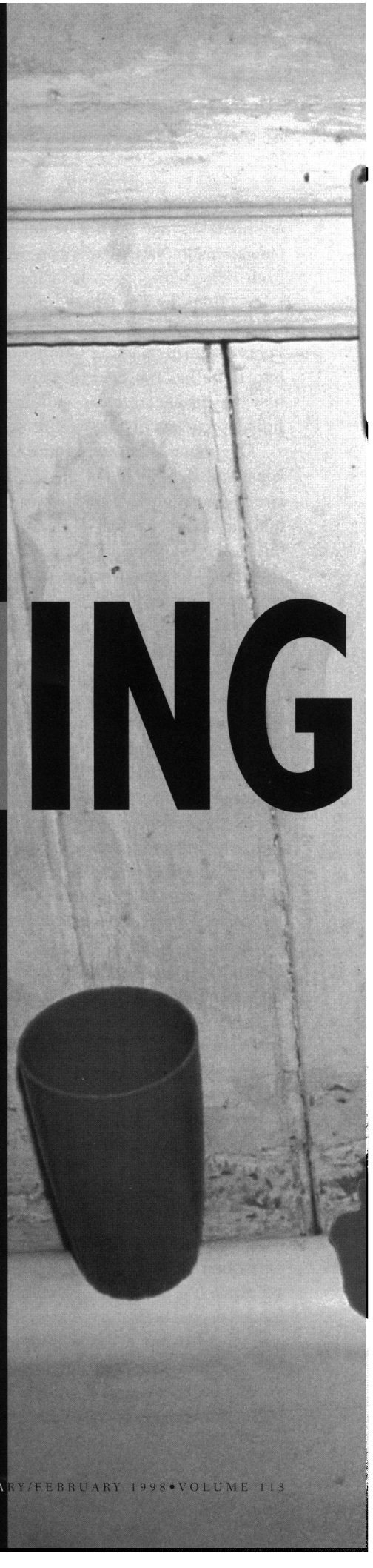
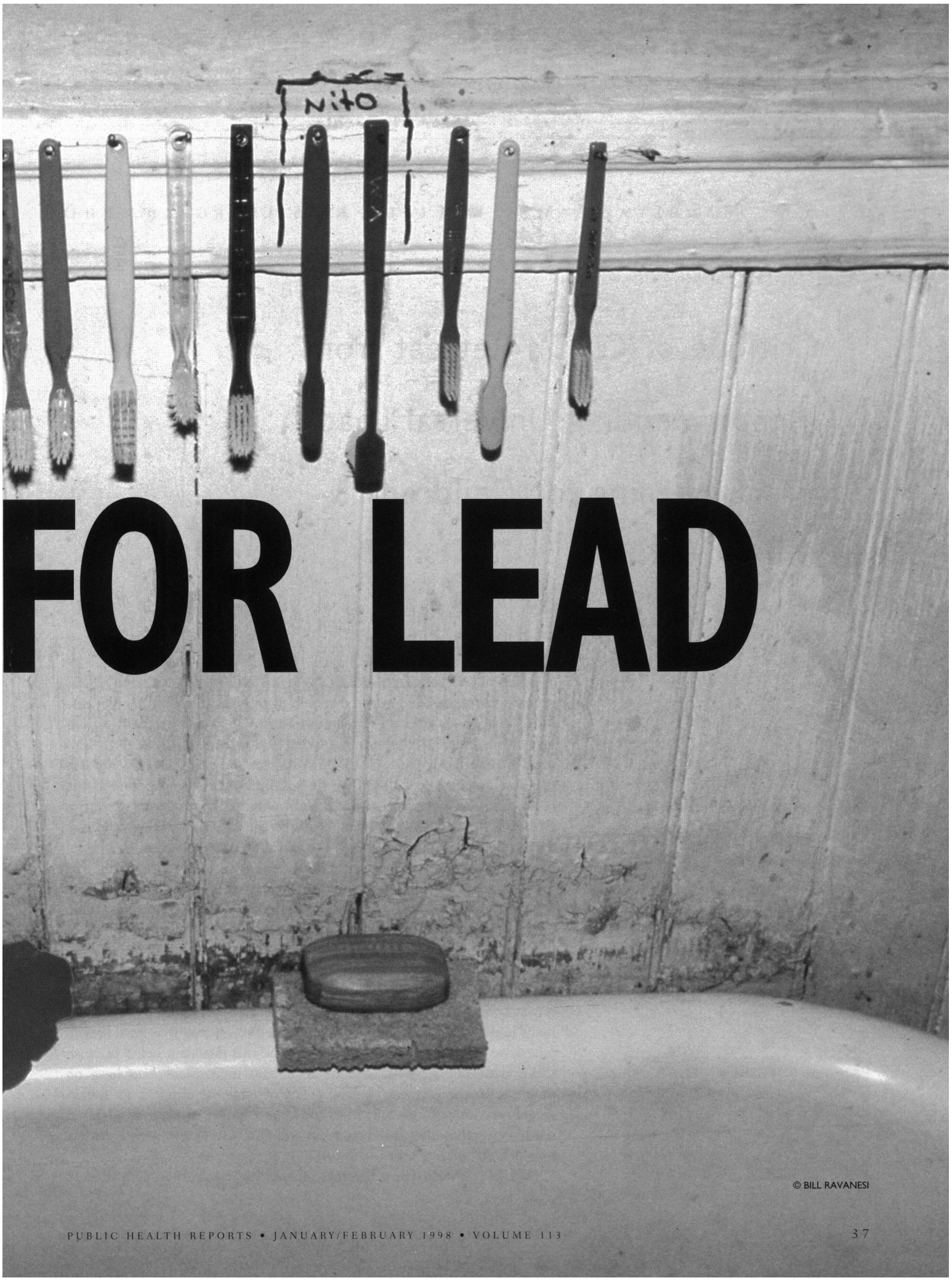
SCREENING



The Centers for Disease Control and Prevention have prepared new guidelines for screening children for lead poisoning, published in *Screening Young Children For Lead Poisoning: Guidance For State And Local Public Health Officials.* Eric Manheimer and Ellen Silbergeld of the University of Maryland submitted the following Viewpoint to *PHR*, finding fault with CDC's reasoning and recommendations. We asked Richard Jackson, the Director of CDC's Center for Environmental Health, to reply. He and his colleagues sent us a Counterpoint explaining and defending CDC's position on lead screening. The two arguments follow.



FOR LEAD

VIEWPOINT

ON LEAD SCREENING

ERIC W. MANHEIMER, MSc ■ ELLEN K. SILBERGELD, PhD

Critique of CDC's Retreat from Recommending Universal Lead Screening for Children

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THE CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC) recently recommended targeted screening of young children for elevated blood lead levels (BLLs), retreating from its 1991 endorsement of universal screening.[1] We believe that blood lead testing fulfills all of the criteria for an effective mass screening program and that CDC has not justified the change in policy. The uncertainties and complexities of the revised policy that targets only certain neighborhoods based on mean BLLs of the resident children, the average age of housing, and the demographic characteristics of the children will obstruct successful identification of lead-exposed children.

We believe CDC's argument that a policy of universal screening will squander resources in areas without a problem instead of focusing them on problematic areas is insupportable. Lead affects a large number of children, and, despite the public attention focused on this issue, not all children with elevated BLLs are currently identified.

CDC's earlier policy endorsed a default position—that every community is at risk for lead until proven otherwise. In contrast, the recent statement implies that communities are assumed to be lead-free until proven otherwise. Targeted screening will reinforce this mistaken belief because those areas not screened will be assumed—unjustifiably—to have no problem. In the end, the revised policy of targeting children in certain neighborhoods will not only miss the large number of exposed children not living in those neighborhoods but will also further ghettoize a disease to which all children are susceptible.

While controversial, screening for lead has rarely been subjected to

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review against established general criteria for screening. The U.S. Preventive Services Task Force defines screening as "those preventive services in which a test or standardized examination procedure is used to identify patients requiring special intervention."[2] Asymptomatic people are screened either to prevent the onset of a condition (primary prevention) or else to find the condition in a preclinical phase before easily detectable symptoms develop (secondary prevention). Each screening test must be evaluated individually to determine whether large-scale screening is the most cost-effective means of preventing disease.

To demonstrate the appropriateness of universal screening, we compare CDC's latest recommendations to criteria based on the World Health Organization's screening guidance. First, we will give a brief synopsis of the 1991 and 1997 CDC statements.

1991 Recommendations: Universal Screening

In 1991, CDC called for universal screening for elevated blood lead at one and two years of age unless children resided in neighborhoods without lead problems.[3] The statement asserted that "because almost all U.S. children are at risk for lead poisoning (although some children are at higher risk than others), our goal is that all children should be screened, unless it can be shown that the community in which these children live does not have a childhood lead poisoning problem. (Deciding that no problem exists requires that a large number of percentage of children be tested.)" The 1991 statement introduced five questions to distinguish between high and low risk children. (*See page* 42.) A child with at least one "yes" answer

"CDC's recent statement implies that communities are assumed to be lead-free until proven otherwise; targeted screening will reinforce this mistaken belief because those areas not screened will be assumed—unjustifiably—to have no problem."

was considered high risk. CDC recommended that all children not living in exempt areas be tested at least twice and children deemed high risk by the questionnaire be tested more frequently.

Under the 1991 CDC recommendations, children with borderline high blood lead—10 micrograms per deciliter (µg/dL) to 14 µg/dL—would be retested until the level declined or rose, at which point medical evaluation and nutritional and educational counseling would be implemented. The 1991 CDC statement stressed that at each pediatric visit the doctor should query parents about potential sources of lead exposure and in particular determine whether any new potential source of exposure had been introduced to the child since the last visit.

Recent unpublished CDC data indicate that since the call for universal screening, the proportion of U.S. children screened for lead has increased from 10% to only 20%. One recent study found that only 12% of pediatricians screened all patients and that 25% did not screen any.[4] Even in the Bronx, NY, an area with serious lead problems due to the age and poor repair of the housing stock, screening rates were no higher than 20% in 1993.[5]

We believe that reversing CDC's 1991 recommendations will either stabilize at currently low levels or reduce the level of screening for this devastating preventable disease.

1997 Recommendations: Targeted Screening

The revised statement issued by the CDC in 1997 is similar to the 1991 statement except that it recommends targeted rather than universal screening. In the 1997 statement, CDC recommends that each state devise and implement a screening and testing plan based on conditions in the state. Health officials may either promote a uniform screening requirement for the entire state or set requirements for different geographic areas or populations subsets within the state. Neighborhoods targeted for testing are to be chosen on the basis of housing age, demographic characteristics, and average BLLs.

To justify the new policy, CDC cited studies showing that universal screening has become less cost-effective as the prevalence of elevated BLLs has dramatically declined.[1] Political and economic pressures have helped drive the change in CDC policy. Many pediatricians and HMOs now oppose universal screening, ostensibly because the lead problem does not warrant it but more likely because under capitation payment systems, universal testing is more work with no additional compensation. We believe that a requirement for universal lead screening, as in the 1991 recommendations, meets a more objective and scientific standard.

Criteria for Effective Screening

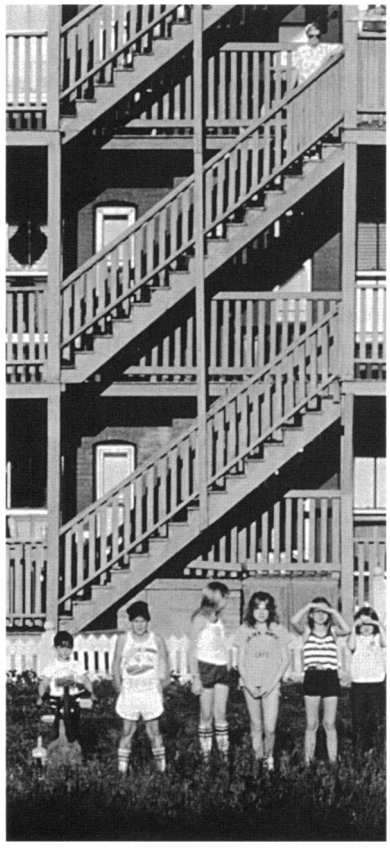
A mass screening test for a non-infectious disease may be considered effective if it satisfies criteria originally developed by the World Health Organization.[6] Screening for elevated BLLs satisfies each one.

First, the condition being screened for must be serious. Most states require newborn screening for congenital hypothyroidism because the consequences of this relatively rare condition, if left untreated—including retardation—are so severe and costly to society. Similarly, elevated lead levels are a serious threat to the health of all, especially young children.

At levels frequently detected in young children, blood lead has subtle yet serious effects. Levels as low as 10 µg/dL, once thought to be harmless, result in neurocognitive deficits.[3] Needleman et al. have shown that lead levels that resulted in no obvious clinical symptoms were nonetheless associated with lowered IQ scores.[7] This loss in IQ appears to be irreversible. In a reexamination of the

original cohort as young adults (ages 17 to 18), Needleman and his co-authors found that children with high tooth lead levels were more likely to have dropped out of high school (odds ratio [OR] = 7.0) and to suffer a reading disability as adults (OR = 6.0) than children with low levels of dentin lead.[8]

Although the average cognitive deficit due to elevated BLLs (five IQ points) is relatively small for an individual,[7] the effect on the population is an important one. Low-level lead exposure shifts the IQ distribution such that 16% of exposed children have severe IQ deficits—instead of 4%. This IQ shift also prevents 5% of children from achieving superior IQ scores.[9] In a recent study, Needleman and colleagues have shown that lead affects aggression and antisocial behavior in even more pronounced ways. Teachers and parents blinded to children's lead status reported high-lead subjects to be more aggressive, delinquent, and antisocial than low-lead subjects.[10]



Second, the condition being screened for must be treatable. All newborns are screened for phenylketonuria because it is treatable by withholding phenylalanine-containing foods from the child's diet. Those children not screened and untreated develop severe mental retardation. Similarly, children with elevated lead levels can be treated medically to reduce the body burden of lead, and the environment can be "treated" to reduce exposure.

The majority of elevated BLLs detected upon screening of U.S. children will be moderately elevated, between 10 µg/dL to 20 µg/dL, not requiring medical treatment.[11] For these children, nutritional and environmental interventions can help prevent or reduce further lead intake. A study by Kimbrough et al.[12] suggests that counseling parents about such interventions may reduce elevated BLLs. Among 490 children living near a lead smelter, 78 with the highest levels received a visit from a caseworker. The caseworker spent 30 to 45 minutes with the family in their home, educating the parents and children about how to avoid potential sources of lead. BLLs declined from a mean of 15 µg/dL to a mean of 8 µg/dL four months later and to 9 µg/dL one year later for those children receiving education. This study does not prove that counseling caused BLL reductions because there was no control group. Nevertheless, we believe it is self-evident that knowledge of elevated BLLs will translate into some risk-reducing behavioral changes.

Third, the condition must be detectable while asymptomatic and timely treatment must reduce morbidity and mortality more effectively than treatment after the appearance of symptoms. Cervical cancer can be detected an average of eight to nine years before it becomes symptomatic.[13] If caught early by Pap smear, these cancers can be treated successfully. However, if the disease is diagnosed through symptoms, treatment is less effective and the prognosis is poor.

Detecting a child with asymptomatic elevated BLLs and employing behavioral, environmental, and nutritional counseling is far better than waiting for symptoms of lead poisoning. Some children with elevated BLLs may develop serious lead poisoning if, because they have not been identified, exposure continues. A child with overt symptoms of lead poisoning, such as encephalopathy, is likely to suffer permanent, serious brain damage or even retardation.

Because cumulative exposure increases the severity of toxicity, immediate identification of children with even mildly elevated BLLs may prevent future effects such as reading disabilities, social problems, and employment difficulties. Screening may also identify environmental sources of lead and prevent others from being exposed.

Fourth, the screening test must be accurate. Accuracy comprises sensitivity, specificity, and positive and negative predictive value. Sensitivity is the proportion of those who correctly test positive among those being screened who truly have the condition. Specificity is the proportion of those being screened who correctly test negative among those who do not have the condition. Positive predictive value is the proportion who screen positive who truly have the condition, while negative predictive value is the proportion who screen negative who really do not have the condition.

Testing for fecal occult blood to detect colon cancer among an asymptomatic, low risk population is an example of a screen with low accuracy. The sensitivity of the test is only 25%, and the positive predictive value, a measure related to both the specificity and the prevalence of the condition, is only 5%. Thus, for every 20 people who initially screen positive and suffer the cost and anxiety of follow-up tests, only one will have colorectal cancer.

The test for elevated BLLs is highly accurate: a positive venous blood lead test almost certainly indicates, at minimum, low-level poisoning, and no expensive confirmatory follow-up tests are required. The U.S. Preventive Services Task Force, using unpublished CDC data, has reported that 80% to 90% of laboratories participating in proficiency testing programs had results of blood lead tests that were within 4 μg/dL of the actual level.[2] The CDC recommends that a venous blood lead test be used in screening rather than a simple finger prick. The latter is more prone to contamination—resulting in false positives if the child's hands are dirty—but acceptable if the testing personnel can show proficiency in following a standard protocol to prevent contamination.[6] To skirt problems of contamination, capillary blood from a finger prick may be tested first; if it is positive, the test will be repeated on venous blood.[14,15]

Fifth, the screening test must be acceptable to the patient and inexpensive. Sigmoidoscopy, more reliable than testing stools for occult blood to detect colorectal cancer, is highly specific yet may not be a valuable screen. There is no evidence it reduces mortality, patients and physicians avoid it, and the cost is high.

Sample questionnaire recommended by the Centers for Disease Control and Prevention for use in assessing the risk of high-dose exposure to lead, 1991

1. Does your child live in or regularly visit a house with peeling or chipping paint built before 1960? This could include a day care center, preschool, the home of a babysitter or a relative, etc.
2. Does your child live in or regularly visit a house built before 1960 with recent, ongoing, or planned renovation or remodeling?
3. Does your child have a brother or sister, housemate, or playmate being followed or treated for lead poisoning (that is, blood lead > 15 μg/dL)?
4. Does your child live with an adult whose job or hobby involves exposure to lead?
5. Does your child live near an active lead smelter, battery recycling plant, or other industry likely to release lead?

SOURCE: Reference 3

Both the capillary and venous blood lead tests pose little risk to patients. In young children, taking capillary blood is routine; drawing a venous sample is somewhat more difficult, but still a routine procedure. The cost of the blood lead test is lower than the cost of many other routinely used screening tests. For example, in Maryland, the blood lead test is reimbursable by Medicare at $17.18 while the prostate specific antigen (PSA) test to detect prostate cancer is reimbursed at $26.11, according to the Medicare Clinical Lab Fee Schedule Database, which sets standards that are often followed by insurance companies and managed care plans. Although more expensive than the blood lead test, the widely used PSA test has poor accuracy and is clearly not recommended as a screen.[2] Universal screening for BLLs would increase the volume of tests performed and further reduce the already low costs.

When discussing value, it is important to consider both test cost and follow-up cost weighed against the benefits of preventing future adverse outcomes. In retracting its endorsement of universal screening, CDC reasoned that the benefits of screening exceed the costs only when the prevalence of elevated lead levels in the community reaches 11% to 14%, based on a cost-benefit analysis published by Briss et al.[1]

This cost-benefit analysis by Briss et al. was flawed in two ways:

First, it omitted the cost of implementing alternative screening protocols. The 1997 CDC statement assumes that to determine which children and which regions should be screened, children will be evaluated by questionnaire and geographical areas by analysis of risk factor prevalence. These assessments will be expensive, and these costs must be included in any cost-benefit analysis.

Second, the analysis omits the increased risk that lead-exposed children pose to others. Briss et al. included lifetime earnings, reductions in special education costs, and primary prevention benefits as the health benefits of reducing elevated BLLs. Yet they failed to include the benefit of reduced crime: in a recent study, Needleman et al. found an association between elevated lead levels and delinquent behavior,[10] and we believe that delinquent children with elevated lead levels are likely to grow up to commit more serious crimes.

Using the Briss et al. cost-benefit analysis to set the criteria, the 1997 CDC statement would permit communities where up to 14% of children have elevated BLLs to go unscreened. For no other disease do we accept that high a rate of exposed individuals. How can we allow one child in seven with lead poisoning to go undetected?

Sixth, the condition must be sufficiently prevalent to warrant screening. Fifty million Americans, mostly adults, have high blood pressure. Most would benefit from monitoring or intervention. Screening is warranted because the prevalence is high.

CDC argues that declining U.S. prevalence favors the change to selective screening for lead. Federal regulations outlawing leaded gasoline and lead-based paint have abated exposures and lowered U.S. BLLs. We believe, however, that the prevalence of elevated BLLs remains sufficiently high to warrant universal screening.

The prevalence of elevated BLLs among all 1- to 5-year-old U.S. children has dropped from almost 90% in 1976–1980, as recorded in the Second National Health and Nutrition Examination Survey (NHANES II) to less than 5% for the most recent study, NHANES III, Phase 2 (1991–1994) (Table 1).[11] Though recent declines are impressive, the U.S. mean BLL is unlikely to continue to drop so rapidly. The removal of lead from gasoline, which was largely responsible for the recent decline in BLLs, was relatively easy to accomplish through regulation, but eradication of the remaining sources of lead will be more difficult. The primary source of lead exposure for children is house paint (almost 75% of occupied housing built before 1980 contains lead-based paint). Children ingest lead dust from decaying paint and contaminated soils and are also exposed through contact with lead used by parents at work or in a hobby.

LIMITATIONS OF TARGETED SCREENING

The recent CDC statement recommends that data on *(a)* children's BLLs, *(b)* the age of housing, *(c)* children's demographics, and *(d)* other sources of lead in the area be used to determine whether children in a given geographic area should be screened. In what follows, we describe the limitations of targeting testing to selected geographic areas.

Targeting by prevalence of elevated BLLs in a region. Area data on children's BLLs gauges the extent of the lead problem. However, because the 1991 universal screening recommendation was implemented slowly and screening rates have recently declined, we lack good information on mean BLLs for most regions. Continuation of universal screening

Table 1. Percentage of U.S. children ages 1–5 years with blood lead levels higher than 10 μg/dL, by year housing built and selected characteristics, National Health and Nutrition Examination Survey, Phase 2, 1991–1994

	Year housing built			*Total*
	Before 1946	*1946–1973*	*After 1973*	
Characteristic	*Percent with elevated blood lead levels*	*Percent with elevated blood lead levels*	*Percent with elevated blood lead levels*	*Percent with elevated blood lead levels*
Ethnicity				
Black, non-Hispanic	21.9	13.7	3.4	11.2
Mexican American	13.0	2.3	1.6	4.0
White, non-Hispanic	5.6	1.4	1.5	2.3
Income[a]				
Low	16.4	7.3	4.3	8.0
Middle	4.1	2.0	0.4	1.9
High	0.9	2.7	0.0	1.0
Urban status[b]				
Population ≥ 1 million	11.5	5.8	0.8	5.4
Population < 1 million	5.8	3.1	2.5	3.3
All children ages 1–5 years	8.6	4.6	1.6	4.4

[a]Income categories were defined using the poverty-income ratio (PIR, the ratio of total family income to the poverty threshold for the year of the interview): low-income was defined as PIR ≤ 1.300, middle-income as PIR 1.301–3.500, and high-income as PIR ≥ 3.501.

[b]Urban status was based on U.S. Department of Agriculture codes that classify counties by total population and proximity to major metropolitan areas; counties are divided into two categories: metropolitan areas with a population ≥ 1 million and metropolitan and nonmetropolitan areas with a population < 1 million.

SOURCE: Reference 11

Personal-risk questionnaire recommended by the Centers for Disease Control and Prevention as a starting point for use in identifying children in non-targeted neighborhoods who require testing, 1997

1. Does your child live in or regularly visit a house that was built before 1950? This question could apply to a facility such as a home day-care center or the home of a babysitter or relative.
2. Does your child live in or regularly visit a house built before 1978 with recent or ongoing renovations or remodeling (within the last 6 months)?
3. Does your child have a sibling or playmate who has or did have lead poisoning?

Screen all children whose parent/guardian responds "yes" or "don't know" to any question.

SOURCE: Reference 1

would allow the creation of a database on BLLs by area, making fact-based decisions possible, whereas targeted screening will limit the availability of information about regional prevalence. Without good information, public health officials cannot know which areas have the largest prevalence of elevated BLLs and target them for intensive intervention.

Targeting by prevalence of older housing in a region. If BLL data by region are not available, the new CDC statement advises that the need for screening be determined by the percentage of housing built before 1950. Because old paint is the greatest source of lead exposure in children, under the new guidelines more intensive screening efforts would target neighborhoods with older housing. Census data on the age of housing stock will be used to subdivide states into geographic areas by prevalence of pre-1950 housing and to decide whether all children within an area are to be screened. While feasible where older housing is highly localized, this scheme will be difficult to implement where older housing is scattered. Zip codes or Census tracts (the levels at which states are subdivided for screening purposes) may not be coterminus with the local health jurisdictions charged with screening and follow-up, thereby creating another possible obstacle to implementation of targeted screening programs. Further, as noted above, some providers and payers already resist screening. When targeted screening is implemented, we suggest that to maximize its effectiveness, CDC should publish a preliminary analysis of Census housing data along with a list of those areas requiring screening of all children, based on the age of housing.

Targeting by prevalence of high risk demographic populations. NHANES III found correlations between elevated BLLs and low income, black "race," and Hispanic ethnicity (Table 1).[16] Children from low-income families can be expected to have higher BLLs because they are more likely to live in dilapidated housing with peeling paint and deteriorating surfaces—shown to be a significant contributor to children's elevated lead levels.[17] Children from higher income families, however, are not immune to lead poisoning and are especially susceptible if they live in or near dwellings undergoing renovation.[14,18] Despite a prevalence of lead poisoning in young inner-city black children six times that of affluent white children,[17] to say that black children are *per se* at increased risk is wrong. As a group, they simply face greater environmental exposures, often due to industrial sources in addition to lead paint.

Lanphear et al. have shown that the difference between black and white children's BLLs can be explained by differential environmental exposure. Among a random sample of 200 children in Rochester, black children—who were found to have higher BLLs than white children—were much more likely to live in homes with elevated lead dust and with painted surfaces in poor condition.[19]

Using "race" and poverty as a marker for lead poisoning reinforces the stereotype that the problem exists only among poor, inner-city people of color, creating a false sense of security among higher socioeconomic status groups and generating little political pressure to tackle the problem, which is seen as afflicting less politically powerful groups. The result is a further delay of much-needed control efforts.

Targeting by prevalence of other risk factors. It is wise to include data on other potential sources of lead exposure (for example, pottery, folk remedies, cosmetics, drinking water, and industrial sources) when planning screening for an area. Areas near lead-containing Superfund sites and lead smelters deserve to be designated for across-the-board screening. But exposures due to less well characterized sources within a region are not a useful guide for screening decisions.

Use of a questionnaire to target high risk children. CDC recommends use of a personal risk questionnaire (*see*

"Children from higher income families are not immune to lead poisoning and are especially susceptible if they live in dwellings undergoing renovation."

page 44) to supplement regional assessments so that children at high risk of lead exposure will be screened even if they do not live in a geographic region in which all children are required to be screened. CDC suggests that one or more positive responses put a child in the high risk group.

Is the 1991 CDC questionnaire predictive of high risk? A recent study in Duluth found that children labeled low risk were as likely to have elevated BLLs as those labeled high risk.[20] Other studies have shown the questionnaire to have a sensitivity ranging from 69%[15,21,22] to 87%.[23] The negative predictive value of the studies ranged from 81%[21,22] to 99%[15,23] depending on the prevalence in the area studied (Table 2). These studies also found that the final three questions on the 1991 personal risk questionnaire would identify very few additional exposed children beyond those identified by the first two questions. Therefore, these three questions were eliminated from the questionnaire proposed in 1997.

The 1997 CDC questionnaire has demonstrated a moderate to high accuracy in epidemiologic studies, but it may not be successful in actual practice. Physicians, especially in HMOs may have little time to spend with each patient. Will these general practitioners and pediatricians make time in each visit to determine possible lead exposures for every child? The questionnaire does not include questions about possible symptoms that could be due to lead exposure (such as developmental delay, speech or language problems, behavioral disorders, or growth failure). Questions on symptoms would identify additional children with elevated BLLs and be a constant reminder to physicians and parents of the devastating effects of lead exposure.

CONCLUSION

The CDC has made a mistake in retreating from its excellent 1991 statement recommending virtually universal screening.

Table 2. Accuracy of the full 1991 CDC sample questionnaire and other lead screening questionnaires, as assessed by four studies

Author	*Questionnaire used*	*Lead levels*	*Sensitivity*	*Specificity*	*Positive predictive value*	*Negative predictive value*
Schaffer et al.	Full 1991 CDC questionnaire	≥10 µg/dL	0.70	0.49	0.35	0.81
	Full 1991 CDC questionnaire	≥15 µg/dL	0.82	0.46	0.12	0.97
Binns et al.	Full 1991 CDC questionnaire	≥10 µg/dL	0.69	0.70	0.05	0.99
	Illinois questionnaire	≥10 µg/dL	0.72	0.64	0.04	0.99
Tejeda et al.	Full 1991 CDC questionnaire	≥10 µg/dL	0.87	0.75	0.21	0.99
	Abbreviated 1991 CDC questionnaire[a]	≥10 µg/dL	0.87	0.77	0.22	0.99
Rooney et al.	Full 1991 CDC questionnaire	≥10 µg/dL	0.77	0.37	0.07	0.97
	Community-specific questionnaire[b]	≥10 µg/dL	1.00	0.42	0.09	1.00

NOTE: See reference 3 for 1991 CDC sample questionnaire and references 21 (Schaffer et al.), 15 (Binns et al.), 23 (Tejeda et al.), and 22 (Rooney et al.).

[a]This questionnaire retained only the two questions concerning the home environment.

[b]This questionnaire was developed to maximize sensitivity and negative predictive value in this population.

The 1997 statement implies that communities are assumed to be lead-free until proven otherwise. Unquestionably, the most important goal is to ensure that those children with the highest BLLs are screened. However, the argument that universal screening will squander resources in areas without a problem instead of focusing them on problematic areas is insupportable. Lead is ubiquitous in the environment; no socioeconomic, ethnic, or geographic group of children is immune to its effects, and no lower threshold for its neurotoxicity has yet been identified. In short, lead is the greatest environmental threat to children in the United States.[24]

The economics and politics of lead poisoning increase the likelihood that children with elevated BLLs will go undetected and unprotected under the new CDC recommendations. Lead poisoning is predominantly—although not exclusively—a disease of poor children, whose limited buying power leaves both the pharmaceutical and medical supply industries and medical care providers unenthusiastic.

The consequences are already visible. The manufacturer of the newest lead chelator has recently stopped production. Industrial research on new detection and treatment methods is at a low level. Because the potential return on investment in research and development for the pharmaceutical and medical supply industries is uncertain in the context of a changing policy on screening, it is even less likely that new agents and devices will be developed.

Pediatricians, usually advocates for children, are not overly supportive of lead screening. They fail to recognize the seriousness of elevated BLLs[3] and seem reluctant to devote the time and resources required for screening.[13] How can we expect public health officials, the only remaining advocates for poor children to prevail, when CDC, the nation's leading public health agency, has retreated from universal screening and retreated from protecting children from lead, their greatest environmental threat?

References

1. Centers for Disease Control and Prevention (US). Screening young children for lead poisoning: guidance for state and local health officials. Atlanta: Department of Health and Human Services; 1997.
2. Preventive Services Task Force (US). Guide to clinical preventive services. 2nd ed. Alexandria (VA): International Medical Publishing; 1996.
3. Centers for Disease Control (US). Preventing lead poisoning in young children: a statement by the Centers for Disease Control. Atlanta: Department of Health and Human Services (US); 1991.
4. Bar-on ME, Boyle RM. Are pediatricians ready for the new guidelines on lead poisoning? Pediatrics 1994;93:178–82.
5. Fairbrother G, Friedman S, DuMont KA, Lobach KS. Markers for primary care: missed opportunities to immunize and screen for lead and tuberculosis by private physicians serving large numbers of inner-city Medicaid-eligible children. Pediatrics 1996;97:785–90.
6. Wilson JMG, Jungner G. Principles and practice of screening for disease. Public Health Papers No. 34. Geneva: World Health Organization; 1968.
7. Needleman HL, Gunnoe C, Leviton A, Reed R, Peresie H, Maher C. Deficits in psychological and classroom performance of children with elevated dentine lead levels. N Engl J Med 1979;300:689–95.
8. Needleman HL, Schell A, Bellinger D, Leviton A, Allred EN. The long-term effects of exposure to low doses of lead in childhood. N Engl J Med 1990;322:83–8.
9. Needleman HL. The current status of childhood lead toxicity. Adv Pediatr 1993;40:125–39.
10. Needleman HL, Riess JA, Tobin MJ, Biesecker GE, Greenhouse JB. Bone lead levels and delinquent behavior. JAMA 1996;275:363–9.
11. Brody DJ, Pirkle JL, Kramer RA, Flegal KM, Matte TD, Gunter EW. Blood lead levels in the US population: Phase 1 of the Third National Health and Nutrition Examination Survey (NHANES III, 1988 to 1991). JAMA 1994;272:277–83.
12. Kimbrough RD, LeVois M, Webb DR. Management of children with slightly elevated blood lead levels. Pediatrics 1994;93:188–91.
13. Centers for Disease Control and Prevention (US). Clinician's handbook of preventive services. Washington: Department of Health and Human Services; 1994.
14. Nordin JD, Rolnick SJ, Griffin JM. Prevalence of excess lead absorption and associated risk factors in children enrolled in a midwestern health maintenance organization. Pediatrics 1994;93:172–7.
15. Binns HJ, LeBailly SA, Poncher J, Kinsella R, Saunders SE. Is there lead in the suburbs? risk assessment in Chicago suburban pediatric practices. Pediatrics 1994;93:164–71.
16. Update: blood lead levels—United States, 1991–1994. MMWR Morb Mortal Wkly Rep 1997;46:141–6.
17. Lanphear BP, Weitzman M, Winter NL, Eberly S, Yakir B, Tanner M. Lead-contaminated house dust and urban children's blood lead levels. Am J Public Health 1996;86:1416–21.
18. Children with elevated blood lead levels attributed to home renovation and remodeling activities—New York, 1993–1994. MMWR Morb Mortal Wkly Rep 1997;45:1120–3.
19. Lanphear BP, Weitzman M, Eberly S. Racial differences in urban children's environmental exposures to lead. Am J Public Health 1996;86:1460–3.
20. Bronson MA, Renier CM. The location of residence as a basis for childhood lead poisoning screening programs [letter]. Am J Public Health 1995;85:589–90.
21. Schaffer SJ, Szilagyi PG, Weitzman M. Lead poisoning risk determination in an urban population through the use of a standardized questionnaire. Pediatrics 1994;93:159–63.
22. Rooney BL, Hayes EB, Allen BK, Strutt PJ. Development of a screening tool for prediction of children at risk for lead exposure in a midwestern clinical setting. Pediatrics 1994;93:183–7.
23. Tejeda DM, Wyatt DD, Rostek BR, Solomon WB. Do questions about lead exposure predict elevated lead levels? Pediatrics 1994;93:192–4.
24. Centers for Disease Control (US). Strategic plan for the elimination of childhood lead poisoning. Atlanta: CDC; 1991. ■