Considering Screening When There May Be Minimal Direct Benefit to the Child

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A core principle of screening is that there should be a direct benefit to the patient. This restriction undervalues the impact that screening could have by not considering the population-level benefits to others, including family members, close contacts of affected individuals, and the broader community. Screening for lead poisoning offers an example of how individual screening has resulted in long-term health improvements for many by identifying and abating lead from the environment. The US Preventive Services Task Force states that the balance of information regarding the benefits and harms of screening for elevated blood lead levels is insufficient to recommend for or against it. However, lead screening has been associated with significant overall public health improvement. In this commentary, we identify generalizable lessons about when it might be appropriate to screen even if there may be limited direct benefit to the child being screened.

HISTORY OF LEAD SCREENING

Childhood blood lead testing of asymptomatic children began in the 1970s. Initially, most blood lead screening was done through local health departments, maternal and child health programs, and other community-based organizations, with support from the Centers for Disease Control and Prevention (CDC) and other federal agencies. Screening was also recommended to occur within primary care and required for Medicaid-enrolled children at 1 and 2 years or by 6 years if not previously done. Regardless of setting, screening was often inconsistent. As late as 1998, only ~20% of Medicaid-enrolled children had ever received a blood lead test. In addition, many children with elevated blood lead levels did not receive follow-up care. Specific screening requirements and recommendations continue to vary widely by state. In a 2017 review of state-based lead screening policies, researchers found that 10 states mandated universal screening, regardless of Medicaid enrollment, usually at ages 1 and 2 years; 8 states mandated screening in high-risk areas; 29 states had screening recommendations; and 5 states neither listed requirements nor recommendations for lead testing on their Web site. Despite this variation, in this same study, the authors found that 49 states reported following the Medicaid regulations. However, the National...
Center for Quality Assurance consistently reports that only ~66% of children enrolled in Medicaid have had at least 1 blood lead test by 2 years of age.\(^7\)

Since at least the 1970s, the mean blood level among all children has sustained a dramatic decline.\(^6\) This success is tempered by data indicating that adverse health effects occur at levels once thought safe. In response, the CDC has lowered the blood lead action threshold over time and now recommends a blood lead reference value of 5 μg/dL.\(^9\)

Public health interventions to decrease lead exposure include eliminating lead from gasoline, water, and air as well as a ban on residential lead-based paint. With the decrease in potential lead exposure, there have been a number of attempts to target screening by using risk and on the basis of known disparities in the risk by lower socioeconomic status, Black race, and housing age rather than universal testing. These risk questionnaires have limited test accuracy because of the many ways that children can be exposed to environmental lead and the emergence of sources of lead in their environments.\(^1\)

Some have argued that instead of continuing to screen children for lead exposure, there should instead be a focus on environmental lead abatement. The claim is that instead of focusing on screening, which can be inefficient and poorly coordinated, focusing solely on eliminating lead from the environment builds on previous policy successes in permanently lowering risk for all. Although control or elimination of lead sources is an important component of any public health endeavor to lower risk, is there still a strong argument for promoting lead screening? The Flint, Michigan, water crisis, in which screening identified an unexpected but significant cause of lead exposure, raises this critical question.\(^10\) In 2019, the Environmental Protection Agency released a report outlining 4 goals for lead poisoning prevention: reducing children’s exposure, identifying lead-exposed children, communicating with stakeholders, and conducting research to inform lead-related efforts.\(^11\) As outlined in this report, the focus of this research is on the use of data and tools to identify high-risk areas for abatement and targeted screening activities. To better understand the role of universal lead screening, we consider the key questions from the standard criteria for screening proposed by Wilson and Jungner\(^12\) and interpret these considerations within the basic ethical principles of beneficence, justice, and respect for persons.\(^13\)

**Is Lead Poisoning an Important Health Problem?**

Children with a blood lead concentration between 5 and 9.9 μg/dL will experience an average decrease in IQ of ~5 points.\(^14\) Intellectual deficits, diminished academic abilities, attention deficits, and problem behaviors, including impulsivity, aggression, and hyperactivity, occur even in children with blood lead concentrations <5 μg/dL.\(^15\) This is a significant threat to children’s long-term health and is associated with significant disparities.

There are population effects that should also be considered. Every child contributes at least a little to population morbidity. The cumulative impact is substantial. Furthermore, most of the total morbidity is contributed by children with blood lead levels <5 μg/dL rather than by children with levels ≥5 μg/dL.\(^16\)

**Is There a Latent or Early Symptomatic Stage?**

Most children with elevated lead levels are asymptomatic. They can only be identified through blood lead testing. Because clusters of childhood lead poisoning are common,\(^17\) identification of 1 child can result in remediation of lead hazards in the environments of children with high blood lead levels who have not been identified as well as prevent exposure to other children. There is rarely a latent or early symptomatic state that would obviate the need for screening. Symptoms of the typical prolonged exposure to environmental lead children have in the United States would not come to clinical attention sufficiently early for effective treatment. Although symptoms of acute lead poisoning (eg, abdominal colic, encephalopathy) can develop with high levels (ie, ≥70 μg/dL), such cases are rare.\(^3\)

**Is There an Acceptable Screening Test?**

Although risk-based screening instruments are often inaccurate, blood lead testing is accurate and widely available. False-positives are uncommon and can be evaluated easily by follow-up blood lead testing, which also confirms the diagnosis.

**Is There an Accepted Treatment?**

Chelation is reserved for children with markedly elevated blood lead levels. Few studies demonstrate that previously elevated blood lead levels in the range typically identified in the United States decline as a result of lead hazard control methods. In a Cochrane review of dust lead reduction studies, researchers found no impact on blood lead levels.\(^18\) This is in some part the result of lead stored in bone being mobilized as external sources of lead are reduced as well as decreased hand-to-mouth activity and absorption of
lead through the gastrointestinal tract as children grow.\textsuperscript{19}

A national network of Pediatric Environmental Specialty Health Units is available to provide treatment and/or support pediatric health care providers in the management children with elevated blood lead levels.\textsuperscript{20} However, eliminating lead hazards can be expensive. Limitations in available resources for inspection as well as limitations in enforcement can cause known environmental lead to remain. Despite these limitations, lead hazard control can prevent elevated blood lead levels in other children living in the same or adjacent housing units. Federal, state, and local public health agencies and individual health care providers can use surveillance systems to identify high-risk areas in which many children have been identified with elevated blood lead levels, thus allowing targeting of limited resources to protect others from exposure. For example, screening allowed recognition of the lead contamination of the Flint, Michigan, water supply and eventually caused improved water for all children in Flint.\textsuperscript{10} Although many children were impacted and there was concern about how long the response took, it is likely that this environmental disaster would have only been detected through screening.

**Is the Cost of Screening Balanced Against Its Overall Benefits?**

The effects of lead are costly. Tens of billions of dollars have been estimated to be lost annually in the United States because of reduced cognitive potential and the associated lost productivity.\textsuperscript{21–23} In 2017, the Pew Charitable Trust estimated that keeping blood lead levels of children born in 2018 at 0 would save $86 billion over the lifetimes of this cohort.\textsuperscript{24} The greatest benefit would result from primary prevention that eliminates blood lead levels \( \geq 2 \mu g/dL \). The investigators also estimated that preventing children from sustained blood lead levels \( \geq 5 \mu g/dL \) would result in a savings of $6.4 billion for the same cohort. There is an extensive body of literature to support the long-term benefits of investments in early childhood, such as Head Start, despite the upfront costs to implement preschool programs.\textsuperscript{25} Although the degree to which children with lead exposure affect the overall economic benefit of preschool is not known, these programs do appear to differentially help those with even minor impairments.\textsuperscript{26,27}

Medicaid reimbursement rates vary widely, but the cost of most tests ranges from $8 to $15. For children with elevated blood lead levels, significant costs are incurred for medical management and environmental inspection, enforcement, and remediation. These costs may be more than offset by the productivity gains that result from preventing elevated blood lead levels and the resultant costs of follow-up care in other individuals.

**Lessons Regarding Screening When There Is No Direct Benefit to the Child**

The ethical principle of justice argues for screening because of the disparities in the risk of lead poisoning and the lifelong harms associated with lead exposure. Screening could be beneficent as long as the benefits to others are maximized and the harms to the child being screened are minimized. This would require a commitment to provide timely follow-through with an environmental assessment and, when necessary, abatement. Unfortunately, follow-up services based on elevated blood lead level do not reverse any damage to children that happened before the elevated blood lead level was identified. These services may also focus on a few common lead sources and not identify those that are less common. Evaluating the gaps in service and addressing them is a matter of urgency. Although the epidemiological data are unclear, detection of elevated blood lead levels through screening could protect those children who would have gone on to higher lead levels. It is also important to recognize that not all children with elevated blood lead levels not detected through screening would necessarily go on to have higher levels.

Since the 1990s, the CDC has maintained a collaborative effort with state and local health departments to collect blood lead surveillance data and to report these data at the federal, state, and local levels. These data enable policy makers and scientists to recognize changes in the nature and extent of lead sources at the community level. This collaboration has weakened recently. The CDC no longer routinely reports lead surveillance data from all states or the most recent biomonitoring data from the National Health and Nutrition Examination Survey. Some lead exposure sources have been eliminated, but others have only been controlled and new sources of lead continue to emerge. In the absence of surveillance and biomonitoring, we cannot be confident that past successes in lead exposure reductions have been maintained.

It is critical to recognize the autonomy of the children being screened, as well as their families. This would include educating families that the screening is a public health activity primarily to help others. Given the pain involved with a blood draw, some might decline screening. In contrast, engaging parents at the time of
screening might get better support for ensuring follow-up. Furthermore, “parents of children with a history of exposure or who may be at risk strongly and consistently urge universal blood lead testing.” Focusing on autonomy might not only help with follow-up but encourage grassroots calls for action. Because the children are at the greatest risk of harm related to lead exposure, recommending lead screening meets the ethical principle of respect for persons because they are not capable of determining if they should be screened.

Explicitly framing childhood lead screening within this public health framework would be a novel approach to care. Research is needed to evaluate how to provide this message to families, clinicians, and public health officials. Given the low rates of screening and follow-up in some communities, it would be possible to do studies across different communities to evaluate whether this approach ultimately addresses the risk of lead exposure at the population level. There are lessons for other childhood preventive services that could come from this research regarding strategies for decreasing disparities and the balance of long-term public health and health care expenditures.

ABBREVIATION
CDC: Centers for Disease Control and Prevention

REFERENCES


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