HEALTH STUDY OF A LEAD EXPOSED POPULATION

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A study of chronic lead effects was carried out in the population of a lead smeltery area exposed for years to elevated concentrations of lead in air. This population shows all the biological changes indicative of increased lead absorption, but no clinical symptoms of lead poisoning.

A retrospective analysis of selected health indices and an examination of general health conditions have been carried out in both the exposed and the control population group. Simultaneously an environmental study has also been carried out.

The investigation is still in progress. The present results indicate that there might be a relationship between certain health indices and lead exposure. However, this has to be confirmed by further analysis of collected data.

The population under investigation are inhabitants of the lead smeltery area in a river valley. The valley is located in the Alpine area about 500 m above the sea level (Fig. 1). The relative height of the surrounding mountains rising mostly steep on both sides of the valley is 600 to 1624 m. The valley widens in a few places and forms terraces.

The climate is subject to sudden changes since this part of the country is a crossroad of air masses. The mean monthly temperatures vary from 3 to 17.5°C with a maximum at about 30°C, and minimum at about —16 °C. Precipitations are most frequent in summer, fog and temperature inversions in winter. The snow, which usually falls in the

Fig. 1. *Lead smeltery valley*

second half of November, stays for 100 to 210 days. The winds blow either from the south-west bringing humid air and rain, or from the north-east bringing dry cold air and fair weather.

Mining and forestry are the main activities of the inhabitants, farming only to a small extent (about 18%).

The region was inhabited as early as the stone age. There were Roman settlements in the valley. The three main mining settlements of today are first mentioned in the 13th century. The oldest document mentioning the lead ore in this area dates from 1424. In 1746 an organized lead smeltery started to operate on the site of the present smeltery. Around 1900 the smeltery was considerably enlarged and modernized enclosing all the small individual smeltering activities in this area. The smeltery has been further developing ever since.

Lead production fluctuated over the years being always more intense in the war periods but constantly showing a tendency to rise. The present production is about 26.000 metric tons of the final product per year.

The population of the valley has been subject to many investigations. In earlier studies occupational lead exposure of smelters was investigated (1). Only in the last decade special attention has been given to the general population living in this area (2, 3).

Our earlier investigation into the biological significance of lead as an air pollutant (1969—1974) included the inhabitants of the smeltery area among the observed population groups (4). The study was carried out at four levels of exposure to lead: 1. rural, 2. urban, 3. lead smeltery area and 4. occupational. Male smeltery area inhibitants made the entire group 3. and a part of group 4.

The biological indices of lead induced changes, measured within that study were: hemoglobin, reticulocyte count (Rtc), stippled cell count (BpE), glucose-6-phosphate dehydrogenase activity (G-6PD), glutathione (GSH), delta-amino levulinic acid dehydratase activity (ALAD), lead in blood (Pb-B), coproporphyrin (CP-U) and delta-amino levulinic acid in urine (ALA). They were correlated among themselves and with the four exposure levels to lead in air.

Averaged coefficients of correlation calculated in order to assess the relationship among different biological indices of lead absorption for the whole population showed a significant correlation in all groups only for BpE and Rtc. To some extent this is also true for ALA and CP-U.

All other parameters correlate well only in group 3, the one showing signs of elevated (»acceptable«) lead absorption (5).

This can be explained by the dynamic relationship between the biological parameters examined which may be different at different exposure levels.

It can be assumed that group 3 (smelter area inhibitants) presents the case when the concentration of lead in blood is in equilibrium with the impaired synthesis of hemoglobin, and therefore makes a good model for lead studies.

Since this population has been living for generations under elevated lead exposure, a careful analysis of the data on general health status may reveal some subtle differences in the frequency or degree of certain impairements which so far have not been attributed to lead exposure, — if such exist.

This idea has been the basis of the present study under the ILZRO LH-171 Project, which started in February 1974.

The study includes a retrospective analysis of selected health indices and an examination of general health condition in both smelter valley inhabitants and in a comparable population group without increased lead exposure, as well as an environmental survey.

ENVIRONMENTAL SURVEY

Lead in air

A comprehensive evaluation of the exposure of smelter area inhabitants to lead in air was done within the previous investigation, and reported earlier (6).

The concentration of lead in air was mesaured continuously in 24 hour samples in the settlements 0.5 and 4.0 km N, 1.5 and 2.0 km SSW, and

2.5 km W of the lead smeltery. In addition indoor concentrations of lead in air were measured simultaneously at three sites over a year. Seasonally size selective sampling was performed at 4 sites.

The measurements started at the end of 1971 and have been carried out ever since.

The yearly cycles of monthly means covering three full cycles and 4 winters (from November 1, 1971 to March 31, 1975) are shown in Fig. 2. The yearly cycle is in the first place influenced by meteorological factors: temperature inversions in winter favouring accumulation of airborne particles in the ground layer and frequent rains in summer washing the particles out of the air. The extremly high concentrations in the winter 1971/72 were, however, partly caused by the defficiency of filter operation. Several daily concentrations over 100 $\mu g/m^3$ were recorded with maximums above 200 $\mu g/m^3$. More than 70% of the results were above 10 $\mu g/m^3$.

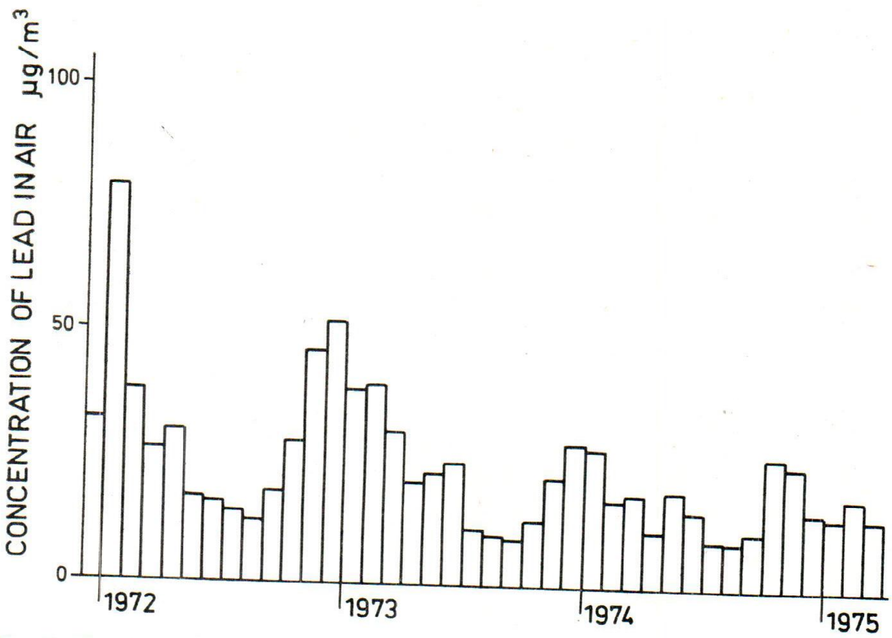

Fig. 2. *Yearly cycles of mean monthly concentrations of lead in air in smelter area*
Averages of 5 sampling sites

In the last two winters the concentrations of lead in air were relatively low. This may be attributed in the first place to the very mild winter with exceptionally favourable meteorological conditions.

Annual means and highest monthly means for the three full yearly cycles at the five sampling sites are shown in Table 1.

Table 1

Annual and highest monthly means of lead in air ($\mu g/m^3$) at the five sites in the smeltery area 1972—1974

Relative position of sampling sites to the smeltery	1972		1973		1974	
	Annual mean	Highest monthly mean	Annual mean	Highest monthly mean	Annual mean	Highest monthly mean
4 km N	23	35	20	31	12	23
0.5 km N	30	51	21	40	16	31
1.5 km SSW	40	122	28	61	21	48
2.0 km SSW	33	102	18	47	16	26
2.5 km SW	29	90	24	45	18	45

Measurements of indoor concentrations have shown that the average indoor/outdoor ratio varies from 0.4 to 0.6.

The mass median diameter of lead particles varied around 2.0 μm with 95% of particles by mass up to about 6 μm.

The average concentration of lead in air in the last five month prior to the health examination within the present study was about 15 $\mu g/m^3$. Since this was a summer season when people spend much time outdoors and have most of the time open windows the correction of the exposure to lead in air for the time spent indoors can be neglected.

In order to get information about sources of lead intake other than air, the lead content in household dust, drinking water and diet was also planned to be assessed in this study. So far only preliminary investigation has been carried out.

Lead in household dust

Samples of household dust have been collected in 27 homes of the families living in the smelter area, 13 of them with father occupationally exposed to lead. All the families previously passed a general and specific health examination. The lead content of household dust varied from 1660 to 9650 ppm (μg/g) in the homes of occupationally exposed fathers ($\bar{x}$ = 4708) and from 1660 to 6320 ppm in the homes of fathers without occupational exposure to lead ($\bar{x}$ = 3830). However, the difference is not statistically significant. Lead levels in household dust, found by *Hammer* and coworkers (7) in another lead smelter city were about double. Compared to a nonsmelter city, the lead content of household dust in the smelter area homes was eight fold.

Lead in drinking water

For preliminary analysis five samples of drinking water from a public water supply and four from private water supplies using spring water were collected. In all the samples lead concentration was much below 100 μg per liter which is the WHO standard for drinking water (8).

Lead in the diet

A questionnaire on diet has been designed using as a basis »Recall questionnaire on kinds and frequences of foods eaten (non-quantitative)« (9), but adapted to our specific requirements. Thirty seven families from the smelter area, 20 of them with father occupationally exposed to lead, have been interviewed about their diet, eating and drinking habits. All the families previously passed a general and specific health examination.

The preliminary inspection of results showed that:

1. With a few exceptions practically all inhabitants from the area under study use drinking water from a public water supply.
2. Practically all examined families buy bread and milk in a food store (allegedly produced in noncontaminated areas).
3. All employed members of the families (men and about 50% of women) get one meal in the workers' canteen, and children in the school canteen.
4. All families even those living in apartment houses have a little garden where they can grow own vegetables.
5. All families pick various berries which grow around and eat them either fresh or preserved, or use them for preparing juices.
6. The main meal consists mostly of meat, potatoes and salad.

Potatoes are bought at the greengrocer's and come from other parts of the country. Salad is grown in own gardens. Meat is bought at the butcher's, mostly beef and pork. Pork comes mostly from other parts of the country, but cattle is bred in contaminated areas. Cases of lead poisoning among the cattle from the area have been reported in the spring time in the first weeks of pasture. About three out of ten families grow chicken.

The data indicate that fruit, vegetable and meat are the possible sources of lead intake.

A detailed study of environmental contamination by lead in the smelter area has been recently done by *Kerin* (10). However, the data from this study are not always applicable to the population group observed in our investigation, which is urbanized and less exposed to the contamined food than the peasants.

In all the visited homes a high standard of housekeeping and cleanliness in general was observed. Fruit and vegetables are thoroughly washed before use. All families use modern facilities for storage and preparation of food.

RETROSPECTIVE STUDY

A comparative analysis of the data on hospital treatment, birth rate, infant mortality, general mortality, fertility, rate of abortion and spontaneous abortion collected in lead smelter area and control area was made for the period 1966—1973.

As shown in Figure 3 the average birth rate was slightly higher in the smelter area than in the control area. At the same time natimortality as well as the infant mortality rate were lower in the valley. General mortality rate was higher in the control area than in the valley. Accordingly, natural population increase was higher in exposed than in the control area. There is a difference in the age structure of the compared groups: the population in the control area is older as shown in Figure 4.

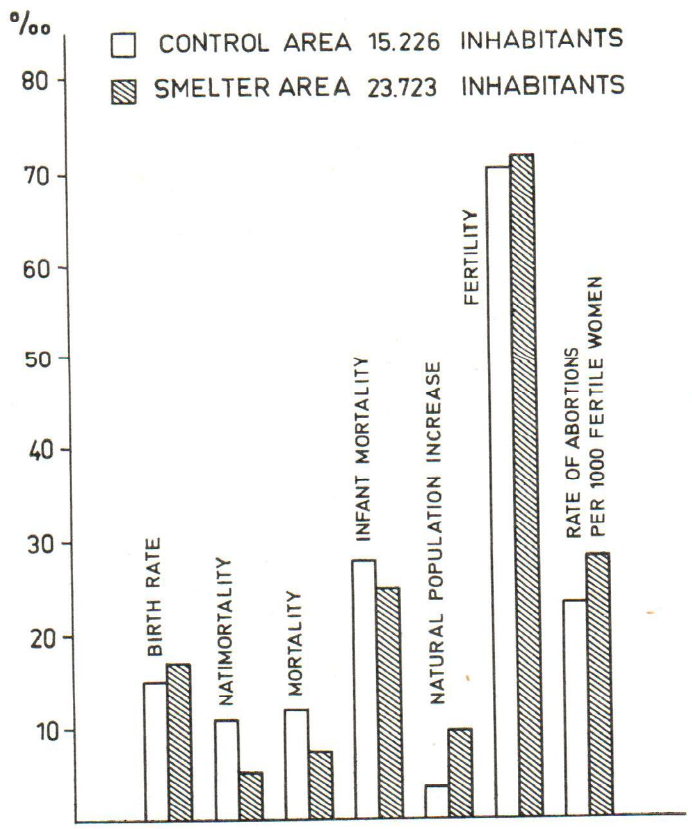

Fig. 3. *Vital statistic data from smelter and control area. Annual means 1966—1973*

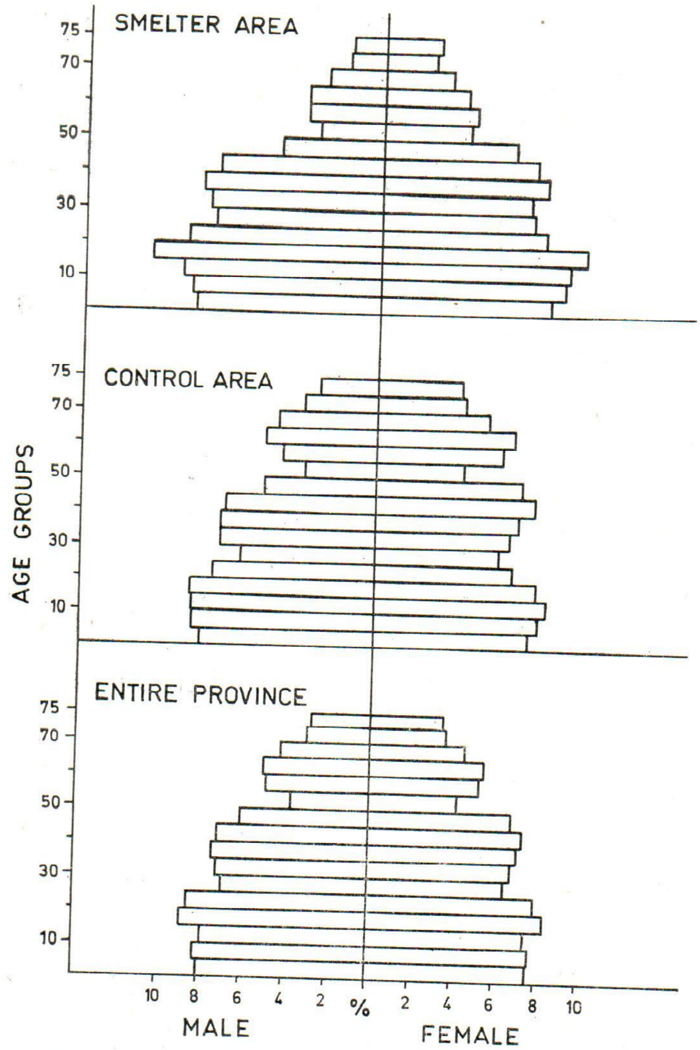

Fig. 4. *Population distribution by sex and age, 1971*

The rate of abortion as well as the ratio between the number of abortions and the number of newborn was higher in the smelter area than in the control area. This may be due to different causes such as the social structure of the population and local customs which probably differ to some extent in the compared groups. However, the rate of spontaneous abortion was also higher in the smelter area than in the control area.

The rate of hospital treatment was higher in the exposed than in the control area. In spite of the fact that hospital facilities and the health insurance system are now practically the same in both areas, in the first years of the observed period there might have been some differences in that respect. In general, the population in the smelter area had slightly better facilities for hospital treatments.

The structure of disease treated in hospital indicates that there are some differences in specific hospital morbidity rate. In the exposed inhabitants the rate of hospital treatment of the following diseases or groups of diseases was higher than in the controls: diabetes mellitus and other metabolic diseases, diseases of the blood and the blood forming organs, alcoholism, hypertensive diseases, ishaemic heart disease, cerebrovascular disease and other diseases of circulation, gastric and duodenal ulcer, nephritis, nephrosis, other disease of urinary system, and diseases of muscles and bones and connective tissue (Figure 5).

The pronounced differences concern ishaemic heart disease and other disease of circulation, diseases of urinary system, disease of muscles and bones and connective tissue, and complications in pregnancy, delivery and puerperium.

In the control area the rate of hospital treated psychoses was slightly higher than in the exposed.

There were practically no differences in the rate of hospital treated mental retardation and congenital malformations.

Figures 5 and 6 show the hospital treatment rate for the same period by sex

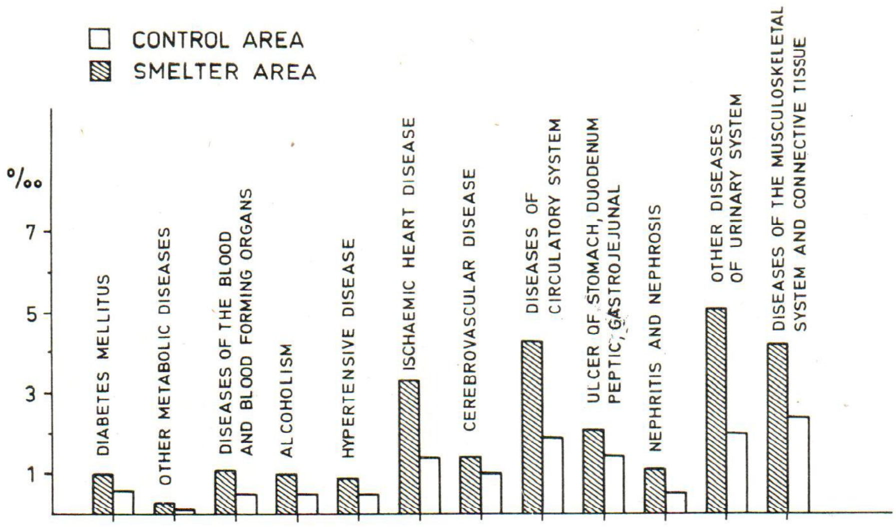

Fig. 5. *Hospital treatment rate of selected diseases 1966—1973 — all inhabitants*

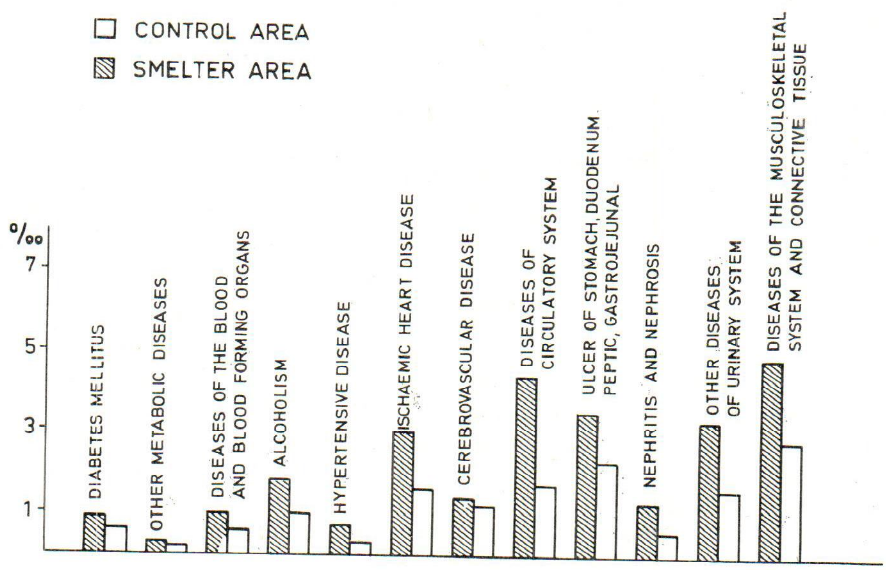

Fig. 6. *Hospital treatment rate of selected diseases 1966—1973 — male inhabitants*

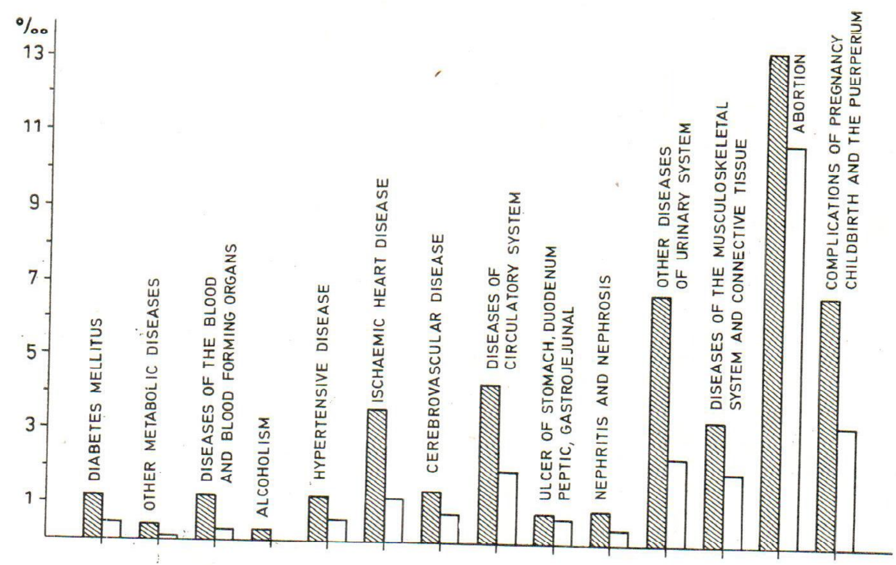

Fig. 7. *Hospital treatment rate of selected diseases 1966—1973 — female inhabitants*

It is interesting to note that the rate of ishaemic heart disease in female smelter area inhabitants is even higher than in males. This finding does not follow the expected relation which was found in the control group.

In the interpretation of these data one should be aware that diseases treated in hospitals do not reflect a general morbidity pattern. This is particularly true for those diseases which are mainly treated by general practitioners and in outpatients departments. Differences in hospital facilities and different attitude of general practitioners towards hospital treatment may also influence the specific hospital morbidity rate.

Data about causes of death and morbidity data from other sources which are being collected will give more evidence as to whether the observed differences are realistic.

HEALTH EXAMINATIONS

Health examinations were planned to be carried out in about 100 families from each of the three groups as follows:

1. families living in the lead smeltery area, father occupationally exposed to lead;

2. families living in the lead smeltery area, father without occupational exposure to lead;

3. families living in the control area.

Families with a child at elementary school were chosen for the examination, so that three members of every family can be examined: father, mother and a child aged 7-14 years.

A hundred families from the lead smeltery area were summoned in autumn 1974 from each of the two groups of families, one having father occupationally exposed to lead (I) and the other having father without occupational lead exposure (II).

Out of a hudred families summoned, 90 appeared for the examination in group I, five of them incomplete, and 73 in group II, four of them incomplete. Therefore results of 85 families (255 subjects) from group I and 69 families (207 subjects) from group II are shown in the tables.

Data were collected by means of a questionnaire designed for this investigation. General data, data on socio-economic status, smoking and drinking habits, on employment history, personal and family history and subjective complaints were collected. Each subject had to pass through a clinical examination, anthropometric measurements and collection of samples for laboratory analysis.

In 36 families from group I and 32 families from group II, all randomly chosen, hemoglobin (Hb), hematocrit (Htc), stippled cell count

(BpE), reticulocyte count (Rtc), deltaaminolevulinic acid dehydratase activity (ALAD) and lead in blood (PbB), deltaamino-levulinic acid (ALA) and coproporphyrin (CP-U) in urine were determined. Protoporphyrins in erythrocytes (EPP) were determined in 19 families from group I and in 15 families from group II.

In all subjects erythrocyte sedimentation rate, erythrocyte count, leukocyte count, serum creatinine, glucose and sediment in urine were measured.

1. *General health status*

The average age of the subjects was 40.1, 38.0 and 11.3 years for fathers, mothers and children in group I, and 43.0, 39.3 and 11.6 years for fathers, mothers and children of group II.

In general the most frequent findings were defective denture, caries, varicose veins in the lower leg, deficiency and deformation of fingers and toes, mostly fingers, as a consequence of injury.

The electrocardiograms showed abnormalities in 14 subjects from group I (coronary heart disease in eight subjects) and in five subjects from group II (coronary heart disease in two subjects).

Increased blood pressure was recorded in eight subjects from group I (6 fathers, 1 mother and 1 child) and in 14 from group II (8 fathers and 6 mothers). Two in each group were known to have hypertension before this examination.

The creatinine in the serum was at the upper limit or slightly increased in 16 subjects from group I and in 14 from group II.

Pathological findings in urine (albumen or sediment) were found in five subjects from group I and in seven subjects from group II.

The significance of all the findings will be finally evaluated after the findings in the control group become available. With regard to seasonal variations in nutrition and in atmospheric lead concentrations it was considered preferable to examine the control group at the same time next year.

2. *Laboratory findings specific for lead effect*

Summarized results of hematological and toxicological analyses performed on a limited number of families from each group are presented in Tables 2 and 3.

In Table 2 arithmetic means ($\overline{X}$) and standard deviations (SD) are given for group I separately for fathers, mothers and children. In Table 3 the same parameters are presented for group II.

The significance of difference in arithmetic means was tested between fathers, mothers, and children within each group and between the two groups for fathers, mothers and children separately.

Fathers in group I, occupationally exposed to lead show findings in accordance with their exposure, significantly different from all other subjects examined. These findings can be classified as »excessive« exposure. Mothers and children in group I have both findings at the level of a slightly elevated exposure and so have all three members of group II families.

Within group I there is a statistically significant difference in all findings between fathers and mothers and fathers and children. There is no significant difference in findings between mothers and children.

Within group II fathers have statistically significantly lower ALAD values, and higher Hb, Htc and lead values than mothers. Statistically significant differences in the same direction were found also between fathers and children for the same parameters except for ALAD. Between mothers and children from group II the only significant difference was in Rtc (higher in mothers).

The significance of difference in arithmetic means of the same members of family between the two groups was also tested. There is a statistically significant difference in all measured values between fathers from group I and group II. There was no difference between mothers from group I and II and between children of the two groups, except for EPP in children (group II group I).

Difference in Hb and Htc between the members of group II families can be attributed to the difference in sex and age. Higher concentration of lead in blood and lower ALAD activity in fathers in group II as compared to the other members of the family could be attributed to the fact that fathers may spend more time in areas with higher contamination levels. Alcohol consumption may be an andditional reason. There is no plausible explanation for the difference in Rtc between mothers and children in group II.

The results indicate that there is no significant difference between the findings in the two other members of the family regardless of father's exposure.

The complete statistical analysis of all the findings will be carried out after the control group has been investigated.

3. *Anthropometric traits*

The analysis of the results of ten anthropometric traits measured in males and females in group I and II showed that there is no statistically significant difference in the anthropometric traits between the two groups of the smelter area inhabitants. Final evaluation of the results will be made after the control group has been investigated.

In conclusion, the results obtained so far indicate that a population exposed for a long period of time to elevated environmental lead levels, which in the average according to laboratory findings can be classified

Table 2

Summarized data of hematological and toxicological analyses. Smeltery area inhabitants. Father occupationally exposed to lead

Statistical parameter	Blood						Urine		
	Hb g %	Htc cm³ %	BpE 10^6 E	Rtc ‰	EPP µg/100 ml E	ALAD units/ ml E	Pb µg/100 ml	ALA µg/100 ml	Copro µg/100 ml
					Fathers				
N	36	36	35	34	19	36	36	36	36
X	14.49	42.42	2197	17.1	491.6	12.96	93.11	3.786	143.5
SD	1.49	2.07	2685	6.41	168.5	13.86	12.07	2.117	138.6
					Mothers				
N	36	36	36	35	19	36	36	36	36
X	13.92	41.26	347	15.8	118.1	54.21	48.03	0.643	18.8
SD	1.25	2.11	541	13.76	110.6	29.58	12.37	0.268	8.92
					Children				
N	36	36	36	32	19	36	36	36	36
X	13.90	41.14	339	11.8	97.5	46.08	52.85	0.678	17.5
SD	1.17	1.72	621	3.82	75.2	25.59	12.20	0.441	12.26

Table 3

Summarized data of hematological and toxicological analyses. Smeltery area inhabitants. Father without occupational exposure to lead.

Statistical parameter	Blood						Urine		
	Hb g %	Htc cm³ %	BpE 10^6 E	Rtc ‰	EPP μg/100 ml E	ALAD units/ml E	Pb μg/100 ml	ALA μg/100 ml	Copro μg/100 ml
Fathers									
N	32	32	31	30	15	32	32	32	32
X	15.29	43.89	461	12.6	143.2	34.20	65.62	0.804	26.7
SD	1.21	1.83	833	4.80	90.6	20.78	13.93	0.586	26.29
Mothers									
N	32	32	31	29	15	32	32	32	32
X	14.11	41.64	600	15.4	111.5	48.60	52.91	0.674	18.9
SD	1.07	1.31	1190	6.92	90.6	25.54	10.81	0.265	13.85
Children									
N	32	32	31	31	15	32	32	32	32
X	13.98	41.02	374	10.5	183.1	40.24	57.26	0.736	20.0
SD	0.88	1.24	835	4.11	110.1	22.28	11.74	0.353	11.31

as »acceptable« exposure, may to some extent differ in morbidity pattern. This however has to be corroborated by additional data and further analysis before definite conclusions are made.

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Sažetak

ZDRAVSTVENO STANJE POPULACIJE IZLOŽENE OLOVU

Kod stanovništva iz okolice talionice olova, već godinama izloženog povišenim koncentracijama olova u zraku (10—100 puta višim nego u urbanim sredinama), nađene su sve biološke promjene karakteristične za povišenu apsorpciju olova, ali ne i klinički simptomi trovanja olovom. Ova je populacija zato vrlo prikladna za proučavanje kroničnog djelovanja olova.

U sklopu ovog istraživanja rađena je retrospektivna analiza izabranih zdravstvenih pokazatelja i ispitivanje općeg zdravstvenog stanja stanovnika iz okolice talionice olova i u sličnoj skupini stanovnika koja nije izložena olovu.

Istraživanje uključuje:

1. Retrospektivnu studiju podataka o morbiditetu i mortalitetu u izloženom i kontrolnom području.

2. Ispitivanje zdravstvenog stanja u 100 obitelji iz ove tri skupine:

2.1. obitelji koje žive u izloženom području s ocem profesionalno izloženom olovu,

2.2. obitelji koje žive u izloženom području s ocem koji nije profesionalno izložen olovu,

2.3. obitelji koje žive u kontrolnom području.

Iz svake obitelji pregledana su tri člana: otac, majka i dijete od 7 do 14 godina (učenika osmoljetke).

3. Studij koncentracije olova u okolini: u zraku, vodi, hrani i piću i u kućnoj prašini.

Istraživanje je još u toku.

Do sada je bila izvršena komparativna analiza podataka o liječenju u bolnicama, natalitetu, mortalitetu dojenčadi, općem mortalitetu, fertilitetu i broju pobačaja u razdoblju 1966—1973. U stanovnika izloženog područja bila je veća učestalost ishemične bolesti srca, i drugih bolesti optoka, bolesti mokraćnog sustava, vezivnog tkiva, mišićnih i koštanih oboljenja liječenih u bolnici nego li u stanovnika kontrolnog područja. Zanimljivo je da je učestalost ishemične bolesti srca veća u žena nego u muškaraca izloženog područja, što je u suprotnosti s očekivanim odnosom kao i s odnosom u kontrolnoj skupini. Učestalost spontanih pobačaja, komplikacija u trudnoći, porodu i babinjama također je veća u izloženom području. Nije bilo razlike u broju duševno zaostalih i onih s prirođenim manama, liječenim u bolnici.

Podaci o uzrocima smrti i izvanbolničkom morbiditetu koji se sada sakupljaju pokazat će jesu li nađene razlike realne.

Podaci o zdravstvenom stanju obiju skupina obitelji iz izloženog područja prikupljeni su upitnicima, a obuhvaćaju opće podatke, podatke o socijalno-ekonomskom stanju, navikama pušenja i uzimanja alkoholnih pića, o zaposlenju, o osobnoj i obiteljskoj povijesti bolesti i o subjektivnim tegobama. Svaki ispitanik je bio podvrgnut kliničkom ispitivanju, antropometrijskom mjerenju i laboratorijskom ispitivanju.

Jednoj trećini obitelji iz svake skupine uzeti su uzorci krvi i urina, pa je određen hemoglobin, hematokrit, broj bazofilno punktiranih eritrocita, retikulocita i aktivnost dehidrataze deltaamino levulinske kiseline u krvi, te delta aminolevulinska kiselina i koproporfirin u mokraći. Manjem broju obitelji određen je i protoporfirin u eritrocitima.

Očevi, profesionalno izloženi olovu imaju nalaze u suglasnosti s njihovom ekspozicijom, značajno različite od ostalih ispitanika. Ovi nalazi se mogu klasificirati kao znak »prekomjerne izloženosti olovu«. Majke i djeca iz istih obitelji imaju nalaze na istom nivou kao i sva tri člana obitelji s ocem bez profesionalne ekspozicije, tj. pokazuju povišenu izloženost olovu. Prema tome nema razlike u nalazima članova obitelji neovisno o profesionalnoj izloženosti oca.

Konačno analiza svih ovih rezultata bit će učinjena nakon što bude ispitana i kontrolna skupina.

DISCUSSION FOLLOWING THE PAPER

ZAVON: Have you investigated the extent of intermarriage in the smeltery area in comparison with the control population? This could be a significant factor in helping to explain the disease incidence if there is much intermarriage among close relations.

FUGAŠ: We have not investigated the extent of intermarriage in the valley. However, the area is not as isolated as it looks from the picture, and the control area is also located within the mountains so we would not expect differences in this respect.

TSUCHIYA: 1. There are many factors indicated in the available literature which relate to a higher incidence of ischaemic heart disease. I wonder if you measured the hardness of drinking water in the two areas.

2. Did you make age-adjustment for your morbidity data?

FUGAŠ: 1. No, we have not measured the hardness of water so far, but this will be done. Thank you for your comment.

ŠARIĆ: 2. In connection with Dr Tsuchiya's question on age-adjustment for our morbidity data I must say that we have not made any age-adjustment for these data as yet. The population in lead smelting area is younger compared with the population in control area, but of course, the whole problem has to be further analyzed using the available data.

As it usually happens, in our retrospective study as well, there are difficulties in obtaining all necessary information. Therefore our mortality and morbidity data have only a relative value, but we might get indications as a basis for further studies.

PALLIES: Is there possibly a difference in the health care delivery systems between the isolated smeltery area community and the controls in that a disease treated in a hospital in the valley might be treated by an individual physician in the controls?

ŠARIĆ: The health care delivery system between the two compared areas is practically the same. We cannot consider the smeltery area as an isolated community particularly if compared with the control area.

M. STANKOVIĆ: To find out the lead body burden of lead smeltery area inhabitants within another study mobilization of lead was performed in 108 inhabitants, mostly women and children, without occupational exposure to lead. In inhabitants living near a lead foundry, lead mobilization was carried out by i. v. injection of 1 g $CaNa_2$ EDTA. The urine samples were collected during 24 hours.

The results showed that only 5.5% of examined persons excreted less than 0.25 mg Pb/l urine and 13% excreted between 0.35 to 0.50 mg Pb/l. The remaining 81.5% excreted from 0.50 to 4.20 mg Pb/l. Our as well as Teisinger's findings suggest 0.34 and 0.35 mg Pb/24h respectively as a normal limit of lead elimination after EDTA application. Teisinger observed values up to 0.50 mg Pb/l in a fraction of urine as upper limit.

Accordingly after mobilization 81.5% persons showed increased mobilization yield, due to abnormal lead body burden.

In a case of chronic animal exposure Teisinger and co-workers (1967) report that after one Ca-EDTA injection 7.9% of the lead body burden (deposit) is excreted in the urine during first 24 hours. If we assume that these animal data could be extrapolated and applied to human beings, it can be expected that in chronically exposed persons about 8% of the total lead body burden will be excreted after an injection of 1 g $CaNa_2$ EDTA. This hypothesis allows to suppose that lead body burden of the exposed inhabitants varies from normal (4—5 mg Pb) to about 10 times higher values — 52.5 mg Pb.