Occupational Cancer in Central European Countries

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The countries of central Europe, including Poland, the Czech Republic, Slovakia, Hungary, Romania, and Bulgaria, suffer from environmental and occupational health problems created during the political system in place until the late 1980s. This situation is reflected by data on workplace exposure to hazardous agents. Such data have been systematically collected in Slovakia and the Czech Republic since 1977. The data presented describe mainly the situation in the early 1990s. The number of workers exposed to risk factors at the workplace represent about 10% of the working population in Slovakia and 30% in Poland. In Slovakia in 1992 the percentage of persons exposed to chemical substances was 16.4%, to ionizing radiation 4.3%, and to carcinogens 3.3% of all workers exposed to risk factors. The total number of persons exposed to substances proven to be carcinogens in Poland was 1.3% of the employees; 2.2% were exposed to the suspected carcinogens. The incidence of all certified occupational diseases in the Slovak Republic was 53 per 100,000 insured employees in 1992. Cancers certified as occupational cancers are skin cancer caused by occupational exposure to carcinogens, lung cancer caused by ionizing radiation, and asbestosis together with lung cancer. Specific information on occupational cancers from Romania and Bulgaria was not available for this paper. It is difficult to predict a trend for future incidences of occupational cancer. Improved control technology, governmental regulatory activity to reduce exposure, surveillance of diseases and risk factors, and vigilant use of preventive measures should, however, ultimately reduce occupational cancer — *Environ Health Perspect* 107(Suppl 2):279–282 (1999). *http://ehpnet1.niehs.nih.gov/docs/1999/Suppl-2/279-282fabianova/abstract.html*

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The countries of central Europe, including Poland, the Czech Republic, Slovakia, Hungary, Romania, and Bulgaria, are currently in a transition period with serious economic problems. These countries suffer from many environmental and occupational health problems created during the previous political system. The situation of the work environment is unsatisfactory because of the economic recession accompanied by insufficient resources for improvement of old-fashioned technologies and replacement of worn-out equipment. This unfavorable situation is reflected in the data on exposures to hazardous agents in the workplace. Generally, the legislation in these countries has followed the recommendations of international agencies such as the International Labor Organization and the World Health Organization. For this article, no specific information was available from Romania and Bulgaria, and only sparse information from Hungary could be included. Parts of the present article have been published previously (*1*).

Exposure to Occupational Carcinogens

Data on workplace exposure to noxious substances and factors have been collected systematically, with yearly updating, in the former Czechoslovakia since 1977; this practice has been continued in the Czech Republic and Slovakia. In 1992, the total number of workers classified as exposed to any occupational hazard in Slovakia was 193,000, representing approximately 10% of the working population. Of these workers, 4.3% were classified as exposed to ionizing radiation and 3.3% were exposed to chemical carcinogens (Table 1). In 1991 about 32% of all employed persons, or 1,753,000 workers were classified as being exposed to occupational hazards in Poland. Of these, 5% were exposed to chemical carcinogens (Table 1).

In the former Czechoslovakia, a computerized system of classification of hazardous working operations had been established, which is still in operation in the Czech Republic and in Slovakia. The system was based on data obtained from monitoring hazardous chemical, physical, and biologic agents in the workplace. Of four categories, workplaces with exposure to chemical factors were classified in categories 3 and 4, depending on the concentration of harmful chemicals in the working environment (up to 50% higher than maximum allowable concentration for category 3 and even higher for category 4). The sparse data available on estimates of the number of workers exposed to specific known or suspected carcinogens are summarized in Table 2. For Slovakia, the agents with the highest prevalence of exposure are tar and other polycyclic aromatic hydrocarbon (PAH) mixtures (1,937 exposed in total, 199 women), cytostatics (1,407 exposed, 897 women), and vinyl chloride (800 exposed, 96 women). Only 376 workers (78 women) were classified as being exposed to asbestos, which is likely to represent a gross underestimation. The total number of workers exposed to carcinogens was estimated to be 6,792 in 1988 (3,981 females), 8,422 in 1991 (1,444 females) and 6,281 in 1992. In 1997 the total number of workers exposed to carcinogens had decreased to an estimated 3,845. The most common carcinogens are now cytostatics, asbestos, PAH, vinyl chloride, and arsenic. Most recently, a new hygienic code with an enlarged list of carcinogens based on the International Agency for Research on Cancer (IARC) documents is being prepared for approval by the state authorities.

In the Czech Republic 2,152 workers, 52 of whom were women, were classified as exposed to known carcinogens. An additional 7,300 workers were employed in occupations and industries entailing exposure to carcinogens; a further 5,800 workers were classified as exposed to suspected carcinogens, among whom the largest group comprised 2,300 health workers exposed to cytostatics.

The first regulation of occupational carcinogens in Poland appeared in 1985. In the directions of the State Sanitary Inspection, 13 occupational chemical factors and ionizing radiation were considered carcinogenic. At present, carcinogens are defined by a national agency on the basis of IARC recommendations. Two lists of

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Abbreviations used: IARC, International Agency for Research on Cancer; SMR, standardized mortality ratio.

Table 1. Number of workers (per thousand) classified as exposed to groups of hazardous agents.

Country	Year	Hazardous chemicals	Chemical carcinogens	Ionizing radiation
Poland	1991	263	88	ND
Czech Republic	1990	79	15	13
Slovakia	1992	32	6.4	8.3

ND, not determined.

Table 2. Estimates of workers exposed to selected known and suspected carcinogens in Poland, the Czech Republic,[a] and Slovakia.

Agent	Poland	Czech Republic	Slovakia
Asbestos	11,000	700	380
Arsenic	–	–	290
Chromium compounds	2,400	–	–
Nickel compounds	–	–	20
Benzidine	–	220	350
β-Naphthylamine	–	670	260
Acrylonitrile	–	57	18
Ethylene oxide	–	190	300
Formaldehyde	2,200	–	–
Vinyl chloride	2,100	390	800
Benzene	8,800	–	47
Aflatoxins	–	77	11
Polychlorinated biphenyls	–	58	150
Cytostatics	–	2,300	1,400

–, No data available. [a]76 of 80 districts.

carcinogenic factors exist: *a*) the list of definite carcinogens (41 chemical substances, 1 physical factor, 2 biologic factors, and 11 production processes), and *b*) the list of possible carcinogens (47 chemical substances and 1 production process).

The rules of exposure monitoring in the factories and enterprises in Poland are regulated in the ordinance of the Council of Ministers (*2*). According to this ordinance, each entrepreneur is obliged at the start of the activity to send information concerning the manufacturing process to the State Sanitary Inspection and the State Labor Inspection. On the basis of this information, the State Sanitary Inspector determines the list of factors to be monitored, the frequency of measurements, and the mode of sample collecting. The entrepreneur is obliged to submit the results to the State Sanitary Inspection and the State Labor Inspection.

Cancer Registration

Reporting of cancer incidence has been compulsory in Poland since 1952, and in the former Czechoslovakia, Hungary, and Romania since 1964. The completeness of the registration, however, was questionable in most regions in these countries for a long period of time. In Poland four regional cancer registries were established during the 1960s. It was estimated that in the mid-1980s only 70% of new cancer cases were registered. Later, the completeness improved and registration of new cases was estimated to be 95% in 1993. The descriptive epidemiologic data on cancer incidence and mortality are now published annually, allowing detection of trends in incidence. In the former Czechoslovakia, underestimation of cancer incidence resulted in the founding of two cancer registries in 1976 covering the later Czech Republic and the Bratislava region in later Slovakia, respectively. The Bratislava registry was expanded in 1980 to cover all Slovakia. The registration is obligatory and the quality has been high, with an estimated completeness of 95%. Certain regions in Romania and Hungary had cancer registries of reasonable quality during the 1970s and 1980s.

Compensation of Occupational Cancer

The occurrence of occupational diseases and poisonings is an important index of the standard of working conditions. In Slovakia in 1992 there were a total of 1,056 cases of newly diagnosed occupational diseases and poisonings, of which 40% were in women. This figure is 16% lower than the corresponding figure for 1991. The total number of occupational diseases hasbeen declining further in the last 5 years. In 1997 only 697 new cases were counted. This decline is most probably related to the disintegration of the dominantly curative occupational health services in many plants and the slow creation of the new preventive occupational health services. In the Czech Republic, the number of recognized occupational diseases was 8603 in 1991.

As for cancer, only skin cancer, lung cancer from radioactive materials, and lung cancer following asbestosis, are certified as distinct entities in the Czech Republic and in Slovakia. Other cases of occupational cancer caused by chemical exposures may be recognized and included in the group of poisonings; their number is not known. The yearly increase in incidence of occupational cancer in former Czechoslovakia was from 0 to 2 cases of skin cancer (1980–1991), and 66 to 115 cases of lung cancer from ionizing radiation (1980–1991). The only sizeable group of compensated cancers was lung cancer from radioactive materials, mainly among uranium and metal miners; in the Czech Republic, approximately 100 such cases are compensated each year, half of whom are below 65 years of age. In contrast, the number of other types of neoplasms is very low. In particular, only a few cases of lung cancer associated with asbestosis in the Czech Republic and Slovakia, and none in Hungary, are compensated (Table 3). In Hungary the total number of registered occupational cancer cases was 107 during a 10-year period (1983–1993). Most of these were malignant lung tumors in miners (103 cases).

In Poland, occupational diseases have been registered since 1971. During the following 25 years the overall number of registered occupational diseases and poisonings was 228,744, including 1,408 cases of malignant neoplasms (*3,4*). The majority of occupational cancers (93%) were diagnosed in men. The numbers of occupational diseases registered yearly increased from 5,008 in 1971 to 11,318 in 1996. In the latter year, 144 cases of occupational cancers were reported. According the ordinance of the Council of Ministers, a disease is determined to be occupationally related if it can be judged to be caused by a health hazard occurring in the work environment and the disease is included in the list of occupational diseases. In the assessment of health hazard, the following factors are taken into account: the degree and duration of occupational exposure and the mode of work. In all cases of possible work-related cancers, an investigation at the workplace is conducted by the sanitary and epidemiologic stations to assess whether contact with carcinogens present in the obligatory list of carcinogens has taken place. Every cancer case that has been recognized and assessed

Table 3. Number of cases of occupational cancer compensated in selected countries.

Types of occupational cancer compensated	Slovakia 1983–1993	Czech Republic 1985–1991	Poland 1985–1991	Hungary 1983–1996
Skin cancer	2	3	53	1
Lung cancer from ionizing radiation	64	691	96	103
Asbestosis combined with lung cancer	8	28	142	0
Pleural mesothelioma	NR	NR	50	–
Leukemia	NR	NR	32	2
Liver cancer	NR	NR	10	1

Abbreviations: NR, not recognized as specific occupational disease; –, no data available.

according to the above-mentioned rules and acknowledged as work related is compensated and reported to the Polish Register of Occupational Diseases. The rules for evaluation of causality of occupational diseases are very similar in Poland, Slovakia, and the Czech Republic.

Most likely, the registered figures do not represent all occupational cancers. A number of problems affect the certification of occupational cancers: the long period of latency, the retirement status of most patients when they are diagnosed, the possible role of smoking habits and other lifestyle factors, and the long duration of the evaluation and certification process. Generally, these problems contribute to underdiagnosis of cases of occupational cancer.

Research on Occupational Cancer

Most studies on occupation and cancer risk in the central European countries have been published in the countries of their origin. Some studies, however, have also been made available in the international literature, more frequently in recent years with increasing collaboration with scientists and organizations outside this particular area. The following are only a few examples of research activities in the central European countries published in English and they do not constitute an extensive or necessarily representative review. As is the case in other parts of the world, the most studies concern the risk of lung cancer.

An elevated risk of lung cancer among uranium miners has been observed in central Europe since before World War II (*5,6*). More recently, the lung cancer mortality experience in a cohort of miners was presented in a series of articles, with increasing duration of follow-up and increasingly refined methods of follow-up and exposure estimates (*7–9*). These studies confirmed the elevated risk of lung cancer associated with exposure to radon and its progeny in uranium mines, and demonstrated the importance in this case of considering additional radon exposure from employment in other mines.

Further analysis of this cohort of uranium miners gave no consistent indication that other cancers are associated with work in uranium mines, with the possible exception of gallbladder, extrahepatic bile ducts, and multiple myeloma (*10*). This lack of a consistent association of cumulative radon exposure with cancers other than lung cancer was also found in an international collaborative study of 11 cohorts of underground miners (*11*).

The risk of lung cancer associated with radiation and dust exposure among iron ore miners (relative risk = 3–4) was investigated in Slovakia (*12*). In Crakow, Poland, a population-based case–control study indicated a 4-fold excess risk of lung cancer among the most highly exposed foundry workers when controlling for smoking habits and partly for exposure in other industries (*13*).

A mortality study in a cohort of workers in the rubber industry in Poland found the expected elevation of bladder cancer and leukemia in the subcohort employed during the period when β-naphthylamine was in use and hypothesized an association of cancer of the gallbladder with occupational activity in the rubber industry (*14*).

In two small cohorts of chrysotile asbestos workers, an elevated risk of lung cancer was found among the men but not among the women (*15,16*). For men employed between 1945 and 1973 and followed until 1985, the standardized mortality ratio (SMR) for lung cancer was 183.3; no cases of mesothelioma were reported. For women employed during the same period, the SMR for lung cancer was 95.6; SMRs for cancer of digestive organs, peritoneum, liver, and pancreas were significantly elevated.

An investigation of the relationship of skin cancer with occupational exposure to PAHs found that only mineral oils elevated risk (*17*), thus confirming a classical epidemiologic association (*18*).

An analysis of a Polish cohort of pulp and paper workers, set up as a part of an international collaborative study, indicated no excess of leukemia, lymphoma, or lung cancer (*19*), but showed an elevated risk of cancer of the peritoneum and prostate. As the cohort was relatively young, the results were based on a small number of cases, and the relationship to occupational exposure was difficult to determine.

Recently, case–control studies and cohort studies have been established to investigate the association between angiosarcoma of the liver and exposure to vinyl chloride monomers, between skin and lung cancer and arsenic exposure, and between lung cancer and exposure to the PAHs in aluminum production.

Conclusions

It is difficult to predict a trend for future incidences of occupational cancers, but data seem to indicate that the incidence of cancer has increased remarkably during the last 5 to 10 years in central European countries. However, improved control technology, governmental regulatory activity to reduce exposure, surveillance of diseases, and risk factors and use of preventive measures would ultimately reduce occupational cancer.

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