

Particulate Matter from Regional Transportation is an Undisputed Local Health Problem

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Notes for Testimony by Wig Zamore (edited to add several new studies since July 07)

Introduction

Many people have been surprised to learn that control of fine particulate air pollution represents over 85% of the net benefit over costs available from all Federal regulations, environmental and other (US OMB last four Reports to Congress). Current US fine particle standards are aimed at moderate control of regional pollution levels. However, available science recognizes that local and near source variations in particulate matter are associated with far higher levels of health impact than between region differences. As societies mature, the major particulate sources of concern move from indoor open fires for heating and cooking, to heavy industry and dirty power plants, to mobile sources. Particle levels and health impacts adjacent to highways and diesel rail are especially problematic.

Premature Cardiopulmonary Mortality in Regional and Local Cohort Studies

Fine particles are associated with 6%, 9% and 14% increases in all-cause, cardiopulmonary and lung cancer mortalities respectively, for every 10 micrograms (millionths of a gram) of fine particulate per cubic meter of air difference between regions (**Pope 2002**).

When analyzed at the local community level, the same 10 µg/m³ increment of fine particulate matter is associated with 16%, 28% and 27% increases in all-cause, cardiovascular and lung cancer mortalities respectively (**Laden 2006**).

Premature Cardiopulmonary Mortality in Near Source Studies (Highway Adjacent)

A recent German study has found women living within 50 meters of a major roadway have 70% greater cardiopulmonary mortality (**Gehring 2006**).

A Netherlands study (**Hoek 2002**) previously found 41% and 95% increases in all cause and cardiopulmonary mortality for those living within 100 meters of highways and 50 meters of busy city streets.

A much larger follow-up to the Netherlands study (**Beelen 2008**) shows more modest results of 3% and 5% increases in all cause and cardiovascular mortality, respectively, for every 10,000 vehicles per day (VPD) on the nearest road.

A 21% increase in pulmonary mortality was found to be associated with total traffic within 100 meters of residence for those in the highest exposure group.

Beelen's study equals ~ 30% and 50% increases in all cause and cardiovascular death for living near a 100,000 VPD highway. However, the study lacked some individual information and had fairly few high exposure participants.

Birth Outcomes and Childhood Cancer Studies

Although public health researchers agree that near highway levels of carbon monoxide and PM exceed the concentrations at which negative birth outcomes should be expected (**Salam 2005**), there were only county (**Bell 2007**) and local studies (**Ritz 2006**) until early 2008.

A Vancouver study (**Brauer 2008**) reported increases in “small for gestational age” (26%) and “low full-term birth weight” (11%) for pregnancies at residences within 50 meters of a highway. Individual air pollutants were also associated with adverse outcomes but to a much smaller extent than exposure to the nearby highway emissions.

Fortunately childhood cancer deaths are so infrequent that it is hard to find statistically significant studies. However one English study has found a 100% cancer mortality increase for children spending their first year of life near major roadways (**Knox 2006**).

Childhood Asthma and Lung Function (Local and Near Roadways)

Research from the California Children's Health Study has shown 50% increased prevalence of asthma for children living within 75 meters of a highway (**McConnell 2006**).

A separate publication from the same large multi-year cohort study shows roughly a 100% increase in asthma for children more exposed to highway pollutants when comparing the 25% and 75% exposure populations, the interquartile range (**Gauderman 2005**).

A recent Netherlands study (**Brauer 2007**) shows 20% to 30% increase in asthma per interquartile range for traffic exposure. This study focused on pre-birth and very early age exposures.

The California Children's Health Study has also shown decreased lung function at year 18 for those who grow up near highways (**Gauderman 2004 and 2007**), with nearly five times as many in the near highway group never reaching 80% of normal lung capacity.

A German study looking at the rapid decrease in regional air pollution in East Germany has found that lung function in children living within 50 meters of busy roads has not been improving at the same rate as their classmates living further away (**Sugiri 2006**).

Chronic Obstructive Pulmonary Disease and Lung Cancer (Local and Near Highway)

A German study has found that women living within 100 meters of a busy roadway have considerably reduced lung function and a 79% greater incidence of chronic obstructive pulmonary disease (COPD) than those living further away (**Schikowski 2005**).

A large cohort study of Los Angeles basin residents has found 44% greater lung cancer mortality in zip codes whose centers lie within 500 meters of a highway intersection (**Jerrett 2005**). (Though this outcome was not quite statistically significant, it is nevertheless fairly powerful as an unintended offshoot of a study of within region gradients.)

A careful study of individual residence address and lung cancer in Stockholm found a 60% greater mortality for those in the highest 10% exposure to transportation pollution 20 years earlier (**Nyberg 2000**). Never smokers, former smokers and light smokers were equally affected. (Heavy smokers were less affected by the transportation pollution.)

A comprehensive study of individual residence address and lung cancer in Oslo found 122% higher mortality risks in a two pollutant model for those most exposed to mobile pollutants (**Nafstad 2003**).

Cardiovascular Disease and Mortality (Local and Near Highway)

A recent study of post-menopausal women in US cities has found cardiovascular and cerebrovascular (stroke) mortality to have much higher association with local than with regional fine particulate levels (**Miller 2007**).

In the Miller study, the increased mortality between cities per 10 $\mu\text{g}/\text{m}^3$ increment was roughly 60% while within cities the same pollution increment was associated with over 100% increase in cardiovascular and cerebrovascular mortality.

A Canadian study has found (**Finkelstein 2005**) a 40% increase in cardiovascular and cerebrovascular mortality from proximity to traffic but only a 6% increase due to overall local pollution levels. Socioeconomic factors were insignificant compared to residential location traffic volumes.

A series of recent German studies (**Hoffmann 2006 and 2007**) has found an 85% increase in coronary heart disease (after adjusting for other factors) for those within 150 meters of busy roadways, and found a 45% increase in problematic coronary artery calcification for those within 100 meters.