

## Lead Toxicity in Children: Health Effects, Policies and Recommendations

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### ABSTRACT:

Lead is a dangerous element that exists naturally in the Earth's crust. Any kind of lead causes a detrimental response in the human body. It is discharged into the environment during the manufacturing of batteries, foundries, ammunition, lead paint, water pipes, and other manufactured goods. It can enter the body through a variety of pathways, including those in the air, water, soil, food, and dust. Concern is raised since there is no amount of lead that is safe for the human body. The problem persists despite several prevention measures that the state and the federal governments have put in place. This review assesses the effects of lead exposure on children as well as suggested solutions to the issue.

**KEY WORDS:** lead toxicity; fetal neurotoxicity; lead poisoning; lead damages

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### INTRODUCTION:

Lead is a dangerous element that exists naturally in the Earth's crust.<sup>[1]</sup>

The environment naturally contains lead. Traces of lead that are naturally present in the environment are not harmful. It is only when lead gets mined and turned into manufactured goods, toxicity sets in.<sup>[2,3]</sup> A few examples are petrol, lead based paints and pigments, solder in food cans, ceramic glazes, incineration of lead containing waste, electronic wastes etc. Lead toxicity has recently gained international attention, mainly because lead's toxicity potential never declines, and it is persistent in the environment.<sup>[3]</sup> As per *Centers for Disease Control and Prevention* (CDC), the environment around a child is lead filled. Children can be exposed to lead from a variety of sources, including gasoline, solder, water pipes, consumer goods, artificial grass, confectionery, traditional medicine, fine jewelry, and toys.<sup>[4]</sup>

Children in the US have recently been exposed

to lead through a variety of unique means. The various sources include lead-containing children's jewelry, Mexican tamarind candy and candy wrappers, food served on imported ceramic bowls and pitchers, breathing lead fumes from melting for fishing weights. Interestingly, there has been a case where the mother and the child were exposed to lead from the bullet in the mother's spine because she had been shot fifteen years earlier.<sup>[5]</sup>

### Lead exposure and child health effects:

**1. Intellectual disability:** Lead exposure is associated with intellectual disability. Lead exposure in children with maximum blood lead levels 7.5 µg/dl is connected with intellectual impairments, claims a global pooled investigation by Lanphear et al. They gathered the information from 1,333 children who participated in seven international population-based longitudinal cohort studies, followed from birth or

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infancy until 5-10 years of age in order to examine the relationship between test intellectual scores and blood lead concentration for children with maximum blood lead levels of 10 µg/dl. The full-scale Intelligence Quotient (IQ) score served as the key outcome indicator. 103 (8%) children had a maximal blood lead concentration <7.5 µg/dl and 244 (18%) of the children had maximum blood lead concentrations below 10 µg/dl.<sup>[6]</sup> When the confounders were taken into account, it was discovered that the blood lead levels and IQ score had an inverse connection. There was a notable 6.9 decline in IQ [95% confidence interval (CI), 4.2-9.4] with an increase in blood lead levels from 2.4 to 30 µg/dl. A rise in blood lead levels was linked to a decline in IQ.<sup>[6]</sup>

**2. Fetal Neurotoxicity:** There are few other factors that also expose children to lead. For example, lead in maternal bones can be linked to fetal neurotoxicity.<sup>[7]</sup> As per the study by Gomaa et al, a 2-fold increase in cord blood lead level (e.g. from 5 to 10 µg/dl) was associated with a 3.1-point decrement in Major Depression Inventory (MDI) score.<sup>[7]</sup>

**3. Fetal death and low birth weight:** Lead-contaminated drinking water is linked to fetal mortality and poor birth weight.<sup>[8]</sup> Fetal fatalities reached their maximum point in 2001, when water lead levels were at their highest, and then began to decline after 2004 when various public health actions were put into place, according to an ecological research conducted during the Washington DC lead crisis.<sup>[8]</sup>

**4. Congenital lead poisoning:** Lead can enter an infant's system through the fetomaternal circulation, which can result in congenital problems in infants, or it can enter an infant's system through breast milk.<sup>[9]</sup> If the mother has chronic lead toxicity, breastfeeding is one of the other keyways that babies become affected.<sup>[9]</sup>

#### **Existing solutions proposed by public health agencies:**

Several federal laws such as Environmental Protection Agency (EPA) Lead Renovation, Repair and Painting Program Rule (RRP) requires that certified home renovators be employed to renovate homes that were built before 1978 to replace lead-based paints; The Water Infrastructure Improvements for the Nation (WIIN) Act gave HHS agencies the go-

ahead to establish the required infrastructure to promote lead poisoning prevention measures, and to take actions to support Flint, Michigan in its recovery.<sup>[10]</sup>

As per CDC's Blood lead screening policy, all children aged nine months to six years should be screened for lead. However, screening should focus on children who have particular risk factors, such as those who live in inadequate housing or come from low-income households.<sup>[10]</sup>

At the state level, Surveillance programs are in place to track the State lead poisoning prevention status and the database is named as Lead Statutes database.<sup>[10]</sup>

#### **RECOMMENDATIONS:**

Despite all these measures and policies at state and federal levels the lead toxicity in children still prevails. Following measures can be implemented to solve this problem. Policies by FDA to reduce the amount of lead in food and household goods, guidelines to lower airborne lead emissions can be undertaken.<sup>[11]</sup> Establishing the surveillance program to identify and address the sources of lead exposure in children similar to that of adults. Implementing policies to provide affordable coverage to ensure that children with elevated blood lead levels have access to developmental and neuropsychological evaluations as well as appropriate, high-quality programs. In addition, increasing public accessibility to local data and artificial intelligence can also be used for surveillance to keep a check in the population.<sup>[12]</sup>

#### **CONCLUSION:**

Much has been learned about the neurodevelopmental and behavioral effects of lead poisoning in children in recent years. Lead damages the brain and central nervous system at high levels of acute exposure, resulting in unconsciousness, convulsions, and even death. A child who has acute or chronic poisoning is usually left with mental impairment and behavioral problems even if they survive. Lead does not currently have any known safe concentrations. We only know that it has detrimental impact on children's health, notably their mental development, even at extremely low concentrations like 5 µg/dl. Even though several policies are in place to prevent and monitor lead exposures in children, but more effective policies need to be implemented such as complete ban of lead in consumer goods, and a better surveillance program to track exposures. So that children can live a

healthy life free of lead.

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