HelmholtzZentrum münchen
German Research Center for Environmental Health

Health Effects of Low Emission Zones in our Cities

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HELMHOLTZ ASSOCIATION

Health benefits from low emission zones naturally could not be proven by now as one has just started to launch them……

London, middle of XX century

Beijing, beginning of the XXI century

Overview

- Traffic-related air pollution and mortality
- Traffic-related air pollution and cardiovascular disease
- Traffic-related air pollution and allergies
- Outlook

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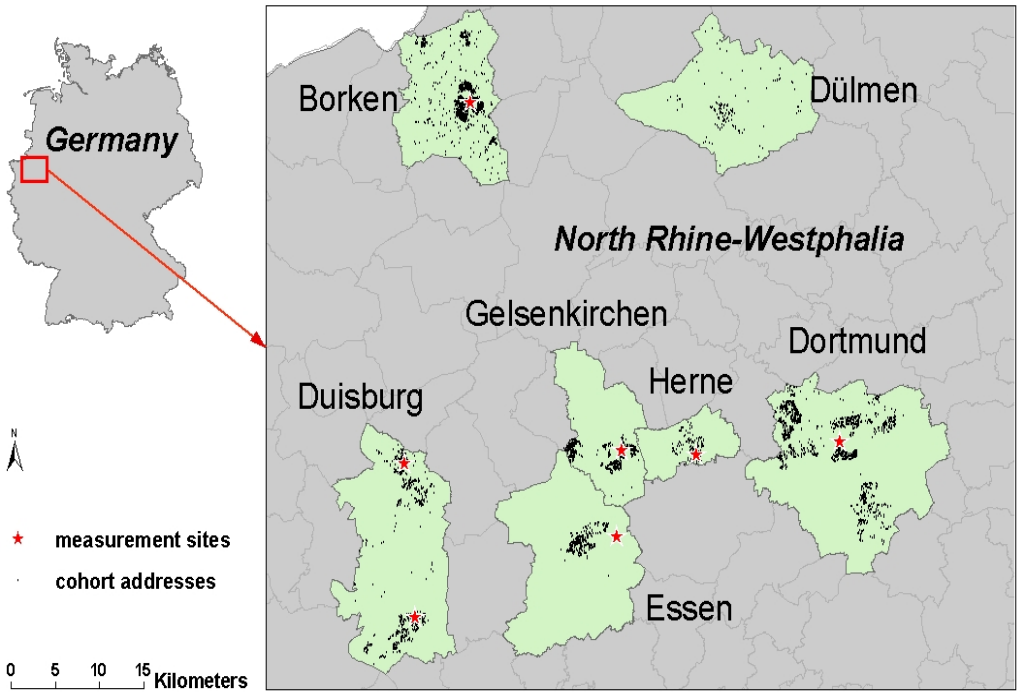
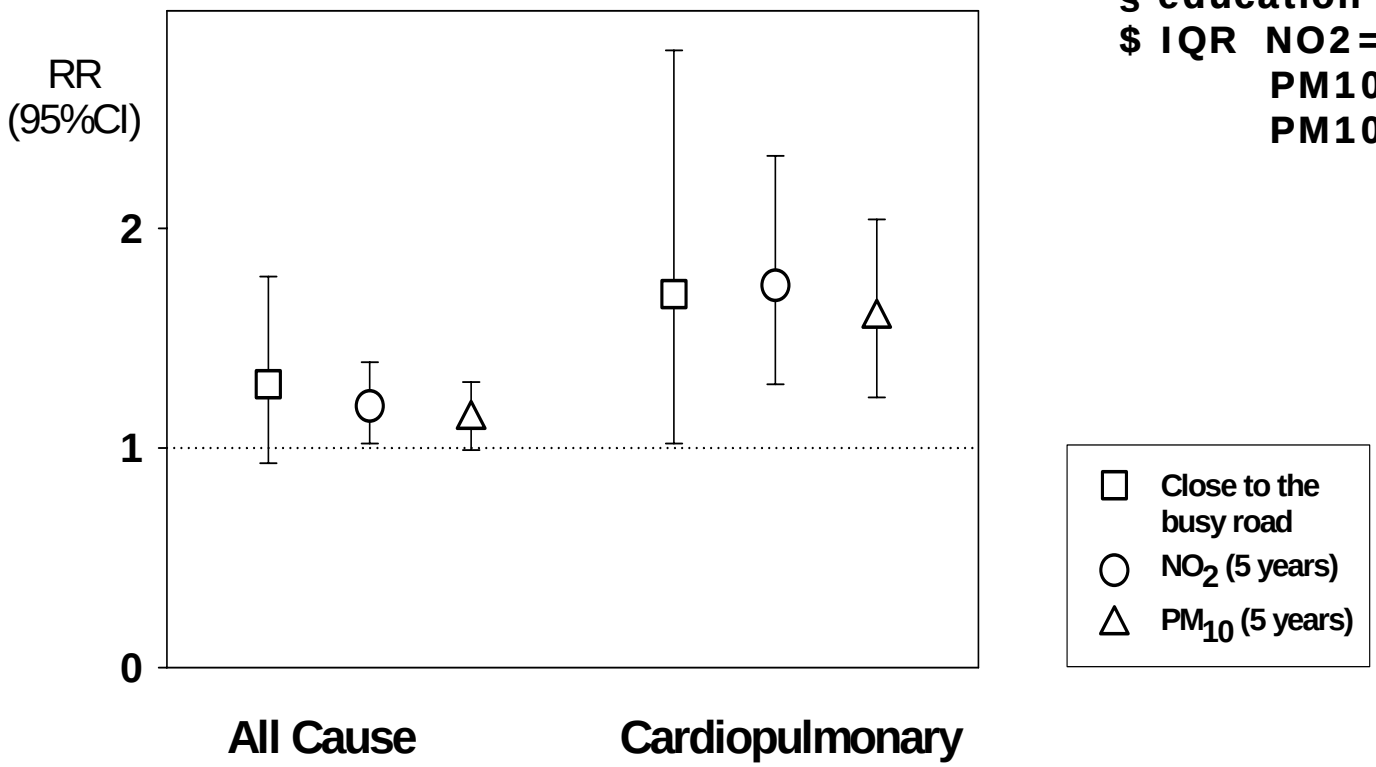
Cohort study in North Rhine-Westphalia

- Women age 50-59 were recruited between 1985 and 1994
- Follow-up until 2003
- Alive (N=4353)
- Dead (N=399)
- Modelling of exposure at residential address



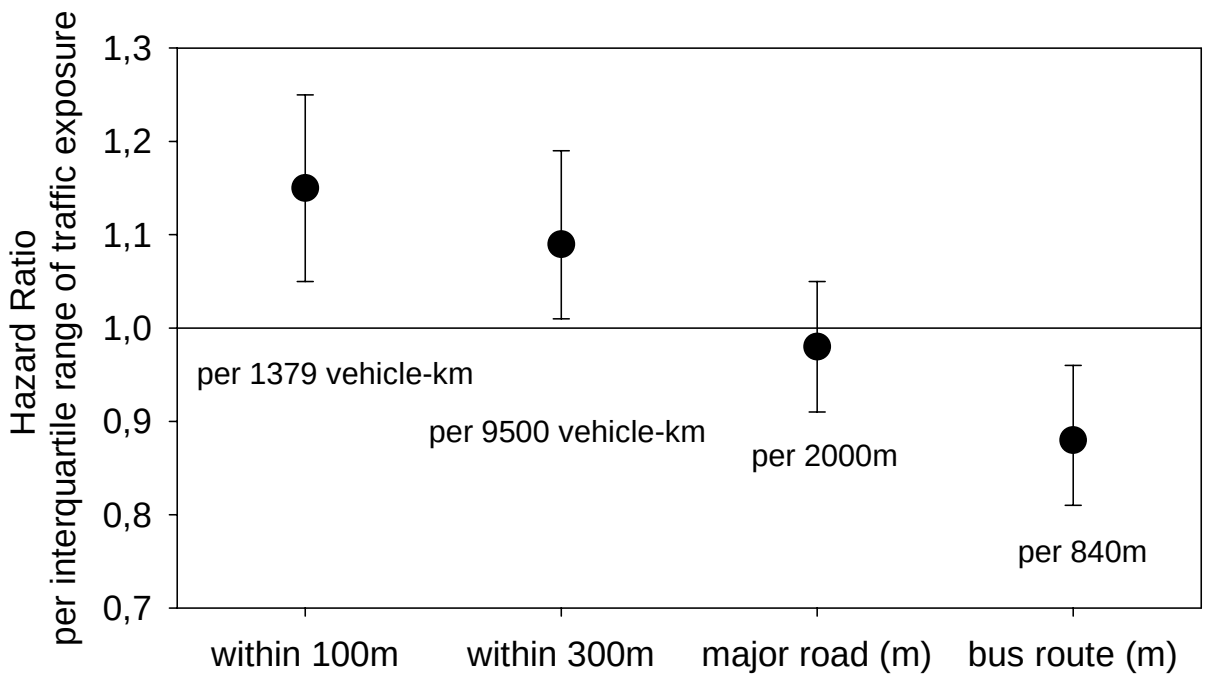
Adjusted§ Relative Risk of Mortality for Increase of Air Pollutants$ and Living Close to Busy Roads



§ education and smoking;
$ IQR NO2=16 µg/m³
PM10: 7 µg/m3;
PM10= 0.71*TSP

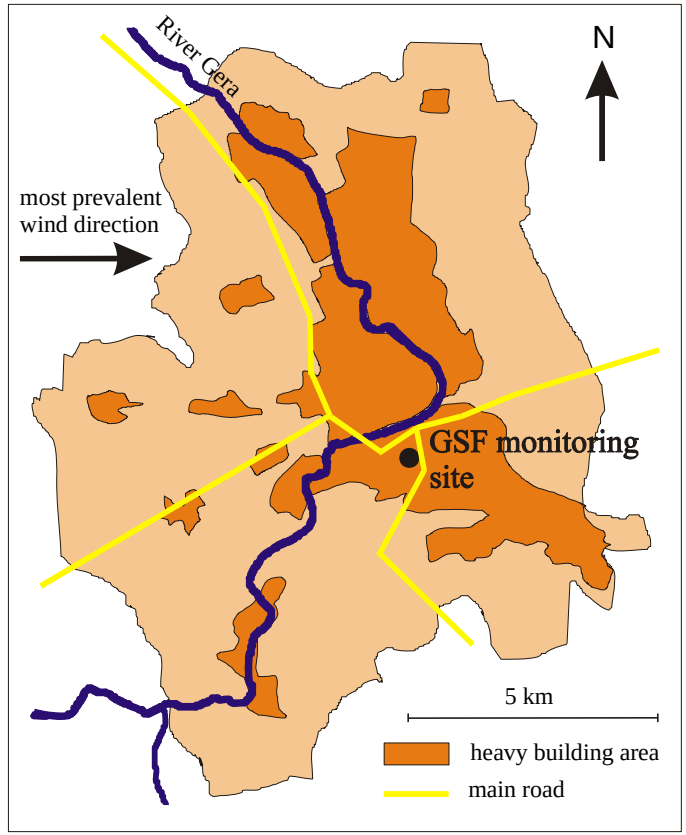
Subjects with heart failure are dying earlier if exposed to traffic at their homes

- 1389 patients with heart failure in Worcester, MA in 2000
- After 5 years, 334 subjects survived
- Traffic exposures at the residences

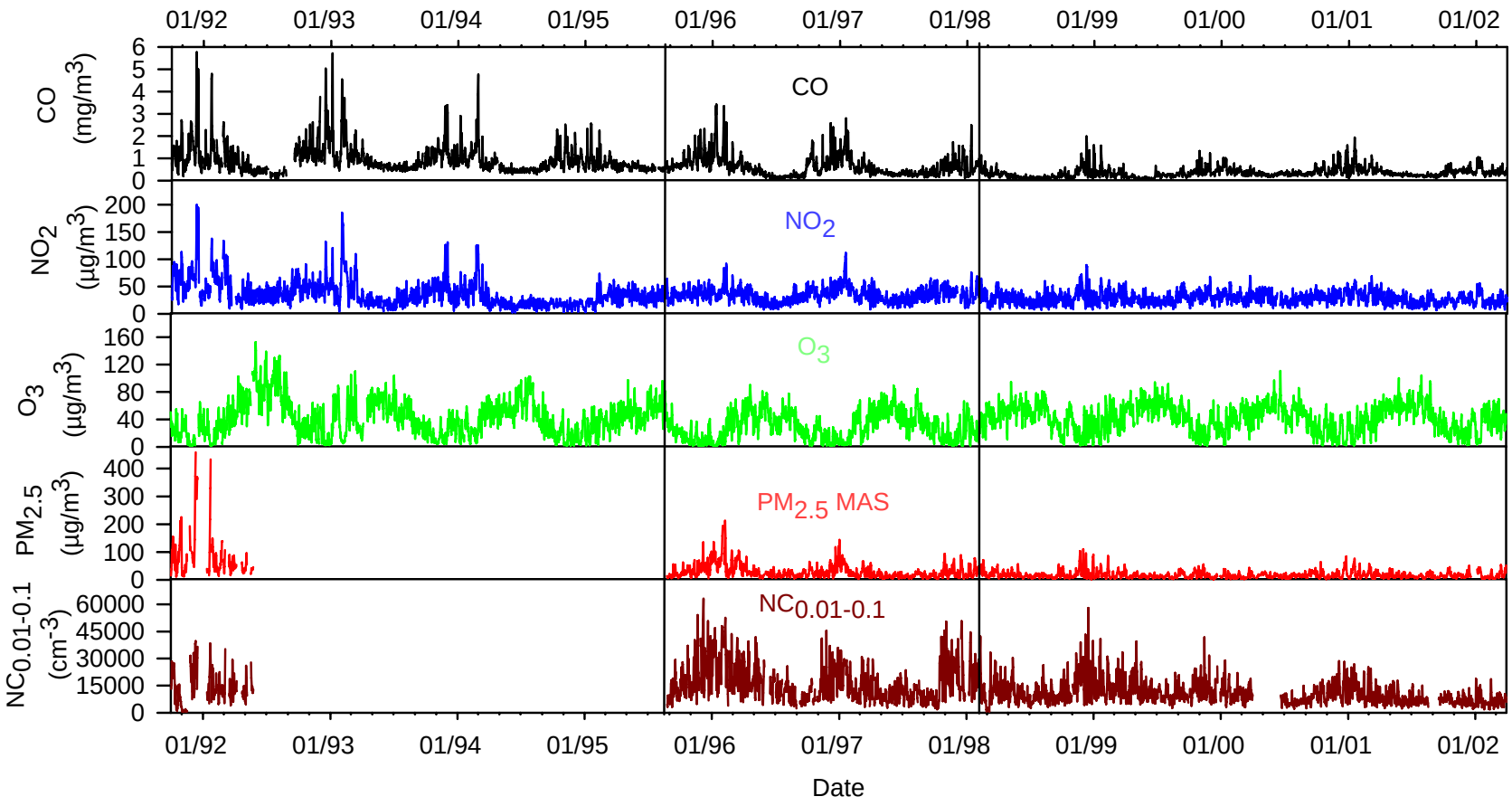


Changes after the German reunification: A time-series study

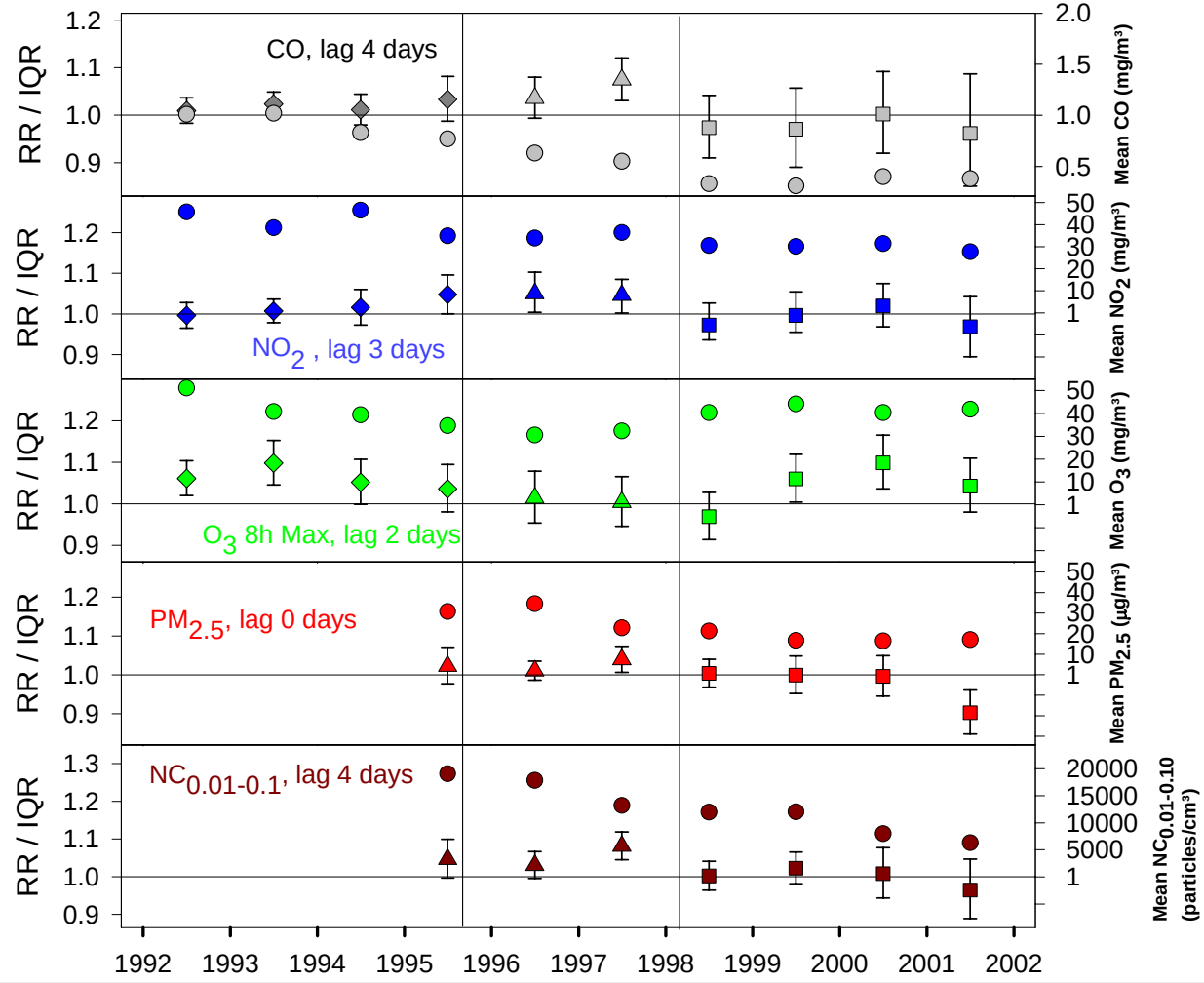
- Daily mortality between October 1991 and March 2002
- Measurements of gaseous and particulate air pollution
- Data on changes in source characteristics



Air Quality between 1991 and 2002, Erfurt, Germany



Changes in relative risks during the study period



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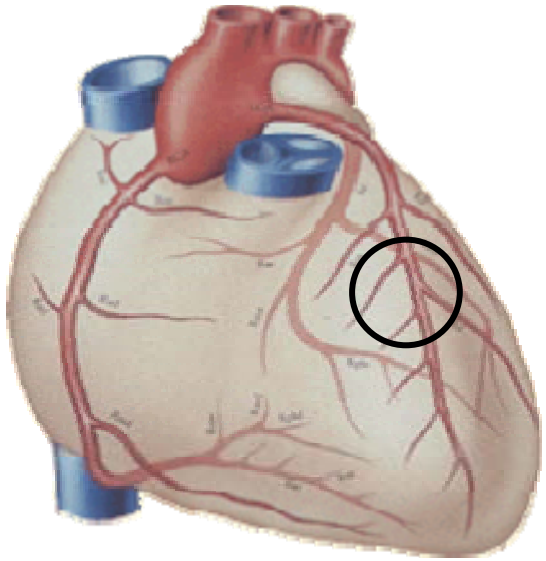
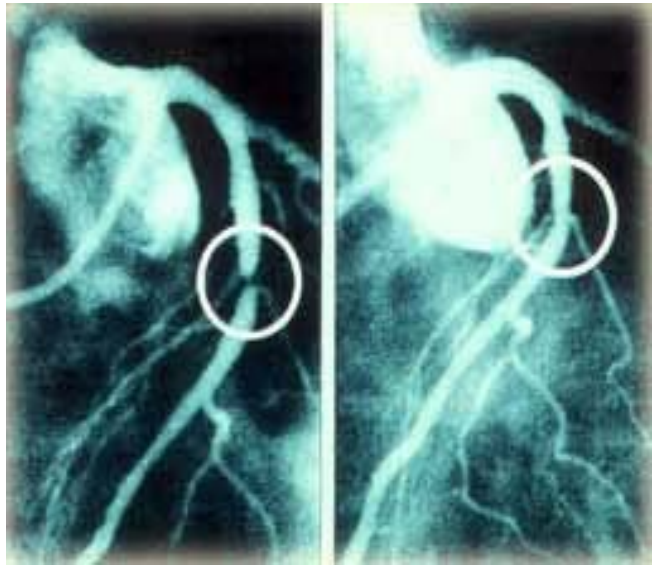
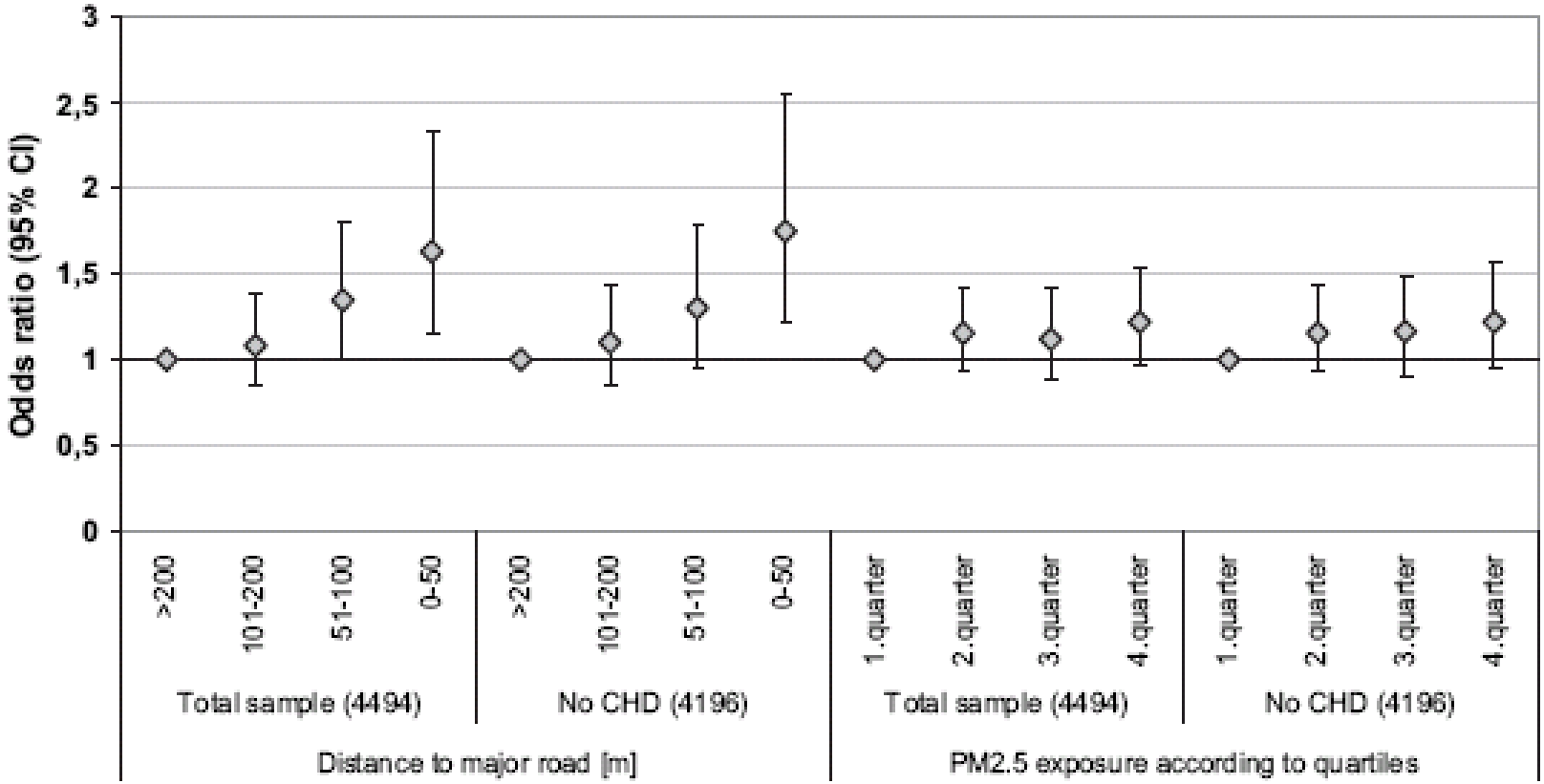
Heart attacks and traffic-related exposures





Healthy heart **Occlusion** **Re-Perfusion**

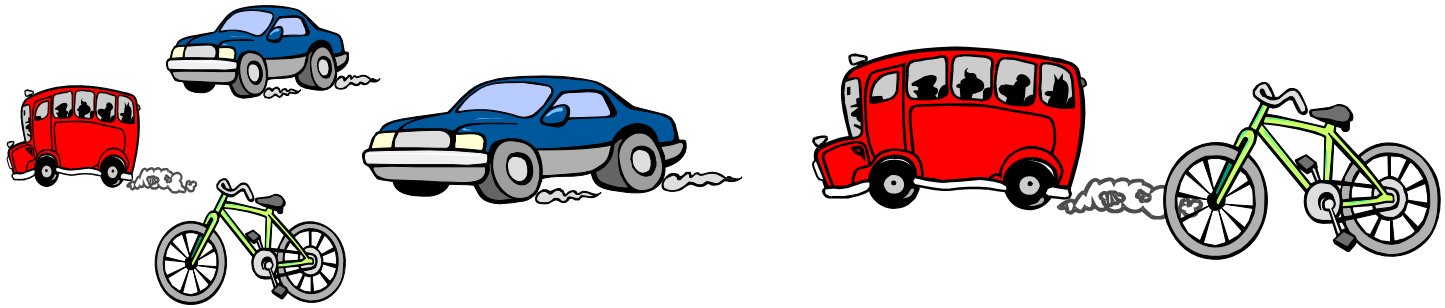
Calcification of arteries in subjects living close to major roads in the Ruhr area, Germany



Study on the triggering of myocardial infarctions

- Myocardial infarction survors age 25 and 74 years based on the KORA Myocardial Infarction Registry, Augsburg, Germany
- Bed-side interview of 1466 cases between 1999 and 2003
- Detailed information on activities 4 days before symptom onset

Times spent in traffic and the triggering of myocardial infarction one hour later

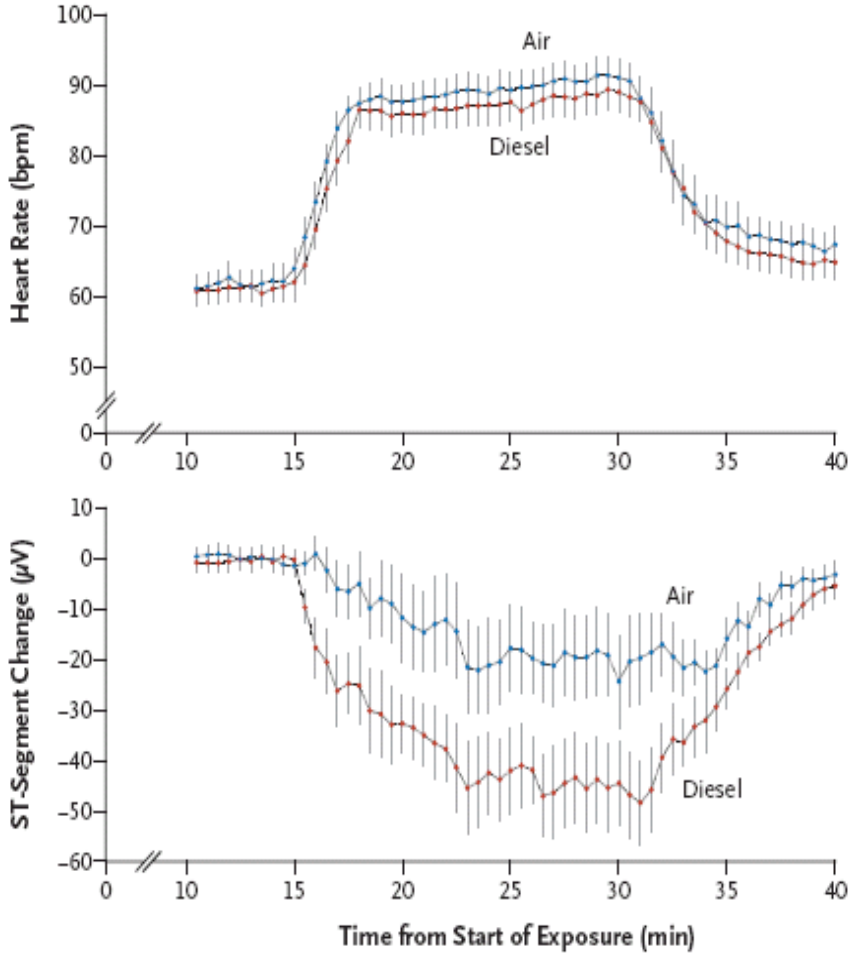


	All	Cars	Bus/Tram	Bicycle
Odds Ratio*	3.2	3.3	2.9	2.6
95% Confidence-interval	2.7 – 3.9	2.7 – 4.1	1.7 – 5.1	1.6 – 4.1

***adjusted for getting up, being outdoors and strenuous exercise**

Exposure to diesel exhaust induces ischemia in patients with coronary artery disease

- Controlled exposure to diesel exhaust; PM concentration: 300µg/m³, Ø 54 nm
- 20 men with coronary artery disease, mean age 60
- Ischemic changes in the ECG during exercise
- Reduced tissue plasminogen activator release after 6-8 hours of exposure



Mills et al. NEJM 2007

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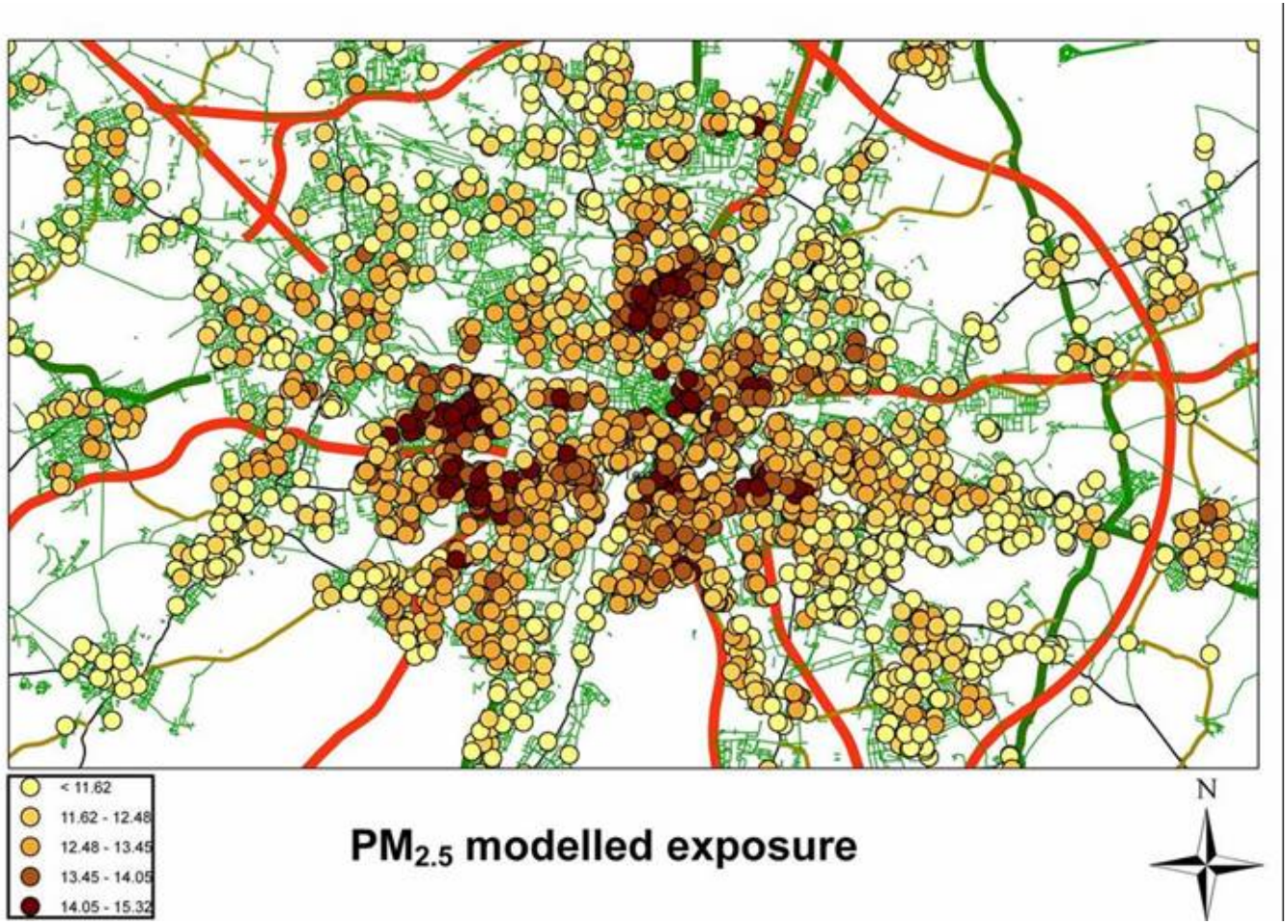
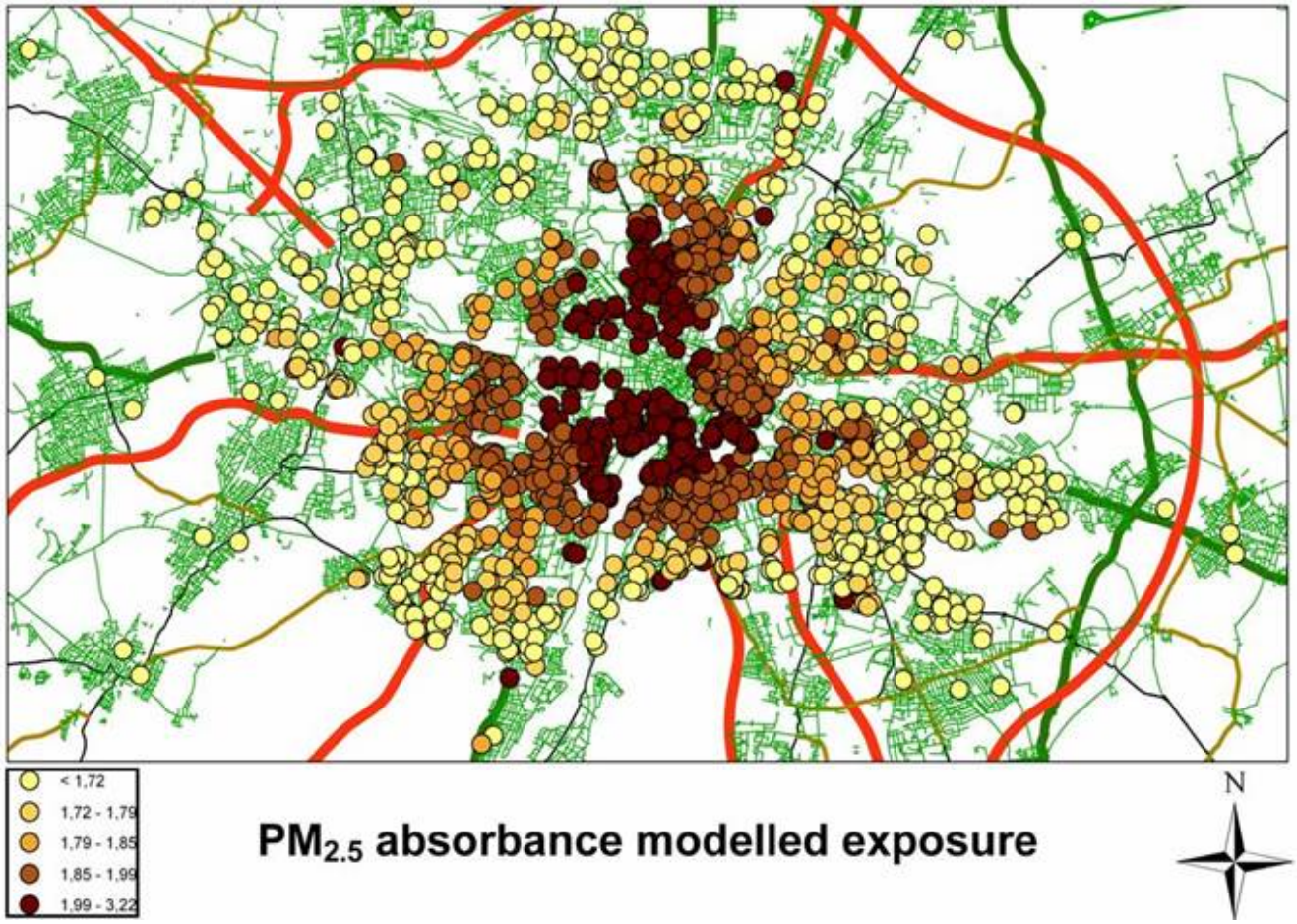
Exposure to fine particles of children in Munich



Exposure to traffic-related particles of children in Munich



GINI and LISA birth cohorts

1995-99 2004

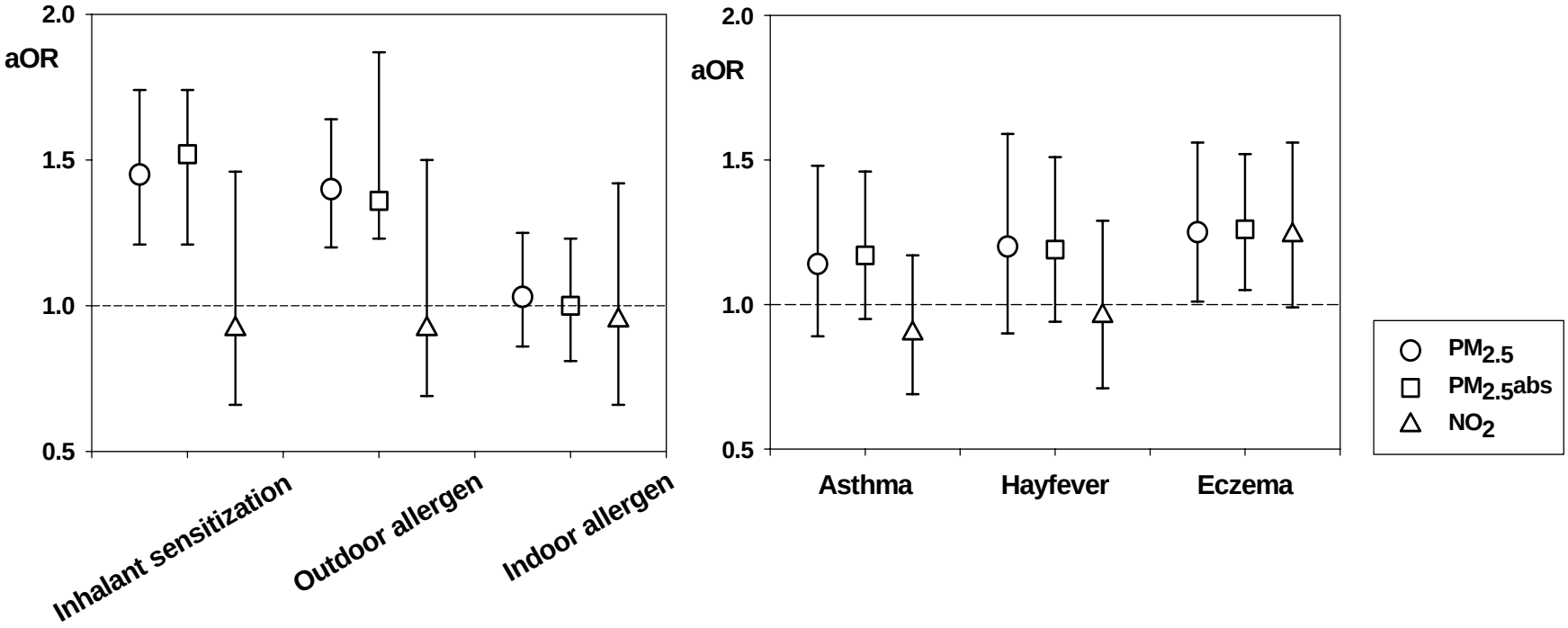





0 0.5 1 1.5 2 4 6

	0	0.5	1	1.5	2	4	6
Diary	X X X X X X X X X X X X						
Questionaire	X	X	X	X	X	X	X
House dust sample		X			(X)		
VOC Measurements	X		X →				
Blood withdrawal	X				X		X
Skin examination							X

Traffic-related air pollution and allergies in children at age 6



Reduced traffic during the Asia Games 2002 in Korea

- Traffic was limited in the entire city of Busan, Korea, during the 2 weeks of the games.
- All traffic-related air pollutants were reduced up to 25% after the games.
- Hospital admissions for asthma in children were 27% reduced after the games.

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Summary

- Traffic-related pollution is associated with cardiopulmonary mortality, atherosclerosis and onset of myocardial infarction
- Traffic-related pollution is associated with development and exacerbation of allergies
- Temporary reductions in traffic were associated with direct effects on health

Outlook

- Low emission zones will reduce exposures for many people if implemented properly
- The health impact is expected to be larger than the reductions to be expected based on PM_{10} concentrations

Questions?