Blood Lead Levels In Nevada Children

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The purpose of this study was to assess the prevalence of plumbism in children one to six years of age in Nevada. During a four-year period from 1992 – 1996, 10,700 children were screened for evidence of blood lead intoxication. The capillary specimens were analyzed by atomic absorption spectrometry. All children with a lead level => 10 ug/L were retested using venous blood. Ninety three percent of the children had blood lead levels < 10 μg/dL

Key words: lead, blood, plumbism, Nevada, children

Introduction

Plumbism has long been recognized as a significant threat to the healthy physical and mental development of children. The Nevada State Health Division did not have a blood lead program at the time of this study nor were there any previously published studies of the incidence or prevalence of lead levels in Nevada children (1). To determine the status of lead intoxication in Nevada children associated with lead-based paint, soil and dust contaminated with lead or any other source of this heavy metal, a screening study was implemented. The Community Health Services, the Bureau of Environmental Health and the Nevada State Public Health Laboratory (NSHL) cooperated to obtain a grant. All personnel time was donated by the three entities in the Health Division, the Washoe County Health District and the Southern Nevada Health District (Clark County).

This survey was intended as a service to the children attending public health clinics as well as a preliminary study to determine if there is evidence of a lead exposure risk and to assess the prevalence of blood lead levels in Nevada children. A concerted effort was made to determine the prevalence statewide as a primary public health concern, to direct intoxicated children to appropriate medical intervention, and to identify and mitigate the source of exposure.

Materials and Methods

The testing and patient follow-up protocol adhered to the recommendations of the Centers for Disease Control and Prevention (CDC) (2). The selected population was children (one to six years of age) participating in Medicaid and Early Periodic Screening, Diagnosis and Treatment (EPSDT) programs seen in the Community Health Services Clinics. Candidate selection was directed to children living in housing suspected of having deteriorated lead based paint and/or lead contaminated house dust. The nursing staff selected the children to participate in the study based on the criteria listed below. Letters requesting participation were sent to the homes in the target areas. At the time of the study, July 1, 1992 – June 30,1996, it was estimated that there were approximately 150,000 children one to six years of age in Nevada.

High-risk areas were identified using the Nevada State Demographer's estimates based on the 1990 U.S. Census data. The criteria selected were census block groups with more than 10 % of children living there between 1 and 6 years of age; a family income of less than $25,000; and urban areas with a high proportion of housing values below $60,000. For Clark and Washoe Counties (Las Vegas and Reno) Parcel geographic data was used. The parcels were identified as residential and constructed prior to 1978. The second criterion was to select those individual parcels with sale prices below $45,000.

The Health Division did not have an Institutional Review Board at that time but the public health nurses obtained written informed consent.

Capillary blood was obtained by the strict finger stick protocol developed by the CDC Advisory Committee on Childhood Lead Poisoning Prevention to avoid any lead contamination. The blood was collected using lead-free pediatric blood collection containers (vol. 300 uL) after spraying the skin with a lead free silicone spray. Specimens were shipped to the laboratory by courier in biohazard bags. The blood

was examined by atomic absorption graphite furnace using a Perkin-Elmer 5100Z Zeeman HGA with an auto analyzer. Whole blood samples were diluted 1:9 with diluent (to a AS/60 cup were added 140 uL diluent, 30 uL of blood, and 130 uL of diluent). This was mixed vigorously with the pipette. The cups were suspended in a rack in an ultrasonic cleaner for four minutes to aid mixing. The sample was then analyzed on a graphite furnace. Internal and external quality control included appropriate standards and controls in the analytical procedure. The instrument stability was checked throughout the run by repeat analysis of a water standard. This standard must be within +/- 15 % of its value for the run to be valid. All steps and results of the procedure met the protocol criteria of the CDC and the Occupational Safety and Health Administration (OSHA). During the study period the NSHL successfully participated in the National Blood Lead Proficiency Testing Program (PbPTP) with the laboratory code number 9-053. OSHA also approved the NSHL for blood lead analysis.

Testing Procedure: Each capillary sample was initially tested singly. If the result was elevated the test was repeated in duplicate. If the repeat test gave discrepant results, i.e., the blood lead level varied between the duplicate samples, the specimen was repeated again in duplicate. Final disposition of each patient was managed as shown in table 1. Elevated blood level from a capillary sample was considered presumptive evidence of lead intoxication. All Children with a capillary blood level of 10 ug/L or above were confirmed by testing venous blood samples.

Results

During the study period 10,700 patients were tested for blood lead. An additional 245 samples (2.3%) were received and found unsatisfactory for examination (hemolyzed, clotted or insufficient quantity). Only 7.0 % of the children tested had 10 μg/dL or greater of lead in their blood. Of those children screened, 93 % had less than 10 μg/dL lead, 5 % had between 10 – 14 μg/dL, 1% had between 15-19 μg/dL, 0.7 % between 20-29 μg/dL and 0.5% had > 30 μg/dL. There was no significant difference in the distribution between rural or city residents.

Table 1. Testing protocol

LEAD LEVEL	ACTION
μg/dL	
< 10	No further testing
10 - 14	Repeat in 3 months
15 - 19	History, repeat test in three months
> 10	Test venous blood

The results of all Nevada children tested are shown in table 2. Those children from Clark County (Las Vegas) are shown in table 3. The results of children tested from Washoe County (Reno) are shown in table 4 while the results of studies on children from the rural counties are shown in table 5.

Table 2. RESULTS OF BLOOD LEAD TESTING STATEWIDE

Total Exams	<10 μg/dL	10-14 μg/dL	15-19 μg/dL	20-29 μg/dL	>30 μg/dL
10,700	9947	497	134	72	50
Percent	93 %	5 %	1 %	0.7%	0.5%

Table 3. RESULTS OF BLOOD LEAD TESTING IN CLARK COUNTY

Total Exams	<10 μg/dL	10-14 μg/dL	15-19 μg/dL	20-29 μg/dL	>30 μg/dL
7394	6801	401	98	52	42
Percent	92 %	5 %	1 %	0.7%	0.6%

Table 4. RESULTS OF BLOOD LEAD TESTING IN WASHOE COUNTY

Total Exams	<10 μg/dL	10-14 μg/dL	15-19 μg/dL	20-29 μg/dL	>30 μg/dL
2246	2322	78	28	12	6
Percent	95 %	3%	1%	0.5%	0.2%

Table 5. RESULTS OF BLOOD LEAD TESTING IN RURAL NEVADA

Total Exams	<10 μg/dL	10-14 μg/dL	15-19 μg/dL	20-29 μg/dL	>30 μg/dL
860	824	18	8	8	2
Percent	96 %	2%	0.9%	0.9%	0.2%

Discussion

It is generally accepted that plumbism is detrimental to child development and in some parts of the nation childhood lead poisoning is considered one of the most significant environmental health problems of children (1). Those children between one and six years of age are most susceptible due to their constant hand to mouth activity. Most children are

asymptomatic even at levels that have been shown to have developmental consequences. Therefore, a systematic protocol of testing is the only reliable means of detection.

The potential sources of lead exposure are numerous and varied. Some of these include food vessels, figurines, medications, dust, paint and gasoline. Occupational sources of lead are also many and diverse. Children are particularly vulnerable to the various illnesses caused by undue exposure to this metal and, they also serve as a sentinel for reservoirs of lead. Targeted screening has been identified as the most cost-effective method for detecting children with elevated blood lead levels. (3). Therefore, older housing was considered the most likely source of plumbism in Nevada. A 1990 report from US dept of Commerce stated that 40 % of the residential housing in Nevada was constructed after 1980 (4). The low level of lead intoxication may be attributed to the fact that 90 % of the population of Nevada has moved into the state after lead-based paints were banned in residential housing (1978). As of 1995 only 30 % of the housing was built before 1970 and leaded gasoline was phased out during the 1980's

If a blood lead at => 10 μg/dL is accepted as the action level, then 7 % of the present study group required educational or medical intervention. Children with elevated blood lead levels were immediately referred for appropriate evaluation and management. Because the prevalence was so low, there were no environmental assessments nor was it decided by Nevada Health Division to establish a blood lead level registry at that time. The study population were all participants in the Medicaid program. It has previously been noted that Medicaid children between the ages of 1 through 2 had elevated levels of blood lead, which was twice that of non-Medicaid patients in the same age group (5).

These results form a base line against which present or future studies can be compared and also should serve as a stimulus for further investigation by Nevada public health officials.

References

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Contributors

T. Hall obtained the funding, sought demographic, geographic and environmental data to select the areas for surveillance. A. F. Di Salvo conceived of the project and directed the collection of samples and the lead analyses.