A broader question raised by the findings of Brown and Rushton is how we evaluate consistency in epidemiological studies, and when one might consider that a controversy about a putative carcinogen might be laid to rest. Clearly for silica one should expect that some new studies will be negative for lung cancer, especially when exposure levels are low. Nonetheless, policy makers must judge the weight of the evidence, as has been done by IARC and the NTP, agencies which evaluated more than 30 epidemiological studies of silica exposed workers. Given this level of past research, it might be considered high time for policy makers to act without the perennial call that "more research is needed".

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Pollution

Long term effects of air pollution in Europe

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Commentary on the paper by Filleul *et al* (see page 453)

There is an extensive documentation in Europe and North America about the short term effects of air pollution (especially particulate pollution) on health and a general consensus about their order of magnitude.¹ In contrast, long term effects, which are potentially very important, have been addressed in only a few cohort studies. This is mainly due to the problems of designing and executing large and expensive studies of long duration. Three studies have reported results from the USA,^{2–4} and only one from a Dutch cohort in Europe.⁵ In this issue, results from another European cohort study performed in France are reported.⁶

The long term effects of particulate air pollution reported so far, exceed those of short term exposures and have a larger impact in terms of years of life lost.^{7–8} The effect estimates from cohort studies, especially the ACS study,³ have been applied in various health impact assessment (HIA) efforts.⁹ Thus, the fact that there are very few such studies in Europe poses important problems: (1) Can we extrapolate from studies done in the USA, especially when there are known quantitative and qualitative

differences between the USA and Europe in the air pollution mix? (2) Are the studies performed so far, enough to get an effect estimate with reasonably general applicability?

The cohort studies reported have used individual data on outcome and confounders, but have generally assessed air pollution in an "ecological" way—that is, using one fixed monitor per city and assuming all residents of this city to be exposed to the same amount of pollution. In the Dutch study,⁵ an effort was made to refine the measurement by adding information on individual residential characteristics (that is, proximity to a major road). The results from these studies are generally consistent, and the fact that all major confounders have been assessed individually leaves little doubt that the reported associations are not due to hidden confounders.

In the study by Filleul *et al*, 24 areas from seven cities are investigated. In all areas a fixed site monitoring station had been established, and persons with residences within a distance from the monitor have been included. Each subject has been assigned an exposure level

corresponding to the relevant monitoring site. Assigning different exposures within the same city according to residence, adds an additional component of exposure misclassification due to the fact that subjects may move around a town and have an exposure closer to the average of all monitors. The authors then excluded the subjects whose exposure was assessed by monitors influenced by local traffic. The assumption was that this exposure may be an overestimate of the population exposure and lead to a biased effect estimate. By excluding these six areas, they excluded the whole city of Toulouse, the highest pollution area of Bordeaux, and the two highest of Marseille. Their argument for excluding these areas is plausible, but highlights the misclassification problems inherent in such assessments and the need to link to real population time-activity survey data (which are usually not available).

It is only after excluding these six areas that an effect of particulate and traffic related pollutants is detected. I think that an analysis at the city level, using as exposure metric the average of all city monitors would provide a useful sensitivity analysis for comparison purposes with previously reported results from other cohort studies.

It should be noted that the above exclusion of monitors influenced directly by traffic should be interpreted as exclusion of measurements hypothesised as being unrepresentative of the population exposure, as the authors correctly point out. It does not mean that traffic pollution is not an important (or indeed the most important) component of exposure to air pollution. The results of the present study reinforce the role

of traffic pollution on human health effects, since the pollutants identified (black smoke and NO₂) as responsible are indicators of traffic pollution. This result is consistent with other results reported in the literature.^{5 10}

The fact that cohort studies assessing long term health effects of air pollution are sparse in Europe and concern specific populations is a problem hindering the attempts to completely evaluate the public health consequences of this exposure. Additionally, there are difficulties concerning exposure assessment with respect to the metrics used, the time period of measurement, and the unknown size of misclassification. The two studies published so far used existing cohort data and managed to provide very useful information with relatively limited resources. However, these studies have obvious limitations as they were initially designed for other purposes. Furthermore, the important differences in air pollution between the USA and Europe cast doubts on the use

of estimates from US cohorts for HIA in European populations.

Therefore, a well planned, multi-centre cohort study designed to assess air pollution effects is now timely and should be considered a research priority.

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