EVALUATION OF PROFESSIONAL RISK OF MALIGNANT NEW TUMORS IN WORKERS OF MINING METALLURGICAL PLANT

The study has showed the existence of high professional risk (standardized relative risk) of malignant new tumors (MNT) development in major productions of Navoi Mining and Metallurgical Combine (NMMC) in not less than 60% of population involved in working environment and labor process. Less than high, but statistically significant professional risk exists for employees of subsidiary industries, who periodically are exposed to complex production-professional factors. This necessitates the development and implementation for these groups of workers a special system of preventive measures aimed both at primary prevention of cancer pathology, i.e. reduction in intensity of effecting production factors or reduction of affected groups, and to improve and increase the efficiency of secondary prevention, i.e. early diagnosis and efficient treatment of cancer patients.

Keywords: Professional risk, the standardized index, morbidity, malignant new tumors, anticancerous fight, cohort study.

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Introduction

Currently professional cancer includes disease from carcinogenic effects on people at work or job. Professional cancer may be the result of contact with chemical or biological substances occurring under the influence of physical impacts, and some industrial processes. We know that 65 substances and types of impacts related to professional activities are inherently hazardous carcinogens for human. In addition, there are 50 conditional carcinogens of occupational cancer, and over 300 substances and types of impacts described as possibly carcinogenic (Simonova, 1998; Lazarev et al., 2006; Kreuxer, 1999; Belkina, 2007; Sibirtsev, 2006). Cancer epidemiology research showed that 90-95% malignancies are caused by carcinogenic factors of the environment and lifestyle. Smoking causes 30% of all malignant tumors, food - 35%, professional carcinogens 4-5%, etc (Zanella, 1999). Carcinogenic professional factors are rarely presented by one particular substance. Often we deal with complex mixtures when not all the constituent parts are known. In this connection, it is essential to identify substances and factors which are responsible for the carcinogenicity of production (Lugasi et al., 2004; Lee-Feldstein et al., 2002). On the average up to 4% or more deaths from cancer are related to occupational exposure to carcinogens at work, but the frequency of malignant tumors in cohorts of people exposed to professional effects of carcinogens are substantially higher. Quantification of “contribution” of professional factors in the development of cancer among the population in developed countries varies widely from 4% to 38% of all cancer cases (Mukasheva, 2004; Shtreffer, 1999).

Compactness of industries in some regions, depreciation of equipment, not providing safe working conditions, suggest that the proportion of professionally-related diseases will be considerable, but the absolute number of cases as a result of the impact of occupational factors is large (Zaridze, 2002). A special case in cancer risk at work is mining industry. Studies of recent years of industrial emissions containing toxic metals, within the radius of 30-50km are biogeochemical pockets with high content of contaminants in objects of the environment, including water and foodstuffs (Lee-Feldstein et al., 2002). In extensive biogeochemical provinces where the content of toxic elements in the natural environment
are higher than in other regions, this problem is particularly relevant (Mukasheva, 2004; Shtreffer, 1999).

As a result of mining and processing industries activities local changes are possible in the natural radiation background and, as a consequence, in levels of population exposure due to the natural sources of ionizing radiation (Shtreffer, 1999). Ionizing radiation, regardless of its form and mode of exposure (internal or external, total or local, single or chronic), has carcinogenic effects through damaging the genetic apparatus of cells (Zaridze, 2002).

The study was intended to assess the occupational risk of forming cancer pathology in workers of the Navoi Mining and Metallurgical Combine (NMMC) and to justify its criteria scientifically.

**Materials and methods**

These studies were performed on the basis of the health department of the Navoi Mining and Metallurgical Combine (NMMC), located in the city of Navoi, Uzbekistan.

NMMC is the largest industrial enterprise in the country for uranium mining and processing, as well as various metals including gold. The plant has operated since 1958. However, mining of these minerals for half a century could not but cause pollution of the environment which, in turn, led to negative changes in health status and, above all, the increase of MNT morbidity in NMMC employees.

In analysis of MNT morbidity in Navoi region population there was direct method of standardization used and based on global standards on a par with Uzbekistan and its other administrative areas (subject to availability of basic statistical data). Materials used in the study included statistical reporting forms containing morbidity and mortality data during the period from 1992 to 2004, HR files of workers and retired from NMMC, data of regional archive from registry office.

The population serviced by NMMC, is significantly less than the rest of the population of the area and is only about 17%. So the absolute number of newly registered MNT in NMMC is substantially less than in the field, despite the fact that the relative incidence rate for this population group is higher. A number of nozologic forms of malignant tumors are annually identified only sporadically and in some years new cases of diseases are not identified, which does not support using direct standardization in comparative analysis of population morbidity serviced by the plant. Therefore to obtain comparable data in Navoi region and population serviced by the NMMC, we used a method of indirect standardization, with standard age-specific rates, taken as a total incidence of MNT for Navoi region as a whole, obtained by summation of the population groups and cases of illness diagnosed in the region and NMMC.

**Results**

Analysis of the figures obtained by indirect standardization method showed that MNT incidence in the population serviced by NMMC is significantly higher than in the rest of the Navoi region population. The highest risk (ten times for men and six for women) is registered for the age group 60-69 years, which can be estimated as the extremely high risk. In the age groups of 40-49 years, MNT risk is in the range from 2.3 to 2.8 and may be rated as average or above average; in the age groups 50-59 years the relative risk is quite high (3.2-3.5), and for 70-year olds - moderate. An exception is the age group of 30-39 years for which the relative risk is less than one, i.e. the standardized incidence rates in this group of individuals serviced by NMMC are lower than the corresponding figures for the population of Navoi region. Quite high proved to be the value of standardized relative risk for the age group from 0 to 29 years old, but too wide range of ages does not allow evaluating it equally correctly like in other age groups (Figure 1).
The value representing relative risk of malignant tumors development among adult population serviced by NMMC significantly varies depending on the localization. For men it is extremely high (from 5 to 18 and more) for MNT, throat, trachea, bronchi, lungs, tongue melanoma, connective tissue, bodies of mouth; above average risk for men is lip neoplasm, and the average - diseases of the liver. For women is extremely high risk of MNT for connective tissue, kidney and stomach; high - for lymph, retikulosarkom and skin. Thus, standardized relative risk of the development of malignant tumors among the adult population serviced by NMMC can be assessed, in general, as high (for men) and above average (for women); in some locations it is extremely high. Obviously most of the population, serviced by NMMC, are direct employees of the plant, for whom the intensity of the additional risk factor impact of carcinogens, polluting the manufacturing process and the environment, are substantially higher than for the common population; based on
what seems appropriate to consider some indicators of occupational risk of formation of MNT.

To assess the professional risk of malignant tumors of the number of male employees of the Navoi mining and steel works was retrospectively formed a cohort with subsequent prospective supervision cases of malignant tumors and death from them. The original number of people in the cohort was 980 people, the total number of observed person-years including casualties due to the death caused by MNT - 11334. The cohort was observed from 1992 to 2004, when total of 82 cases of malignant tumors were registered, from them 76 deaths were recorded (Table 1).

All employees selected in the cohort were divided into three main professional groups: I group - 185 basic production employees (the average age 42.9±5.4 years) dealing with harmful factors of working environment and labour process up to 60% of working time; II group - 295 sub-production workers (the average age 42.6±5.5 years) contacting with production factors to 40% of working time. III group, or group of comparison, comprised of 500 workers and employees of the plant (the average age of 43.01 ± 2.1 years) that in the process of labour did not have direct contact with harmful factors of production. All three work groups had comparable accommodation, health care and similar lifestyle. The proportion of smokers among members of the cohort was stable high and fluctuated from 72% to 81%. To calculate ratios and subsequent comparative analysis was performed an indirect standardization using the above mentioned standard - total MNT morbidity of population serviced by NMMC, and the rest of the population of Navoi region.

Analysis of the results showed that the standardized incidence of MNT in the first group is significantly higher than in the other two, while in the second it is higher than in the third. In the first group, the greatest morbidity have been characterized for the ages 40 to 49 years and 60-69 years, in the second group this trend continued, but at much lower levels of morbidity. In the third group, the significant age differences in MNT morbidity were not identified. It should be noted that during the whole observation period not a single case of MNT was revealed for persons in the age group of 30-39 years, which makes it impossible to evaluate for it the level of professional risk.

### Table 2. Standardized relative risk of malignant tumors in population serviced by NMMC, and in workers of NMMC.

<table>
<thead>
<tr>
<th>Population, serviced by NMMC</th>
<th>Age group, years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40-49</td>
<td>50-59</td>
</tr>
<tr>
<td>Population, serviced by NMMC</td>
<td>2.9</td>
<td>5.6</td>
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</tbody>
</table>

### Table 2. Standardized relative risk of malignant tumors in population serviced by NMMC, and in workers of NMMC.

<table>
<thead>
<tr>
<th>Workers of NMMC</th>
<th>Age group, years</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>40-49</td>
<td>50-59</td>
</tr>
<tr>
<td>I Group</td>
<td>6.9</td>
<td>6.1</td>
</tr>
<tr>
<td>II Group</td>
<td>1.6</td>
<td>2.4</td>
</tr>
<tr>
<td>III Group</td>
<td>0.8</td>
<td>0.7</td>
</tr>
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Comparing the results with standardized MNT incidence in adults of Navoi region and population serviced by the plant, makes obvious that in the first and second groups remains a strong tendency of MNT morbidity advancing. The tendency appears for the first group already in the age of 40-49 years; in the second group it becomes statistically significant only for aged 60-69 years. Standardized incidence rates in the third group in all three age ranges does not differ from population-based indicators, or even is placed on the lower level. Standardized relative risk of MNT in the first working group is extremely high, ranging from 40 years; in the second group it achieves similar level only at the age of 60. In the third group there is only a small increase of the risk in the age of 60-69 years.
and the risk does not exceed the level below the total average in the third group with no regard to the age structure (Table 2).

**Conclusion**

The study has showed the existence of high professional risk (standardized relative risk) of MNT development in major productions of Navoi Mining and Metallurgical Combine (NMMC) in not less than 60% of population involved in working environment and labor process. Less than high, but statistically significant professional risk exists for employees of subsidiary industries, who periodically are exposed to complex production-professional factors. This necessitates the development and implementation for these groups of workers a special system of preventive measures aimed both at primary prevention of cancer pathology, i.e. reduction in intensity of effecting production factors or reduction of affected groups, and to improve and increase the efficiency of secondary prevention, i.e. early diagnosis and efficient treatment of cancer patients.

**References**


