of 0.48ug/dL or higher.

**Overview:** Several studies have shown that only a small percent of children on Medicaid are being screened for lead poisoning. During the time period (before 1991) when universal screening was recommended by the CDC only a small percentage of children were being screened.

**Results:** Of the 410 children screened, only 71% with a moderately elevated blood lead levels of 0.97umol/L or higher returned for follow-up within a 2 month period. Only 34% of children with slight elevations (0.48-0.92 umol/L) were retested on time. A comparison showed that 61% of children with mildly elevated blood lead levels and 29% of children with moderately elevated blood lead levels did not receive appropriate follow-up in a timely manner.

**Conclusions:**

Follow-up for lead poisoning is inadequate. Universal screening with follow-up is still a necessary public health intervention for lead poisoning prevention.

Wasserman, G. A., Graziano, J. H., Factor-Litvak, P., Popovac, D., Morina, N., Musabejovic, A., Vrenezi, N., Capuni-Paracka, S., Lekiv, V., Preteni-Redjepi, E., Hadzialjevic, S., Slavkovich, V., Kline, J., Shrout, P., & Stein, Z. (1994). Consequences of lead exposure and iron supplementation on childhood development at age 4. Neurotoxicology and Teratology, 16(3), 233-240.

**Keywords:** McCarthy Scales, blood lead concentrations, iron deficiency anemia

**Objective:** To prospectively study lead exposure and early childhood development looking at an exposed and a non-lead exposed town in Yugoslavia.

**Overview:** Pregnant women were recruited from a lead smelter town in Yugoslavia and a non-lead exposed town 20 miles away. The women and their children were followed for 4 years. Blood lead levels were obtained prenatally, at birth and at 6-month intervals to age four. A total of 332 children was followed for the length of the study and assessed at age 4 using the General Cognitive Index of the McCarthy Scales of Children's Abilities (MSCA). The mean blood lead levels of the exposed group were 39.9  $\mu\text{g}/\text{dl}$  and 9.6  $\mu\text{g}/\text{dl}$  for the non-exposed group. The most sensitive period of exposure occurred between 18-24 months for blood lead levels between 10-25  $\mu\text{g}/\text{dl}$ , there was an estimated 3.8 point loss in cognitive ability at age 4.

**Conclusion:**

The study supports the conclusion that continuing lead exposure is associated with cumulative losses in cognitive function during the preschool years.