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LETTERS

Transfer of particulate matter pollution from smoking to non-smoking coaches: the explanation for the smoking ban on Italian trains

A major struggle is growing in Italy between the pro- and anti-tobacco lobbies concerning the voluntary decision of Trenitalia, the corporation that manages the long distance, reservation only Eurostar (ES) trains, which introduced a complete smoking ban starting from March 2004. However, even non-smokers are doubtful about a total ban and wonder whether this decision could be an excessive penalty for smokers on these trains, with journey times of up to six hours.

Before the ban, ES trains had two smoking coaches (the first and the last carriages out of a total of 11). The smoking coaches were separated from the adjacent non-smoking carriages by automatic sliding doors and each coach was equipped with a separate HVAC (heat, ventilation, and air conditioning) system.

To verify air quality in ES trains before the ban, we measured the concentrations of fine particulate matter (PM_{2.5}) in the different

coaches during a trip from Milan to Rome. PM_{2.5} comprises respirable particles < 2.5 µm in diameter, which represent a risk factor for respiratory and cardiovascular diseases and for lung cancer.^{1,2} PM_{2.5} is also used as an official index of outdoor air quality (15 µg/m³ as a maximum yearly average level of PM_{2.5} is the present US limit). It can be measured easily in real time (every two minutes) with portable instruments, and is a recognised although non-specific marker of environmental tobacco smoke (ETS).^{3,4}

As shown in fig 1, the first measures taken in a non-smoking coach positioned in the centre of the train detected PM_{2.5} concentrations mainly within outdoor limits (15 µg/m³), taken as reference for acceptable air quality, with the exception of a brief small peak around 7 pm. After transfer to the non-smoking coach next to the smoking car, a dramatic increase of PM_{2.5} concentrations was found with a peak of 180 µg/m³. As expected, measurements taken in the smoking coach revealed exceedingly high values of PM_{2.5} that reached a maximum of about 250 µg/m³. Returning to the non-smoking coach far from the smoking ones, PM_{2.5} concentrations returned to normal values.

Our data show that present HVAC equipments cannot preserve non-smoking coaches from ETS pollution deriving from smoking cars, which is transferred mainly to the adjacent cars, but can reach coaches further away, as shown by the isolated PM_{2.5} spike recorded at 7 pm. After these results were confirmed in supplementary monitoring in collaboration with Trenitalia, the company's management took the decision to issue the smoking ban.

Passengers of ES trains who choose to sit in non-smoking coaches have, for many years, been exposed to a hidden health risk, as these non-smoking coaches have, in fact, been heavily polluted by ETS from adjacent

smoking cars. The acknowledgement of these data can be useful for the development of smoking policies on railways in other countries; moreover, if shared by the mass media, these findings could make a ban on smoking on trains more acceptable because such a measure is intended to preserve the health of non-smokers and rail employees, not to be merely prohibitive.

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Deaths caused by secondhand smoke: estimates are consistent

In 2001 Woodward and Laugesen estimated the number of deaths caused by secondhand cigarette smoke in New Zealand, using an indirect method based on studies of disease specific mortality risks.¹ Most of the relative risks used in this estimation were taken from studies conducted in other countries. We now have an opportunity to check the accuracy of this estimate using a more direct method based on all cause mortality risks taken from a recent New Zealand study.²

Hill *et al* compared mortality among New Zealand never smokers living with cigarette smokers with that of never smokers in non-smoking households.² They report adjusted mortality rate ratios for 45-74 year olds from two periods: 1981-4 and 1996-9. For men the ratios were 1.17 (95% confidence interval (CI) 1.05 to 1.30) and 1.16 (95% CI 1.04 to 1.30) respectively; for women 1.06 (95% CI 0.97 to 1.16) and 1.28 (95% CI 1.16 to 1.42). Assuming a rate ratio of 1.15 constant over age and sex, and applying this to 1996 census counts of never smokers living in households with at least one smoker (approximately 55 340 adults), we estimate that passive smoking accounts for 73.5 deaths per year in the 45-74 year age group.

We have repeated the calculations conducted by Woodward and Laugesen, restricting the analysis to deaths caused by exposures in the home, and including only the age group 45-74. The base is again the 1996 New Zealand census population. The results are 2.7 lung cancer, 57.9 heart disease,

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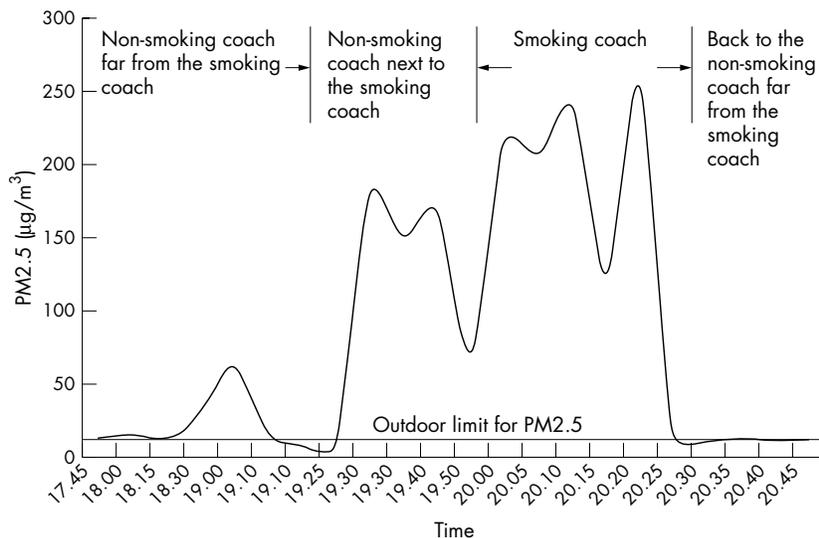


Figure 1 Particulate matter concentrations (PM_{2.5}) in smoking and non-smoking coaches on a long distance train.

and 46.3 stroke deaths per year (106.9 in total). This estimate includes never-smokers and ex-smokers (compared with the study by Hill *et al*, which was restricted to lifetime never smokers²). In their 2001 paper, Woodward and Laugesen undertook sensitivity analysis showing that the overall number of deaths was reduced by 45% if ex-smokers were excluded.¹ In this instance, 106.9 would come down to 58.8 deaths per year. Note that this does not include deaths that may be caused by other passive smoking related conditions (such as chronic lung disease or other cancers). Thus, 58.8 deaths per year is in close agreement with the estimated 73.5 deaths based on the study by Hill *et al*.²

Both estimates of the number of deaths caused by passive smoking have their weaknesses—for example, Hill *et al* had to assume that living with a smoker was a reliable measure of exposure to second hand smoke.² As a result, these calculations should be viewed as a guide to, not a precise measure of, the burden of disease. But it is encouraging that two different methods of estimating attributable deaths in the same population produce broadly consistent answers. It should add to the confidence with which

policymakers, health educators, and others use estimates of the passive smoking burden, while conscious of the significant uncertainties that accompany all calculations of this kind.

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CORRECTION

The publisher would like to apologise for the miss referencing in the Editor's choice, Chapman S. Harm reduction (*Tobacco Control* 2003;**12**:341). The references list should have read:

1 Foulds J, Ramstrom L, Burke, *et al*. effect of smokeless tobacco (snus) on smoking and public health in Sweden. *Tobacco Control* 2003;**12**:349–59.

2 Bates C, Fagerstrom K, Jarvis MJ, *et al*. European Union policy on smokeless tobacco: a statement in favour of evidence based regulation for public health. *Tobacco Control* 2003;**12**:360–7.

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