

Prevention of Lead Paint Poisoning Among Baltimore Children

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THE BALTIMORE CITY Health Department was one of the first municipal agencies to recognize the problem of lead poisoning in children resulting from pica associated with flaking and peeling paint (1). The department demonstrated its concern by a continuous and evolutionary program aimed at the detection and prevention of this malady (2).

History of Program

Since 1935, as an aid in diagnosis, the bureau of laboratories of the department has provided a free service to physicians and hospitals for the quantitative determination of lead in blood (3). The resultant followup in the field and the heightened interest on the part of the pediatric services of the city's large hospitals enabled the department to acquire relatively accurate morbidity data. From 1956 through 1964 there were 540 clinically diagnosed cases of lead paint poisoning (plumbism) and 797 cases of abnormal lead absorption among Baltimore children, or a total of 1,337 cases.

All the clinically diagnosed cases of lead poisoning were investigated as were all instances of abnormal absorption of lead as evidenced by a blood level exceeding 0.06 mg. of lead per 100

grams of blood. The homes of patients were visited, and paint samples obtained for testing from surfaces accessible to the affected children. The owners were required to remove paint from the indicated areas (2).

In 1949 a public health nurse was assigned to the department's bureau of industrial hygiene to investigate reported instances of abnormal absorption of lead in young children and to insure compliance in the removal of the offending paint (4). Preventing a recurrence of the disease was deemed especially important as there is a highly significant correlation between second attacks of encephalopathy and severe permanent brain damage (5).

Pamphlets designed to highlight the problem were used by public health nurses and sanitarians in clinics and in their home visits. Information on lead paint poisoning was mailed periodically to physicians and hospitals. Exhibits and other visual aids were shown at various meetings and in public buildings. Newspapers, regional trade periodicals, medical and public health publications, and radio and television programs all were used to inform the public of the serious consequences attending the ingestion of lead paint by children.

The first effort toward legislative control of the problem was the adoption in 1951 of a regulation, under the ordinance on the hygiene of housing, that prohibited the use of paint containing lead pigment in the interior of dwellings (6). This was followed in 1958 by an ordinance requiring a warning label on paints containing more than 1 percent of lead and stating that the paint contained lead; was harmful if eaten;

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should not be applied to the interior of dwellings or to toys, cribs, or other surfaces of potential hazard; and prohibiting any indication on the label that the paint was suitable for use on interior surfaces of homes (7).

In 1956 the commissioner of health organized the lead paint poisoning prevention committee, composed of staff members directly concerned with the problem (8). Initially used in an advisory capacity, the committee progressively assumed a more dominant role in planning and directing programs for prevention of the disease.

During 1957, in order to assess the prevalence of lead paint in Baltimore homes and with a view to its possible removal as a preventive measure, the committee conducted a survey in 100 blocks of dwellings (9) randomly selected for lead paint sampling by a rapid screening test devised in the bureau of laboratories (10). Lead in excess of 1 percent in paint was detected in 70 percent of 667 dwelling units. In the same year public health nurses collected paint scrapings from 300 homes of indigent persons on medical care. Positive tests for lead were obtained in scrapings from 58 percent of the homes.

Only a few paint samples were taken from each dwelling in the survey. A limited study by the bureau of industrial hygiene indicated a 98 percent probability of homes with positive findings of lead paint if more extensive paint samplings were collected. It was also demonstrated that in approximately 71 percent of the homes where enforced removal of lead paint had been required as a consequence of lead absorption, the family had vacated the dwelling unit for various reasons in less than a year.

While urban renewal and the reformulation of paints could be expected to reduce the amount of lead paint in homes, it was assumed that the presence of lead paint in older homes would continue to be a problem for many years. Thus in 1961 the possible extension of enforcing paint removal in those census tracts having the highest incidence of plumbism was suggested.

The following is an estimate of the health department personnel that would be needed to effect the removal of lead paint from 1,000 dwelling units.

<i>Operation</i>	<i>Man-days per 1,000 units</i>
Initial inspections (5 per man per day)-----	200
Reinspections (7 per man per day of the 90 percent found positive)-----	129
Second reinspection (70 percent of positives)--	90
Third reinspection (20 percent of positives)----	26
Additional reinspections including court appearances (5 percent of positives)-----	9
Followup after court action (2 percent of positives) -----	26
Total -----	480

Enforcing the removal of paint requires much more inspection time than most housing law-enforcement procedures. Added to the usual problem of repeated callbacks to gain access to all dwelling units in a structure is the time required to carefully scrape paint from several surfaces in each room of the dwelling.

Since the average sanitarian works 225 days each year, 2.1 sanitarians per year for 1,000 dwelling units, or 155 sanitarian-years, would be required to effect removal of lead paint from the 73,726 dwelling units in the 44 census tracts of Baltimore that showed 10 or more cases of lead poisoning or abnormal lead absorption in children from 1956 through 1962. Comparing this manpower requirement with the total of 64 people on the sanitarian staff assigned to all sanitary surveillance activities of the city showed the economic unfeasibility of this approach to the prevention of lead paint poisoning.

Hard-Sell Educational Plan

In view of the information that we have outlined and on recommendation of the director of sanitary services, the lead paint poisoning prevention committee decided to formulate a "hard sell" educational pilot study. It would be directed to parents and others responsible for the care of children under 4 years of age who were living in selected census tracts of the city where a high potential existed for lead paint poisoning. Early in 1962 the committee adopted a plan for a 3-year intensive education effort with a person-to-person approach. The effectiveness of the project was to be measured in terms of the combined total of diagnosed cases

of lead paint poisoning and elevated lead levels in the blood. This total was considered to be a more accurate index of affected children than the fewer number of clinically diagnosed cases of plumbism.

Project plan. Three pairs of like socioeconomic census tracts were selected. Each pair of tracts had similar experience with lead intoxication of children from 1956 through 1961 (table 1). One census tract of each pair was designated for action, and the other served as a control.

To maintain continuous rapport with the parents of susceptible children, the committee decided to delegate the fieldwork to a single person with the necessary personality, academic preparation, and experience in housing inspection. A sanitarian with these qualifications was assigned exclusively to the project. He was required to obtain basic demographic information as well as data relating to attendance at health department clinics—an index of parental responsibility—and to ascertain the educational level of the heads of households in those dwelling units housing children under 4 years of age.

Course of project. The study was launched in May 1962. Since no reliable data were available for locating or identifying the susceptibles, it was necessary to visit each house and each family on a block-by-block tour. The same operation was repeated on subsequent rounds since there was no means of knowing which families had moved. During the study, 1,517 families with children under 4 years of age were interviewed in the study tracts.

Painted surfaces accessible to children were inspected in the presence of the persons charged with their care. The same persons were instructed in the dangers of lead paint poisoning and its adverse sequelae, for the purpose of improving the environment and the psychological control of susceptible children. A leaflet on lead paint poisoning in children was discussed and left for further study. After appraising the educational level in the study area, a simpler illustrated leaflet was prepared. The hard-sell program consisted of five visits by the sanitarian at 6-month intervals and six letters sent between visits to remind parents of the dangers of lead paint poisoning.

Results

In 1962, the first year of the program, 7 children (4.1 per 1,000) in the study tracts were affected as compared with 12 children (5.8 per 1,000) in the three control tracts. The only abnormal elevations of lead in children under 4 years of age in the study tracts, subsequent to the investigator's visit, were two cases detected as a consequence of an interview in which a visit to the clinic had been urged.

A marked contrast in the attack rate between control (7.7 per 1,000) and study tracts (2.9 per 1,000) was noted in 1963. Of the five blood-lead elevations that were detected in the study tracts three occurred before a visit and two after three visits.

In 1964, the third year of the hard-sell program, no elevations of lead were reported from study tract A or its control, B. Only one was reported from another study tract, E, and this as a consequence of a visit; its control, F, showed 6 cases. Study tract C, however, showed 10 blood-lead elevations (16.3 per 1,000) of which 4 were clinically diagnosed as plumbism. None were found in its control tract, D. For nine positive findings, there were one to five educational visits.

Although a high degree of mobility among residents in the study tracts had been anticipated, the actual instability of the population proved to be much greater than expected. Only a third of the families remained in residence for the entire program, which greatly diminished the opportunity for repetitive hard-sell mes-

Table 1. Lead poisoning cases in selected census tracts of Baltimore, 1956-61

Census tract	Combined cases ¹	Combined rates ²
Study A.....	20	7.6
Control B.....	19	7.8
Study C.....	31	8.9
Control D.....	35	8.7
Study E.....	31	7.8
Control F.....	46	7.8

¹ Including elevated lead levels.

² Per 1,000 children under 4 years of age, based on 1960 census.

sages. Table 2 indicates the number of visits to each of the families that were found to be living in the three study tracts at the end of the program. From 21.3 to 24.4 percent of the families in the study tracts received only one visit, which indicated that they had moved into the study tracts within the preceding 6 months.

Discussion

During this study (1962-64) a combined total of 23 cases of plumbism and elevated blood-lead levels occurred in the three census tracts designated as the study area. The annual average rate was 4.5 per 1,000 children under 4 years of age. A combined total of 34 cases occurred in the three control tracts, with an annual average rate of 5.4 per 1,000 children under 4 years of age (table 3). Compared with the previous experience in the study and control tracts, no significant reduction in lead paint poisoning in the action area can be demonstrated. The chart shows a pattern of wide annual fluctuations from 1956 through 1964 that make a short-term interpretation of trends difficult. The educational hard-sell program apparently did not materially alter the already established trends.

The possibility was explored that a heightened awareness and aroused parental concern

Table 2. Number of visits to the 786 families residing in Baltimore study census tracts at end of program, 1964

Visits per family	Number of families	Percent of total families
Study tract A.....	201	
1.....	49	24.4
2.....	50	24.9
3.....	34	16.9
4.....	9	4.4
5.....	59	29.4
Study tract C.....	284	
1.....	62	21.8
2.....	55	19.4
3.....	38	13.4
4.....	28	9.8
5.....	101	35.6
Study tract E.....	301	
1.....	64	21.3
2.....	61	20.3
3.....	48	15.9
4.....	15	5.0
5.....	113	37.5

Table 3. Average rates¹ for clinically diagnosed cases of plumbism and elevated levels of lead in the blood, by study and control census tracts of Baltimore, 1956-64

Census tract	Average rates		
	1962-64	1959-61	1956-58
Study A.....	0.8	6.8	8.4
Control B.....	1.6	7.8	7.1
Study C.....	10.9	10.9	6.0
Control D.....	4.0	11.5	6.0
Study E.....	1.0	4.5	10.9
Control F.....	8.1	10.8	4.8
All study.....	4.5	7.4	8.5
All control.....	5.4	10.4	5.6

¹ Per 1,000 children under 4 years of age.

Table 4. Number and rate¹ of children in study and control census tracts from whom specimens were taken for blood-lead test, Baltimore, 1961-64

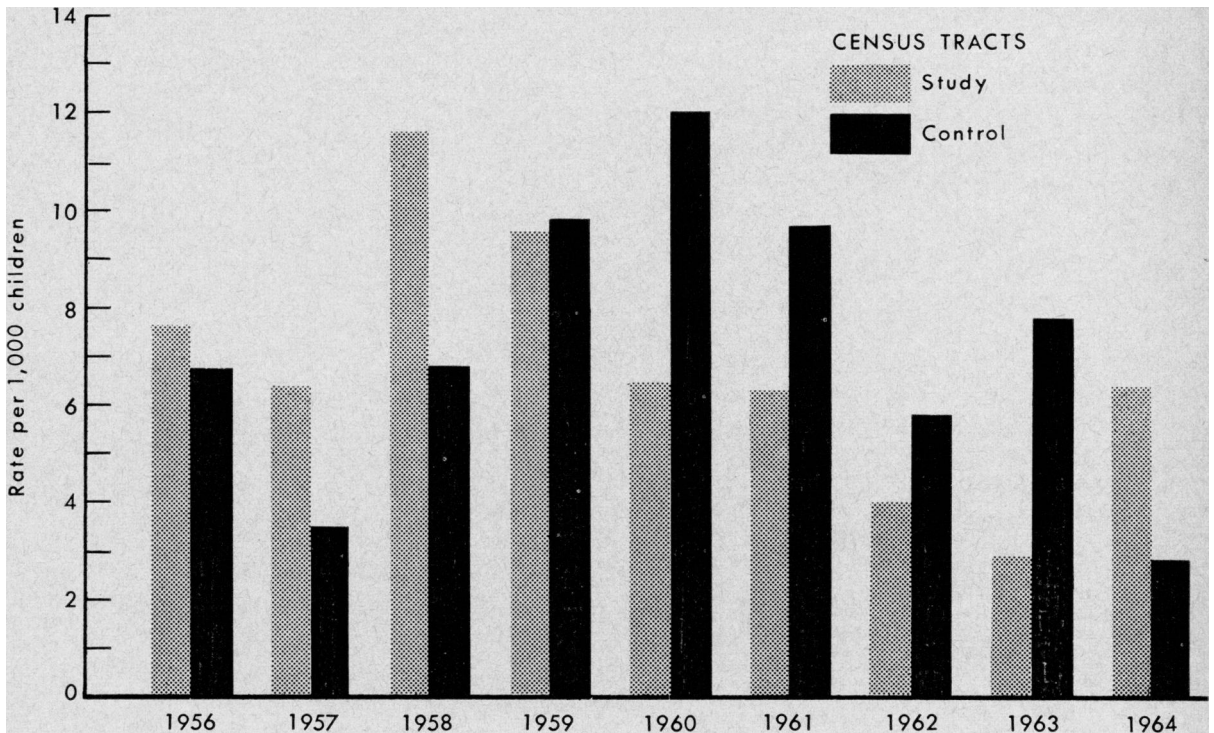
Year	Study tracts		Control tracts	
	Number	Rate	Number	Rate
1961.....	45	26.2	49	23.5
1962.....	45	26.2	28	13.4
1963.....	39	22.7	45	21.6
1964.....	44	25.6	33	15.9

¹ Per 1,000 children under 4 years of age, based on 1960 census.

occasioned by the sanitarian's visits would be reflected in an increased number of blood-lead tests in children residing in the study areas. This supposition was found to be generally valid (table 4) when the data were corrected for frequency of blood-lead tests per 1,000 children under 4 years of age residing in the respective census tracts.

The possibility was examined that earlier discovery of children with elevated blood-lead values would be accompanied by a reduction in clinically diagnosed plumbism. From 1962 through 1964 there were 18 (2.9 per 1,000 per year) diagnosed cases of plumbism reported from the control tracts as compared with 9 (1.7 per 1,000 per year) in the study tracts subjected

Average annual rates for total cases of lead paint poisoning and elevated blood-lead levels per 1,000 children under 4 years of age, all study and control tracts, Baltimore, 1956-64



to intensive education. However, when the data were compared with the attack rates experienced during the two 3-year periods preceding the study (table 5), again it was apparent that the educational program did not alter the already established trends.

Summary and Conclusions

An intensive "hard sell" program was conducted in Baltimore during 1962 through 1964 to prevent lead paint poisoning in three census tracts of the city. The primary emphasis was on home visits by a sanitarian and personal communication with the person caring for the child.

It was impossible to demonstrate statistically that the program reversed the trends either of clinically diagnosed plumbism or abnormal absorption of lead in children under 4 years of age. During the 3-year program, the average annual rate of diagnosed lead poisoning and elevated blood-lead levels among children under 4 years of age was 4.5 per 1,000 in the study area and 5.4 in the control area. During the preceding

3-year period, the average annual rate had been 7.4 in the study area and 10.4 in the control area.

The limited success of the hard-sell program apparently would not justify its citywide expansion with relatively costly professional personnel on a full-time basis for home instruction.

Table 5. Average rates¹ for clinically diagnosed cases of plumbism in the study and control census tracts of Baltimore, 1956-64

Census tract	Average rates		
	1962-64	1959-61	1956-58
Study A.....	0.0	1.4	3.9
Control B.....	.7	3.1	.7
Study C.....	4.4	2.8	4.4
Control D.....	2.5	4.0	2.5
Study E.....	.4	1.9	7.0
Control F.....	4.1	3.0	1.7
All study.....	1.7	2.2	5.2
All control.....	2.9	3.4	1.8

¹ Per 1,000 children under 4 years of age.

The educational procedure would appear to have possible application to community-centered projects such as poverty programs, where area workers in frequent contact with residents could be trained by their health departments to include education on the prevention of lead paint poisoning as part of the routine family visits. Such education would have its greatest effect in large-scale programs, where the highly mobile population would not be lost as people move from place to place within the general area.

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