

## Abstract

# Lead- and cadmium levels in children living close to a copper and lead smelter in Sweden

Birgitta Jön Lagerkvist & Nils-Göran Lundström

*Environmental Medicine, Department of Public Health and Clinical Medicine, Umeå University, SE 90187 Umeå, Sweden*

## Objective

The aim of the present project was to measure lead (Pb) and cadmium (Cd) levels in blood in school children living in the neighbourhood of the Ronnskarsverken, a big copper- and lead smelter in Northern Sweden.

## Subjects and methods

In November 2001 blood lead and cadmium levels were determined in 153 eleven-year old children from four different schools in the surroundings of the smelter. The metals were analysed with ICP-MS (inductively coupled plasma mass spectrometry). The detection limits were 0.06 µg/l for lead and 0.006 µg/l for cadmium. Internal and external Quality Controls were regularly undertaken. The children's parents filled in a questionnaire concerning the family size, parents' occupation, number of pets in the household, and the children's leisure time activities outdoors. Multi-factor ANOVA analyses were used to examine how these factors affected the blood metal levels. As the metal levels were not normally distributed, logarithmic val-

ues of metal levels have been used in the statistical calculations.

## Results

The blood Pb- and Cd levels were low. Geometric means were 0.086 µmol/l (17.8 µg l) and 0.8 nmol/l (0.09 µg/l) respectively. The Cd levels in blood were slightly higher in girls, and mean blood Pb was higher in boys than in girls, but the differences were not statistically significant (Table 1). 1 nmol Cd l = 0.11 µg/l; 0.1 µmol Pb l = 20.7 µg l.

The metal levels were significantly lower than those in umbilical cord blood in a study from the same area ten years earlier. During those ten years the smelter's Pb and Cd emissions to air had decreased from 52 to 3.8 tons y, and from 1.3 to 0.06 tons y, respectively. The children had been living in the neighbourhood of the smelter for 2 to 12 years (mean = 9.3 y), and in 22% of the families one adult was working at the smelter. These factors had, however no significant effect on the children's blood metal levels. Neither did parental smoking or the children's outdoor activities affect the blood metal levels. The blood Cd levels were significantly correlated to the presence of

*Table 1.* Cadmium (Cd)- and lead (Pb)-levels in blood in school children in the smelter area, mean ± standard deviation ( $\bar{X} \pm SD$ ), median, geometric mean (GM) and range.

Metal	Boys (N=80)	Girls (N=73)	All (N=153)
Cd nmol/l	0.9 ± 0.7	1.1 ± 0.7	1.0 ± 0.5
Median, GM	0.8	0.8	0.8 GM=0.8
Range	0.1–4.9	0.2–3.9	0.1–4.9
Pb µmol/l	0.098 ± 0.040	0.090 ± 0.038	0.094 ± 0.029
Median, GM	0.090	0.083	0.086 GM=0.086
Range	0.027–0.270	0.033–0.223	0.027–0.270

Table 2. Lead (Pb)-levels in blood in school children in four different schools in the smelter area, mean  $\pm$  standard deviation ( $\bar{X} \pm SD$ ). The Ursvik school is close to a thoroughfare.

Metal	Aura school* N = 22	Örjan school N = 31	Yttre Ursviken N = 36	Ursvik school N = 64
Pb $\mu\text{mol/l}$	0.077 $\pm$ 0.022	0.098 $\pm$ 0.035	0.088 $\pm$ 0.037	0.102 $\pm$ 0.045

\*Significant difference in blood lead levels between the Aura school with the lowest lead level and the Ursvik school,  $P < 0.05$ .

pets (cat/dog) in the family,  $P < 0.05$ . Children living near a thoroughfare with heavy traffic had significantly higher blood Pb levels than children living at a greater distance from roads with high traffic intensity,  $P < 0.05$  (Table 2).

### Conclusion

This study in Swedish school children in a smelter area showed low blood levels of lead and cadmium.

The metal levels had decreased since 1990, and were lower than in other recent international studies. Present emissions from the smelter did not seem to influence the blood metal levels to any great extent.

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