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Occupational exposure to carcinogens in Estonia, Latvia, Lithuania and the Czech Republic in 1997

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Objectives The aim of the study was to estimate the numbers of workers exposed to carcinogens in Estonia, Latvia, Lithuania, and the Czech Republic.

Methods CAREX is an international information system on occupational exposure to 139 known and suspected carcinogens. It provides exposure data and estimates of the numbers of exposed workers by country, carcinogen, and industry. The CAREX method, which has been previously applied in the member states of the European Union, was applied in the present study to the exposure situation in Estonia, Latvia, Lithuania, and the Czech Republic in 1997. The preliminary estimates generated by CAREX were reviewed and revised by national experts mainly for asbestos, benzene, and lead, which were of special interest for this project.

Results The numbers of workers exposed to carcinogens covered by CAREX in 1997 were about 180 000 (29% of employed persons) in Estonia, 260 000 (28% of employed persons) in Latvia, 470 000 (28% of employed persons) in Lithuania, and 1 400 000 (28% of employed persons) in the Czech Republic. The most common exposures were solar radiation (7–13% exposed at least 75% of the worktime), environmental tobacco smoke (4–5% exposed at least 75% of the worktime), wood dust (3–5% exposed), crystalline silica (2–3% exposed), diesel exhaust (2–3% exposed), radon and its decay products (2% exposed), benzene (0.9–1.7% exposed), and lead and inorganic lead compounds (0.8–1.4% exposed). Exposure to asbestos was slightly less prevalent (0.3–1.1% exposed).

Conclusions These preliminary results indicate that a substantial proportion of the workers in the studied countries were exposed to carcinogens.

Key terms asbestos, benzene, CAREX, diesel exhaust, environmental tobacco smoke, lead, silica, radon, solar radiation, wood dust.

In the mid-1990s the “Europe Against Cancer” program of the European Union (EU) prompted a project to estimate the burden of occupational cancer in Europe, which included a component on occupational exposure to carcinogens. The review of available literature, including the monograph series of the International Agency for Research on Cancer (IARC), indicated that direct estimates of the numbers of exposed workers were usually not available. Therefore, it was obvious that most of the figures had to be derived indirectly by professional judg-

ment, on the basis of available published and unpublished information on workers exposed to carcinogens. An international group of experts developed an estimation procedure and an information system called CAREX (from CARcinogen EXposure). The results of the project were published in a project report, in 15 country reports, and in the scientific literature (1).

In 1999–2000, the CAREX approach was applied to the Estonian, Latvian, Lithuanian, and Czech exposure situation in 1997, as part of the EU-INCO Copernicus

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project "Comparative Analysis of Occupational Health System and Practices as Part of Preventive Health Care Systems in Seven European Countries (FIBELLC project)". The results are reported in the present paper.

Subjects and methods

The estimation method has been described in detail elsewhere (1). Briefly, CAREX is an international information system on occupational exposure to 139 known and suspected carcinogens. It provides exposure data and estimates of the numbers of exposed workers by country, carcinogen, and industry. Due to the lack of direct data on the numbers of workers exposed, agent- and industry-specific prevalences of exposure in two reference countries (Finland, the United States) with comprehensive data on exposures were first applied to the industrial structure of the countries under study to generate crude default estimates. These preliminary estimates were reviewed and revised by national experts mainly for asbestos, benzene, and lead, which were of special interest for this project.

The procedure in the studied countries included the following two main phases: (i) the provision of industry-specific data on the labor force according to the International Standard Industrial Code (ISIC), revision 2, and (ii) the modification of preliminary estimates generated by the CAREX system.

In Estonia, laborforce data collected by the Estonian Statistical Office were used as the main source for the CAREX study. Official statistics directly provided data on 33 industrial classes of the 55 classes in CAREX. Data that were not directly available were estimated on the basis of the average distribution of the labor force in the industrial classes of the CAREX system in the EU member states. The main sources of exposure data in Estonia were the published and unpublished reports and papers of research institutes and the Public Health Inspection system. Based on these sources, 23 own estimates were incorporated into CAREX for benzene, asbestos, and lead. The numbers of workers exposed to other carcinogens were reviewed, but the default estimates were kept as such.

In Latvia, laborforce data were compiled using information from the Latvian Central Statistical Board. Because revision 1 of the NACE (Nomenclature Générale des Activités Économiques dans les Communautés Européennes) classification used in the European Union was adopted in Latvia in 1997, conversion was made of the data to the United Nations ISIC, revision 2, used by CAREX. Because official statistics mostly provided numbers of legally employed workers, estimates of the Latvian Central Statistical Board, including also noncon-

tract and self-employed workers, were used. Occupational health specialists of the State Labour Inspectorate and the Institute of Occupational and Environmental Health, as well as other experts, were involved in the exposure assessment process. Altogether 30 own estimates for asbestos, benzene, lead, hexavalent chromium, silica, environmental tobacco smoke, and acrylamide were added to CAREX. If a Latvian estimate was not available, the most appropriate of the Finnish, United States, or their average value, was used as the estimate of the prevalence of exposure for Latvia.

In Lithuania, the State Department of Statistics uses ISIC, revision 3, which covers also self-employed persons and farmers. Some of these figures were first corrected to compensate for the incomplete coverage of data provided by enterprises and organizations. Laborforce data were then converted from ISIC, revision 3, to ISIC, revision 2, jointly by the Lithuanian CAREX team and the State Department of Statistics. Lithuania adopted the Law on Human Safety at Work in 1993, according to which a hygienic assessment of workplaces is mandatory. The results of these hygienic assessments were used by the specialists of the Institute of Hygiene Center of Occupational Medicine to generate four of their own estimates on exposure to asbestos, benzene, and lead for the CAREX system.

In the Czech Republic, most of the laborforce figures could be converted to the ISIC, revision 2, classification from official statistics, which are based on the NACE, revision 1, classification of the European Union. The missing figures were estimated on the basis of the average distribution of the labor force in the industrial classes of the CAREX system in the member states of the European Union. The Czech estimates of the prevalence of exposure to asbestos, benzene, and lead among employed persons rely mostly on the records of the Czech Hygienic Service and district authorities. With the permission of the Major Hygienic Officer, the National Institute of Public Health at Prague asked for collaborative assistance from the Regional Hygienic Officers. All regions except two, covering 80% of the employed population, participated in the project. The data were summarized at the regional level and forwarded to the National Institute of Public Health. The final estimates were based on the assumption that the structure of the labor force in the missing parts of the Czech Republic is similar to the parts of the country that provided data. Altogether 335 own estimates of occupational exposure to asbestos, benzene, and lead in the Czech Republic were included in CAREX.

A more complete CAREX documentation, including definitions, laborforce data, country reports, and detailed results, is currently freely available on the internet through the Finnish Institute of Occupational Health (www.occuphealth.fi/list/data/CAREX).

Results

The numbers of workers exposed to carcinogens covered by CAREX were about 180 000 (29% of employed persons) in Estonia, 260 000 (28% of employed persons) in Latvia, 470 000 (28% of employed persons) in Lithuania, and 1 400 000 (28% of employed persons) in the Czech Republic in 1997 (table 1). The most common exposures were solar radiation (7–13% exposed at least 75% of the worktime), environmental tobacco smoke (4–5% exposed at least 75% of the worktime), wood dust (3–5% exposed), crystalline silica (2–3% exposed), diesel exhaust (2–3% exposed), radon and its decay products (2% exposed), benzene (0.9–1.7% exposed), and lead and inorganic lead compounds (0.8–1.4% exposed). Exposure to asbestos was slightly less prevalent (0.3–1.1% exposed).

Discussion

Apart from a few previous industry-specific figures, the estimates of occupational exposure to carcinogens produced during this project are the first ones published for Estonia, Latvia, Lithuania, and the Czech Republic. According to the results, exposure was widespread, comprising 28–29% of the employed population in 1997. The corresponding prevalences in the member states of the European Union in 1990–1993 were slightly lower, ranging from 17% to 27% (1).

As in the EU member states, a substantial part of all exposures originated from natural sources (ultraviolet radiation from the sun, radon from the ground) or from activities not directly related to work processes (environmental tobacco smoke at work). The contribution of these environmental factors in the studied countries was 42–57% of all exposures.

Exposure to ultraviolet radiation from sunlight was very prevalent in Lithuania and Latvia, where a greater proportion of the employed than in Estonia and the Czech Republic worked outdoors (mainly in agriculture). In Estonia, exposure to wood dust was proportionally common due to large wood and furniture industries. Lithuania has oil refineries, which raised the rank of benzene as a carcinogen. The Czech Republic is the most industrialized of the countries under study, and exposures to lead and asbestos were relatively common. However, comparisons across countries are partly hampered by the estimation procedure and lack of accurate empirical data on the numbers of exposed persons. The exact figures presented here should be viewed with caution because the estimation method could not take into consideration country-specific exposure patterns, with the exception of exposure to asbestos, benzene, and lead. In spite of these limitations, we think that the prevalence

Table 1. Most common carcinogen exposures (in thousands) by agent and country in 1997.

Agent	Estonia	Latvia	Lithuania	Czech Republic
Solar radiation	62	120	210	370
Environmental tobacco smoke	31	41	79	270
Wood dust	34	35	47	180
Silica, crystalline	19	19	40	170
Diesel exhaust	21	20	37	130
Radon	14	19	34	120
Benzene	7	8	29	67
Lead and its compounds	6	7	17	71
Ethylene dibromide	6	10	27	50
Formaldehyde	9	6	10	44
Asbestos	2	3	7	56
Glasswool	4	5	9	40
Hexavalent chromium	3	4	7	38
Polycyclic aromatic hydrocarbons	3	4	8	35
Tetrachloroethylene	3	5	11	30
Nickel compounds	1.1	2	3	33
Sulfuric acid mist	0.8	0.9	1.3	14
Styrene	1.1	1.5	2	14
Methylene chloride	0.6	0.4	0.7	4
Trichloroethylene	0.3	0.4	0.9	4
Total, exposures	240	320	600	1 800
Total, exposed workers	180	260	470	1 400
Percentage of employed	29	28	28	28

figures produced by the CAREX method are potentially useful in the assessment of occupational cancer risks at the national level. When combined with data on exposure levels, they can also contribute to the decrease in carcinogen exposures and thereby to the prevention of occupational cancer among exposed workers.

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