



Editorial

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Environmental tobacco smoke—a major preventable cause of impaired health at work

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Environmental tobacco smoke — a major preventable cause of impaired health at work

Environmental tobacco smoke is one of the most widespread occupational health hazards of today. Epidemiologic and other scientific data support the view that regular long-term exposure to environmental tobacco smoke causes increased risk of lung cancer and an excess of other respiratory diseases, as reviewed by Boffetta (1), Husgafvel-Pursiainen (2), and Jaakkola & Jaakkola (3, 4). In addition, epidemiologic evidence suggests that exposure to environmental tobacco smoke is associated with mortality from cardiovascular diseases, reviewed by Jousilahti et al (5). Several reports indicate that also reproductive health may be affected by exposure to environmental tobacco smoke (6). Environmental tobacco smoke thus constitutes a significant but preventable cause of morbidity and death among nonsmokers.

At work, environmental tobacco smoke is a particular kind of exposure since it is not related to work processes such as production, manufacturing or service but is, instead, connected to individual smoking, and therefore it is again more readily preventable. The introduction of smoking restrictions or nonsmoking policies not only prevents occupational exposure to environmental tobacco smoke but also encourages workers to stop or reduce their smoking, the result being important health benefits, as observed in multiple studies (7–12).

Exposure to environmental tobacco smoke is increasingly regulated in many developed countries. In Finland, statistics indicate that this type of exposure has been declining during the last few decades, ever since legislative actions were first taken in 1995 and smoking prevalence began to decrease. In 2000, 14% of nonsmoking men and 13% of nonsmoking women aged 15 to 64 years were exposed to environmental tobacco smoke either at work or at home (13). In the middle of the 1980s, about 25% of employed nonsmoking men and 15% of employed nonsmoking women were exposed at least 1 hour daily at work. In 2000, these proportions were 8% and 4%, respectively (13).

In the United States, data from 1994 indicated that about 65% of nonsmoking adults and 27% of children were exposed to environmental tobacco smoke at that time (14). Nevertheless, a recent nationwide survey of exposure of the general population to environmental chemicals indicated a considerable reduction in the overall level of exposure to environmental tobacco smoke since 1988–1991 (15).

Work-related exposure to environmental tobacco smoke and legislation in Finland

According to Kauppinen & Virtanen (16), around 300 000 workers are exposed to tobacco smoke at their workplaces in Finland. Among these people, about 10% are exposed for almost their entire worktime; this group includes mainly those who work in restaurants, bars, hotels, and similar places. The time-weighted 8-hour average exposure for all occupations is approximately 1 µg nicotine/m³ air. The exposures at restaurants are considerably higher, the measured levels fluctuating from less than 1 µg/m³ to more than 100 µg/m³ in bars that are very smoky. The number of those passively exposed at home in Finland is about 600 000; this estimate includes those exposed only occasionally (16). Outside homes and work-sites, some 1 million people are occasionally exposed to environmental tobacco smoke in various settings, like restaurants, cafeterias, and other social environments (16).

The amendment of the Finnish Tobacco Control Act (1995) restricted indoor smoking at work to rooms isolated from other premises and equipped with proper ventilation. Subsequently, occupational exposure to environmental tobacco smoke decreased substantially in most worksites but not in places

like restaurants, where smoking was not regulated at that time. Another amendment to the Tobacco Control Act restricted smoking of customers in restaurants by prescribing that 30% of customer seats should be smokeless as of March 2000. This restriction was strengthened in July of 2001 to include 50% of customer seats in restaurants with a size of 50 m² or more. Because smoking in restaurants was not entirely prohibited by this amendment, questions rose about the possible need for a health-based exposure limit for tobacco smoke, and the criteria to be applied for smoke-free premises. It is too early to know whether this action will be taken in the near future.

Review of exposure to and health impact of environmental tobacco smoke

The Finnish Ministry of Social Affairs and Health requested the Scientific Committee on Health Effects of Chemicals (KATA) to evaluate the existing scientific data on the health risks of environmental tobacco smoke, with special emphasis on current exposure in the country. This supplement summarizes, mainly in the form of review articles, the principal scientific data and literature that were reviewed in the statement (17). The main areas covered in this supplement include an updated summary of exposure to environmental tobacco smoke in various sectors and occupations in Finland (16), a 15-year follow-up of overall exposure (13), and an assessment of exposure and its biological effects with biomarkers (2). In addition, reviews concerning risks of lung cancer (1) and cardiovascular diseases (5) among persons exposed to environmental tobacco smoke, other respiratory health effects in both adults and children (3, 4), and the effects of exposure on reproductive health (6) are included. Finally, at the specific request of the Ministry, an attempt was made to estimate quantitatively the risks of lung cancer and cardiovascular diseases based on the current exposure situation in Finland, as presented below.

Quantitative risk estimates

In 1993, the Environmental Protection Agency (EPA) in the United States (18), followed by the Occupational Safety and Health Administration (OSHA) in 1994 (19), made quantitative risk estimations based on exposure levels in the United States in the 1980s. The EPA reached the conclusion that environmental tobacco smoke causes 3000 lung cancer deaths annually (18). The EPA assessment did not separate occupational and domestic exposures. The Agency stated, however, that it was not possible to evaluate the range of variation without using many assumptions about both the model and the accuracy of the parameters used to derive the population estimates; consequently, estimates as low as 400 and as high as 7000 were presented (18). A direct application of the EPA estimate to Finland, whose population is about 50 times smaller, would give an estimate of 30 annual lung cancer deaths.

In its estimations (19), OSHA used risk ratios of 1.34 and 1.28 for the occurrence of occupational lung cancer and coronary heart disease, respectively, in relation to exposure to environmental tobacco smoke. When exposure was assumed to be constant throughout workers' worklives, 141–722 and 2094–13000 deaths from lung cancer and cardiovascular diseases, respectively, were estimated to occur annually in the United States. When the OSHA approach and the current exposure data for Finland (16) are applied, the result would be 134–337 cases of occupational lung cancer during 45 years of exposure (ie, 3–7 cases annually) due to exposure to environmental tobacco smoke at work.

The assessments and estimations of Repace et al (20–27) were based mainly on studies from the 1980s, which estimate that a citizen of the United States who is involuntarily exposed to tobacco smoke will get a daily dose of 0–14 mg of nicotine with an average value of 1.4 mg. The lung cancer risks of passive smokers were calculated from the cancer mortality studies of Phillips and his co-workers (28, 29), who focused on nonsmoking Seventh Day Adventists. Using this data, Repace & Lowrey (20) estimated that exposure to environmental tobacco smoke would cause 7.4 lung cancer deaths per

100 000 person-years. An average daily exposure of 1 mg of smoke tar would cause 56 lung cancer deaths per 100 000 person-years.

Later Repace & Lowery (25) estimated that tar and nicotine appear in smoke in the proportion of 10:1, respectively. After modeling the conditions in the workplaces and physiological processes, they concluded that a nicotine concentration of 7.5 ng/m³ in indoor air (8-hour time-weighted average) would cause a risk of 1×10⁻⁶ during 40 workyears (6.7 ng/m³ during 45 years). In Finland, the average exposure at work is estimated to be 10 µg/m³ in restaurants and 2 µg/m³ in other occupational sectors (16). The presumption from the Repace model that a daily exposure to a nicotine concentration of 6.7 µg/m³ from environmental tobacco smoke for 45 years causes 1 case of lung cancer per 1000 exposed workers annually leads to the conclusion that current exposure to environmental tobacco smoke in Finland would cause some 50 lung cancers during 45 years of exposure — approximately 1 case/year. Similar assumptions for domestic exposure would result in approximately 8 cases annually. In Norway, the exposure standard of 10 µg/m³ for facilities where smoking is allowed is based on the estimations of Repace and his co-workers (30).

An estimation of the increased risk of diseases other than lung cancer, in quantitative terms, is less founded on current data. However, according to recent studies, the excess risk of cardiovascular diseases associated with exposure to environmental tobacco smoke is on the order of 25–30%, thus being close to that of lung cancer. On the other hand, mortality from cardiovascular diseases is approximately seven times more prevalent than that of lung cancer (31). Therefore, it can be estimated that mortality from cardiovascular diseases in relation to exposure to environmental tobacco smoke may be 5–10 times higher than that from lung cancer.

The uncertainties of the quantitative risk estimations are considerable — a recent study (32) with a different approach estimated mortality in Finland from exposure to environmental tobacco smoke based on causes of death, exposure prevalences, and risk ratios from selected epidemiologic studies. According to that estimate, the attributable fractions of cause-specific mortality from exposure to environmental tobacco smoke were 2.8% for lung cancer, 1% for chronic obstructive pulmonary disease, 4.5% for asthma, 3.4% for ischemic heart disease, and 9.4% for cerebrovascular stroke. The study estimated that altogether about 250 deaths related to environmental tobacco smoke occurred in 1996 in Finland.

In summary, environmental tobacco smoke is a common public health hazard that can be eliminated. The scientific data indicating serious health effects among exposed adults, as well as the estimated numbers of morbidity and mortality attributable to environmental tobacco smoke, speak strongly for a need for strict preventive actions, such as legislation prescribing smoking restrictions or bans, supported by smoking cessation campaigns. Trends indicating declining exposures to environmental tobacco smoke among employees, as well as among the general population, following regulatory actions encourage continued efforts.

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