

## THE PHARMA INNOVATION

# Lead Poisoning- The Future of Lead's Impact Alarming on Our Society

Debjit Bhowmik<sup>1</sup>, K. P. Sampath Kumar<sup>2\*</sup>, M. Umadevi<sup>3</sup>

1. Karpagam University, Coimbatore, Tamil Nadu, India

2. Department of pharmaceutical sciences Coimbatore medical college, Coimbatore, Tamil Nadu, India

3. Centre for Plant breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore

---

Lead is particularly dangerous because once it gets into a person's system, it is distributed throughout the body just like helpful minerals such as iron, calcium, and zinc. And lead can cause harm wherever it lands in the body. In the bloodstream, for example, it can damage red blood cells and limit their ability to carry oxygen to the organs and tissues that need it, thus causing anemia. Most lead ends up in the bone, where it causes even more problems. Lead can interfere with the production of blood cells and the absorption of calcium that bones need to grow healthy and strong. Calcium is essential for strong bones and teeth, muscle contraction, and nerve and blood vessel function. Although laws and bans in developed countries limit and control the use of lead in various household substances, Indian laws lag far behind in this respect. Lead is the most toxic of all environment pollutants, and many children living in metro cities in India are susceptible to lead poisoning. Increased levels of lead in the blood may lead to anemia, stomach aches, headaches, appetite loss, impaired hearing, lowered IQ levels, and, depending on the degree of lead poisoning, they may also lead to slow growth and a damaged nervous system.

---

*Keyword:* Lead's Impact, Dangerous, Toxic

**INTRODUCTION:** Lead poisoning is also called 'plumbism'. This is because of the ill-effect of lead and lead-containing materials on various organs. Lead has no beneficial effects and children and women are most vulnerable. The World Health Organisation (WHO) estimates that 1.2 crore people are overexposed to lead and 99%

of the most serious cases are in the developing world. Lead gets absorbed through lungs, intestine and skin. It gets accumulated in red blood cells (RBCs) and other organs. Lead enters the foetus from the mothers' blood. Once it gets accumulated in the brain, it cannot be removed. Lead is also stored in bones for a long period. Lead especially affects the nervous system and kidneys. In children, lead decreases IQ and in adults, causes kidney-, muscle- and nerve-related disorders. Lead is present in products used for

---

Corresponding Author's Contact information:  
Debjit Bhowmik  
Karpagam University, Coimbatore, Tamil Nadu, India  
E-mail: [debjit\\_cr@yahoo.com](mailto:debjit_cr@yahoo.com)

---

everyday life. We cannot live without lead. It was used in paints until 1970. In petrol, it is used as tetraethyl lead. It is commonly found in ceiling dust at home. People working in industries using lead in any form are exposed to it. It is found in solder and ceramic glaze. At home, it is found in TV sets, computer monitors, cosmetics like lipsticks, nail polish and even in bindis. more than 93% of paints manufactured in India is lead-based. The Bureau of Indian Standards (BIS) has fixed an upper limit of lead in paints at 1,000 ppm. However, in developed countries, lead content is below 600 ppm. In the US, lead content in domestic paints is below 90 ppm. With recent efforts in India by Quality Council of India, major paint manufacturers are bringing down the lead content. Lowering of IQ, short attention spans, anaemia are some of the effects. Elevated lead can cause hearing and reading disabilities and high concentration (around 100 micrograms per 100 ml of blood) can cause death of a child. As of March 2000, more than 50% of children below 12 years of age in 2000 had blood lead levels above 10 milligram per decilitre. Yes, yellow paint and many coloured pigments have high lead content. Even kumkum and sindoor have abnormal levels of lead in them. Many crayons and painted pencils cause lead poisoning in children. It is difficult to classify unless we test them. At the National Referral Centre for Lead Poisoning, we have highly-sensitive equipment, XRF, to measure lead and other toxic heavy metals such as mercury, cadmium and arsenic. We need awareness programmes, monitoring of blood lead levels, preventing usage of lead-based products and enacting legislation to control pollution due to lead. The most important step is to prevent use of painted idols in water bodies

### SIGNS OF LEAD POISONING

Many kids with lead poisoning don't show any signs of being sick, so it's important to eliminate lead risks at home and to have young kids tested for lead exposure.

When kids do develop symptoms of lead poisoning, they usually appear as:

- irritability or behavioral problems
- difficulty concentrating
- headaches
- loss of appetite
- weight loss
- sluggishness or fatigue
- abdominal pain
- vomiting or nausea
- constipation
- pallor (pale skin) from anemia
- metallic taste in mouth
- muscle and joint weakness or pain
- seizures

These symptoms also can indicate a wide variety of other illnesses, so if your child has any of them, talk to your doctor. A blood test may be necessary to look for lead poisoning or other health problems.

### SYMPTOMS

Initially, lead poisoning can be hard to detect — even people who seem healthy can have high blood levels of lead. Signs and symptoms usually don't appear until dangerous amounts have accumulated.

### Symptoms in children

The signs and symptoms of lead poisoning in children may include:

- Irritability
- Loss of appetite
- Weight loss
- Sluggishness and fatigue
- Abdominal pain
- Vomiting
- Constipation
- Learning difficulties

### Symptoms in newborns

Babies who are exposed to lead before birth may experience:

- Learning difficulties
- Slowed growth

### Symptoms in adults

Although children are primarily at risk, lead poisoning is also dangerous for adults. Signs and symptoms in adults may include:

- High blood pressure
- Declines in mental functioning
- Pain, numbness or tingling of the extremities
- Muscular weakness
- Headache
- Abdominal pain
- Memory loss
- Mood disorders
- Reduced sperm count, abnormal sperm
- Miscarriage or premature birth in pregnant women

### CAUSES

Lead is a metal that occurs naturally in the earth's crust, but human activity — mining, burning fossil fuels and manufacturing — has caused it to become more widespread. Lead was also once a key ingredient in paint and gasoline and is still used in batteries, solder, pipes, pottery, roofing materials and some cosmetics.

### Lead in paint

The use of lead-based paints for homes, children's toys and household furniture has been banned in the United States since 1978. But lead-based paint is still on walls and woodwork in many older homes and apartments. Most lead poisoning in children results from eating lead-based paint chips.

### Water pipes and imported canned goods

Lead pipes, brass plumbing fixtures and copper pipes soldered with lead can release lead particles into tap water. Although lead solder in food cans

is banned in the United States, it's still used in some countries.

### Traditional remedies

Some cases of lead poisoning have been traced to the use of certain traditional medicines, including:

- **Greta or azarcon.** This fine orange powder — also known as alarcon, coral, luiga, maria luisa or rueda — is a Hispanic remedy taken for an upset stomach, constipation, diarrhea and vomiting. It's also used to soothe teething babies.
- **Litargirio.** Also known as litharge, this peach-colored powder is used as a deodorant, especially in the Dominican Republic.
- **Ba-baw-san.** This Chinese herbal remedy is used to treat colic pain in babies.
- **Ghasard.** A brown powder, ghasard is used as a tonic in India.
- **Daw tway.** A digestive aid used in Thailand, daw tway contains high levels of lead and arsenic.

### Other sources of lead exposure

Lead can also sometimes be found in:

- **Soil.** Lead particles that settle on the soil from leaded gasoline or paint can last for years. Lead-contaminated soil is still a major problem around highways and in some urban settings.
- **Household dust.** Household dust can contain lead from lead paint chips or from contaminated soil brought in from outside.
- **Pottery.** Glazes found on some ceramics, china and porcelain can contain lead that may leach into food.
- **Toys.** Lead is sometimes found in toys and other products produced abroad.
- **Traditional cosmetics.** Kohl is a traditional cosmetic, often used as eyeliner. Testing of various samples of kohl has revealed high levels of lead.

## RISK FACTORS

Factors that may increase your risk of lead poisoning include:

- **Age.** Infants and young children are more likely to be exposed to lead than are older children. They may chew paint chips, and their hands may be contaminated with lead dust. Young children also absorb lead more easily and sustain more harm from it than do adults and older children.
- **Living in an older home.** Although the use of lead-based paints has been banned since the 1970s, older homes and buildings often retain remnants of this paint. People renovating an older home are at even higher risk.
- **Certain hobbies.** Making stained glass requires the use of lead solder. Refinishing old furniture may put you in contact with layers of lead paint.
- **Country of origin.** People who live in developing countries are at higher risk of lead poisoning because those countries usually have less strict rules regarding exposure to lead. American families who adopt a child from another country may want to have the child's blood tested for lead poisoning.
- Because lead can harm an unborn child, pregnant women or women likely to become pregnant should be especially careful to avoid exposure to lead.

## TREATMENT

Treatment for lead poisoning varies depending on how much lead is in the blood. Small amounts often can be treated rather easily; the most important part of therapy is reduction of lead exposure. Gradually, as the body naturally eliminates the lead, the level of lead in the blood will fall. Kids with severe cases and extremely high lead levels in their blood will be hospitalized to receive a medication called a chelating agent,

which chemically binds with lead, making it weaker so the body can get rid of it naturally. Calcium, iron, and vitamin C are important parts of a healthy diet and also help to decrease the way the body absorbs lead. Your doctor may recommend your child take supplements if there's not enough intakes in his or her diet. All siblings of a child found to have lead poisoning also should be tested. Doctors will report cases of lead poisoning to the public health department.

## EFFECTS OF LONG-TERM LEAD POISONING

Lead poisoning can lead to a variety of health problems in kids, including:

- decreased bone and muscle growth
- poor muscle coordination
- damage to the nervous system, kidneys, and/or hearing
- speech and language problems
- developmental delay
- seizures and unconsciousness (in cases of extremely high lead levels)

## HOW LEAD POISONING OCCURS

Most commonly, kids get lead poisoning from lead-based paint, which was used in many U.S. homes until the late 1970s, when the government banned the manufacture of paint containing lead. That's why kids who live in older homes are at a greater risk for lead poisoning. Also at risk are those who immigrate to the United States or are adopted from a foreign country that doesn't regulate the use of lead. Children with a history of pica, a disorder characterized by persistent and compulsive cravings to eat non-food items (like dirt, paint chips or clay), are also at risk of lead poisoning.

Lead is also found in other environmental areas, including:

- Contaminated soil, which is found near busy streets, in part because lead was an ingredient in gasoline until the late 1970s. The soil that

surrounds homes that were painted with lead-based paint also might be contaminated. Contaminated soil is a particular concern because it can introduce lead dust into the home.

- water that flows through old lead pipes or faucets, if the pipes begin to break down
- food stored in bowls glazed or painted with lead, or imported from countries that use lead to seal canned food
- some toys, jewelry, hobby, and sports objects (like stained glass, ink, paint, and plaster)
- some folk or home remedies, such as greta and azarcon (used to treat an upset stomach)

### THE FUTURE OF LEAD'S IMPACT ON OUR SOCIETY IS ALARMING

With a policy plan to generate 12.3 giga-Watts of electricity from solar energy in India, we are on the verge of becoming the world capital of lead poisoning. Students and researchers will be facing challenges with opportunity in the days to come,” Dr Venkatesh Thuppil, Director, National Referral Centre For Lead Poisoning in India, said. He was delivering guest lecture on ‘Translational Research and Lead Poisoning’ at a programme organised by the Department of Biochemistry at Rajarajeshwari Medical College. “We have challenging years ahead. The years, starting from 2020, are crucial as native lead is becoming rare in nature. Currently lead is usually found in ore with zinc, silver and copper and it is extracted together with these metals. The main lead mineral in Galena (PbS) and there are also deposits of cerrussite and anglesite which are mined. Galena is mined in Australia, which produces 19 percent of the world’s new lead, followed by the USA, China, Peru and Canada. Some quantity is also being mined in Mexico and West Germany. The total production of new lead in the world is 6 million tonnes a year and workable reserves are estimated to be 85 million tonnes, which is less

than 15 years’ supply,” he observed. He maintained that National Referral Centre for Lead Poisoning in India has come out with several projects to protect the environment from lead pollution with ‘a hope that awareness alone can prevent up to 60 per cent of the problem’. Dr Thuppil encouraged students to come out in large numbers and take up as research activities on lead poisoning. Most parents have already cleared their children's toy boxes of playthings containing lead-laden plastics or paint. But according to a new study published on Monday in *Pediatrics*, the toxic heavy metal may continue to lurk in other, less expected sources in the home — like in the kitchen pantry. After several reports of lead poisoning in Indian children in the Boston area were linked to consumption of Indian spices, researchers at Children's Hospital Boston and the Harvard School of Public Health decided to measure the amount of lead in the seasonings as well as in ceremonial powders commonly used to mark newborn Indian infants for religious and cultural purposes. The team visited 15 Indian specialty stores in the Boston area and purchased 71 cultural powders and 86 spices and food products. About 25% of the food items, including spices such as cardamom, fenugreek and chili powder, contained more than 1 microgram of lead per gram of product. About 65% of the ceremonial powders, including *sindoor*, which is used as a symbol of marriage, contained the same amount. Those levels are below the E.U.'s acceptable threshold of 2 to 3 mcg/g of lead, but the study's authors say that regardless of the amount, the presence of lead in these products should be a reason for concern, since they could potentially add to exposure from other sources of the neurotoxin in a child's environment. (Three of the food products the team tested exceeded the E.U. guidelines: two brands of *sindav* salt and one type of *sindaloo* powder, or sea salt.) With repeated exposure at high enough levels, lead can cause cognitive damage and behavioral changes in children. In most cases, lead poisoning can be treated by reducing the child's exposure and by making sure he or she eats a balanced diet with sufficient iron, calcium and vitamin C — deficiencies in these can increase the body's

absorption of lead. In extreme cases of extended lead exposure, doctors use drugs called chelating agents, which bind to the lead and pull it out of the body through urine. In severe cases of prolonged poisoning, however, the cognitive and developmental damage may be permanent, says Dr. Cristiane Lin, the study's lead author, who is now at Seton Medical Center in Austin, Texas. Studies have shown that a blood level of 10 mcg of lead per deciliter of blood is associated with potentially irreversible harm, although recent studies have shown that as little as 5 mcg/dL can also be dangerous. By extrapolating from their data, researchers estimated that if a population of children under age 4 was routinely exposed to Indian spices or ceremonial powders, the additional ingestion of lead would lead to a threefold increase — from 0.8% to 2.8% — in the percentage of children with a blood level of lead over 10 mcg/dL. "Our message is to say, Be aware of these products that may contain lead," says Lin. "From a pediatrician's perspective, it's good to push for screening of nonpaint sources of lead." Although the majority of lead-poisoning cases in the U.S., about two-thirds, occur when young children lick or ingest lead-containing paint as it peels or chips off walls, the new study reminds doctors and parents that they need to be aware of less obvious sources. Imported products such as the ones studied by the Boston group are a particular problem, since environmental standards around the world are not the same as they are in the U.S. In countries like India, for example, leaded gasoline is still commonly used in cars (in the U.S. it was replaced by unleaded fuel in the 1970s), and the lead from car exhaust can seep into the ground, saturating the soil in which food plants, including those that are dried and ground into spices, are grown. Such environmental exposure is the most likely source of lead in the products they tested, say the authors. Currently the Food and Drug Administration, which oversees the safety of food products imported into the U.S., does not have specific guidelines for screening lead in dried products like spices. That's because the FDA feels there is no safe level of lead in dried products, since studies have not yet established

that lead exposure doesn't lead to adverse health effects. The agency has different thresholds for acceptable lead levels depending on the product and how it is to be used, says FDA spokesperson Ira Allen. For example, in 2006 the agency lowered its acceptable level of lead in candy, which children are likely to eat in large amounts. The FDA also reaffirmed its position that paints used in candy labels should be entirely lead-free, or they would be in violation of the Federal Food, Drug and Cosmetic Act. "We look at imports and we look for lead and other elements," says Allen. "But we do it on a targeted basis, and some of that basis is how the product is intended to be used. Since last spring, the agency has been reviewing its protocols for spices, to determine whether the risk of contamination or exposure to elements such as lead from dried products imported from overseas warrants more scrutiny. "We have extensive surveying of imported foods at major ports," says Allen. "Obviously we can't look at everything, but we do target inspection based on where the food comes from and what the history of the product is, and we do ban certain products. The levels of lead found in Indian spices and powders in the current study may not set off the FDA's alarms, but, as Lin and her team note, it should alert pediatricians to diagnosing lead poisoning and getting exposed youngsters into treatment sooner.

### LEAD POISONING COULD LURK IN SPICES

Lead poisoning occurs when lead builds up in the body, often over a period of months or years. Even small amounts of lead can cause serious health problems. Children under the age of 6 are especially vulnerable to lead poisoning, which can severely affect mental and physical development. At very high levels, lead poisoning can be fatal. Lead-based paint and lead-contaminated dust in older buildings are the most common sources of lead poisoning in children. Other sources include contaminated air, water and soil. Adults who work with batteries, home renovations or in auto repair shops also may be

exposed to lead. While treatment is available for lead poisoning, some simple precautions can help prevent it. Lead is a silent potent toxin that can severely damage our health. It has proven to be extremely dangerous for children and pregnant women. Lead has no biological utility and is hard to eliminate from the body. Lead when ingested, inhaled, or absorbed through skin can cause health problems as it is highly toxic to humans. Lead is a potent neurotoxin. At low levels lead poisoning in children causes an IQ-deficit brain and reduction in attention span like attention deficit hyperactivity disease (ADHD), learning and reading disabilities, anemia, colic, kidney damage, impaired growth, behavioral problems, and at times hearing loss. At much higher levels, lead poisoning can cause coma, convulsions and even death. These effects are long-term and may be irreversible. Recently a study was conducted by Toxics Link, a NGO, to evaluate the levels of lead exposure among people in India. Toxic levels of lead was found in 54 samples of junk/artificial jewellery collected from different markets of the city. Ravi Aggarwal, Director, Toxics Link said, "Lead is being used indiscriminately in toys, paints, and artificial jewellery even though its toxicity is well known and accepted. It is rather astonishing that there is no standard guideline or attempt to protect millions of children in India from its exposure, knowing that it can permanently lower their IQ level." The report also states that despite practicing international standards and prohibiting its use in jewellery and other similar items, there still is no strict and clear cut "regulation" for the same in India. Associate Director of Toxics Link, Satish Sinha adds, "Blame it on lack of accountability, awareness, or regulations, the fact stands tall that lead is being used in children's jewellery and toys all across the country". He further stated that, "Products meant for children's use must be free from toxic substances and hence should not contain lead." Apart from its presence in artificial jewelry and toys, at least 91% of paints that are manufactured in the country are still lead-based, which pose a serious threat to health and environment in general. In several developed countries lead paint is banned. A

comprehensive national policy and a strict law are much needed to ensure the production of lead-free paints.

World-wide there are six major sources of lead exposure and include –

- Gasoline additives
- Food can soldering
- Lead-based paints
- Ceramic glazes
- Drinking water systems (lead pipes)
- Cosmetic and folk remedies

During one particular festival, idols of Lord Ganesha are being immersed in water all across the country. Even a 2 kg idol of Ganesha usually contains a minimum of 6-8 gm of lead in it. Several much bigger idols are immersed in lakes, rivers, and tanks during the festival. All this contaminates our water supply with toxic levels of lead. However some awareness is catching up in small pockets. This year during the Ganesha Festival in Bangalore over 40 per cent of Ganeshas were eco-friendly with no paint on them. In Kolkata too, a notification has been issued to all Durga idol makers to utilise lead-free paints. Generally speaking lead is being used indiscriminately by small scale industries, cottage industry, junk jewelry makers, print shops, and other workshops in home settings. It is time that the Government of India's legislations are implemented on this health pollutants to save our children. The World Health Organisation (WHO) report estimates that there are 120 million people who are overexposed to lead and 99 per cent of the most serious cases are from developing countries. Chronic lead exposure is known to bring about significant damage to DNA. It is estimated that the cost of lead poisoning among children in India is over Rs 3,000 million per year. To combat this grave situation, a combined effort is needed, including government regulations, public awareness, and social responsibility of

the industry. All streams of society should channelize their efforts to meet and combat the challenge.

## **BANGALORE LEADS IN LEAD POISONING**

Along with sobriquets such as the Garden City, Silicon Valley of India, Pub Paradise and others, Bangalore may soon add a new tag to itself—the Lead City. The air here is apparently loaded with lead that it has started telling quite early on its residents, particularly in the blood samples of youngsters. It shows up as low IQ, hyper-activity, lack of attention and learning disabilities among children, abnormally early onset of osteoporosis among women, low backache, pain in the joints and persistent anaemia. In worse cases, it causes encephalopathy, paralysis and death. At around 40 micrograms/decilitre, Bangalore's lead scenario is pretty bad and among the worst in the country, says Dr T. Venkatesh, Director of the National Referral Centre for Lead Poisoning in India (NRCLPI), at the St Johns' Medical College Hospital. "Lead may be a wonderful thing with several uses, but only as long as you keep it out of your system. The treatment is expensive and the only way is to regulate and keep pollution under check," according to Dr Venkatesh. About 15 years ago, if 16 per cent of Bangalore's pre-teens showed lead content of more than 10 micrograms per decilitre, today this has increased to over 40 per cent. According to him, no other city has the kind of dubious growth in lead absorption as Bangalore. This growth, he says, connects well with the city's phenomenal growth of vehicular traffic. Unleaded petrol — which is not quite fully lead-free — can help only to some extent. Bangalore, like Kolkata, has large, unorganised groups of battery recyclers who buy from individual vehicle-owners. The Environment Ministry's new rules that lead acid batteries should be collected back by registered manufacturers are yet to catch up. These unorganized recyclers are often beyond the control of the Pollution Control Board. In India, on an average, 53 per cent of recyclers show above the 10 mg/dl limit — much higher than a

bigger lead user, the US. The campaign against lead poisoning came into focus in 1997 through a five-year Project Lead Free, started by the George Foundation and supported by Admiral O.S. Dawson. The non-profit National Referral Centre was then set up. The center hopes to gradually spread the message among manufacturers, policy-makers and the lead-user chain by setting up State level referral centres. The first such centre was set up last week in Hyderabad. The National Referral Centre has launched an awareness campaign and database exercise for nearby Anekal taluk. Anekal, along with Mangalore, is a beehive of lead-based commercial activities. "We are working through students of several colleges in Bangalore. There will be the lead map of Anekal. Our next step will be to develop a lead map of India," Dr Venkatesh said. Lead is also used to remove impurities from silver jewellery. The workers risk absorbing high levels of lead into their system, Dr Venkatesh says, adding that the silver industry has been advised to use exhausts and provide masks to its workers. The soldering units are another high-risk group. They employ a large number of women who may also be passing it on to their unborn children. Some practitioners of traditional medicine also use lead. Lead poisoning is not merely an urban malady. Many villagers absorb it through their grinding mills. Then there are the traffic police, victims of contaminated water and those who live near auto garages. NGOs like Delhi-based India Lead Zinc Development Association and Slowpoison are working with lead related agencies to create awareness on lead poisoning. What is needed, Dr Venkatesh says, is regular environmental monitoring, identification of the lead source, awareness building and regulated use. "And also avoid brightly painted Ganesh idols and the use of Holi colours," he adds. The battery industry has also woken up to the cause. The National Referral Centre is coordinating with Exide, Amara Raja and other manufacturers and has mooted a six-monthly screening of blood samples of their workers. It has sought customs and excise subsidies on the import of lead screening equipment, which are too few and have to be imported from the US.

## CONCLUSION

Researchers conducted the study on children living in Chennai, India, and examined how lead exposure influenced scores on three motor skill tests—copying figures, matching designs and using pegboards. Despite the 2001 phase-out of lead in gasoline in India, the study found that blood lead levels in children remain relatively high, with half (52.5 percent) of the children having a level greater than 10 milligrams. An increase of 10 milligrams decreased the children's visual score by 2.6 points and 2.9 points for the drawing subtest. "The implications are that in addition to the well-known effects of losing points of IQ, kids with modest levels of elevated lead exposure can also be expected to perform less well on the kinds of functions requiring hand-eye coordination, like writing, drawing or riding a bicycle," said Dr. Howard Hu, professor of environmental health sciences, epidemiology and internal medicine at the University of Michigan and the study's principal investigator. The study, conducted from 2003 to 2006, involved 814 children between ages 3 to 7. The children's blood sample was measured with a lead analyzer. Data collected from each child's parent or primary caregiver involved a questionnaire that covered topics related to the child's birth history, gender, school, parents' education and occupation, socio-economic background. Other factors included living conditions, nutritional and dietary habits of the child, and environmental surroundings, such as industrial exposure, traffic exposure, hobbies and residential exposure from paints and toys. Children completed three tests, including a drawing task in which they copied designs arranged in order of increasing difficulty. Starting at an age appropriate item, the child proceeded until three consecutive items were failed. The matching task involved arranging items in order of increasing difficulty. Children marked which of four options "goes best" with the standard item, and each child continued until he or she made six errors in a series of eight consecutive items. On the pegboard task, the child inserted as many round pegs as possible within 90 seconds using the dominant hand. The

greatest decline in motor skills occurred at blood lead levels greater than 30 milligrams, resulting in poor scores with pegboard and matching tests.

## REFERENCE:

1. Markowitz M. Lead poisoning. In: Kliegman RM. Nelson Textbook of Pediatrics. 18th ed. Philadelphia, Pa.: Saunders Elsevier; 2007. <http://www.mdconsult.com/das/book/body/208746819-6/0/1608/0.html>. Accessed Jan. 14, 2011.
2. Hurwitz RL. Childhood lead poisoning: Clinical manifestations and diagnosis. <http://www.uptodate.com/home/index.html>. Accessed Jan. 14, 2011.
3. McGuigan MA. Chronic poisoning: Trace metals and others. In: Goldman L, et al. Cecil Medicine. 23rd ed. Philadelphia, Pa.: Saunders Elsevier; 2008. <http://www.mdconsult.com/das/book/body/191371208-2/0/1492/0.html#>. Accessed Jan. 14, 2011.
4. At-risk populations: Pregnant women. Centers for Disease Control and Prevention. <http://www.cdc.gov/nceh/lead/tips/pregnant.htm>. Accessed Jan. 14, 2011.
5. Goldman RH, et al. Adult lead poisoning. <http://www.uptodate.com/home/index.html>. Accessed Jan. 14, 2011.
6. Folk medicine. Centers for Disease Control and Prevention. <http://www.cdc.gov/nceh/lead/tips/folkmedicine.htm>. Accessed Jan. 17, 2011.
7. Centers for Disease Control and Prevention, et al. Lead poisoning associated with use of litargirio: Rhode Island, 2003. MMWR. 2005;54:227. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5409a5.htm>. Accessed Jan. 17, 2011.
8. Lee DA, et al. Childhood lead poisoning: Exposure and prevention. <http://www.uptodate.com/home/index.html>. Accessed Jan. 17, 2011.
9. Lead in paint, dust and soil. Environmental Protection Agency. <http://www.epa.gov/opptintr/lead/pubs/leadinfo.htm>. Accessed Jan. 18, 2011.
10. International adoption and prevention of lead poisoning. Centers for Disease Control and Prevention.

<http://www.cdc.gov/nceh/lead/tips/adoption.htm>. Accessed Jan. 18, 2011.

11. Centers for Disease Control and Prevention, et al. Recommendations for blood lead screening of Medicaid-eligible children aged 1-5 years: An updated approach to targeting a group at high risk. *MMWR*. 2009;58:1. <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5809a1.htm>. Accessed Jan. 18, 2011.

12. Mitchell-Heggs CA, Conway M, Cassar J. Herbal medicine as a cause of combined lead and arsenic poisoning. *Hum Exp Toxicol*. 1990 May;9(3):195–196. [PubMed]

13. Yu EC, Yeung CY. Lead encephalopathy due to herbal medicine. *Chin Med J (Engl)* 1987 Nov;100(11):915–917. [PubMed]

14. Smitherman J, Harber P. A case of mistaken identity: herbal medicine as a cause of lead toxicity. *Am J Ind Med*. 1991;20(6):795–798. [PubMed]

15. Cullen MR, Robins JM, Eskenazi B. Adult inorganic lead intoxication: presentation of 31 new cases and a review of recent advances in the literature. *Medicine (Baltimore)* 1983 Jul;62(4):221–247. [PubMed]

16. McElvaine MD, Harder EM, Johnson L, Baer RD, Satzger RD. Lead poisoning from the use of Indian folk medicines. *JAMA*. 1990 Nov 7;264(17):2212–2213. [PubMed]