Quantitative estimation of lung cancer deaths attributable to passive smoking from spousal exposure in Europe

Daniela Porta[1], Francesco Forastiere[1], Paolo Carrer[2], Anna Clara Fanetti[2], Carlo A Perucci[1]

[1]Azienda Sanitaria Locale Roma E, Rome, Italy
[2]Dpt. of Occupational and Environmental Health, University of Milan, Hospital L. Sacco, via G.B. Grassi 74, 20157 Milano, Italy

INTRODUCTION

Lung cancer is the most common cancer in the world and accounts for 12.3% of all new cancer in Europe. About 375,000 new cases of lung cancer were estimated for Europe in 2000; 303,000 in men and 72,000 in women. The number of deaths was about 347,000 (280,000 in men and 67,000 in women). However, there are substantial differences in incidence of lung cancer in the different regions and populations within Europe (Tyczynxki, 2003). Estimates for the year 2000 indicate that the highest age-standardized incidence rates in men (per 100,000 inhabitants) are in Hungary (95.5), Croatia (82.5), Bosnia Herzegovina (82.2) and Yugoslavia (80.9). The lowest rates are in Sweden (21.4), Iceland (31.5), Portugal (33.9) and Norway (35.1). In women the highest rates are observed in Denmark (27.7), Iceland (23.8), Hungary (22.6) and the UK (21.8). In women, the lowest incidence rates are observed in Spain (4.0), Belarus (5.0), and Portugal (5.5).

There are also differences in temporal trends. In men, lung cancer mortality is declining in Northern and Western Europe (UK and Finland), although it is already low and fairy stable in Sweden and Norway. In Central and Eastern Europe, however, lung-cancer mortality is increasing. In women, there was high and increasing mortality in the UK until the end of the 1980s. Since then, however, a plateau has been reached and rates have started to decline. In Sweden and Norway, mortality has been increasing during the past 25 years, although it is still much lower than in the UK. In Southern Europe, mortality from lung cancer is either quite low and stable in countries like Greece, or increasing at a moderate rate in Italy and Portugal.

Epidemiological studies indicated cigarette smoking as the predominant cause of the disease, but there are sound scientific data that air pollution, both indoor and outdoor, may cause lung cancer. The lung cancer risks associated with indoor and outdoor air pollutants need to be considered in the context of cigarette smoking, that is the leading cause, and other causes of lung cancer. Workplace exposures contribute substantially, either independently or by modifying the risk of smoking. Indoor air is contaminated by multiple pollutants generated by combustion sources, biological sources, gaseous pollutants released from household products, furnishings and building materials, and by entry of pollutants in outdoor air. These pollutants consist of a number of carcinogens, including several that have been linked to lung cancer, such as tobacco smoke (ETS), radon, asbestos and other fibers.

Environmental tobacco smoke (ETS) indicates the mixture of sidestream smoke and exhaled mainstream smoke that contaminates indoor air when smoking is taking place. The inhalation of ETS by nonsmokers is generally referred to as involuntary or passive smoking. The exposures of involuntary and active smoking differ quantitatively and, to some extent, qualitatively. Nevertheless, tobacco smoking in indoor environments increases levels of respirable particles, nicotine, polycyclic aromatic hydrocarbons, carbon monoxide, acroleine, and many other substances. Measurements of components of tobacco smoke in public and commercial buildings, various workplaces, and residences have shown widespread contamination by ETS. Studies using biomarkers of exposure including nicotine and its metabolite, cotinine, have further shown that ETS components are inhaled and absorbed by nonsmokers.

The adverse effects of exposure to environmental tobacco smoking (ETS) are well established (Office of Environmental Health Hazard Assessment, 2005). Several well-conducted studies have shown higher risk of coronary artery diseases, lung cancer, respiratory diseases and stroke associated with exposure to passive smoke. ETS exposure could occur in private households, work and public places. Several countries have enacted legislation that prohibits smoking in work and public places, but the interest towards policies to address exposure in households is more limited. Studies conducted in the '90 have elucidated the relationship between exposure to ETS from spouse and lung cancer risk and relative risks (RR) have been provided, resulting in 1.36 for men and 1.22 for women (Boffetta et al, 1998).

The aim of the present work is to examine the overall impact of ETS exposures on lung cancer mortality in 25 European countries. The resulting figures are helpful to quantify the overall burden of indoor environment on cancer mortality.

METHODS

We considered the population of the 25 EU countries aged 35+ years in the year 2000. Statistics of lung cancer mortality by gender were available from an extensive publication reporting estimates of the health burden due to active smoking (Peto et al, 2006).

We calculated the number of lung cancer cases attributable to ETS from spouse, i.e. the Proportional Attributable Risk (PAR), by applying the following formula:

$$PAR = Pe\,(RR-1) / Pe(RR-1) + 1$$

where :

Pe = *Prevalence of people exposed to ETS from spouse.*

RR= *Relative Risk of having lung cancer being exposed to ETS from spouse*

Country specific data on prevalence of exposure to ETS from spouse were estimated. We applied the proportion of exposure to ETS from spouse derived from the large European case-control study (Boffetta et al, 1998) (63% for women and 13% for men) to the prevalence of smoking of each country (WHO, 1999-2001). A correction factor to consider the proportion of married subjects and that smokers tend to marry smokers was applied. The relative risks applied (and 95% Confidence Intervals, CI) were those resulting from the same study, namely 1.36 (1.02-1.82) for males and 1.22 (1.12-1.32) for females. These values are consistent with a comprehensive meta-analysis: 1.24 (95% CI: 1.13-1.36) (Hackshaw, 1997)

The number of attributable cases was derived by multiplying the PAR by the number of lung cancer cases "*not attributable to active smoking*". These figures were derived from the publication referenced above (Peto et al, 2006) as the difference between total lung cancer deaths and smoking attributable lung cancer deaths. All the calculations were made separately for men and women.

RESULTS

Table 1 and 2 illustrate the relevant figures for males and females, respectively. The total EU25 population aged 35+ was more than 118 millions males and about 132 millions females. A total of 170,343 lung cancer deaths were observed in the year 2000 in men and 52,847 in women. Lung cancer deaths not attributable to smoking were about 15,000 in men and 18,500 in women. Active smoking was more prevalent in Central-Eastern Europe for males and Western and Northern Europe for females.

A total of 916 (54-1928) lung cancer cases due to exposure from spouse were estimated for males and 2,449 (1,424-3,357) for females. The largest burden is for Western and Southern Europe for males (especially Germany and UK) and females (especially Germany, Italy, and France). These figures correspond to an attributable proportion of 0.5% in males and 4.6% in females.

DISCUSSION

This indicates that exposure from passive smoking exposure at home is relevant factor contributing to lung cancer etiology in Europe. In this study, we considered only exposure from spouse and no other individuals in the family. In addition, ETS exposure at work and in other places was not considered. Our figures are then an underestimate of the true attributable cases.

As a limitation of the present study, it should be considered that several figures were estimated and they were based on information collected during the nineties. Changes in prevalence of active smoking, changes of smoking behaviors in public places and indoor, changes in family composition may have altered the exposure distribution of the population and thus the number of attributable lung cancer cases. New data should be collected for a more recent period.

REFERENCES

Boffetta P, Agudo A, Ahrens W, et al. Multicenter case-control study of exposure to environmental tabacco smoke and lung cancer in Europe. *J Natl Cancer Inst* 1998; 90: 1440-50.

Hackshaw AK, Law MR, Wald NJ. The accumulated evidence on lung cancer and environmental tobacco smoke. *BMJ* 1997; 315: 980-988.

He J, Vupputuri S, Allen K, Prerost MR, Hughes J, Whelton P. Passive smoking and the risk of coronary heart disease – A meta-analysis of epidemiologic studies. *N Engl J Med* 1999;**340**: 920-6.

Office of Environmental Health Hazard Assessment. California Environmental Protection Agency. Health Effects Assessment for Environmental Tobacco Smoke. 2005. ftp://ftp.arb.ca.gov/carbis/regact/ets2006/app3exe.pdf

Peto R, Lopez AD, Boreham J and Thun M. Mortality from smoking in developed countries 1950-2000 (2nd edition: data updated 2006) http://www.ctsu.ox.ac.uk/~tobacco/

Tyczynski JE, Bray F, Parkin DM. Lung Cancer in Europe in 2000: epidemiology, prevention , and early detection. *Lancet Oncol* 2003; 4: 45-55.

WHO.http://www.who.int/tobacco/global_data/regional_databases/en/