Traffic and the heart

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This editorial refers to ‘Residence close to high traffic and prevalence of coronary heart disease’† by B. Hoffmann et al., on page 2696

A small but growing body of evidence suggests that being near traffic may not be good for our hearts.

Time series studies have shown associations between various air pollution components and cardiovascular deaths and hospitalizations for the last 15 years or so. These studies, the day-to-day variation in pollution levels is associated with day-to-day variations in cardiovascular death or hospitalization rates. Temporal pollution variations are largely driven by weather patterns, which by themselves may also affect cardiovascular health. How best to disentangle effects of meteorology and air pollution on the cardiovascular system has been the topic of heated debate. At current pollution levels in highly developed regions of the world, the estimated impacts on cardiovascular mortality and morbidity are modest even on ‘high’ pollution days, being in the order of perhaps 5–10% excursions over baseline—but it has been impossible to identify a threshold below which no effect occurs, and all of these small, day-to-day health impacts add up to considerable numbers over years.

Cohort studies conducted in the US have provided evidence that long-term exposure especially to very small particles in the air, leads to reduced life expectancy as a result of increased cardio-respiratory mortality. These studies have had a major impact on regulatory advice and decisions in the air pollution field worldwide, as the estimated impacts of long-term exposure to fine particles put air pollution quantitatively in the same league as such well known public health scourges as traffic accidents and obesity.

Airborne fine particles come in many different sizes, shapes, compositions, and from many different sources. So, for obvious reasons, the search has been on for which particles and which sources contribute most to harm. Several lines of evidence are now converging on traffic pollution as one of the major culprits. Some studies use source apportionment techniques to identify which particles contribute most to observed effects on cardiovascular mortality or morbidity. It has been suggested from such studies that particles from traffic are more harmful than particles from most other sources. Others have found that effects of fine particles are stronger in areas with high concentrations of nitrogen oxides, an indirect indication that traffic is a major source of particles in such areas.

The most direct evidence now comes from studies that have specifically targeted populations living close to busy roads. This is a fairly recent class of studies—initially, mostly focused on respiratory health of children living near busy roads, but now increasingly investigating long-term cardiopulmonary outcomes in cohorts of adults. The study of Hoffmann et al. is an example of such a study: it shows that subjects living close to busy roads in highly urbanized areas in the German Ruhr area are more likely to suffer from cardiovascular disease than subjects living further away. When these associations are assumed to be causal, this study adds evidence to the literature showing increased cardiovascular morbidity from proximity to traffic.

These studies offer a set of peculiar challenges. One is that living close to busy roads may be associated with other risk factors for cardiovascular disease that are not easily controlled. The investigators in this study included a large set of confounders, including educational level, as a measure of socio-economic status. However, some studies have suggested that neighbourhood social characteristics such as unemployment levels have additional effects on health, and further adjustment for such factors may be warranted in studies of this type. Another issue is that air pollution may be more clearly associated with fatal than non-fatal myocardial infarctions; in a baseline questionnaire study such as that described in the Hoffmann paper, fatal MIs are missed for obvious reasons, and effects of traffic pollution on cardiovascular outcomes may actually have been underestimated because of this.

Perhaps the biggest challenge is exposure assessment. Classifying subjects based on the location of their homes relative to major roads is attractive and simple—but not all roads are the same, and subjects, especially of working age, do not spend 24 h a day sitting outside next to the front door of their homes. Several studies have suggested that traffic composition and movement are more important than road classification. Other studies using personal exposure measurements to validate simple GIS-based exposure classifications have found that associations between measured personal exposure and road classification are relatively weak. The cohort in the Hoffmann study was on average 60 years old at the time of enrolment, and one

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would expect that in this cohort, born between roughly 1925 and 1955, the proportion of men having a job or having had a job requiring some travel away from the home was larger than the proportion of women. Yet, associations were stronger for men than for women, which raises questions with respect to potential confounding by occupational exposures in this industrial area, as acknowledged by the authors.

The real strength of the study is, likely, that it has systematically assessed the location of the home address with respect to busy roads at baseline in a prospective design. As this cohort is followed through time, there will be excellent possibilities to address just about all the inevitable limitations of cross-sectional studies and to perform validity studies on some of the key exposure and health outcome variables. Even a relatively large cohort such as this one will run into statistical power problems when addressing rare outcomes or when performing subgroup analyses. The time is right for pooling data from comparable studies in this area, so that more precise estimates of exposure–response relationships can be obtained.

The need for studies like this is underscored by the European policy development on air pollution. Time and again, regulators, policy makers, and interest groups have expressed reservations about extrapolating findings from US-based cohort studies to Europe, and this uncertainty—real or perceived—is delaying policy development, possibly at the expense of public health protection in Europe. One could, of course, argue that Americans, too, are human beings, that their sources of air pollution are not all that different from ours, and that a large series of studies on short-term effects of air pollution on cardiovascular outcomes have shown very similar results on both sides of the Atlantic; but the most convincing arguments will come from proper follow-up of European cohorts.

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**References**


