

Box 6

Lead Industries Association, Inc.Lead Health Safety Committee
Lead Hygiene & Safety Bulletin

1951 - 1961	(Nos. 80 - 140)
1962 - 1963	
1964 - 1966	(Nos. 155 - 164)
1965 - 1966	(Nos. 161 - 170)
1967	

LEAD Hygiene

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SAFETY Bulletin

80-140

LEAD INDUSTRIES ASSOCIATION

480 LEXINGTON AVENUE

NEW YORK 17, N. Y.

CONFIDENTIAL
FOR YOUR INFORMATIONDecember 8, 1944
LEAD HYGIENE AND SAFETY
FILE 15-101-40SUBJECT: INVESTIGATION OF
"PAINT EATERS"

To Members of the Lead Industries Association:

Allegations are often made in the public press about lead and its toxic effect on adults or children which, to say the least, appear open to serious questioning. Being given widespread circulation they make unpleasant reading for the lead producer, cause our industry's serious damage and, most of the time, needless alarm to the public. We have advised our members occasionally of examples taken from the press, and the results of our investigations.

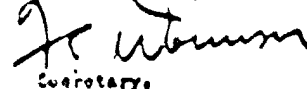
In recent years increasing attention has been given to lead poisoning in children, emphasis stemming from the time, back in 1928 I believe, when one doctor recommended the use of the X-ray in detecting the presence of lead in the bones of children. He was attracted by the hypothesis that because lead goes into the bones in lead poisoning, the X-ray could be used to detect the heavy metal in bones—certainly a highly desirable short-cut, if true, compared with laborious laboratory confirmation. Today it is common therefore, to find hospitals using the X-ray almost exclusively as a diagnostic tool to detect lead poisoning in children.

For several years however, it has seemed to me that the use of the X-ray was open to serious objection and that the number of alleged cases of lead poisoning in children were greatly out of proportion to any possible public exposure. After the appearance of an article in December 21, 1943 issue of "Time" entitled "Paint Eaters" I determined to make a thorough investigation of the entire subject with the result as indicated on the attached preliminary report.

Although my investigation has not been completed, I am convinced that once again lead has received the blame for many cases of illness which are not ascribable to it. I am hopeful that, as a result of my investigation and further work contemplated, the medical profession, itself, will correct the impression which is now widespread that the X-ray alone is an accurate diagnostic tool in lead poisoning cases among children.

It has given me great pleasure to work with doctors in various medical circles and hospitals who have been as deeply interested in this problem as I have. I found them all sincere scientists ready to modify their views as evidence proves their current conclusions untenable.

Very truly yours,


Secretary


TIME

THE WEEKLY MAGAZINE

MEDICINE

Paint Eaters

If your child is slow with building blocks, but quick on tantrums, he may be a lead eater. Many a parent knows that baby should not be given toys glorified with lead paint. But not all parents realize that children threatened in this respect may start chewing lead paint off window-sills and other places. (Parents make a mistake when they carefully repaint cribs with lead-containing paint.) And not many doctors realize that one consequence of the phobic passion by children may be stupidity. Last week doctors and parents learned the word from an article in the *American Journal of Diseases of Children*, by Dr. Randolph Kenneth Byers and the late Elizabeth Evans Lord, Ph.D., of Boston.

Years ago Dr. Lord had a hunch that there was more to lead poisoning than anemia, constipation, palsy, loss of appetite, nervous disorders and deposits of lead in the long bones and along the gums. She noticed that some lead-poisoned babies differed psychologically from normal babies, patiently traced the effects in the school careers of 30 children, of whom 18 had been paint eaters.

All but one child, Dr. Lord discovered, were school failures. Only five had normal IQs, and four of the five were so erratic that they could not learn easily. Most of the other children were so stupid (IQs 40 to 60) and ill behaved that they had to repeat classes, attend special classes or even give up school entirely. One little girl but people just to see them bleed, and was expelled from school for dancing on the desks and the piano.

TIME, NOVEMBER 20, 1948

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PRELIMINARY REPORT OF INVESTIGATION OF
"PAINT EATERS" TYPE ARTICLE

The "Time" Article - Its Background

In the December 20, 1943 issue of "Time," on page 42, an article appeared entitled, "Paint Eaters," a copy of which is attached. Because of the prominence given to this alleged large-scale incidence of lead poisoning in children, and the seriousness of the implications, an immediate investigation was undertaken.

We began by procuring a copy of the November, 1943 issue of the "American Journal of Diseases of Children" containing the paper by Dr. Randolph K. Byers and Elizabeth E. Lord, Ph.D. (deceased) in Boston, entitled, "Late Effects of Lead Poisoning on Mental Development," on which the "Time" article was based, and studied it carefully.

The article consists of 24 pages and describes the histories of 20 alleged cases of lead poisoning in infancy contracted by children chewing paint on cribs and toys, each case being investigated in later years for after effects and showing sub-normal mental development in the children. Any one unfamiliar with lead poisoning would be greatly impressed with the appearance of the article. In fact, prestige and authoritativeness was given it as the American Medical Association made it the leading article in the November issue of the "American Journal of Diseases of Children."

Criticisms of Article

The paper of Byers and Lord is, however, open to serious criticism on many important points, both from the economics of the situation and the medical aspects, as follows:

(1) Nowhere does any analysis appear of the paint or toys alleged to have caused the lead poisoning cases described and yet this is easier to do than chemical analyses of biological material for lead.

(Some years ago our Association conducted an industrial survey to ascertain whether or not crib manufacturers were using any lead paint on their merchandise, and, as was to be expected, received an altogether negative response. Paints used nowadays by crib manufacturers are primarily compounded with zinc oxide, titanium or lithopone, these pigments being chosen to use than white lead. In addition, the chances of any repainting with white lead are small as quick-drying enamels of a zinc oxide, lithopone or titanium base are generally used in furniture paints.)

(2) No laboratory confirmation of any lead case is given as no blood analyses or urine analyses of the children for lead were made.

(3) Several of the cases are conflicting in the evaluation of the medical evidence given.

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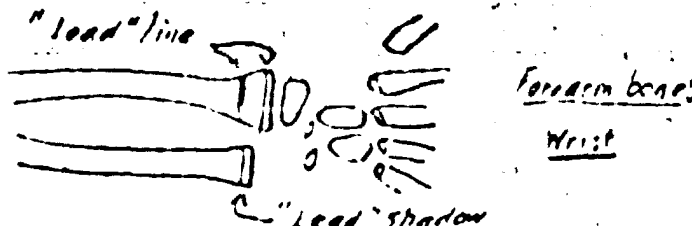
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(4) The X-ray was used in all cases and wherever it showed a dense band at the growing edges of the long bones the case was diagnosed as lead poisoning. In fact, the X-ray is given primary and almost sole consideration in practically every "lead" case described.

The U. S. Public Health Service Findings

It so happens that the work of Dr. Fairhall of the U. S. Public Health Service, described in Public Health Report No. 6, Vol. 58, February 23, 1943, entitled, "Identification of Lead in Bone Tissue," has shown that the X-ray is worthless as a diagnostic tool to determine the presence of lead in the bones primarily because the amount of lead which is taken up by the bones in the human body is too small to be detected by the X-ray. Again this might be expected. The human body can not tolerate large amounts of lead in the blood and if the dense bands shown by the X-rays, alleged to be lead, are lead, then the poor children must have grams of lead in their bones, which is absurd, as at most the amount of lead would be in fractional milligrams per gram of bone.

For many years (since 1928) medical literature has carried references to the use of the X-ray in determining the presence of lead poisoning in children, it being maintained that when the X-ray disclosed dense bands around the extremities of the long bones, as shown in the diagram below, these dense areas were lead.



An important group of doctors today firmly believe the X-ray findings to be conclusive despite the fact that the dense wide band is known to be given by phosphorous, titanium, calcium and probably other elements. And, to complicate the situation further, the so-called "lead line" is known to occur in rickets, a common ailment in children. It was not, however, until the recent work of Dr. Fairhall, referred to above, that doubt was cast upon the value of the X-ray as the sole diagnostic tool in lead cases among growing children.

Objections to Dr. Fairhall's Conclusions

Because Dr. Fairhall's work was done on dogs, its value is discounted by one X-ray school which claims that the phenomena they describe only occurs in growing children. Inasmuch as Dr. Fairhall's work was not done on growing dogs they allege it was not conclusive. That is where the controversy rests today.

My own feeling, from rather careful reading of all the literature on the subject, inclines me to believe that even if the growth factor is con-

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sidered it will have no effect on altering Dr. Fairhall's conclusions. Dr. Fairhall points out that the dense shadow is probably caused by calcium and not by lead.

Interview with Dr. Evers

With the kind assistance of Dr. Aub of the Harvard Medical School; I had a frank and friendly discussion with Dr. Evers and Dr. Crothers of the Children's Hospital in Boston about his paper. As a result I feel that any future investigation of alleged lead poisoning cases in the Children's Hospital, or any other hospital in Boston, will be more thoroughly done and that there will be actual confirmation of the exposure, if any, and also laboratory confirmation of the existence of lead. I pointed out to Dr. Evers that current medical practice inclined to the view that it was absolutely necessary to have laboratory confirmation, chiefly through urine analyses and blood examination (lead content and basophilic aggregation tests) to demonstrate the presence of lead in human system. I found that Dr. Evers was not aware of Dr. Fairhall's investigation on the X-ray as a diagnostic tool in lead poisoning cases and he deplored the notoriety that had been given his paper. Dr. Evers was deeply interested in my observations and is anxious to investigate this subject further to ascertain the truth.

My conclusion, after consulting various experts in Boston, Washington and Cincinnati, is that, while there may have been some lead poisoning among children in Boston, it has never been conclusively proven and, that the case made out by Drs. Evers and Lord that there is a connection between retarded mental development in later years and lead poisoning itself, is far from proven. As Dr. Aub told me he felt that children who have sub-normal appetites, or the disease known as "pica" which caused them to chew on inedible articles, were sub-normal to start with.

Investigation of Johns Hopkins X-ray Studies

In the course of my investigation I found it was necessary to review the literature over many years on the subject of X-ray shadows in the bones of children. Dr. Evers in Boston had referred me to the work at Johns Hopkins as being basic in the field. I, therefore, read numerous papers on the subject and discovered that only one of them presented any analytical evidence that the so-called "shadow" in the bone is actually due to the presence of large amounts of lead itself. As few children alleged to be lead cases died an autopsy for corroborative evidence was rare.

This was the fundamental difficulty which Dr. Park and others ran into when they wrote their article, "X-ray Shadows in Growing Bones Produced by Lead; Their Characteristics, Cause, Anatomical Counterpart in the Bone and Differentiation" an important paper which appeared in the August, 1933 issue of the "Journal of Pediatrics." This paper has been considered a highly authoritative basic study of the subject and is 23 pages long. The only analytical evidence I could find in it appears on page 206 of the Journal, and reads as follows:

"The lead is the chief and probably the essential cause of the shadow, if the analysis of Aub in Vogt's case and the analyses in Caffey's case hold for others. In Vogt's case Aub found that in the dense areas at the ends of the bones the lead per gram of bone was 0.027 and the calcium 0.024 grams. The ratio of lead to calcium

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was greater than 4 to 1. In Caffey's case 1 gram of dry bone taken from the dense zone yielded 0.7 grams of lead."

It so happens that the analysis quoted by Dr. Park as having been made by ABB was fortunately done at Harvard, where our medical research has been centered for many years. Accordingly, it was easy for me to check the analyses quoted.

Important Error Disclosed

I discovered, to my great surprise, that Dr. Park and his associates had made an astounding error. They had misquoted Dr. ABB's analysis, using the designation 0.527 grams instead of milligrams. In other words, they reported 1,000 times as much lead in the bone shadow than actually occurs.

I also checked the other references, that of Dr. Caffey, and found that a similar error had been made, that instead of 0.7 grams of lead it should have been 0.7 milligrams, another error of about 1,000 times the correct amount.

The conclusion, therefore, of Dr. Park and his associates as to the ratio of lead to calcium is, of course, incorrect.

Confirmation from X-ray Manufacturer

I then felt that my investigation had resolved itself into a simple engineering problem, namely, can the X-ray detect, by a differential shadow, the presence of .0005 grams of lead per gram of dry bone? In other words, if we have two one-gram pieces of bone to examine, one completely lead-free and the other containing .0005 grams of lead diffused throughout, would the X-ray plate show a difference in the two shadows?

I took this problem to a specialist in the X-ray Department of the General Electric Company and he assured me that they had difficulty enough, as it was, to produce X-ray shadows and that their technique had not been sufficiently developed to detect such extremely minute differences in the lead content of the bones.

After completing this investigation I then arranged to call on Dr. Park at Johns Hopkins, where I was courteously received. Dr. Park's work has gone unquestioned for many years but he acknowledged the error and he was sorry that it had occurred. He promised to make a correction in a future article.

I called Dr. Park's attention to my mystification in accounting for the many cases of lead poisoning alleged to have occurred in the Baltimore area from children chewing paint off cribs and toys, particularly as we knew that lead was not used for that purpose, although it probably would be used on the exterior of homes. I expressed surprise that none of the staff of the Hospital had ever taken the trouble to analyze the paint on toys or cribs to ascertain whether or not lead was present. Dr. Park said he would do so in the future, or send a sample to us for analysis.

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Dr. Park, however, still feels that even if lead itself may not be present in the so-called 'shadow' in amounts sufficiently great to be detected that lead poisoned children show the manifestation of a shadow so that it may be sometime yet before some medical authorities abandon the X-ray altogether in diagnosing lead poisoning among children.

Incidentally, Dr. Fairhall has made some experiments in actually leading bone structures of dogs to show that even highly leaded bone will not produce an X-ray shadow distinguishable from non-leaded bone. This work is described in Dr. Fairhall's bulletin previously mentioned.

I have also interviewed Dr. Cowgill of the Yale Medical School, who has done a lot of work on lead. He has been unable to confirm the "lead" shadow phenomenon in bones.

Analytical Work on Blood Examination for Lead

Dr. Park described to me some of the leaded cases among children. One case I remember particularly because the child had been alleged to have lead in the blood but wasn't excreting it in the urine - which also seems strange to me.

As a matter of fact, the analytical work being done in Baltimore on blood is another subject which I am currently investigating as here, too, I can not reconcile some of the local findings with knowledge of the possibilities of an adequate lead exposure to provide for either lead absorption or lead poisoning in children.

Conclusion

This investigation has not been concluded, but to date convinces me that once again lead has been unfairly attacked in the public press. More work will have to be done, and I think should be done, to provide a complete answer to the questionable prevalence of lead poisoning in children.

This investigation shows that the medical profession possesses a mental picture of paint that is far from accurate. I fear they believe that all paint contains lead whereas we know that is far from correct.

Very truly yours,

H. W. Wansler
Secretary.