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Lead hazard is 'ubiquitous' in substandard housing

Potentially toxic levels of lead have been found on the walls of deteriorating dwelling units in every area of the country.

In fact, a recent NEW survey shows "the presence of high lead (content) paint on the walls was as ubiquitous as to be unproductive of elevated blood lead values, regardless of man." This would render a "housing-based" detection program meaningless and therefore a "child-based" program is essential. Roger A. Challop, MD, said in reporting on the survey at a joint meeting of the American Pediatric Society and the Society for Pediatric Research.

Dr. Challop described the survey, which was designed to assess the incidence of elevated blood lead levels in specific high-risk neighborhoods of 37 cities (see map), as one of the largest in terms of geographic representation. He and his colleague Edward B. McCabe, MD, tried to select cities without any lead poisoning detection programs, cities that "may not have had the resources, level of suspicion, or technical expertise to look for lead poisoning that some of the larger, 'lead-belt' cities had."

The study was aimed at children 1 to 6 years old who lived in substandard housing built before 1940. There are now 7.5 million such houses in the United States, he added.

A total of 2,309 children—50 to 150 each from cities as diverse as Harrisburg, Pa., Lexington, Ky., Albuquerque, NM, and Sacramento, Calif.—were tested by the anodic stripping voltammetry method (finger stick technique). The results in a representative sample were confirmed by the Chelator atomic absorption spectrophotometry method (venipuncture technique).

Nine percent (211) of the children had blood lead levels $\geq 40 \mu\text{g}/100 \text{ ml}$, and all but four of the cities had at least one child with elevated blood lead levels. The 9% figure is lower than that reported in previous studies, Dr. Challop explained, because he counted only those children he returned to confirm the initial screening results by the venipuncture method.

Also, he selected cities where there had been few if any lead poisoning cases reported and no previous lead detection activities. Among the cities with the highest incidence of elevated levels were Charleston, SC, and Harrisburg, with 41.6% and 33.1% respectively of those tested having high blood lead levels.

"Even more alarming," commented Dr. Challop, "is the extent of the problem in the housing units tested." Out of the 289 dwelling units surveyed, 73.1% had at least one easily accessible interior surface with elevated lead levels.

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wall with a very high lead concentration of at least 2 mg sq cm of wall surface. Significant, but borderline, levels of 1 or 2 mg sq cm were found in another 14% of the houses. "If exterior surfaces were included, over 55% of the houses tested had at least one accessible surface that could be chipped or chewed that contained high amounts of lead."

High lead levels were found on wall surfaces in every one of the cities surveyed. At least 48% of the houses tested in each city had high levels on interior walls. Dr. Chalup, and Dr. McCabe, both pediatric consultants to the CPHH, concluded: "As long as there are pre-World War II houses, with poor children living in them, the potential for lead poisoning exists."

The homes of most of the children were tested, too. A portable wall analyzer was used to measure the lead content of paint on interior and exterior surfaces. In most old housing, Dr. Chalup said, the lead content was in excess of 10%, or 2 mg/sq cm. In other words, a child who eats a paint chip the size of an adult's finger nail every day for three months, would build up a blood lead level of at least 40 µg/100 ml.

Out of the 2,300 children tested, 94% were under 5 years old and 51% were black. Although the amount of flaking paint, the incidence of paint with high lead levels, and the number of children with a history of pica were similar for both black and white children, they differed sharply with regard to actual blood lead levels. While 18.7% of the non-black children had elevated levels (above 40 µg/100 ml), 22.9% of the blacks did. "Cultural or genetic factors in addition to poorer housing conditions may account for this difference," Dr. Chalup said.

There was no statistically significant correlation between elevated blood lead levels and the presence of loose, flaking paint or elevated levels and the parent's negative response to the question about a history of pica. It is obvious, Dr. Chalup said, that "susceptibility to high lead paint per se does not guarantee the elevation of blood lead levels in children."

Nor do high blood levels automatically mean the child will suffer neurological damage. In fact, Dr. Chalup stressed that all children with a positive test in their survey were asymptomatic. Their parents and physicians thought they were healthy and reported nothing at all. Even in children with confirmed lead poisoning (around 60 µg/100 ml), for example in a child hospitalized for treatment but without seizures or encephalopathy, "we wouldn't expect to see any symptoms, or any difference in IQ tests between those with over 60 µg/100 ml and those with under 40 µg/100 ml. The big question, of

course, is what happens to kids who are exposed to high blood lead levels over a long period of time."

To get a lead poisoning survey team from the Bureau of Community Environmental Management to come to a town, city officials had to agree to follow certain guidelines spelled out in the protocol for this pilot project. All children with lead levels above 40 µg/100 ml had to be retested by the venipuncture method and treated, if necessary, without regard to their ability to pay. Also, their dwellings were to be repaired or the families were to be moved to safe housing.

So far, local physicians have treated 30 children found during the survey to have elevated lead levels (about 60 µg/100 ml or higher). Another 13 children diagnosed as the result of the publicity generated by the survey in the local community, have been diagnosed and treated. Some 40 children have been released or their homes repaired. Ninety percent of the cities studied have gone on to apply for grants from the Bureau of Community Environmental Management in order to establish their own lead poisoning programs.

Dr. Chalup hopes to establish a private pediatric practice in a low socioeconomic area of New York City.

Blood lead test designed for mass screening

A mass screening technique for detection of lead poisoning seems to be just around the corner.

Several investigators are reporting encouraging results with tests that require only a prick of the finger to draw blood and a few minutes to obtain a reading.

The more reliable and most widely accepted method of measuring blood lead levels has called for venipuncture to get the required 5 to 10 ml blood and for highly skilled technicians to collect and process the samples.

Now, investigators at the Analytical Toxicology Laboratory of the New York State Department of Health have developed a new test which they claim is just as accurate and far better suited to automation than the conventional venipuncture technique. Instead of 10 minutes per test, processing takes only 3½ minutes from start to finish—from opening the carton containing the sample to reading the results.

For greater accuracy during preliminary evaluation of the method, each blood sample is being tested four times and the results are averaged, but this adds only 50 seconds to the processing time.

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The specially designed atomic absorption spectrometer can process 340 samples an hour (60 an hour if processed in quadruplicate). Eventually, the investigators plan to process each sample only two or three times.

In an interview with JAMA Medical News, Douglas Mitchell, PhD, pointed out that results with the vaporization method may vary by as little as 5% or as much as 15%, depending on the laboratory. In his own laboratory, where each vaporization sample is processed three times, the standard deviation is 6%, or even 4% "if we're very careful."

So said he can achieve the same level of accuracy with the micro-technique by dividing the sample into four parts, processing them separately, and then averaging the results. If processed only once, the margin of error is about 8%. Compared to other micro-techniques, he added, the new test is "at least as accurate as the best results that have been reported to date."

Dr. Mitchell's method, involving direct measure-

ment of the blood lead concentration, is actually a modification of the DeVoies Cup procedure. Fifty microliters of blood are diluted with a detergent solution and dispensed into four nickel cups. The samples are dried in an oven and fed into a spectrometer to obtain a reading. The investigator reported that a number of quality controls are built into the system to eliminate, for example, "wild" readings resulting from contamination by lead-containing dust particles.

For field trials in Albany and Westchester counties, blood samples are now being collected and shipped to Dr. Mitchell's laboratory in Guilderland, NY. Although both the vaporization test and the new micro-technique are now being used to determine the blood lead levels of the samples, Dr. Mitchell says, he plans to phase out the slower, more complicated method within the next two months.

Working with Dr. Mitchell, who is director of the laboratory, is Kenneth Alden, PhD, senior research scientist.

New test measures lead levels indirectly

Another—indirect—method of determining blood lead levels has been worked out by investigators at New York University. The simple, reliable test costs less than two cents for materials and also requires only a prick of the finger. Even an inexperienced technician can process 500 tests a day, George Pinnell, MD, reported at a joint meeting of the American Pediatric Society, Inc. and the Society for Pediatric Research.

His technique is based on the measurement of free erythrocyte protoporphyrin (FEP) in red blood cells. The concentration of free protoporphyrin increases in proportion to the amount of lead in the blood, because the lead interferes with hemoglobin synthesis in the bone marrow. Dr. Pinnell modified conventional methods of measuring the FEP concentration because they were far too cumbersome for mass screening.

His test requires only 50 µl of blood and can be processed in just one minute. Almost anyone can collect the specimen, he noted. After pricking the finger, a tiny amount of blood is dripped onto a piece of the same filter paper used for PPK testing in newborns. The paper is allowed to dry for a few minutes and then can be sent to a laboratory for processing. Alternatively, the blood specimen can be put directly into a test tube containing 100 µl saline and a trace of citrate. A mixture of ethyl acetate and acetic acid is added. After agitation and centrifugation, the supernatant is mixed with hy-

drochloric acid and then read in a spectrophotometer at an excitation wave length of 405 mµ and emission wave length of 615 mµ. The concentration of free erythrocyte protoporphyrin is expressed in µg/100 ml of red blood cells (RBC).

The investigators have tested 8,000 blood samples with lead content already measured in the conventional way. (One-half of the samples had levels over 40 µg/100 ml.)

All individuals with blood lead levels over 40 µg/100 ml and 75% of those with levels between 30 µg and 40 µg/100 ml have FEP levels of at least 80 µg/100 ml RBC. However, only 7% of those with blood lead levels below 40 µg/100 ml have an FEP level of 80 µg. "The clinical significance of blood lead levels above 40 µg but below 60 µg is uncertain," Dr. Pinnell admitted. Nonetheless, all samples with blood levels over 40 µg/100 ml were clearly identified by their increased FEP content.

He said one of the FEP test "should allow every child in this country between one and six years of age to be tested for exposure to lead and should contribute greatly to the eradication of lead poisoning with the associated unnecessary loss of human lives and severe neurological sequelae."

Working with Dr. Pinnell, professor of pediatrics and director of pediatric hematology at NYU, is Bernard Davidson, MD, assistant commissioner of laboratory services New York City Department of Health.