

Letter from the editor

Lung cancer risk and workplace exposure to environmental tobacco smoke

Introduction: The UK's public places became smoke-free zones as of yesterday. The ban has been enforced because passive smoking increases the risk of lung cancer. More specifically, the UK Government has decided that people who work in smoky places, such as pubs and bars, are being placed at too high a risk of smoking-related diseases. But what is the evidence to support this decision? Can the barman in our local pub breathe a sigh of relief that his chances of developing lung cancer have just been reduced? Or are the claims of links between work exposure to tobacco smoke and lung cancer less categorical than they might appear?

A recent systematic review and meta-analysis, published in the *American Journal of Public Health*,^[1] has examined how real the dangers of workplace environmental tobacco smoke (ETS) exposure really are. The authors included in their analysis only studies that featured people with specific workplace exposure to tobacco smoke, and excluded studies that featured former smokers (who could therefore have developed lung cancer as a result of their own smoking, rather than through passive smoking). The analysis also stratified the studies depending on the level of exposure, and weighted the evidence on several key issues, such as the geographical location of the study, the sex of the participants, and the levels of exposure to other lung carcinogens (such as coal heating fumes in China).

Results: Stayner's review identified twenty-five studies that fulfilled the inclusion criteria. Of these studies, twenty reported relative risk (RR) estimates for lung cancer associated with workplace ETS that were greater than 1, indicating an excess lung cancer risk among non-smokers exposed to workplace ETS. The meta-analysis found an overall RR of 1.24 (95% CI 1.18 to 1.29), suggesting that people exposed to ETS were 24% more likely to develop lung cancer than non-exposed people. In addition, the authors found that people in the highest workplace exposure categories were twice as likely to develop lung cancer compared with non-exposed people (RR 2.01, 95% CI 1.55 to 2.60). The meta-analysis found no evidence of heterogeneity or publication bias.

Discussion: Stayner's systematic review and meta-analysis demonstrates that workplace ETS increases the risk of lung cancer by a quarter, and high levels of workplace ETS (as would be experienced by someone working in a bar or club^[2]) lead to double the risk of cancer. Interestingly, the 24% figure is the same as that reported in the original analysis that linked lung cancer with passive smoking in the home, published in the *BMJ* a decade ago (RR 1.24, 95% CI of 1.13 to 1.36).^[3] Such concordance, along with the finding of a relationship between the level of exposure and the size of the effect, strongly suggests that the link between workplace ETS and lung cancer is real. But can we be certain that chance, bias, or confounding have not influenced, or indeed created, the association between tobacco workplace ETS exposure and lung cancer?

Demonstrating a link between workplace ETS exposure and lung cancer is not easy. Ideally, an investigator would find two groups of people, one of which is exposed to ETS at work, and another which is not, and follow them for forty or fifty years, after which time he or she would identify whether more people in the smoke-exposed group developed cancer compared with the non-exposed group. This type of investigation, known as a *cohort study*, is of the kind famously performed by Richard Doll

and Richard Peto, demonstrating the link between smoking and lung cancer[4] [5]. However, because of the length of time and size of population required to obtain useful data, these types of study are rare. More easy to perform is a *case-control study*, where, in this example, an investigator would go to a hospital and speak to a group of people with lung cancer to determine whether or not they had been exposed to ETS at work. The investigator would then ask a group of people without lung cancer the same questions, and compare answers between groups to identify any association between ETS and lung cancer. Case-control studies of this nature were examined by Stayner and colleagues in their meta-analysis.[1] A key advantage of case-control studies is that they involve people who already have the disease in question, rather than people who might potentially develop the disease in the future, and so reduce the number of people required to be involved. A key disadvantage is that the case-control design is more susceptible than other study designs to the influence of bias, as we shall discuss here with respect to the Stayner's meta-analysis.

Firstly, someone suffering from lung cancer may recall being exposed to high levels of ETS more readily than someone without lung cancer. Such selective recollection could bias the data in favour of a link between cancer and workplace ETS. Secondly, if one of the groups in the case-control design has a potentially fatal disease, as with our lung cancer example, it is possible that people in that group will die before they are interviewed. Consequently, investigators are often only able to talk to a next of kin. While the next of kin might be in a position to report their relative's exposure to tobacco smoke at home, it would be much more difficult for them to comment accurately on the level of ETS exposure at their work.[1] Lastly, asking someone whether they worked in a smoky environment for most of their life gives little information about the amount of smoke they inhaled. Indeed, a study of nicotine concentrations in various different workplaces revealed huge variations not only between different offices and bars, but also between days within the same office (in one case, office workers on four separate shifts had a 50-fold range in daily exposure to environmental tobacco smoke).[2] Although the issues identified above could weaken the conclusions of Stayner's meta-analysis, they were all considered by the authors of the paper, and efforts were made to account for them in their calculations.

Conclusion: Overall, the systematic review and meta-analysis by Stayner and colleagues is the most extensive attempt to date to investigate the link between passive smoking at work and lung cancer. Although some of the data from the included studies are of limited quality, the fact that nearly all the included studies identified an increase in the risk of lung cancer in the groups exposed to ETS provides strong support for that association being genuine. While it is difficult to judge the accuracy of the low- and high-level exposure data, the presence of an exposure-response curve again strengthens our confidence in the association. Stayner's data allow us to conclude with a high degree of confidence that working in a smoky environment significantly increases the risk of developing lung cancer. The UK Governmental legislation, and employers' adherence to it, is therefore of the greatest importance if further needless deaths from workplace tobacco smoke exposure are to be prevented.

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