Short report
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Exposure to environmental tobacco smoke in the workplace as risk factor for occupational lung cancer

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Tobacco smoke is the single factor known to have caused the highest proportion of cancer. It is associated with the most frequent cancers both in males (lung cancer) and females (breast cancer) (1,2). According to the official data of the Cancer Registry of Vojvodina in 1997, the incidence of lung cancer was very high in both males and females, being the most frequent malignancy in males (31.2%) and at the fourth place in females (6.2%). In the percentage structure of mortality lung cancer was the most common malignancy in mortality structure of males (35.9%) and the second in females (9.0%) (3). The oncological problem of lung cancer is likely to be even more serious in future, especially in developing countries, if no action is taken to prevent the spread of tobacco smoking (4).

Our previous study showed that in various occupations in the Province of Vojvodina (agricultural workers, forestry workers, bridge construction workers) smokers, ex-smokers and non-smokers account for 60%, 10-20% and 20-30%, respectively (5). At present in Europe, occupational exposures might be responsible for 13 to 18 % of lung cancers in men and 1 to 5% in women (6). Numerous epidemiological studies show that occupational exposure to certain substances is associated with an increased risk of developing lung cancer (like asbestos, arsenic, chromium VI, nickel, cadmium, polycyclic aromatic hydrocarbons, crystalline silica etc.) (7).

Although cigarette smoking as non-occupational factor is the major cause of lung cancer, exposure to environmental tobacco smoke (ETS) in the work place as occupational factor may still play significant role (8,9). ETS is a term now widely used to refer to the mixture of sidestream smoke and exhaled main stream smoke that pollutes air locations where tobacco smoking is taking place (10). In fact, ETS is the smoke that nonsmokers are exposed to when they share air space with someone who is smoking. ETS contains numerous carcinogenic agents (polycyclic aromatic hydrocarbons, aromatic amines, nitroso compounds etc.) (11).

First results of our ongoing study of health status of the population in Yugoslavia indicate that in the region of South Bačka, 55.4% of employees are daily smokers, or have smoked daily at least one year continuously. Among them 16.7% smoked more than 20 years. Also, the study showed that 36.9% employees are exposed to tobacco smoke in the work place more than one hour during their working hours (half of them are exposed more than five hours).

Recent studies have shown a statistically significant increase in lung cancer risk related to workplace ETS and have provided evidence of increasing risk with increasing duration of workplace ETS exposure (12-14). Corresponding median risk from ETS exposure in U.S. nonsmokers during the 1980s is estimated at about two lung cancer deaths (LCDs) per 1000 at risk, and for most-exposed nonesmokers, about two LCDs per 100. According to International Agency for Research on Cancer data risks in the other countries appear similar (15).

Workplace exposures are variable because of the difference in: a) the size and ventilation characteristics of workplaces, b) the number of smoking coworkers-workers, and c) smoking policies in different workplaces (16).

For atmospheric nicotine in the workplace, the *de minimis* or "acceptable" lifetime risk level of 1 lung cancer death per million nonsmokers at risk occurs at 7.5 nanograms per cubic meter (8-hr time-weighted average) (15). Mean concentrations measured in workplaces that allow smoking generally range from 2 to 6 $\mu g/m^3$ in offices, from 3 to 8 $\mu g/m^3$ in restaurants, and from 1 to 3 $\mu g/m^3$ of blue-collar workers. Mean nicotine concentrations from 1 to 3 $\mu g/m^3$ have been measured in the homes of smokers. Furthermore, workplace concentrations are highly variable, and

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some concentrations are more than 10 times higher than the average home levels, which have been established to cause lung cancer (17). It appears that workplaces without effective smoking policies considerably exceed the *de minimis* risk standard (15).

Biomarkers are desirable for quantitating human exposure to ETS and for predicting potential health risks for exposed individual. At present cotinine, measured in blood, saliva or urine appears the most specific and the most sensitive biomarker of ETS exposure (18,19). For cotinine in body fluids *de minimis* risk occurs at a daily average level of 2.6 picograms of cotinine per milliliter of urine excreted. Using this *de minimis* risk standard for ETS, personal nicotine monitors and sensitive cotinine assays, it is now possible to monitor individual workplaces or individual workers to determine risk from the workplace carcinogen ETS using standard industrial hygiene techniques (15).

ETS exposure is preventable by engineering or policy means. Regulatory and legislative initiatives should be directed toward elimination of ETS from the workplace (including offices, public spaces such as bars, restaurants, schools, public transportation etc.). Also, employers should provide training concerning the health hazards of ETS and voluntary personal smoking-cessation programs (20).

Legislative measures (such as advertising bans, price increases and limits on smoking in public places) have been adopted in recent years, although these measures have still tended to focus on tobacco consumption rather than on the problem of tobacco production. Thus, the industry has shifted its promotional activities to developing countries, so that more people are exposed to tobacco smoke than ever before (21). Legislative measures about smoking cessation in Yugoslavia have their history and the latest Law concerning smoking ban in closed spaces was brought in 1995., but without adequate implementation (22). In most instances developing countries lack the political and economic strength needed to impose the kinds of restrictions that are increasingly being adopted in western countries. The inequalities in health between industrialized and developing countries are therefore increasing (21).

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