

Lead Poisoning in Children in New York City, 1950-1954

An Epidemiologic Study

MARY CULHANE MCLAUGHLIN, M.D., M.P.H., JAMAICA, NEW YORK

(From the Jamaica Health Center, New York City Department of Health)

IN RECENT years lead poisoning in young children as a result of eating paint containing lead has become increasingly more prevalent, so that now it has become an important cause of mortality from poisoning in children. For many years the problem has existed in New York, but because of poor morbidity reporting and lack of diagnosis, the size of the problem could never be ascertained. Many times the diagnosis was made on postmortem examination. With the development of improved laboratory service in the City Health Department and elsewhere, there has been an increase in accuracy of diagnosis.

Diagnosis

Lead poisoning is manifested differently in children and in adults. In many cases the diagnosis is not suspected before severe and irreversible damage is done to the brain. Early symptoms may consist of pallor, lack of appetite, constipation, abdominal pain, and listlessness, while more advanced ones may be ataxia, tremor, loss of consciousness, and convulsions. Many cases are clinically recognized only when the child has convulsions as a result of increased intracranial pressure. Cases have been reported of emotional and behavior problems in children traced to lead encephalopathy. Children have been treated for schizophrenia who were later found to have lead poisoning.

A rapid diagnosis is stimulated many times on eliciting a history of pica in the child (pica is a craving for unnatural articles of food, e.g., paint, wood, etc.). This may be the only ready clue which can be used to start treatment before irreparable damage is done to the brain. Diagnosis can be helped by examinations of the blood for stippling and the urine for coproporphyrins, as well as x-ray examination of long bones. A quantitative determination of lead in the blood and urine is helpful and may

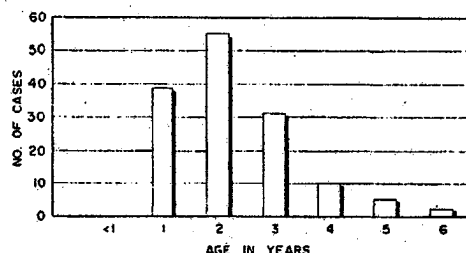


FIG. 1. Age distribution of cases of lead poisoning in New York City, 1950 to 1954.

TABLE I.—AGE AND SEX DISTRIBUTION OF 143 CASES OF LEAD POISONING

Year	Cases Reported	Age in Years						Males	Females
		1	2	3	4	5	6		
1950	1	1	..	..	..	..	..	..	1
1951	18	5	9	3	1	..	..	9	9
1952	20	6	6	5	2	..	1	5	15
1953	24	8	7	9	..	..	..	10	14
1954	80	19	34	14	7	5	1	39	41
Total	143	39	56	31	10	5	2	63	80

give an index of lead absorbed. In addition, an x-ray of the chest might be done. Keefer and Mokrohisky¹ have shown that the x-ray shows a sharp line of demarcation between bone and cartilage at the costochondral junction with dense bands at the anterior costal end. This sign may appear earlier than other x-ray signs.

Recognizing early symptoms of lead poisoning may prevent permanent brain damage with consequent blindness, mental retardation, epilepsy, and spastic paralysis. Pediatricians are becoming increasingly aware of this problem, and this increase in the index of suspicion has helped in the diagnosis of obscure cases.

A review of the records of 143 children reported to the Department of Health as cases of lead poisoning in New York City 1950-1954 was made and several factors studied: (1) age, sex, and

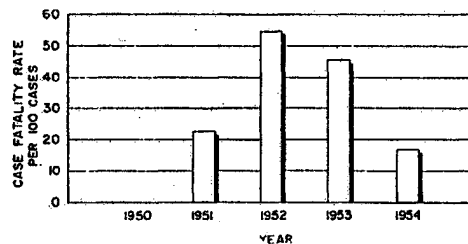


FIG. 2. Case fatality from lead poisoning in children, New York City, 1950 to 1954.

TABLE II.—CASE FATALITY IN CHILDREN FROM LEAD POISONING

Year	Number of Reported Cases	Number of Deaths	Case Fatality (Per Cent)
1950	1	..	..
1951	18	4	22.2
1952	20	11	55.0
1953	24	11	45.8
1954	80	13	16.3
Total	143	39	27.3

race, (2) case fatality, (3) seasonal incidence, (4) history of pica, (5) presence of encephalopathy, and (6) geographic distribution.

Age, Sex, and Race

Of 143 cases reported during the five-year period, 1950-1954, the age distribution can be seen in Table I and Fig. 1. No cases were reported in children under one year of age. It is well known that the toddler likes to wander around and seek new experiences and often puts foreign materials in his mouth—in fact, often ingests them. Parents seem to be keenly aware of this when the children are playing out of doors and warn the children not to put something in their mouths because it is "dirty." However, these same children are permitted to chew on window sills, tables, etc., to "cut their teeth." Many times children will pull off flaking paint and plaster and eat it. This seemed to be most frequent source according to the records. Parental ignorance of the danger of ingesting paint is quite apparent. In a recent study made by sanitarians in the Department of Health in which parents of children known to ingest paint were interviewed, one half of these did not know that eating paint was hazardous.

Eighty or 56 per cent of cases were reported in females, and 63 or 44 per cent were reported in males.

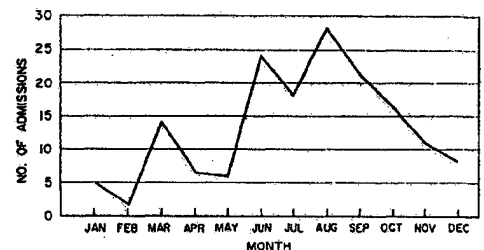


FIG. 3. Month of admission to hospital of children with lead poisoning.

A review of 134 of the 143 records of lead poisoning cases showed that 73 cases occurred in white children and 61 in Negro children. Twenty-eight of the white children were of Puerto Rican extraction. This number is lower than it actually should be because many cases had no record of place of birth or place of parent's birth. When an analysis of names was made, there were 64 children who were thought to be of Puerto Rican extraction on the basis of Puerto Rican names. Negro children and children of probable Puerto Rican extraction accounted for 89 per cent of the cases of lead poisoning.

Mortality

From 1950 to 1954 there were 36 deaths in children from lead poisoning in New York City or a reported case fatality of 27.3 per cent. From Table II and Fig. 2 it will be readily noted that with an increasing awareness by medical personnel of the symptomatology of lead poisoning, reporting has improved so that in 1954 the non-fatal cases reported were seven times greater than the fatal cases, and the case fatality dropped from 55 per cent in 1952 to 16.3 per cent in 1954.

Seasonal Incidence

It has long been recognized that there is an increase in severity of symptoms of cases of lead poisoning during the summer months. Rapoport and Rubin² in 1941 showed in their experiment with rats that it was the ultraviolet rays of the sun that caused symptoms to appear and not the heat.

A study was made of the hospital admission dates of the 143 children to ascertain when their symptomatology became so severe that it was clinically recognizable and admission to the hospital was made. Figure 3 shows that the

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greatest number of hospital admissions were in August, with June having the second highest. A total of 151 admissions of 143 children were listed. Several children were admitted two and three times, each time with recurrent encephalopathy. In one case in particular, repeated episodes of high blood lead with ensuing convulsions reduced the child to the status of a living vegetable with no motivation, drive, or ability to take even the remotest interest in things around him.

History of Pica

Eighty-two per cent of the children had a history of eating paint, plaster, etc., which was known to the parent. In nine families there were multiple known cases in the same family with six deaths and 13 clinically ill children. All children in these nine families had a history of pica.

Geographic Distribution

The 143 cases were distributed geographically as follows: Manhattan 37, Bronx 14, Brooklyn 86, Queens six, and Richmond none. Within the borough of Manhattan certain districts had a concentration of cases. For instance, in the lower east side and lower west side health districts many cases have been reported. It is interesting to speculate about the reason for the high incidence in these areas. It is true that in most of the cases in these areas children are of Puerto Rican extraction and living in rooming houses where an entire family occupies one room. Most apartments are in bad repair with paint peeling from walls and loosened plaster falling on floors. However, the same situation holds for parts of east Harlem where very little lead poisoning is reported.

When the lead poisoning cases in children are reviewed, it is found that over 60 per cent of the cases are being reported by only three hospitals. The concentration of cases in lower east and lower west side districts could be accounted for when the zoning of hospital cases is studied. Bellevue Hospital covers this area, and the pediatric staff has been doing special studies on lead poisoning. Likewise the areas in Brooklyn with large numbers of reported cases of lead poisoning are serviced by Cumberland and Kings County Hospitals which seem more acutely aware of the problem than some others. This must be

substantiated when we consider the fact that only 33 per cent of the cases admitted to Bellevue and 41 per cent of those admitted to Kings County had encephalopathy, while 69.5 per cent of cases admitted to the other hospitals had encephalopathy.

The possibility of earlier diagnosis in Bellevue and Kings County may be entertained since fewer children in these institutions were recorded as having encephalopathy, an admittedly late sign. Hospitals whose staffs were aware of early symptomatology of lead poisoning presumably may have averted neurologic manifestations by prompt treatment.

The lower east side and west side in Manhattan and Fort Greene and Bedford in Brooklyn are the districts with most reported cases. These areas have substandard housing with few repairs being made, and most have peeling paint and fallen plaster. Many of the apartments have been turned into rooming houses, often with an entire family in one room. It is this combination of poor housing and alert hospital staff that could account for the concentrations found.

Sibling History

As stated before, 19 children from nine families were reported to have clinical lead poisoning. It is possible that many other cases were missed in siblings of known cases. Their symptoms may have been so mild or vague as to escape notice by the family.

To study this point, a city-wide study has been started wherein all siblings seven years and under of a known lead poisoning case will be examined to ascertain the presence of subclinical lead poisoning. In addition, a study is also being made of all known cases of pica that attend the child health stations to determine whether they have any symptoms of lead poisoning or have a high blood lead, so that they may be considered potential cases.

Summary

1. Lead poisoning has been reported in 143 children in New York City from 1950 to 1955 with 39 deaths. With better reporting and diagnosis the case fatality fell from 48 per cent in 1953 to 15.2 per cent in 1954. The five-year case fatality was 27.3 per cent.

2. All cases were in children six and under

with 67 per cent of children in their first and second year.

3. Seventy-three cases occurred in white children and 61 cases in Negro children. Nine cases had no race recorded. Twenty-eight of the children were on record as of Puerto Rican extraction. The more likely number is 64.

4. Eighty cases or 56 per cent were in females and 63 per cent in males.

5. Sixty per cent of the hospital admissions were in June, July, August, and September, the summer months of the year. There were 151 admissions of 143 children.

6. Eighty-two per cent of children had a history of pica known to the family. Nine families had multiple cases, all of which were known to have pica. Most cases were reported in areas where housing was substandard and where the hospitals were interested in the problem.

Conclusion

The necessity for further intensive study of certain epidemiologic aspects of lead poisoning in children is apparent. However, even more important is the fact that hospitals and medical

personnel must be alerted to the possibility of missed cases. A campaign similar to the educational campaign on gas poisoning is to be instituted. The multiple cases in nine families leads us to question whether other cases in siblings are being missed. A study to examine all siblings age seven or under is being undertaken by the department, and it is hoped that some light may be shed on this topic.

A more intensive search must be made for children with known pica so that if lead poisoning is present, therapy can be initiated before symptoms occur. All child health stations in New York City will now include the question of pica in child health conferences with referral for blood analysis for lead if a positive history is obtained.

By these measures it is hoped that not only will more information on the epidemiology of lead poisoning be obtained but, more important, that early diagnosis will eliminate the more dire symptoms and resulting incapacities.

References

1. Keefer, G. P., and Mokrohisky, J.: *J. Pediat.* 43: 146 (Aug.) 1953.
2. Rapoport, M., and Rubin, M.: *Am. J. Dis. Child.* 61: 245 (1941).

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