Methodological issues in determining the relationship between street trees and asthma prevalence

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The toxicity of CO is very well known to alter oxygen saturation in red blood cells, but only at concentrations that are far above those observed in England during the time period 1996–2004. Exposure to CO at the current criterion concentration (9 ppm) produces carboxyhaemoglobin of only about 1–2%, which is clinically insignificant.

Hence, I find it less than plausible that the very low ambient levels of CO in England could be the direct cause of so many deaths from respiratory disease.

I can present an alternative hypothesis to explain these pollutant–mortality correlations. I have argued that the use of methyl ether (such as methyl tert-butyl ether (MTBE) or tert-amyl methyl ether (TAME)) in gasoline creates MN in the exhaust. As CO is primarily an engine exhaust product, increased CO would be expected to be strongly correlated with MN exhaust product, increased CO would be expected to be strongly correlated with MN exhaust product, increased CO would be expected to be strongly correlated with MN exhaust product, increased CO would be expected to be strongly correlated with MN exhaust product, increased CO would be expected to be strongly correlated with MN exhaust product.

Furthermore, MN can easily be confounded with NO2, as I have argued previously.2 One review6 stated: “The overall results suggest that outdoor NO2 was serving as a marker for more causal airborne agents rather than a direct effect of NO2.”

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Methodological issues in determining the relationship between street trees and asthma prevalence

A study published in the July issue of the Journal of Epidemiology and Community Health7 documents the relationship between the density of street trees and the prevalence of childhood asthma in New York City. Findings suggest that street trees are associated with a lower prevalence, although no causality was inferred. I would like to point out a number of methodological issues which should benefit future studies on this subject.

The prevalence of asthma was determined for 4-year-old and 5-year-old children using data from school screenings in 1999. Street tree density was derived from the 1995 street tree census completed by the Parks and Recreation Department of the City of New York and expressed as the total number of trees on street segments divided by the land area. Data were aggregated at the level of United Hospital Fund (UHF) areas. Additional variables used in the analysis were population density, racial/ethnic composition and a measure of proximity to pollution sources. The initial correlation analysis suggested a negative association between street tree density and prevalence of asthma. However, one of the strongest positive associations was between street tree density and population density. This initially appears somewhat counterintuitive, until it is recognised exactly which types of trees are included in the analysis. The street tree census conducted by the Parks and Recreation Department of the City of New York considered only trees along city streets, and trees in parks and open space were not included. As a result, the street tree density derived by this study7 is a substantial underestimate of the actual number of trees within a UHF area, in particular in areas with large areas of parks and open space. In fact, a recent study by the Forest Service8 estimates that New York City has about 5.2 million trees, while the latest street tree census in 2005–2006 counted 592 130 trees.8 Street trees, therefore, account for only around 11% of trees within the study area. The strong correlation between street tree density and population density is strongly driven by the fact that the total length of street segments per unit area increases with population density. Logic suggests that overall tree density and population density are probably negatively associated since many parks and open spaces occur in areas with lower (average) population density. The pattern in street tree density by UHF areas is therefore a poor representation of the overall tree density.

Figure 1 provides an example of a park in Brooklyn adjacent to a residential area. Although numerous trees are visible on the residential streets, the number of trees in the park far exceeds the number of

Figure 1  Digital orthophoto of a portion of Prospect Park in Brooklyn, New York City, adjacent to a residential area. Source: United States Geological Survey 2006.
street trees. While fig 1 is not representa-
tive for the entire study area, it illustrates
how not including trees in parks and open
spaces presents a misleading picture of the
potential effects of trees on local air
quality in urban areas.

The argument could be made that street
trees are more relevant than those in parks
and open spaces since street trees are much
closer to the residential homes. However,
Lovasi et al do not make this argument and
instead aggregate all variables at the level of
UHFs. This aggregation does not allow for a
determination of street tree density in close
proximity to the residential addresses of
asthma cases. If street trees in close prox-
nity are deemed of greater relevance than
trees in parks and open spaces at greater
distances, an individual- or street segment-
level analysis is required.

A second methodological issue relates to
the determination of the measure of
proximity to pollution sources. Relying on
the methodology presented by a recent
study on sources of air pollution in New
York City,1 Lovasi et al1 create uniform
distance buffers around toxic release inven-
tory sites, stationary point sources and
major truck routes and then determine the
percentage of each UHF falling within one
or more of these buffers. While the specific
distances and types of sources were derived
from the original study,1 the authors fail to
highlight the many limitations of this
approach, as detailed at length in the
original study, including the use of single
buffer distances, treating all pollution
sources as being similar and ignoring
cumulative effects from multiple sources.
Perhaps more importantly, the original study1
used the individual geocoded resi-
dential locations of asthma hospitalisation
cases and determined whether they fell
within a particular buffer or not. Lovasi
et al1 instead determined the prevalence of
asthma as a rate based on the number of
children within each UHF and compared this
with the percentage of the area of the
UHF falling within one of more of the
buffers around the pollution sources, with-
out considering the proximity of individual
cases to pollution sources. The data aggre-
gation to the level of UHFs represents a
very substantial loss of information. No
evidence is presented that aggregation at
the level of UHF areas is justified given the
nature of the research question since it
remains unclear at what (spatial) scale the
potential effects of street trees on air
quality are expected to occur.

Future research efforts in this area should
consider the following three refinements.

1. Developing a more robust measure of
tree density which includes trees in
parks and open spaces. This could be
addressed by using land use or land
cover maps supplemented with field
sampling as employed by the Forest
Service.2

2. Using individual-level analysis instead of
aggregation to coarse units. This would
involve geocoding individual address
locations of asthma cases and creating
individual-level measures of tree density
and proximity to pollution sources, as
well as creating a meaningful sample of
non-asthma cases for comparison.

3. Employing more robust measures of
proximity to pollution sources. One
approach to accomplishing this is to
use cumulative distribution functions.3

While each of these three elements
requires considerable effort, they should
contribute to a much improved understand-
ing of the complex relationships between
tree density and asthma prevalence.

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Gender differences in spousal
household material status
estimation

Gender differences in socioeconomic
inequalities in mortality are well known.1
However, gender differences in self-reported
socioeconomic status in public health sur-
veys has been much less frequently investi-
gated. We aimed to compare the material
status estimates provided by men and
women in spousal pairs, obtained from the
larger genetic epidemiology study in Croatia
that was focusing on the families, thus
enabling spousal pairs analysis. A total of
182 spousal pairs from the Adriatic island of
Vis were included in this study. Household
material status was estimated as the equally
weighted sum of 16 questions on various
items that were either present or absent
from the household, as in our previous study.2
Examiners were also asked to pro-
vide the information on their education level
(years of schooling). Additionally, we asked
examiners to provide information on three
questions that were used as control ques-
tions: examinee’s marital age, their spouse’s
marital age and a number of children they
have. The data were analysed with the
paired non-parametric Wilcoxon test. The
results indicated no gender difference in any
of the three control questions. As expected
on the basis of the official population census,3
men had significantly higher educa-
tion level than women (10.5 ± 3.2 vs.
9.6 ± 3.5 years, respectively; p < 0.001).
Additionally, men provided significantly
higher self-reported material status esti-
mates than women (10.1 ± 2.2 vs. 9.6 ± 2.4,
respectively; p = 0.027). This result indicates
that either men were prone to overestima-
tion, or women were prone to underestima-
tion of the household material status.
Theoretically, the only way to further
explore these differences would be to com-
pare the responses with the actual house-
hold, which was well beyond the scope of
this study. The finding of unequal gender
estimates in this population is even more
interesting knowing that we had previously
described a high level of socioeconomic
homogeneity and virtual lack of health
inequalities in the Vis Island population.4

Admittedly, these results might be confined
to the investigated island population and
not very prevalent in other populations.
Nevertheless, we propose that differences
in self-reported socioeconomic estimates
depending on the examinee’s gender should
be taken into account, especially in studies
that use gender-dependent socioeconomic
estimates in pooled analyses.

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