

## **HEALTH INDICATORS FOR ASSESSMENT OF THE EFFECT OF THE ENVIRONMENT ON THE POPULATION**

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**Abstract.** Study of the health of the population in the area identified as 'hot spot' with environment contaminated by heavy metals and particulates from the metallurgical industry was performed. The health of the population was assessed by means of indicators depicting the demographic processes and morbidity. The local demographic indicators proved to be better as compared to the mean indicators for the country but showed a clear negative trend in time. On the background of an almost stable birth rate an increase in mortality and reduction growth in population is observed. The negative tendency could be influenced to a small degree by the quality of the environment and to a greater degree by the negative changes in the social and economic status in the country. The analysis of the morbidity pointed out increase of haematologic diseases, cardiovascular diseases, endocrine, nutritional and immunity disorders, as well as complication of pregnancy and childbirth among the population during the last years. In summary the negative changes in the environment create a potential threat to the health of the population in the area on the background of the socio-economic status and the quality of the medical care.

*Keywords:* environmental pollution, population at risk, demographic and morbidity indicators.

### **AIMS AND BACKGROUND**

Protection of the population health from the adverse effects of the environmental factors is the main purpose in the development of local environmental health action plans (LEHAP). Population health evaluation is expected to be performed by reliable indicators depicting the health risk provoked by the adverse effect of the environmental factors. The set of indicators for the evaluation of the health status is based on two types of indicators: indicators depicting the demographic processes and indicators describing the population morbidity, as recommended by WHO (Refs 1 and 2).

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## EXPERIMENTAL

The area of the town of Kurdjali in Bulgaria is identified as a 'hot spot' in relation to the quality of the environment as it is being constantly polluted by the emissions of a metallurgical plant creating health risk for the population. The study of the environmental quality performed by the National Centre of Hygiene, Medical Ecology and Nutrition (NCHMEN) characterises the existing status<sup>3</sup>.

Air pollution monitoring performed during several decades showed the adverse effect of the metallurgical plant by polluting air with the heavy metals lead and cadmium. Emissions of particulates by the building industry in the area added to the air pollution<sup>3</sup>.

The average yearly concentrations of lead and cadmium aerosols during the period 1992-2002 exceed the standards independently of the trend of decrease of the pollution by these metals lately. The reduction trend of the pollution is probably due to the reduced production of the main emitters of harmful pollutants.

The recent studies of the drinking water showed no increased health risk created by the toxic metals lead and cadmium as well as by arsenic. The effective treatment of the waste waters of the metallurgical plant added to the compliance of the content of heavy metals and arsenic in the dam waters with the national standards<sup>4</sup>.

Soil pollution monitoring in the area of the metallurgical plant showed an increase of heavy metals, mainly lead.

The above information gave grounds for applying health indicators to determine the population health risk in the studied area.

## RESULTS AND DISCUSSION

The demographic indicators of birth rate, total mortality and natural growth in the city of Kurdjali were observed for the period 1990-2002.

Changes in the demographic characteristics of the city could be defined as contradictory. Birth rate, excluding the decrease marked in 1992 and 1997, showed an almost constant level of 10 to 11 ‰, much higher and stable as compared to the average national birth rate that was in a constant decrease for the entire decade (Table 1).

The total mortality of the population in Kurdjali shows a clear trend of increase starting from 5.4‰ in 1990 and reaching 9.2 and 8.9‰ in 1999 and 2000, respectively. It follows the same dynamics as the national mortality, but on a lower level during the whole period.

Birth rate and mortality mark the growth of the population. On a background of a negative growth in population of Bulgaria, the growth in popula-

**Table 1.** Demographic indices for the city of Kurdjali population

Years	Birth rate (‰)		Total mortality (‰)		Growth in population	
	Kurdjali	Bulgaria	Kurdjali	Bulgaria	Kurdjali	Bulgaria
1990	10.1	12.1	5.4	12.5	4.7	-0.4
1991	11.1	11.1	5.8	12.8	5.3	-1.7
1992	8.6	10.4	5.6	12.6	3.0	-2.2
1993	12.7	10.0	8.3	12.9	4.4	-2.9
1994	11.1	9.4	9.0	13.2	2.1	-3.8
1995	11.4	8.6	8.8	13.6	2.6	-5.0
1996	10.6	8.6	8.2	14.0	2.4	-5.4
1997	8.9	7.7	9.3	14.7	-0.4	-3.0
1998	10.6	7.9	9.3	14.3	1.3	-6.4
1999	10.7	8.8	9.2	13.5	1.5	-4.8
2000	10.1		8.9		1.2	1.9

tion of Kurdjali has a positive value, but demonstrating a clear trend of decrease. Starting by +4.7 in 1990 it keeps a positive value and a constant decrease coming down to +1.2 in 2000.

Compared to the negative demographic changes in Bulgaria during the last decade the demographic indices for the population of Kurdjali are better, but during the period they show a clear negative tendency. On the background of a constant birth rate and an increase of total mortality, a decrease of natural growth is shown.

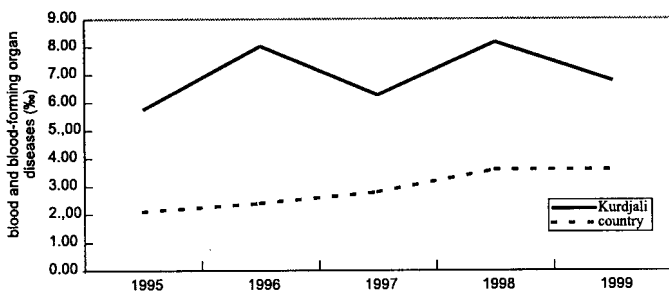
There is no reason to consider that the negative demographic changes are connected only with the environmental quality of the town. Most probably they are also influenced by the social status inevitable for the transitive period of the country.

Morbidity and mainly diseases supposed to provide information about the role of environmental pollution on the health were analysed. Among the main groups of diseases were the respiratory diseases, diseases of the blood and blood-forming organs, the diseases of the nervous system, the diseases of the skin, endocrine, nutritional and metabolic diseases, and immunity disorders, neoplasms, and complications of pregnancy, childbirth, and puerperium.

The morbidity of Kurdjali and its dynamics for the period 1995-1999 were compared with the average morbidity of the country.

The dynamics of the cancer diseases proved to be favourable. The morbidity of cancer diseases among children as well as among adults proved to be constant and lower as compared to the average of the country.

The endocrine, nutritional and metabolic diseases, and immunity disorders showed a steep decrease after the starting 1995 year followed by constant stable values. Their levels are significantly lower than the average national morbidity.



**Fig. 1.** Incidence of the blood and blood-forming organs diseases (in %) among adults in Kurdjali in parallel with country incidence of the blood and blood-forming organs diseases in the period of 1995-1999

The diseases of the blood and blood-forming organs such as anaemia including iron deficiency anaemia are alerting. No clear trend is noticed but a constant increase of 2 to 3 times over the mean morbidity of the country among adults, is observed (Fig. 1).

The diseases of the cardiovascular system follow the average country level that shows a moderate increase for the last years.

Another big group of diseases to consider are the diseases of the respiratory system. The total morbidity of respiratory diseases is of an almost constant level. The morbidity is significantly under the average of the country (about 2 times), while among the adults a small tendency of increase is observed during the last 2 years – 1998 and 1999.

Complications of pregnancy, childbirth, and puerperium showed an unfavourable trend for the period after 1997. Compared to the start level of 4.65% they showed a double increased in 1998, reaching 5.85%.

The skin and subcutaneous diseases varied to a small degree during the period as for children so for adults.

Morbidity was negatively influenced among children and adults and requires more attention. These are the diseases of the blood and blood-forming organs that, showing no additional trend of increase, demonstrate levels two to three times higher than the country average. The diseases of the cardiovascular system increased during the period 1995-1999 and their level almost equals the country average. Higher attention needs the endocrine, nutritional and metabolic diseases, and immunity disorders among the children population, while the complications of pregnancy, childbirth, and the puerperium are of interest among the adults.

Environmental pollution by inorganic and organic compounds, biological and physical agents are undeniably a health risk for the population. The social state of the population associated with the dynamic changes of the political and economic situation during the last years also modified population health. The increased levels of morbidity may be the result of environmental pollution and

changes in socioeconomic conditions and the state of the medical care service as well, which are the so-called stress factors creating a negative health effect.

The presentation up to here shows only the probable causes that might take part in the forming of the health status of the population. The specifying of the exact causes of the increased morbidity requires additional epidemiological studies.

## CONCLUSIONS

In conclusion it is possible to summarise that demographic changes among Kurdjali population are better than the same indices in the country. Nevertheless their dynamics showed a negative trend. On the background of an almost unchanged birth rate a marked increase of total mortality and decrease of natural growth in population were seen. The negative trend to a smaller degree might be influenced immediately by the environmental quality and to a greater degree – by the negative changes of the socioeconomic state of the country.

The analysis of the data showed increased morbidity among Kurdjali population for the following groups of the diseases:

- diseases of the blood and blood-forming organs with levels twice to three times higher than the country average;
- diseases of cardiovascular system demonstrated a constant increase parallel with the country average level;
- endocrine, nutritional and metabolic diseases, and immunity disorders among child population and complications of pregnancy, childbirth, and the puerperium among adults show a trend of increase recently.

The environmental pollution together with the negative changes in the social state due to the dynamic economic changes lately as well as the changes in medical care service characterising the transitory period of health reform are a potential health risk for the population.

We may outline in conclusion that negative changes of the quality of environmental components create a health risk for the population on the background of the state of socioeconomic and health care of the population.

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