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Lead Exposure in the Construction Industry: Results from the California Occupational Lead Registry, 1987 through 1989

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ABSTRACT

The construction industry is exempt from the medical monitoring portions of the US Federal Occupational Safety and Health Administration General Industry Lead Standard. Of 28 construction workers reported to the California Occupational Lead Registry through March 1989, 11 (39%) had blood lead levels of 2.90 μmol/L (60 μg/dL) or greater, the level at which immediate removal from lead exposure is mandated in nonconstruction industries. Many workers had not been warned of possible lead exposure. The exemption of the construction industry from the General Industry Lead Standard should be reconsidered. (*Am J Public Health.* 1992;82:1669–1671)

Introduction

Lead exposure among construction workers is an issue of growing concern in occupational health. Several episodes of severe lead poisoning among construction workers have been reported.[1–8] Furthermore, the construction industry (which includes demolition workers, painters, electricians, and ironworkers, among others), is exempt from the medical monitoring requirements of the Occupational Safety and Health Administration General Industry Lead Standard.[9–11] In this report, we describe lead-exposed construction workers identified through a statewide laboratory-based lead registry.

Methods

A description of the California Occupational Lead Registry has been published elsewhere.[12] To summarize, in 1986 the state legislature mandated that laboratories report blood lead levels greater than 1.20 μmol/L (25 μg/dL) to the Department of Health Services.[13] The California Occupational Health Program receives reports for persons over 16 years of age; reported persons are assigned an industry code using the Standardized Industrial Classification (a widely used coding scheme for industry).[14]

For this study, 2 years of registry records (April 1987 through March 1989) were reviewed. Persons who had been assigned a Standardized Industry Code referent to the construction industry (15, 16, or 17), or who had a job title of painter, construction worker, or laborer, were identified as construction workers. Additional information was obtained from standardized telephone interviews with the construction workers.

Results

Twenty-eight (1%) of the 2680 persons in the lead registry were identified as construction workers, but construction workers constituted 18% of all workers with peak blood lead levels of 3.85 μmol/L (80 μg/dL) or greater. Eleven (39%) construction workers had peak blood lead levels of 2.90 μmol/L (60 μg/dL) or greater, the level at which immediate removal from workplace lead exposure is required by the Occupational Safety and Health Administration in nonconstruction industries (Table 1). Six construction workers with peak blood lead levels of 3.60 to 6.25 μmol/L (75 to 130 μg/dL) had been hospitalized for chelation therapy after becoming acutely ill with myalgias, weakness, and abdominal pain. One worker developed persistent bilateral wrist drop. All hospitalized workers reported ongoing problems with fatigue, myalgias, and difficulty concentrating.

All construction workers reported performing tasks that involved contact with paint at the time their elevated blood

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TABLE 1—Distribution of Peak Blood Lead Levels among Persons Reported to the California Occupational Lead Registry: April 1987 through March 1989

Peak Blood Lead Level, μmol/L	Construction Workers		Others[a]		
	No.	%	No.	%	Total
1.25–1.90	8	29	1777	67	1785
1.95–2.85	9	32	748	28	757
2.90–3.80	4	14	95	4	99
≥3.85	7	25	32	1	39
Total	28	100	2652	100	2680

Note. The χ^2 for construction workers vs others was 122.68 (3 *df*, $P < .0001$).
[a]The majority of this group was employed in lead battery plants, smelters and foundries, and radiator repair shops.[12]

lead was discovered. Eighteen had been cutting painted metal with acetylene torches, seven had been removing paint by scraping or sandblasting, and one had been applying leaded paints. (We were not able to determine the specific tasks for two workers, although they were identified in the registry as painters.)

The construction workers were employed at nine different work sites. At six sites, workers were neither aware of the presence of lead nor tested for lead exposure until a worker became symptomatic. Workers from the other three sites were reported to the registry as a result of being screened for elevated blood lead by their employer. The three sites that performed blood lead monitoring also provided protective respiratory equipment and training regarding lead exposure; respirators and training were not available at the unmonitored sites. None of the 15 workers at monitored sites were hospitalized or disabled as a result of lead toxicity.

Although three sites took measures to prevent excessive lead exposure, these measures may not have been consistently provided. At one site, screening for blood lead had been done only while a particular safety officer had been employed.

Discussion

Although we found a relatively small number of construction workers in the registry, these workers tended to be highly exposed and represented a large proportion of all workers with blood lead levels of 3.85 μmol/L (80 μg/dL) or greater. Lead registries maintained by other states have also found that construction workers are proportionally overrepresented at high blood lead levels.[15] This pattern probably reflects the lack of mandated medical surveillance for elevated blood lead in the construction industry. Voluntary medical monitoring in the construction industry is reported to be extremely limited,[16] and in the absence of screening programs only symptomatic workers with high levels of lead exposure are likely to be tested. We suspect that there is a large reservoir of construction workers with reportable blood lead levels who have yet to be tested and come to the attention of the lead registry.

Although the presence of a medical monitoring program for lead does not guarantee that workers will be protected from excessive lead exposure, it may heighten employers' and workers' awareness of lead hazards and stimulate use of control measures. In this study, the three work sites that provided blood lead monitoring also offered their employees protective respiratory equipment and training regarding lead exposure. Screening also identifies workers with elevated blood lead levels, who can then be removed from lead exposure before more serious toxicity develops.[11]

In this small case series, paint was implicated as the most common source of exposure to lead for construction workers. Leaded paint is still widely present in the environment. The Agency for Toxic Substances and Disease Registry has estimated that, as of 1980, more than 52% of all housing units in the nation contained paint with a concentration of lead greater than 0.06% (the current limit for household paint[17]).[18] In addition, paint containing up to 90% lead may still be used in some circumstances, particularly on outdoor metal structures.

Construction workers represent a large pool of workers potentially at risk for lead exposure. Based on 1986 state employment statistics, there are approximately half a million construction workers in California alone[19]; estimates suggest that at least 8% of this group are at risk of exposure to lead.[16] To protect this large population of workers from excessive lead exposure, programs need to be devised that will (1) identify sites where lead may pose a risk, (2) encourage use of exposure control measures and personal protective equipment, and (3) monitor employee exposure through medical surveillance. As part of this effort, the exemption of the construction industry from the General Industry Lead Standard should be reconsidered. □

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References

1. Centers for Disease Control. Lead poisoning in bridge demolition workers—Massachusetts. *MMWR.* 1989;38:687–694.
2. Booher LE. Lead exposure in a ship overhaul facility during paint removal. *Am Ind Hyg Assoc J.* 1988;49:121–127.
3. Spee T, Zwennis WCM. Lead exposure during demolition of a steel structure coated with lead-based paints. I. Environmental and biological monitoring. *Scand J Work Environ Health.* 1987;13:52–55.
4. Pollock CA, Ibels LS. Lead intoxication in paint removal workers on the Sydney Harbour Bridge. *Med J Aust.* 1986;145:635–639.
5. Fischbein A, Leeds M, Solomon S. Lead exposure among iron workers in New York City: a continuing occupational hazard in the 1980s. *NY State J Med.* 1984;84:445–448.
6. Landrigan PJ, Baker EL, Himmelstein JS, Stein GF, Wedding JP, Straub WE. Exposure to lead from the Mystic River Bridge: the dilemma of deleading. *N Engl J Med.* 1982;306:673–676.
7. Campbell BC, Baird AW. Lead poisoning in a group of demolition workers. *Br J Ind Med.* 1977;34:298–304.
8. Zimmer FE. Lead poisoning in scrap-metal workers. *JAMA.* 1961;175:238–240.
9. *Code of Federal Regulations: Lead.* Washington, DC: Occupational Safety and Health Administration; 1978. 29 CFR 1910.1025.
10. Marino PE, Franzblau A, Lilis R, Landrigan PJ. Acute lead poisoning in construction workers: the failure of current protective standards. *Arch Environ Health.* 1989; 44:140–145.
11. Rempel D. The lead-exposed worker. *JAMA.* 1989;262:532–534.
12. Maizlish N, Rudolph L, Sutton P, Jones JR, Kizer KW. Elevated blood lead in California adults, 1987: results of a statewide surveillance program based on laboratory results. *Am J Public Health.* 1990;80:931–934.
13. Calif Health and Safety Code §309.71.

14. *Standard Industrial Classification.* Washington, DC: Office of Management and Budget; 1972.
15. Centers for Disease Control. Surveillance for occupational lead exposure—United States, 1987. *MMWR.* 1989;38:642–646.
16. Rudolph L, Sharp DS, Samuels S, Perkins C, Rosenberg J. Environmental and biological monitoring for lead exposure in California workplaces. *Am J Public Health.* 1990;80:921–925.
17. *Code of Federal Regulations: Regulations of Lead-Containing Paint and Certain Consumer Products Bearing Lead-Containing Paint.* Washington, DC: Consumer Product Safety Commission; 1977;42: 44192–44202.
18. Agency for Toxic Substances and Disease Registry. *The Nature and Extent of Lead Poisoning in Children in the United States: A Report.* Washington, DC: US Department of Health and Human Services; 1988.
19. California Employment Development Department. *California Employment and Payrolls.* Sacramento, Calif: State of California; 1986.

Potential Lead Exposures from Lead Crystal Decanters

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ABSTRACT

We measured the concentrations of lead leached into 4% acetic acid, white port, and a synthetic alcoholic beverage that were stored in lead crystal decanters for 1-, 2-, and 10-day periods at room temperature. In decanters from 14 different manufacturers, measured lead concentrations ranged from 100 to 1800 μg/L. The pH of the leaching medium is probably the dominant factor determining the extent of lead leached, with greater leaching occurring at lower pH values. The consumption of alcoholic beverages stored in lead crystal decanters is judged to pose a hazard. (*Am J Public Health.* 1992;82:1671–1673)

Introduction

Significant concentrations of lead, a reproductive toxicant, can be leached by alcoholic beverages contained in lead crystal decanters and glasses for periods ranging from less than 30 minutes to several years.[1,2] The concentration of lead leached into sherry, port, and scotch whiskey was reported to reach a maximum after 6 to 8 weeks, with a typical concentration of about 1200 μg/L.[1] In the present study, the potential lead exposures for people from such beverages stored in lead crystal decanters are compared with the regulatory level established for California's Proposition 65.[3]

Methods

The method used was a modification of a procedure used to determine lead leached from glazes on ceramic products.[4] The leaching media included a commercial alcoholic beverage (white port), 4% acetic acid, and a synthetic alcoholic beverage. The latter contained 20% vol/vol ethanol/water, 2000 mg of D-galacturonic acid monohydrate per liter, and 400 mg of citric acid per liter, adjusted to pH 3.0. Selection of the organic acids, concentration, and pH were based on reported values for wine.[5]

Twenty-three lead crystal decanters representing 14 different manufacturers, including five sets of duplicate decanters, were evaluated. The decanters were coded alphabetically, with the duplicate decanters identified as A1, A2 through E1, E2.

Lead concentrations of the three leaching media were less than 2, 40 ± 1.6, and 6.0 ± 1 μg/L for 4% acetic acid, the synthetic alcoholic beverage, and port, respectively. The corresponding pH values were 2.2, 3.0, and 3.4. The lead concentration for port is the mean and standard deviation for nine bottles. The 10th bottle, which was used for leaching decanter P, contained 28 μg/L, sampling without pouring.

A Perkin-Elmer Model 5100PC atomic absorption spectrometer with a Model HGA-600 graphite furnace was used for lead determination. Recoveries of lead in all media were 96% to 107% near the lower limit of quantitation and were 98% to 103% near midrange. Precision was ±8% or better in all cases. All leachate lead measurements were well above the limit of quantitation.

Results

With the synthetic alcoholic beverage used as the leaching medium, Figures 1a–c illustrate the change in leachate lead concentration over time for decanters from 12 manufacturers. The results are uncorrected for the level of lead in the leaching medium. The label "C1, L" denotes an instance in which results for two

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