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The ceramics industry and lead poisoning

Long-term testing

by Edorado De Rosa, MD, Andrea Rossi, MD, Daniela Toffolo, MD,
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DE ROSA E, ROSSI A, TOFFOLO D, BRIGHENTI F, ROSA A, CAROLDI S. The ceramics industry and lead poisoning: Long-term testing. *Scand j work environ health* 6 (1980) 312—315. The investigation evaluates the efficiency attributed to some measures (improvements in environment, individual health habits) in reducing the risk of lead poisoning in the ceramics industry. The evaluation of the average levels of lead in the blood of 154 exposed workers was carried out in four plants at a time interval of six to eight months. The study considers the variations in relation to possible measures brought about during the interval. A reduction of environmental risk was in effect shown by a clear improvement in the blood lead levels, which still, however, exceeded the internationally recommended limits in many of the subjects. It was concluded that further improvements can only be made by reducing the lead content of the glazes used.

Key terms: blood lead level, environmental hygiene, glazes, occupational lead exposure, pottery.

In our preceding report (1) on some problems regarding the risk of excessive lead absorption in ceramics industry workers, we concluded that this risk is mainly linked to type of production, job, and methods of using glazes. Essential ways of reducing the risk are the introduction of better work conditions and individual hygienic habits. We believed it useful to evaluate the efficiency of these simple provisions by carrying out new blood lead (PbB) determinations with workers from four companies already examined in previous investigations. The results are presented in this report.

Subjects and methods

The ceramics industries considered in this study were two plants (A₁ and A₂, pro-

ducing tiles for the building industry) using a wet-glaze process and one plant (B, producing tiles for building) using a dry-glaze process. PbB tests were carried out in these factories before and after aspiration equipment had been installed on the glazing line, health regulations introduced, and personal hygiene recommended. Also, the workers on wet-glazing jobs in a building tile plant (C), in which both individual and environmental measures had been implemented before test 1, were examined for a second time.

In the dry-glazing plant in particular, the glaze vats were now enclosed in plexiglass cases, the operator outside working through an opening large enough for his glove-protected hands. The top part of the case was also equipped with aspiration equipment which efficiently limited the dispersion of lead-rich dusts outside the case.

All the workers of the factories in question were tested for the second time for PbB levels six to eight months after the first test. The number of subjects examined was lower in test 2 because the

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new PbB value was only determined for operators still working; in other words those subjects no longer in their original jobs in the previous investigation — either because of therapy or a change of job — were excluded. The sample examined on both occasions was therefore 154 persons at risk, while the population originally tested in all four companies totalled 210.

The PbB testing method and the normal values for our laboratory have been reported elsewhere (1).

Results

Table 1 shows the characteristics of the cases reexamined in comparison with the whole population of test 1.

There were no significant differences as

regards sex, age, and exposure between the reexamined group and the initial one. The average PbB values observed during both tests, for the 154 subjects considered in this report, are shown in table 2. Statistical significance between the two tests was analyzed with Student's paired t-test; during test 2 the average PbB value was clearly less than before, on a highly significant level, for all three companies which had modified their work environments. In plant C, where the average PbB value was already lower than that of the other plants and in which the situation was unchanged both from the environmental and personal points of view, no significant changes in PbB values were noted.

Table 3 shows that the PbB reduction was significant for all jobs. In particular the glazers started with a higher average

Table 1. Characteristics (sex, age, length of exposure) of the workers examined during the first (210 subjects) and second (154 subjects) surveys.

Plant ^a	Number of workers	Males (%)	Females (%)	Age (a)	Exposure (months)
				Mean ± SD	Mean ± SD
<i>First Survey</i>					
A ₁	74	57	43	29 ± 13	40 ± 28
A ₂	40	73	27	32 ± 11	35 ± 25
B	25	68	32	36 ± 16	75 ± 50
C	71	61	39	33 ± 11	77 ± 28
<i>Second Survey</i>					
A ₁	56	52	48	28 ± 13	39 ± 27
A ₂	29	66	34	33 ± 12	36 ± 27
B	13	85	15	37 ± 18	81 ± 50
C	56	64	36	33 ± 11	74 ± 29

^a Plants A₁, A₂, C: tiles (wet glazing); plant B: tiles (dry glazing).

Table 2. Average blood lead (PbB) values for the 154 subjects analyzed in tests 1 and 2 in the different plants. Percentage of increasing or decreasing PbB levels is reported.

Plant ^a	PbB $\mu\text{mol/l}$		p-value ^b	PbB		
	Test 1	Test 2		Increased	Decreased	No variation
	Mean ± SD	Mean ± SD		(%)	(%)	(%)
A ₁	2.7 ± 0.7	2.2 ± 0.6	< 0.001	5.3	91.1	3.6
A ₂	2.7 ± 0.8	2.1 ± 0.8	< 0.001	6.9	89.7	3.4
B	4.5 ± 0.7	2.8 ± 0.6	< 0.001	—	92.3	7.7
C	2.1 ± 0.5	2.1 ± 0.5	NS	30.4	58.9	10.7

^a Plants A₁, A₂, C: tiles (wet glazing); plant B: tiles (dry glazing).

^b Student's t-test, paired, NS = not significant.

Table 3. Average blood lead (PbB) values in tests 1 and 2 according to jobs in plants A₁, A₂, B.

Job	Number of workers	PbB ($\mu\text{mol/l}$)		p-value ^a
		Test 1	Test 2	
		Mean $\pm$ SD	Mean $\pm$ SD	
Glazing	25	3.8 $\pm$ 1.1	2.8 $\pm$ 0.7	< 0.001
Kiln work	13	3.1 $\pm$ 1.1	2.2 $\pm$ 0.5	< 0.05
Miscellaneous	7	2.9 $\pm$ 0.4	2.5 $\pm$ 0.5	< 0.05
Decoration	34	2.5 $\pm$ 0.4	2.0 $\pm$ 0.4	< 0.001
Selection	19	2.2 $\pm$ 0.6	1.8 $\pm$ 0.7	< 0.05

^a Student's t-test, paired.

Table 4. Distribution of male and female workers according to the blood lead (PbB) levels.

PbB level ($\mu\text{mol/l}$)	Males		Females	
	N	%	N	%
< 1.9	27	28.4	29	49.2
1.9–2.9	48	50.5	29	49.2
> 2.9	20	21.1	1	1.6

level and, during test 2, remained at a slightly higher value with respect to the other groups.

Table 4 shows the distribution into three ranges of PbB values for workers from all four plants after test 2.

Discussion and conclusion

Two points may be considered on the basis of the results of this study. First it is shown that the introduction of environmental changes and some individual health regulations is really effective in reducing PbB values and, consequently, the risk of excessive lead absorption. PbB reduction is significant both for the more directly exposed workers, such as the glazers, and for those doing jobs which are in themselves only slightly dangerous but which are affected by the pollution caused by the dusts of lead-rich glazes.

Second we should point out the small differences in the average PbB values in test 2, on one hand among the plants in which improvements (A₁, A₂, B) had been made, and plant C on the other, in which preventive measures were already being

used before test 1. These values, comparable among themselves, are in any case higher than those reported by Hernberg for an exposed population in the Finnish ceramics industry (2).

In particular 21 % of the male workers of all four plants continue to have PbB values that are higher than 2.9 $\mu\text{mol/l}$ (60 $\mu\text{g}/100\text{ ml}$), and 50.8 % of the females have PbB levels in excess of 1.9 $\mu\text{mol/l}$ (40 $\mu\text{g}/100\text{ ml}$), the limits recommended in 1977 (3). It is therefore clear that the improvements described, although effective, are not sufficient to reduce the PbB levels of the exposed population to within today's commonly recommended limits of acceptability. It is possible that, if the same workers were tested again in time, further reductions in their PbB levels would be seen. In effect, a limitation was imposed on our work by the fact that the tests were not carried out long after the time when preventive measures were introduced (in three of the plants). However, average PbB values comparable with those of plant C, in which such measures had been adopted some time ago, were reached. This situation leads us to believe that, even though further reduction in current PbB levels may be reached, it will be small.

In conclusion, for the type of production and technology used, further preventive success will only be obtained by changing the composition of the raw materials, i.e., reducing the lead content of the glazes. In this way, not only the high-risk jobs, but also those which do not involve direct exposure, will be made safer. The higher average PbB levels in our cases with respect to those reported by Hernberg (2) may be due to the different lead content

of the glazes, as well as to a difference in work environments.

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