

Prevalence and Determinants of Lead Intoxication in Mexican Children of Low Socioeconomic Status

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This paper reports on the prevalence of lead poisoning in children between 1 and 5 years of age living in a marginal area to the north of Mexico City and also includes an evaluation of sources of exposure to this metal in the same area. The results show that 67.5% of the children studied have blood lead (PbB) levels ≥ 10 $\mu\text{g}/100$ ml. Twenty-one percent of these children (1987) had PbB levels that required medical evaluation (≥ 20 $\mu\text{g}/100$ ml– ≤ 40 $\mu\text{g}/100$ ml), and 112 children needed medical treatment (PbB ≥ 40 $\mu\text{g}/100$ ml). In addition, the study found that the probability of higher blood lead levels (≥ 20 $\mu\text{g}/\text{dl}$) corresponds to children whose mothers use lead-glazed pottery dishes (OR = 2.80; CI 95%, 1.55–5.07) and to children who habitually bite colored pencils (OR = 2.05; CI 95%, 1.13–3.71) compared, respectively, with children whose mothers do not use that type of dishes and children who do not bite pencils. Our results provide baseline information for estimating the impact and costs of population-based interventions aimed at these populations and also confirm the need to strengthen health education programs to promote the reduction of lead exposure in the general population. *Key words:* blood lead, children, environmental sources, epidemiology, Mexico, prevalence. *Environ Health Perspect* 104:1208–1211 (1996)

Several studies have reported that exposure to lead is an important health problem in Mexico (1–5). Sources of exposure to this metal, which have been identified, include the use of lead-glazed pottery for cooking and storing food (6–10), residing in areas with heavy vehicular traffic (6,9,11), consumption of canned foods (6,12), and the presence of lead in indoor and outdoor dust (13,14).

Research in Mexico about the lead poisoning problem has proceeded through well-defined stages. The first studies, carried out in the mid-1960s, focused on the determination of lead contents in glazed pottery dishes (15,16). During the 1970s and the early 1980s, both clinical studies of lead poisoning (17–20) and studies aimed at determining levels of lead in human biological samples such as urine (21–24), hair (25), and blood (PbB) (14,22–24,26–29) were carried out.

More recently, epidemiological studies focused on the identification of sources of lead intake for specific population subgroups such as nursing infants (7,12), preschool and school-aged children (9–11,13), pregnant women (7), adults (6,8,13,30), and artisans or other occupationally exposed groups (31).

Evolving from this context, new research to be undertaken must support the implementation and evaluation of intervention programs aimed at reducing exposure to lead in Mexico. Therefore, more accurate estimates of the prevalence of lead poisoning in vulnerable groups, such as children, become essential.

In this paper we present the true prevalence of lead poisoning (as estimated from a

probabilistic sample) among children from 12 to 59 months of age who live in a marginal area at the northern edge of Mexico City. We also include an assessment of the sources of exposure to this metal in the same area.

Methods

During the period from February 1991 to March 1992, a longitudinal study of general child health conditions was carried out in Chimalhuacan, State of México, which is a suburban area adjacent to Mexico City with high levels of atmospheric pollution (mainly suspended particles). The majority of the residents are of very low economic status, and public services such as running water, electricity, sewage, etc., are deficient (32). We only used cross-sectional data corresponding to one of the household visits when PbB levels were measured.

The study population was made up of children aged from 12 to 59 months who were selected through a household sampling frame specifically developed for this research.

Initially, based on maps of the entire residential area, 121 blocks were randomly chosen; later, we compiled detailed listings of all the households in the selected blocks. Finally, through household visits, we identified a total of 603 eligible children in the specified age bracket. More details about the methodology for the study are described elsewhere (López-Cervantes et al., submitted).

The mothers of all eligible children were asked to participate in the study; upon acceptance, they signed a letter of informed

consent. In those households having more than one eligible child, only one subject was selected at random to constitute the final sample for the study reported herein.

In total, 411 mothers were approached and agreed to participate in the study; along with the interviews, 371 blood samples were obtained from the children, thus rendering a 90.3% (371/411) overall response rate. Reasons for not obtaining blood samples for 40 children included sickness at the time of the visit and, more often, extreme nervousness and crying.

A structured questionnaire was used for the interview, which included questions about environmental sources of lead, socioeconomic characteristics of the family, family health history, sickness profile of the child, and use of health services. During the visit, each child was weighed and measured, using standardized instruments and procedures.

Finally, a 1-ml blood sample was obtained for each child by qualified nurses using lead-free tubes. Lead contents were determined by spectrophotometric atomic absorption (Perkin Elmer 3000, Perkin Elmer, Mexico City, Mexico). Duplicate measurements were performed for all samples. Laboratory analysis included internal and external quality control procedures, with standards provided by the Centers for Disease Control and Prevention (CDC). Also, hematocrit and hemoglobin values were obtained for each blood sample.

Statistical analysis. Prevalence of lead poisoning levels was estimated using the corresponding individual sampling weights

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Table 1. General characteristics of the study population

Characteristic	No.	Mean ± SD	CI 95%
Children's age (months)	411	36.3 ± 14.3	35.0–37.7
Mother's age (years)	409	28.0 ± 6.0	27.4–28.6
Blood lead level (µg/dl)	371	15.0* ± 8.5	7.6–9.4
Children's weight (kg)	409	13.4 ± 2.7	13.1–13.7
Children's height (cm)	405	90.7 ± 10.6	89.7–91.7
Hemoglobin (g/dl)	360	12.9 ± 1.4	12.8–13.0
Hematocrit (%)	360	39.6 ± 3.1	39.3–39.9

*Geometric mean = 12.7

(i.e., the inverse of the product of the selection probabilities); hence, we present both the proportions and the absolute numbers of children for each particular category of blood lead contents or other factors as estimated for the whole study area. Because the distribution of PbB levels is skewed to the left, we used a log transformation of this variable, and statistical procedures such as *t*-tests or ANOVA (analysis of variance) were used for contrasting subgroups on the bases of their geometric means.

In a later step, a case-control approach was used to calculate odds ratios (OR) for assessing the importance of putative sources of lead intake, using the cut-off points recommended by the CDC for the diagnosis of poisoning due to this metal (<10 µg/dl, 10–14 µg/dl, 15–19 µg/dl, ≥20 µg/dl) (33). All the analyses were performed using the statistical software STATA 4.0 (Stata Corporation, College Station, TX).

Results

Table 1 shows the characteristics of the study population. On the average, children were approximately 3 ± 1.2 years old while the mean age of the mothers was 28 ± 6 years. The overall arithmetic mean blood lead level was 15.0 ± 8.5 µg/dl (geometric mean = 12.2 µg/dl).

According to the anthropometric and clinical measurements, the average weight of the children was 13.4 ± 2.7 kg and their average height was 90.7 ± 10.6 cm. The mean hemoglobin level was 12.9 ± 1.4 g/l and the mean hematocrit was 39.6 ± 3.1%.

The prevalences of lead poisoning (levels ≥10 µg/dl) by age and sex subgroups are shown in Table 2. We estimated that out of all the children from 12 to 59 months of age living in Chimalhuacán, Mexico, 67.5% had PbB levels equal or greater than 10 µg/dl (which corresponds in absolute numbers to a total of 3132 girls and 3241 boys). Most subjects (45.4% of the total) had lead levels between 10 and 19 µg/dl. However, 21.1% of the children (an estimated *n* = 1987) had PbB levels requiring medical evaluation (≥20 µg/dl, but <40 µg/dl), and

Table 2. Prevalence of lead poisoning^a by age and sex in Chimalhuacán, Mexico

Lead level (µg/dl)	Boys		Girls		Total No. (%)
	<2 years No. (%)	≥2 years No. (%)	<2 years No. (%)	≥2 years No. (%)	
<10	496 (16.2)	1191 (38.8)	433 (14.1)	946 (30.8)	3066 (32.5)
10–14	230 (10.3)	947 (42.5)	257 (11.5)	795 (35.7)	2229 (23.6)
15–19	175 (8.1)	880 (40.8)	242 (11.2)	860 (39.9)	2157 (22.8)
≥20	393 (19.8)	616 (31.0)	324 (16.3)	654 (33.0)	1987 (21.1)
Total	1294 (13.7)	3634 (38.5)	1256 (13.3)	3255 (34.5)	9439 (100.0)

^aLead poisoning = blood lead levels ≥10 µg/dl

there were 122 children in need of medical treatment (PbB ≥40 µg/dl), whose presence was unsuspected before the study.

The geometric means of blood lead did not show significant variation according to the age or sex of the child, age, occupation, or education of the mother, time residing in the study area, levels of hemoglobin, or hematocrit (Table 3).

In contrast, PbB levels were significantly elevated in children whose mothers habitually cooked or stored foods in lead-glazed pottery, as compared to children whose mothers did not use those items (14.9 vs. 11.7 µg/dl; *p* = 0.003) (Table 4). Likewise, children who lived in houses with walls that had been painted in the year before the interview had higher blood lead levels than those living in houses that were not recently painted (13.9 vs. 12.2 µg/dl; *p* = 0.046). Biting colored pencils was also a determinant of higher blood lead levels in children (13.8 vs. 12.1 µg/dl).

Finally, crude ORs showed that preparing food in lead-glazed pottery and a history of biting colored pencils significantly increased the risk of having blood lead levels ≥10 µg/dl; the ORs were 1.54; CI 95%, 0.95–2.50, and 1.77; CI 95%, 1.10–2.85, respectively. Meanwhile, the risk for high PbB levels in relation to recently painting the house interior walls was not significantly elevated (Table 5).

When the analyses were repeated using ≥20 µg/dl as the cut-off point for PbB, we found again that children whose mothers habitually used lead-glazed pottery dishes were more likely to belong to the high PbB category (OR = 2.80; CI 95%, 1.55–5.07).

Biting colored pencils was significantly associated with PbB levels between 15 and 19 µg/dl, as compared with blood levels below 10 µg/dl (OR = 2.05; CI 95%, 1.13–3.71).

Discussion

The principal finding of this research is the estimation of a true population number of children (*n* = 6373) with lead poisoning [PbB levels ≥10 µg/dl, as defined in the CDC guidelines (33)] in a well-defined geographic area with a population of very

Table 3. Geometric means for blood lead^a according to selected variables

Variable	No.	Mean	Min-max	≥10 µg/dl (%)
Children's age in months				
≥23	96	13.06	1–46.99	66.7
24–35	66	12.68	3.00–45.6	69.7
36–47	98	12.93	3.00–50.90	73.5
≥48	111	12.30	1.99–47.94	68.5
Children's sex				
Female	170	13.32	3.00–50.90	72.3
Male	201	12.18	1–47.94	67.2
Mother's age (years)				
≤25	129	14.15	1–50.90	76.7
26–30	112	11.82	1.99–45.60	63.4
≥31	128	12.06	3.00–47.94	67.2
Maternal employment				
Housewife	307	12.67	1–50.90	69.4
Paying job	64	12.67	3.00–33.11	70.3
Maternal education				
Illiterate	34	12.43	3.00–33.11	76.5
Elementary	222	12.67	3.00–50.90	65.3
Junior high	96	13.73	1.99–36.23	78.1
High school +	17	9.49	1–26.84	58.8
Time living in the area				
≤6 months	14	15.02	2.32–35.87	78.6
6–12 months	26	12.18	5.00–50.90	69.2
>12 months	331	12.67	1–47.94	69.2
Hemoglobin (g/dl)				
<12	94	13.06	3.00–46.99	69.0
≥12	277	12.55	1–50.90	71.3
Hematocrit				
≤40	183	12.93	1–50.90	72.1
>40	188	12.43	1.99–46.52	67.0

^aBlood lead in µg/dl.**Table 4.** Geometric means for blood lead^a according to sources of exposure

Variable	No.	Mean	Min-max	% ≥10 µg/dl
Mother habitually cooks in lead-glazed pottery				
Yes	239	14.88	1.99–50.90	66.5
No	130	11.70	1–45.60*	75.4
House painted in last year				
Yes	134	13.87	3.00–51.0*	73.13
No	237	12.18	1–49.40	67.5
Child bites colored pencils				
Yes	142	13.73	1.99–50.90*	76.8
No	229	12.06	1–47.94	65.07

^aBlood lead in µg/dl.**p*<0.05.

Table 5. Odds ratios for different blood lead levels and selected variables

Blood lead levels (µg/dl)	Mother habitually cooks in lead-glazed pottery				House painted in last year				Child bites pencils			
	No (n)	Yes (n)	OR	CI 95%	No (n)	Yes (n)	OR	CI 95%	No (n)	Yes (n)	OR	CI 95%
≥10	159	98	1.54	0.95–2.50	160	98	1.31	0.82–2.10	149	109	1.77	1.10–2.85
<10	80	32	1.0	Referent	77	36	1.0	Referent	80	33	1.0	Referent
10–14	67	20	0.75	0.39–1.43	58	30	1.11	0.61–2.01	51	37	1.75	0.97–3.17
15–19	51	32	1.57	0.85–2.88	47	36	1.64	0.91–2.96	45	38	2.05	1.13–3.71
≥20	41	46	2.80	1.55–5.07	55	32	1.24	0.69–2.25	53	34	1.55	0.86–2.82

low income and to confirm the importance of specific sources of exposure to this metal in the Mexican population.

Our estimate of the average level of PbB in the children studied was 15.0 µg/dl (67.5% with levels ≥10 µg/dl), which is similar to that reported in 1993 by Jiménez et al. (10), who studied children between 3 and 13 years of age attending schools in Mexico City.

The main sources of exposure to lead that we identified, i.e., the use of lead-glazed pottery and biting colored pencils, are the same as previously reported by other authors (6–10). In this respect, it is important to note that Mexican regulations have already established an allowable limit for lead contents in lead-glazed pottery sold for use in cooking, eating, and drinking (34); there is also a limit of bioavailable lead in school materials covered with paint, such as pencils (35,36). Although in Mexico the importance of lead poisoning has been recognized and regulations strengthened, at least three actions are still necessary to control this problem: strict enforcement of the regulations, strengthening of epidemiological surveillance systems, and the design and development of population-based interventions.

Primary prevention interventions are needed in communities like Chimalhuacán and should include health education and the elimination of sources of lead in the household, but secondary prevention programs are also urgently required, including early detection and medical treatment.

Eliminating sources of lead in Mexico constitutes a sociocultural problem. The use of glazed pottery for cooking and storing foods is a deeply rooted tradition for the Mexicans; hence, the only viable alternative seems to be a change in the processes and materials used in this artisanship. These dishes and jars must be prepared at a temperature high enough to prevent the contamination of foods and beverages (36), but most of the artisans still lack access to high temperature (990°C) ovens. It is estimated that 30% of the Mexican population use glazed pottery regularly (13); thus, approximately 24 million people are exposed to lead from this single source.

According to our results, at least 1987 (21.1%) children living in the area of Chimalhuacán, Mexico, were in need of medical evaluation, and 112 of them (5.6%) required immediate medical treatment with chelating agents (33). All the mothers of the children participating in the study were given detailed information about the problem and were given the opportunity to attend the ABC Hospital of Mexico City for treatment with one of the research team members free of charge.

The benefits of an intervention to reduce lead levels should be evaluated, taking into consideration the chronic neurological damage that lead can cause. In a study by Bellinger et al. (37), a 4.8 point reduction in the intelligence quotient (measured with the Bayley scale) was found in children under 2 years old with umbilical cord lead levels of ≥10 µg/dl when they were compared with children with lead levels of <3 µg/dl. In Mexico, these findings have been confirmed in children 7–9 years of age (9).

Finally, studies should be carried out to determine the costs and the potential benefits of screening programs for lead poisoning. The existing epidemiological surveillance system in Mexico is limited in terms of coverage and opportunity for preventing lead damage, hence, restricting the potential impact of any intervention.

In this context, lead poisoning in Mexico constitutes a public health challenge, but no simple solutions are envisioned. Perhaps one of the few real options at hand in the short term is the implementation of vigorous community-based health education programs.

REFERENCES

- Cendejas S, Díaz A. El problema de la toxicidad en la loza artesanal Mexicana. *Salud Publica Mex* 16:83–88 (1974).
- Molina-Ballesteros G, Zuñiga-Charles MA, Sánchez-Anzaldo FJ, Garza-Chapa R. Plomo: Sus implicaciones y efectos sobre la salud. *Gac Med Mex* 115:57–64 (1979).
- Rothenberg SJ, Schnaas-Arrieta L, Pérez-Guerrero IA, Fernández-Alba J, Karchmer S. Evaluación del riesgo potencial de la exposición perinatal al plomo en el Valle de México. *Perinatol Reprod Hum* 3:48–61 (1989).
- Albert LA, Badillo F. Environmental lead in México. *Res Environ Contam Toxicol* 117:2–49 (1991).
- Romieu I, Palazuelos E, Hernández-Avila M, Ríos C, Muñoz I, Jimenez C, Cahero G. Sources of lead exposure in Mexico City. *Environ Health Perspect* 102:384–389 (1994).
- Lara-Flores E, Alagón-Cano J, Bobadilla JL, Hernández-Prado B, Ciscomani-Begoña A. Factores asociados a los niveles de plomo en sangre en residentes de la Ciudad de México. *Salud Publica Mex* 31:625–633 (1989).
- Rothenberg SJ, Pérez-Guerrero I, Perroni-Hernández E, Schnaas-Arrieta L, Cansino-Ortiz S, Suro-Cárcamo D, Flores-Ortega J, Karchmer S. Fuentes de plomo en embarazadas de la Cuenca de México. *Salud Publica Mex* 32:632–643 (1990).
- Hernández-Avila M, Romieu I, Ríos C, Rivero A, Palazuelos E. Lead-glazed ceramics as major determinants of blood lead levels in Mexican women. *Environ Health Perspect* 94:117–120 (1991).
- Muñoz I, Romieu I, Palazuelos E, Mancilla-Sánchez T, Meneses-González F, Hernández-Avila M. Blood lead level and neurobehavioral development among children living in México City. *Arch Environ Health* 48:132–139 (1993).
- Jiménez C, Romieu I, Palazuelos E, Muñoz I, Cortés M, Rivero A, Catalán J. Factores de exposición ambiental y concentraciones de plomo en sangre en niños de la Ciudad de México. *Salud Publica Mex* 35:599–606 (1993).
- Romieu I, Palazuelos E, Meneses F, Hernández-Avila M. Vehicular traffic as a determinant of blood-lead levels in children: a pilot study in México City. *Arch Environ Health* 47:246–249 (1992).
- Rothenberg JS, Schnaas-Arrieta L, Pérez-Guerrero I, Hernández-Cervantes R, Martínez-Medina S, Perroni-Hernández E. Factores relacionados con el nivel de plomo en sangre en niños de 6 a 30 meses de edad en el estudio prospectivo de plomo en la Ciudad de México. *Salud Publica Mex* 35:592–598 (1993).
- Romieu I, Carreón T, López L, Palazuelos E, Ríos C, Manuel Y, Hernández-Avila M. Environmental urban lead exposure and blood lead levels in children of Mexico City. *Environ Health Perspect* 103:1036–1040 (1995).
- Ordoñez BR, Ruíz L, Mora R. Investigación epidemiológica sobre niveles de plomo en la población infantil y en el medio ambiente domiciliario de Ciudad Juárez, Chihuahua en relación con una fundición del Paso, Texas. *Bol Oficina Sanit Panam* 80:303–317 (1976).
- Viniestra G, Escobar R. El riesgo de saturnismo por la cerámica folklórica Mexicana. *Salud Publica Mex* 8:69–77 (1966).
- Cambell EE, Miller HM, Biere MR. El plomo oculto en la cerámica de Tonalá. *Salud Publica Mex* 8:905–908 (1966).
- Alvarez PA, Kutz J, Salas M, Rodríguez RS, González N. Intoxicación aguda por plomo (reporte en una familia). *Rev Mex Ped* 41:645–656 (1972).
- Montoya MA, Moisés SB, Barquet RM. Saturnismo por loza de barro vidriado. *Rev Med IMSS Méx* 17:243–252 (1978).
- Montoya-Cabrera MA, Hernández-Zamora A, Portilla-Aguilar J, García-Melgar M. Intoxicación mortal por plomo, debida a la ingestión de limonada en loza de barro vidriada. *Rev Méd IMSS Méx* 117:154–158 (1981).

20. Montoya-Cabrera MA, Saucedo-García JM, López-Martín G, Falcón-Díaz O, Rodríguez-Blanca MC. Niveles de plomo en niños con hiperactividad y atención deficiente. Respuesta a la administración de D-penicilamina. *Bol Med Hosp Infant Mex* 42:88-91 (1985).
21. Molina-Ballesteros G, Zuñiga-Charles MA, Sánchez-Anzaldo FJ. determinación del ácido delta aminolevulínico urinario en población expuesta a plomo. *Arch Invest Méd Méx* 7: 115-122 (1976).
22. Montoya MA, Hernández A. Intoxicación por plomo. Origen de la exposición al metal en tres familias. *Rev Méd IMSS Méx* 19:337-339 (1981).
23. García E, Junco PR, Molina G, Arrieta ND. Efectos tóxicos por impurezas de plomo encontradas en fábricas de aluminio. *Rev Méd IMSS Méx* 19:561-565 (1981).
24. García JE, Molina G, Cueto LM, Cárdenas A, Zuñiga MA. Niveles de plomo en alfareros. *Higiene* 29:129-139 (1979).
25. García JE, Rivas F, Olivares N. Concentraciones de plomo en el cabello. *Salud Publica Mex* 25:343-349 (1983).
26. Montoya-Cabrera MA, Maldonado-Torres L, Landazuri-Laris P, Montes-Allende F, Escobar-Márquez R, Margain-Compean JC. Determinación de plomo en la sangre del cordón umbilical en recién nacidos normales. *Arch Invest Méd Méx* 12:457-462 (1981).
27. Molina G, Zuñiga MA, Cárdenas A, Solís PR, Solís PV. Concentración de plomo en sangre de niños de familias alfareras. *Bol Oficina Sanit Panam* 92:33-40 (1982).
28. Molina G, Zuñiga MA, Cárdenas A, Medina R, Solís Cámara Ph, Solís Cámara P. Alteraciones psicológicas en niños expuestos a ambientes domésticos ricos en plomo. *Bol Oficina Sanit Panam* 94:239-247 (1983).
29. Legaspi JA. Niveles de plomo en sangre, en población general del Valle de México. Estudio preliminar. *Gac Med Méx* 124:375-380 (1988).
30. Junco P, Arrieta ND. Concentración de plomo en la sangre de los habitantes de la Ciudad de Monterrey, Nuevo León. *Gac Med Méx* 129:63-67 (1993).
31. Namihira D, Saldivar L, Pustilnik N, Carreón GJ, Salinas ME. Lead in human blood and milk from nursing women living near smelter in México City. *J Toxicol Environ Health* 38:225-232 (1993).
32. CONAPO. Sistema automatizado de información sobre la marginación en México 1990. México DF, Consejo Nacional de Población, 1993.
33. Centers for Disease Control. Preventing lead poisoning in young children. Atlanta, GA:U.S. Centers for Disease Control and Prevention, 1991.
34. SSA. NOM-010-SSA1-1993. Normas y anteproyectos de normas oficiales Mexicanas, 12/11/93. Mexico City:Secretaría de Salud, 1993.
35. SSA. NOM-007-SSA1-1993. Normas y anteproyectos de normas oficiales Mexicanas, 12/11/93. Mexico City:Secretaría de Salud, 1993.
36. SSA. NOM-Q-46-1991. Norma oficial Mexicana. Mexico City:Secretaría de Salud, 1991.
37. Bellinger D, Leviton A, Waternaux C, Needleman H, Rabinowitz M. Longitudinal analyses of prenatal and postnatal lead exposure and early cognitive development. *N Engl J Med* 316:1037-1043 (1987).

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