

What Does Childhood Lead Poisoning Cost Cleveland? Estimates of Selected Monetary Costs

Environmental Health Watch

Most of the cost of childhood lead poisoning - for the children, for their families, and for the community – cannot be measured. How do you calculate the psychological pain of not being able to succeed in school, the diminished hopes and dreams parents have for their children, or lead poisoning's contribution to the problems of failing schools, juvenile crime and poor workforce readiness?

For some interventions and outcomes associated with childhood lead poisoning, it is possible to make reasonable rough estimates of the dollar costs - healthcare, special education, juvenile justice, and lost future earnings. As you will see from the details of our methodology, these estimates are conservative, but the costs are enormous.

Estimates Based on Blood-lead Testing Data for Cleveland Children in 2004

The lifetime monetary costs of selected interventions and outcomes are estimated for the group of Cleveland children who had blood-lead levels equal to or greater than 5 micrograms of lead per deciliter of blood ($\mu\text{g}/\text{dL}$) when they were tested in 2004¹. This was 6,517 children, 42% of children tested (30% of children under six years old, based on the 2000 census). The distribution of blood-lead levels (BLL) of children tested is shown in the following table:

| | Total Tested | Blood Lead Level ($\mu\text{g}/\text{dL}$) | | | | | | | | Level of concern $\geq 10\mu\text{g}/\text{dL}$ | | Level of awareness $\geq 5\mu\text{g}/\text{dL}$ | |
|-------------------|--------------|----------------------------------------------|-------|-------|-------|-------|-------|-------|-----|-------------------------------------------------|-------|--------------------------------------------------|-------|
| | | 5-9 | 10-14 | 15-19 | 20-24 | 25-34 | 35-44 | 45-69 | 70+ | Total | % | Total | % |
| City of Cleveland | 15,435 | 4,824 | 1039 | 346 | 160 | 94 | 33 | 19 | 2 | 1,693 | 11.0% | 6,517 | 42.2% |

Direct Medical and Public Health Costs: \$1, 603,000

The direct medical costs in our estimate are the cost of blood-screening, medical follow-up and medical treatment. Costs are based on Medicaid reimbursement. The treatment costs for the children with BLL between 10 and 45 $\mu\text{g}/\text{dL}$ are blood screening, vitamin therapy, and doctor's visits. For severely poisoned children, chelation treatment becomes an additional cost, which at the highest level of poisoning is necessary as an inpatient treatment. (Costs are estimated utilizing information gathered from departments of pediatrics at MetroHealth

¹ The amount of lead in a child's blood is measured in micrograms of lead per tenth of a liter of blood ($\mu\text{g}/\text{dL}$). In 1990, the Centers for Disease Control established a lead level of 10 ($\mu\text{g}/\text{dL}$) or greater as the "level-of-concern" (now commonly considered "lead-poisoned"). The level of concern is the level at which CDC recommends public health actions be initiated. At the time, CDC did not define the threshold of 10 ($\mu\text{g}/\text{dL}$) as "lead poisoning," acknowledging damage below 10 mcg/dl. Since that time, research has continued to suggest that children suffer from adverse effects from lead, including intellectual impairment, and attention deficit hyperactivity disorder at levels well-below 10 $\mu\text{g}/\text{dL}$. The four public health departments in Cuyahoga County (Cleveland Department of Public Health, Cuyahoga County Board of Health, Lakewood Department of Human Services and the Shaker Heights Health Department), based on recommendations of the Medical Committee of the Greater Cleveland Lead Advisory Council, have established a child blood-lead level of 5 $\mu\text{g}/\text{dL}$ as a new "level of awareness" in the region, the level at which response should be initiated. The level of awareness of 5 mcg/dl recognizes that many more children than previously acknowledged are potentially hurt by lead - more than 40% of children tested in Cleveland in 2004 and more than 20% in the First Ring Suburbs.

Medical Center and Rainbow Babies and Children's Hospital in Cleveland, OH).² Public health costs include case management and home inspections. There were 272 cases handled by the Cleveland Department of Public Health in 2004. The Medicaid reimbursement rate for home inspection and case management was \$463.⁴

Estimated Direct Medical Costs

| BLL μg/dL | Follow- up Measures | | | | | | | |
|--------------|--------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------|--------------------------------------------------|---------------------------------------------------|----------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------|
| | Vitamins (\$5/bottle, one bottle lasts 2 months) | Blood Draw (phlebotomy fee laboratory analysis fee) | Doctor Visits (\$283/visit) | Outpatient Chelation (\$315/trea tment) | Inpatient Chelation (\$6,500/ treatment) | Sub-total: Cost by Blood-lead Level | Number of Children | Total estimated cost for the cohort (rounded to the nearest thousand dollars) |
| 5-9 | -- | \$46.30 | ----- | \$0.00 | \$0.00 | \$46.30 | 4824 | \$ 223,000 |
| 10-14 | \$90 | \$46.30 | \$283.00 | \$0.00 | \$0.00 | \$419.30 | 1039 | 436,000 |
| 15-19 | \$90 | \$46.30 | \$566.00 | \$0.00 | \$0.00 | \$702.30 | 346 | 243,000 |
| 20-24 | \$90 | \$92.60 | \$1,132.00 | \$0.00 | \$0.00 | \$1,314.60 | 160 | 210,000 |
| 25-34 | \$90 | \$92.60 | \$1,132.00 | \$0.00 | \$0.00 | \$1,314.60 | 94 | 124,000 |
| 35-44 | \$90 | \$92.60 | \$1,132.00 | \$0.00 | \$0.00 | \$1,314.60 | 33 | 43,000 |
| 45-69 | \$90 | \$185.20 | \$2,264.00 | \$315.00 | \$6,500.00 | \$9,354.20 | 19 | 178,000 |
| 70+ | \$90 | \$185.20 | \$2,264.00 | \$730.00 | \$6,500.00 | \$9,769.20 | 2 | 20,000 |
| | | | | | | | | \$1,477,000 |

Estimated Public Health Costs

| Cases | Cost per case | Total costs |
|-------|---------------|-------------|
| 272 | \$463 | \$125,936 |

Special Education: \$ 1,023,000

Medical research has shown a strong link between elevated blood-lead level in children and IQ loss and learning disabilities, resulting in the need for special education services for many children. It is estimated that 20% of children with blood lead levels over 25 μg/dL will need an average of 3 years of special education.⁵ In 2004, the average annual cost of special education for one child in Cleveland was \$11,524. From the table below, for the 30 children in 2004 estimated to be enrolled in special education due to elevated blood-lead, the total costs were \$882,734.⁶

Estimated Cost of Special Education Due to Lead Poisoning

| | |
|--------------------------------------------------|---------------------|
| Price of special education per student | \$11,524 |
| Estimated number of children BLL > 25 in 2004 | 148 |
| Estimated number who will need special education | 30 |
| Cost per year of special education services | \$ 341,110 |
| Total cost of 3 years of special education | \$ 1,023,330 |

Juvenile Justice: \$10,382,000

² Long-term health outcomes related to lead exposure, such as hypertension, and their related costs are not included in these estimates. These costs could be substantial.

⁴ Due to staff limitations, families moving, and inability to gain access to some homes, not all identified children with elevated blood-lead received case management.

⁵ Schwartz J. *Societal benefits of reducing lead exposure*. *Environmental Research* 1994; 66:105-124.

⁶ The cost of special education may be much higher due to research showing a detrimental effect on learning at blood-lead levels far below 25 μg/dL.

The neurobehavioral impairment resulting from lead poisoning associated with IQ loss and learning disabilities are also associated with delinquency (Korfmacher 2004). It is estimated that at least 10% of youth who engage in delinquent behavior have been lead poisoned (Needleman 2002). By applying this rate to the total juvenile justice budget in 2004 as shown in Table 3, the cost can be estimated for the average period of 3 years during which the juvenile justice system would be involved. The cost to the system may be much larger if the child needs more years of service. **Many juvenile offenders will go on to adult criminality and incarceration, with the associated large monetary costs to society. These costs, however, are not captured by this study**

Cost of Juvenile Delinquency due to Lead Poisoning

| | |
|-------------------------------------------------|---------------------------|
| Juvenile Justice Budget 2004 | \$34,607,538 ⁸ |
| Rate of population attributed to Lead Poisoning | 10% |
| Cost of services for one year | \$3,460,754 |
| Total Cost for 3 yrs of juvenile justice | \$10,382,262 |

Lost Future Earnings: \$ 127,277,000

There is a well-established relationship between lower IQ and lower income earned throughout an individual’s lifetime. This in turn results in less taxable income for the community. Based on cost calculations utilized by Korfmacher (2003) and adapted from Grosse *et al* (2002), the earnings lost per increase of 1 µg/dL of blood-lead level (BLL) is \$3720.

In 2004, there were 6,517 0-6 year olds with BLL over 5 µg/dL (average 7.25 µg/dL which is 5.25 µg/dL above background level according to Korfmacher). The total earnings lost for this cohort are based on the number of children poisoned at over 5 µg/dL, the earnings lost per µg/dL, and the average BLL above background. (6,517 * \$3720 * 5.25 = \$127,277,010) By assuming an average income tax rate of 10%, the tax dollars lost are estimated to be \$12,727,701. These figures are conservative compared to the cost resulting from alternative methods proposed by Landrigan et. al. (2002)¹⁰ which are based on national blood lead averages.

Summary

The table below (**Selected Estimated Life-time Monetary Costs to the Community for Children Identified with Blood-Lead => 5 µg/dL Tested in 2004 in Cleveland**) illustrates the tremendous lifetime costs of selected interventions and outcomes - **\$140,285,000**. As indicated, the cost estimates are all quite conservative and the actual costs are certainly much higher. Only about a third of children were tested and no doubt many of the untested children had elevated lead levels. Special education and juvenile justice

⁸ Annual Report. (2004). Cuyahoga County Juvenile Court. Retrieved from. <http://juvenile.cuyahogacounty.us/annualreport.htm>

¹⁰ Loss of lifetime earnings can also be calculated using the method proposed by Landrigan et. al. (2002). This study summarized research showing that lead reduces IQ at levels below 10 µg/dL. Landrigan and colleagues applied an IQ loss of .25 points per µg/dL to the national average blood lead level of 2.7 µg/dL among children 5 years of age which results in a loss of 1.61% of lifetime earnings (2.39% per IQ point). By applying Landrigan’s national earnings figures to the total number of children in the city of Cleveland less than 6 years old (46,388 according to 2000 Census), the total lifetime earnings lost would be \$523,061,666. The number of children living in pre 1940 housing in the city of Cleveland is much higher than the national average resulting in a much higher cost than this figure.

interventions may be necessary for more children for longer than periods. Numerous adverse health conditions are associated with lead poisoning later in life and those costs were not included.

Childhood lead-poisoning is enormously costly to society, even in the limited and narrow examination presented here. Cost-benefit analyses have consistently demonstrated the net societal benefit in reducing lead hazards, even at substantial cost.¹¹ The same is certainly true for Cleveland.

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¹¹ Schwartz J. Societal benefits of reducing lead exposure. Environmental Research 1994; 66:105-124.

**Selected Estimated Life-time Monetary Costs to the Community for Children
Identified with Blood-Lead => 5 µg/dL Tested in 2004 in Cleveland**

| Timeline: (Years) | 1-6 | 7-14 | 15-18 | 18+ | Total |
|----------------------|-------------|--------------|--------------|----------------|----------------------|
| Medical Costs | \$1,603,000 | | | | \$1,603,000 |
| Special Education | | \$ 1,023,000 | | | \$ 1,023,000 |
| Juvenile Justice | | | \$10,382,000 | | \$10,382,000 |
| Lost Future Earnings | | | | \$ 127,277,000 | \$127,277,000 |
| Total | | | | | \$140,285,000 |