



June 1990

Case Studies in Environmental Medicine

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Lead Toxicity

Environmental ALERT . . .



17% of the children in the United States are at risk of lead poisoning.



In addition to renal disease, cardiovascular effects, and reproductive toxicity, lead may cause irreversible neurologic damage.



Blood lead levels once considered safe are now considered hazardous, with no known threshold.



Lead poisoning is a wholly preventable disease.

This monograph is one in a series of self-instructional publications designed to increase the primary care provider's knowledge of hazardous substances in the environment and to aid in the evaluation of potentially exposed patients. The Agency for Toxic Substances and Disease Registry (ATSDR) and the Centers for Disease Control (CDC) designate this continuing medical education activity for 1 credit hour in Category 1 of the Physician's Recognition Award of the American Medical Association and 0.1 continuing education units for other health professionals. See pages 25 to 27 for further information.

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U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances and Disease Registry

N2164

Who's at Risk

- ☐ Young children have a great potential for lead exposure and are especially susceptible to its toxic effects.
- ☐ Since blood lead readily crosses the placenta, lead poses a substantial threat to the developing fetus.
- ☐ Workers may bring lead dust home on skin and clothes and unknowingly expose family members.

By and large, children show a greater sensitivity to lead's effects than adults do. The incomplete development of the blood-brain barrier in very young children (up to 36 months of age) increases the risk of lead's entry into the developing nervous system, which can result in prolonged neurobehavioral disorders. Children absorb and retain more lead in proportion to their weight than do adults. Young children also show a greater prevalence of iron deficiency, a condition that can increase gastrointestinal absorption of lead.

Three to four million children in the United States (approximately 17%) are at increased risk of lead poisoning. A breakdown according to socioeconomic and demographic strata shows that no economic or racial subgroup of children is free from the risk of having blood lead levels high enough to cause adverse health effects. Sizable numbers of children from families with incomes well above the poverty line have been reported to have elevated blood lead levels. The prevalence of elevated levels, nevertheless, remains highest among inner-city, underprivileged children who live in deteriorating pre-1970s housing containing leaded-paint surfaces.

Since lead readily crosses the placenta, the fetus is at great risk. Fetal exposure can cause potentially adverse neurologic effects *in utero* and during postnatal development. According to the Public Health Service, in 1984, more than 400,000 fetuses were exposed to lead through maternal blood lead concentrations associated with early developmental effects.

More than 1 million workers in over 100 different occupations may be exposed to lead. In lead-related industries, workers not only may inhale lead dust and lead oxide fumes, but may eat, drink, and smoke in or near contaminated areas, increasing the probability of lead ingestion. If showers and changes of clothing are not provided, workers can bring lead dust home on their skin, shoes, and clothing, thus inadvertently exposing family members.

Challenge

(1) Who else in the family or community discussed in the case study is at risk of lead poisoning?

(2) Evaluate the exposure potential and risk to the fetus mentioned in the case study.

Exposure Pathways

Lead is a naturally occurring element that has been used almost since the beginning of civilization. Because of the many industrial activities that have brought about its wide distribution, lead is ubiquitous in the environment today. All humans have lead in their bodies, primarily as a result of exposure to manmade sources.

Today, the major environmental sources of metallic lead and its salts are paint, auto exhaust, food, and water. For children, the most important pathways are ingestion of chips from lead-painted surfaces, inhalation of lead from automobile emissions, food from lead-soldered cans, drinking water from lead-soldered plumbing, and medications in the form of folk remedies.

The lead in automobile emissions may be inhaled directly or deposited in the soil. Children playing near roads and freeways may not only breathe the exhaust fumes, but may come in contact with contaminated dirt. Automobile emissions may be an important source of lead for urban residents, particularly if traffic congestion is nearby.

The lead content of paint was not regulated until 1977. Many older structures, residential and commercial, have leaded paint that is peeling, flaking, and chipping. Children can ingest loose paint as a result of pica (compulsive eating of nonfood items) and through mouthing of items contaminated with lead from paint, dust, and soil. High levels of lead in soil and house dust have been associated with increased blood lead levels in children.

Food may contain lead from the environment or from containers. Agricultural vehicles are not required to use unleaded gasoline; consequently, lead can be deposited on and retained by crops, particularly leafy vegetables. Acidic foods have been found to leach lead from lead solder in cans and lead glazes used in making pottery and ceramicware. Water from leaded pipes, soldered plumbing, or water coolers is another potential source of lead exposure. Stationary or point sources of lead include mines and smelters.

Several folk remedies used in this country have been shown to contain large amounts of lead. Two Mexican folk remedies are *azarcon* and *greta*, which are used to treat "empacho," a colic-like illness. *Azarcon* and *greta* are also known as *liga*, *Maria Luisa*, *alarcon*, *coral*, and *rueda*. Lead-containing remedies and cosmetics used by some Asian communities are *chuifong tokuwan*, *pay-loo-ah*, *ghasard*, *bali goli*, and *kandu*. Middle Eastern remedies include *alkohl*, *kohl*, *surma*, *saoott*, and *cebagin*.

- ❑ The primary sources of environmental exposure to lead are leaded paint, auto emissions, and drinking water.
- ❑ A wide variety of workers, hobbyists, and substance abusers may encounter potentially high levels of lead. Certain folk remedies may also cause lead poisoning.
- ❑ Lead enters the body primarily through ingestion and inhalation.