

Health and Particles: The Epidemiologic View

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The overall picture

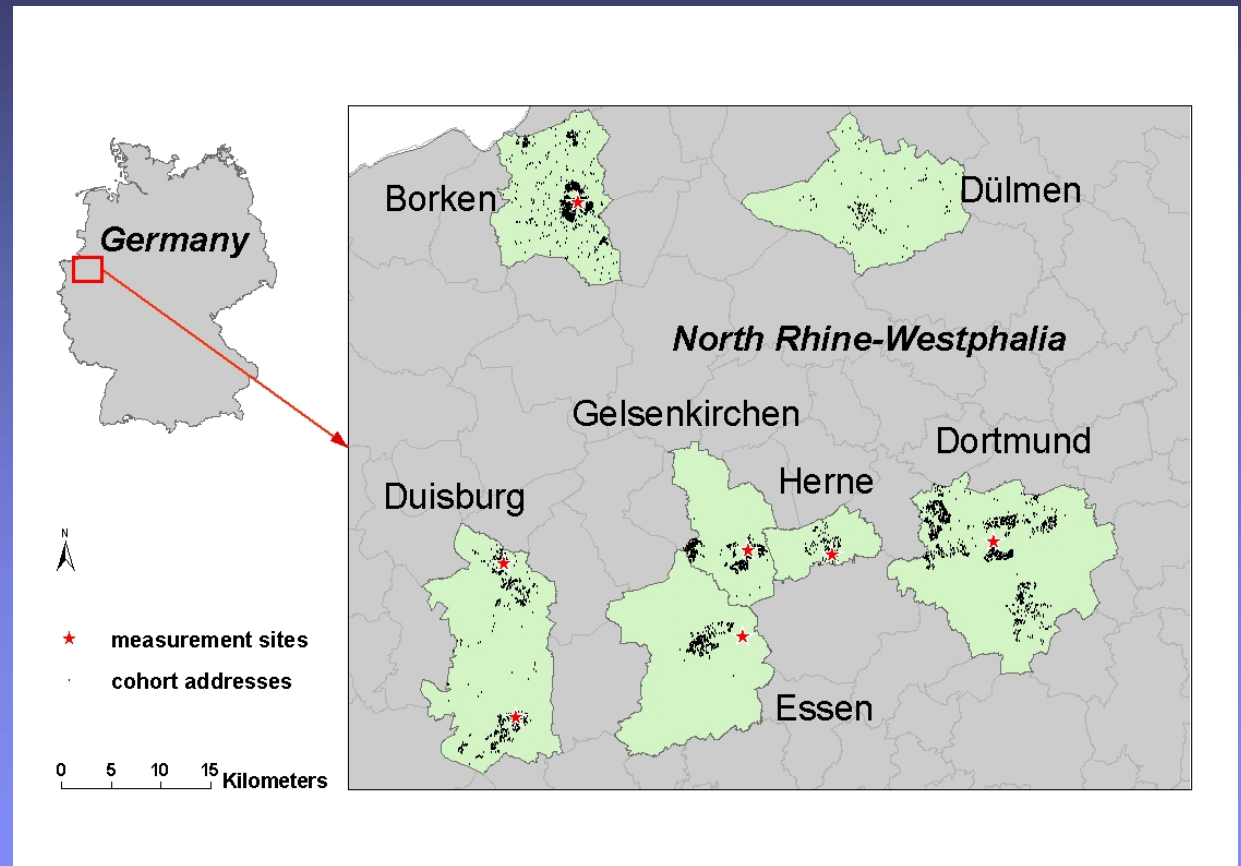
- Short-term health effects of PM on mortality are observed around the world
- Long-term health effect studies indicate that mortality is increased in polluted areas compared to less polluted areas
- Current EU regulation for PM₁₀ builds on results from the American Cancer Society Study
- Cardiovascular disease has the largest population impact

Outline

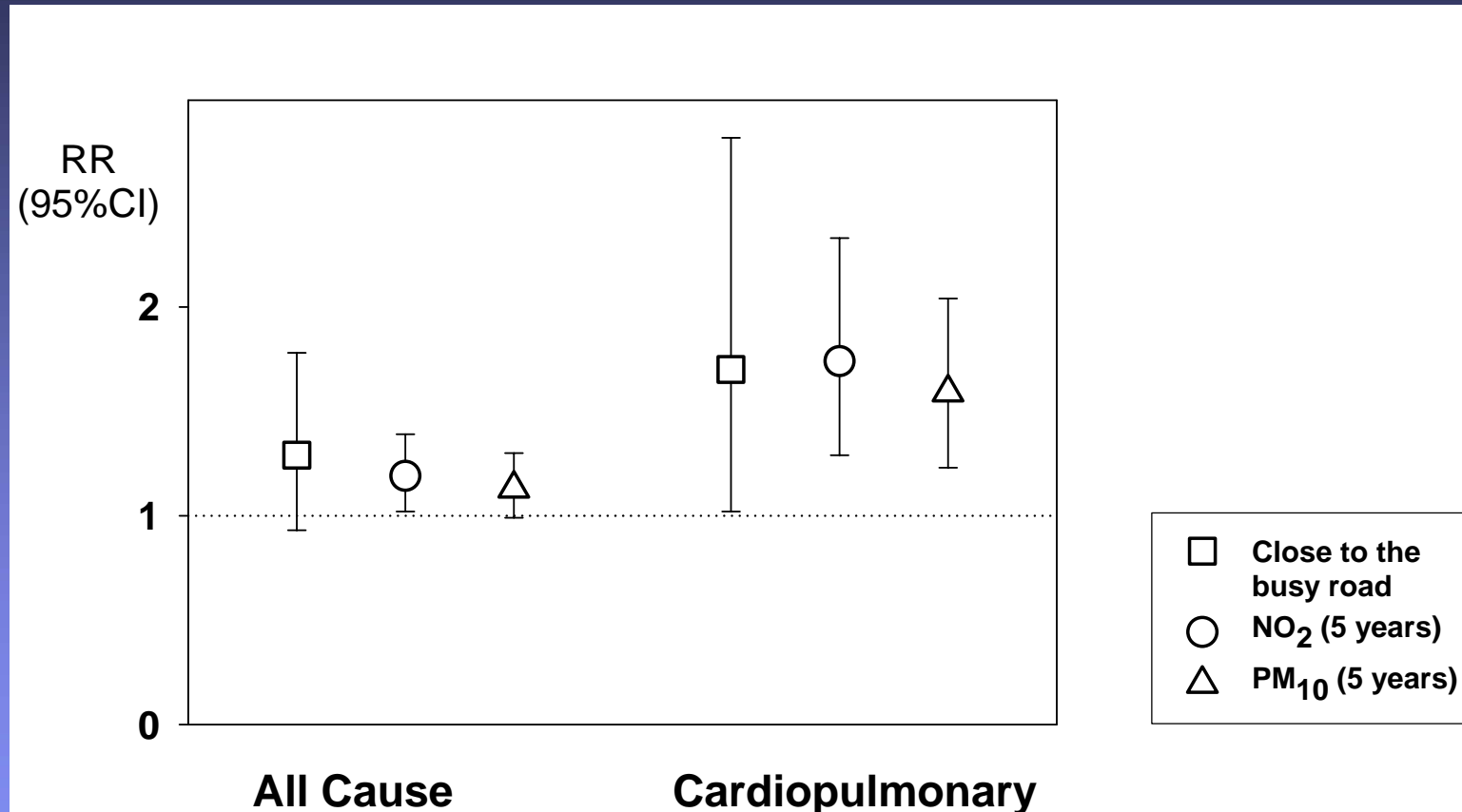
- **Recent study on long-term health effects from North Rhine-Westphalia**
- **Evidence for health effects of fine and ultrafine particles on the cardiovascular system**

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



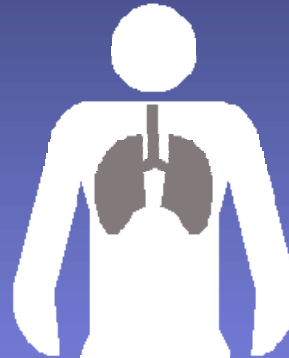
Adjusted[§] Relative Risk of Mortality for IQR[§]-Increase of Air Pollutants and Living Close to Busy Roads



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

Who is susceptible and why?

Inhalation of ambient particles



Local Effects
Inflammation



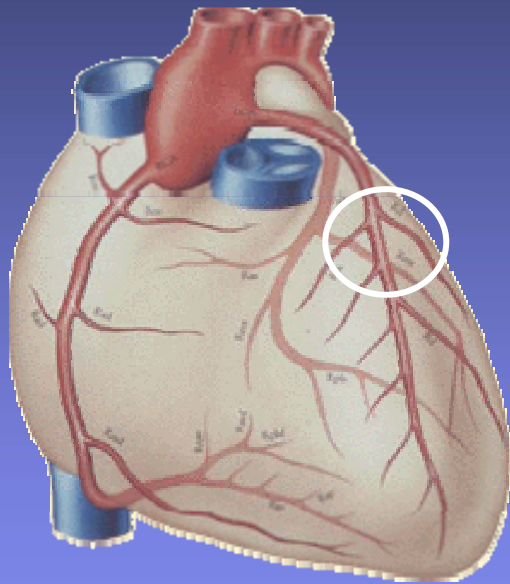
Asthma attacks
Bronchitis

Systemic Effects
Acute phase proteins
Cytokines

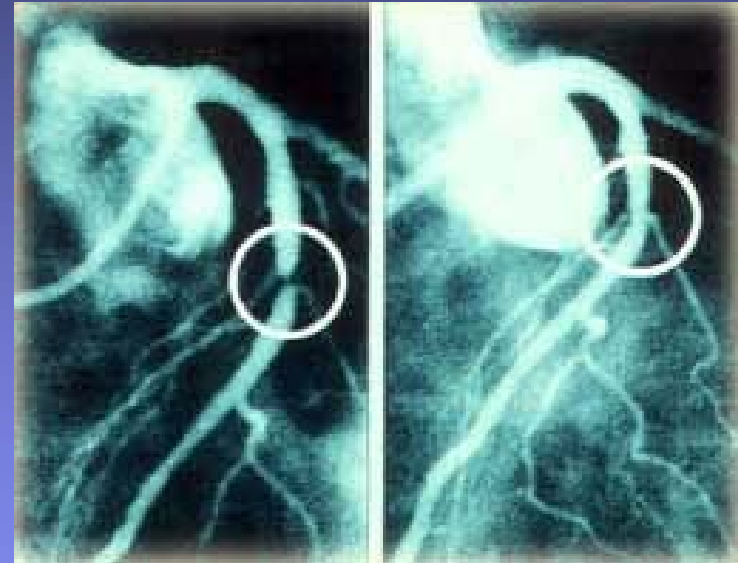


Ischemia
Arrhythmia

Myocardial Infarction: Occlusion of the Coronary Arteries



Healthy heart

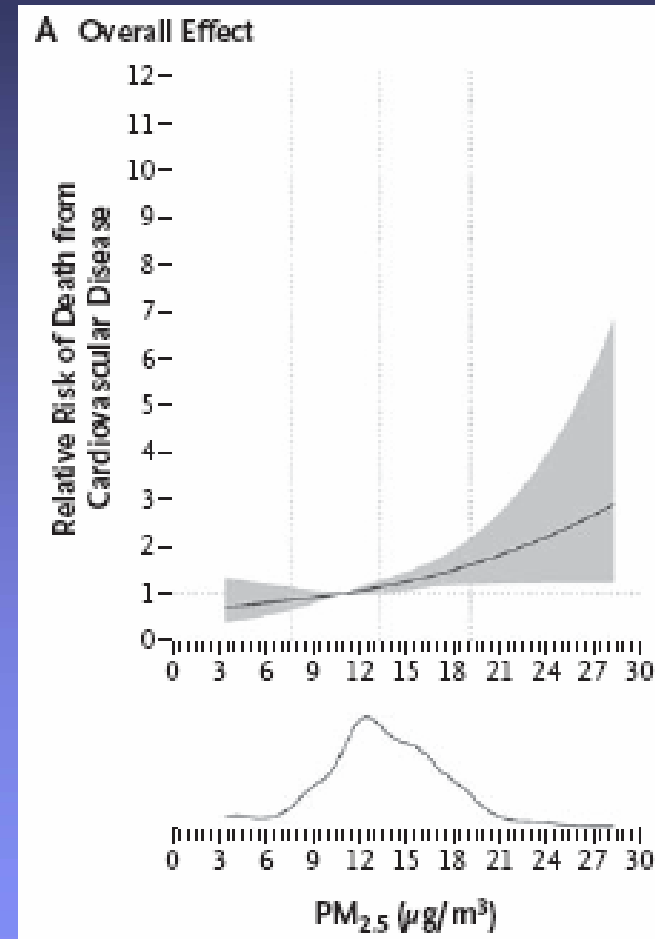


Occlusion

Re-Perfusion

Women Health Study

- Cohort Study of 66,000 women across the US
- Recruited 1994 to 1998
- Median Followup 6 years
- 1816 women had one or more fatal or nonfatal cardiovascular events
- Hazard ratio: 1.24 (1.09 to 1.41) per 10 $\mu\text{g}/\text{m}^3$ $\text{PM}_{2.5}$

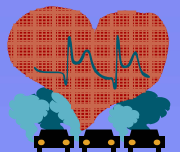


Miller et al., NEJM 2007

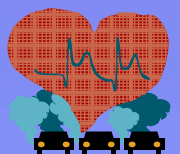
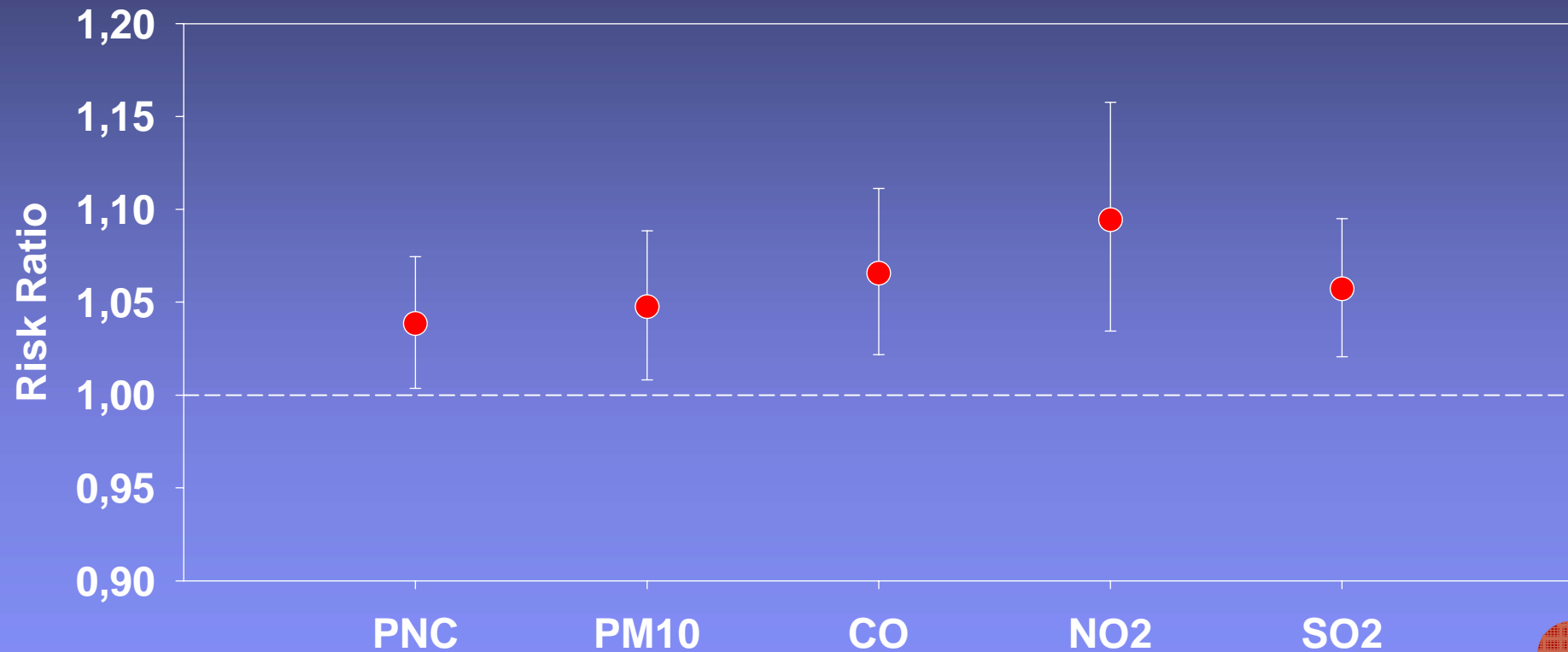
HEAPSS: Follow-up of Myocardial Infarction Survivors

City	Period of Follow up	Persons followed	Cardiac readmissions*
Augsburg	1995-2000	1562	298
Barcelona	1992-2000	1135	296
Helsinki	1993-2000	4042	1316
Rome	1998-2001	7400	1837
Stockholm	1994-2000	7911	3877

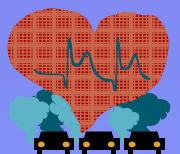
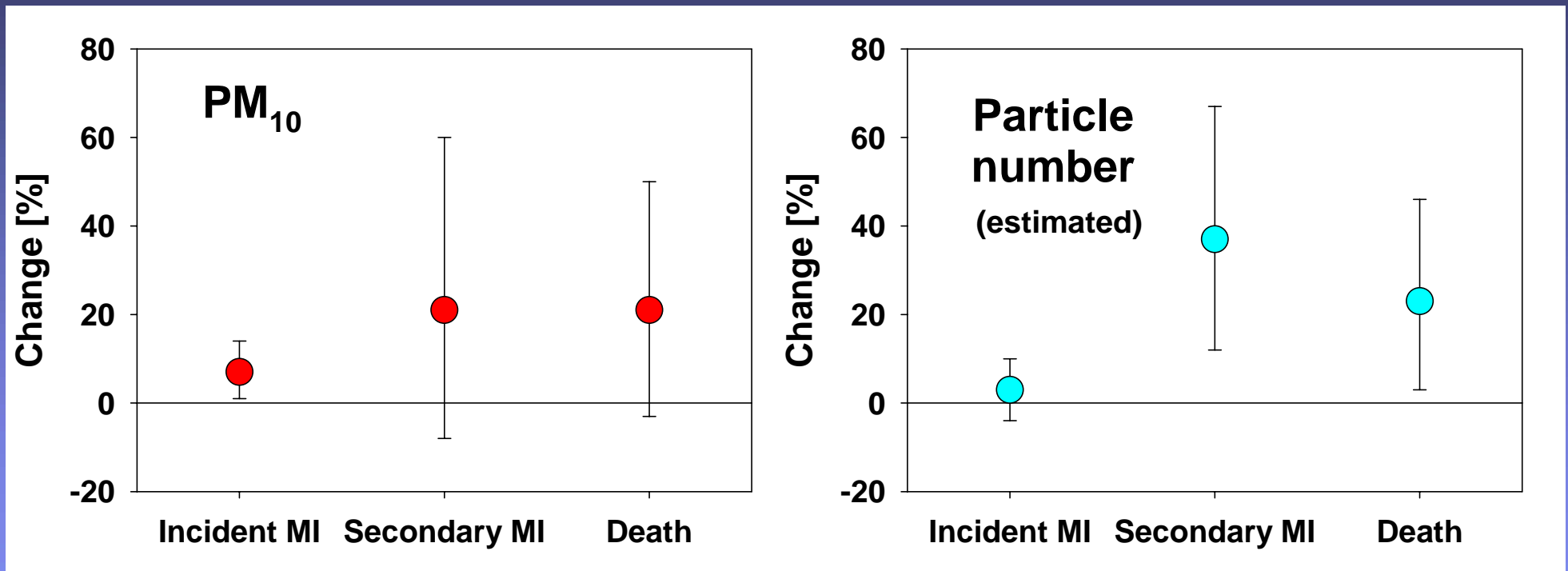
*hospital admissions for acute angina, acute myocardial infarction, dysrhythmia or heart failure



Air pollution and cardiac readmission in myocardial infarction survivors



Particles and Myocardial Infarction HEAPSS-Follow-up Augsburg, 1995-2000

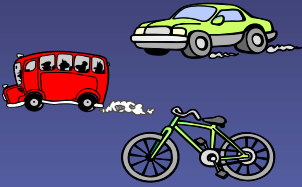





Study on Triggers of Heart Attacks

- A study of nonfatal heart attacks age 25 to 74 years based on the Coronary Event Registry Augsburg
- Bedside interview of 1466 cases from 1999 to 2003
- Detailed recollection of activities during the 4 days before the event



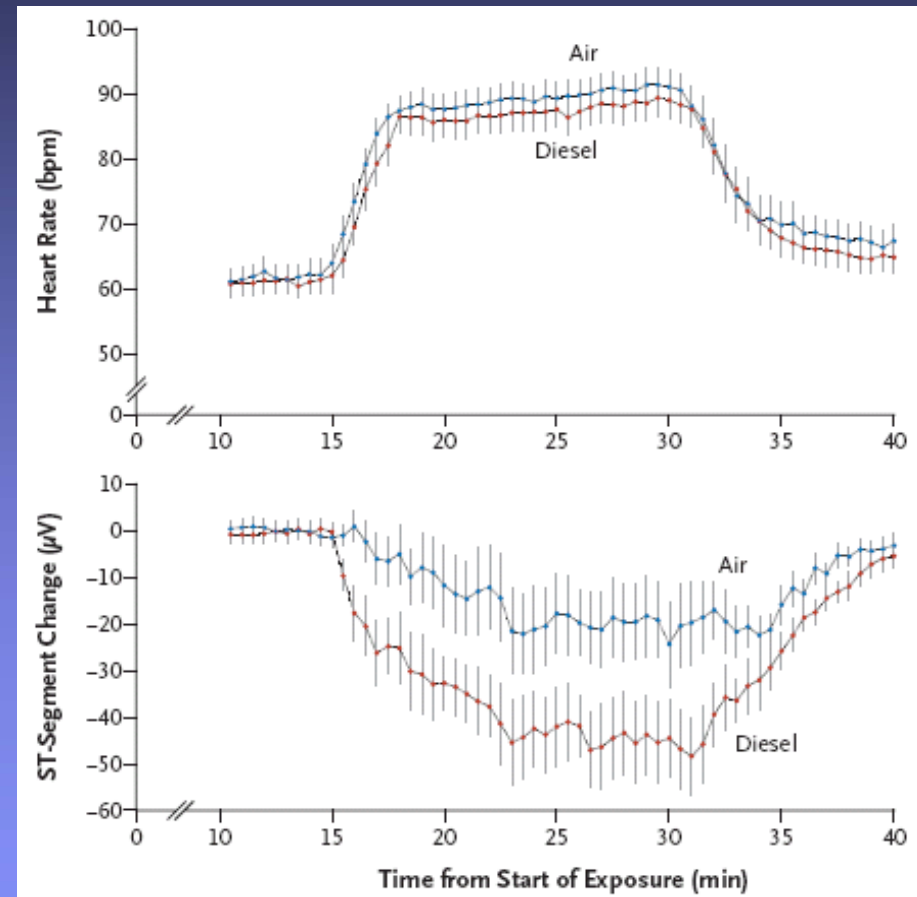
Times Spent in Traffic and Heart Attacks one hour later

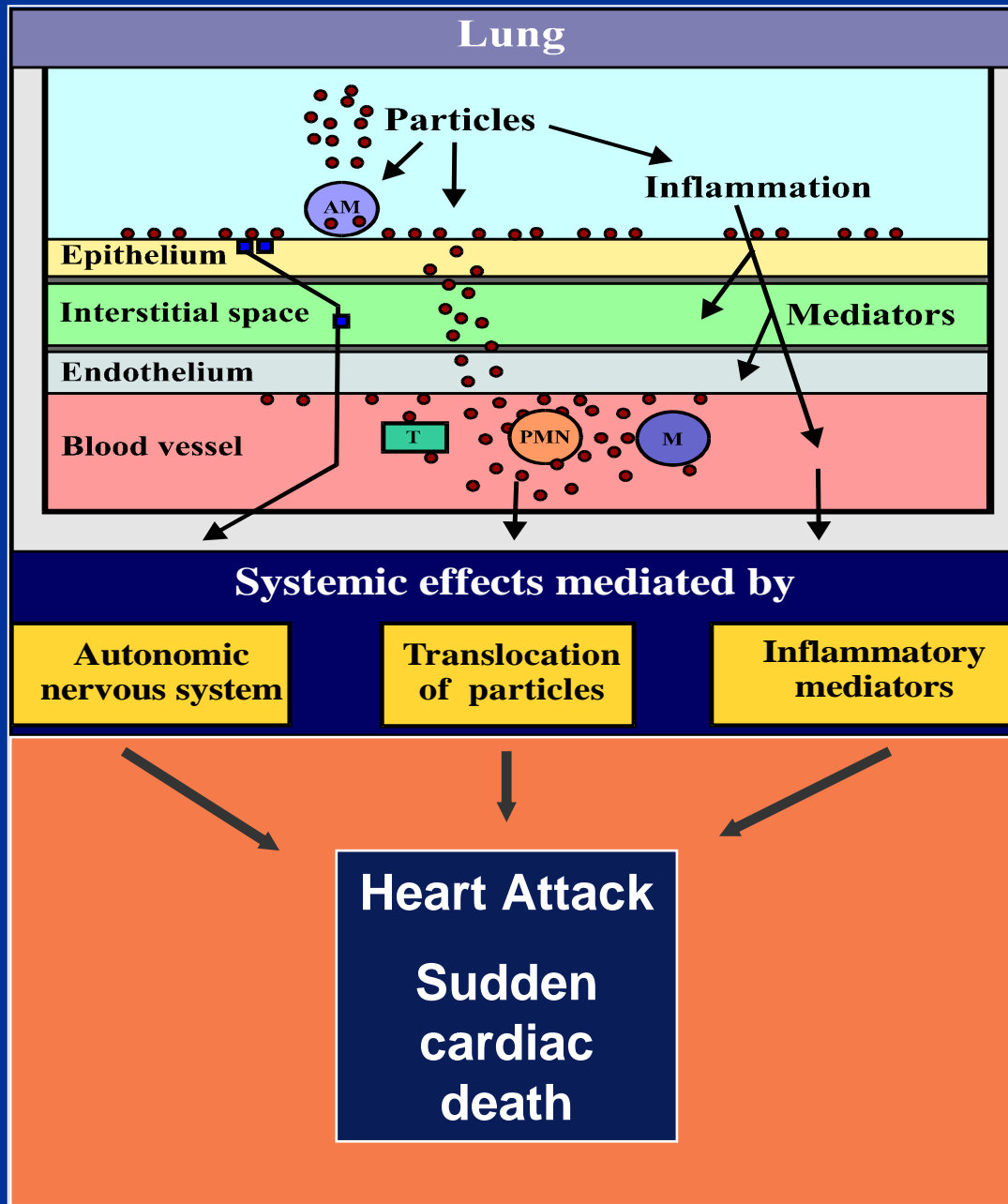
				
	Traffic	Cars	Public Transport	Bicycles
Odds Ratio	2.9	2.6	3.1	3.9
95% Confidence Interval	2.2 – 3.8	1.9 – 3.6	1.4 – 6.8	2.1 – 7.2

Peters et al. 2004 NEJM
Peters et al. 2005 HEI Report

Exposure to diesel exhaust induces ischemia in patients

- Controlled exposure to diesel exhaust; PM concentration: $300\mu\text{g}/\text{m}^3$, 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





Lung

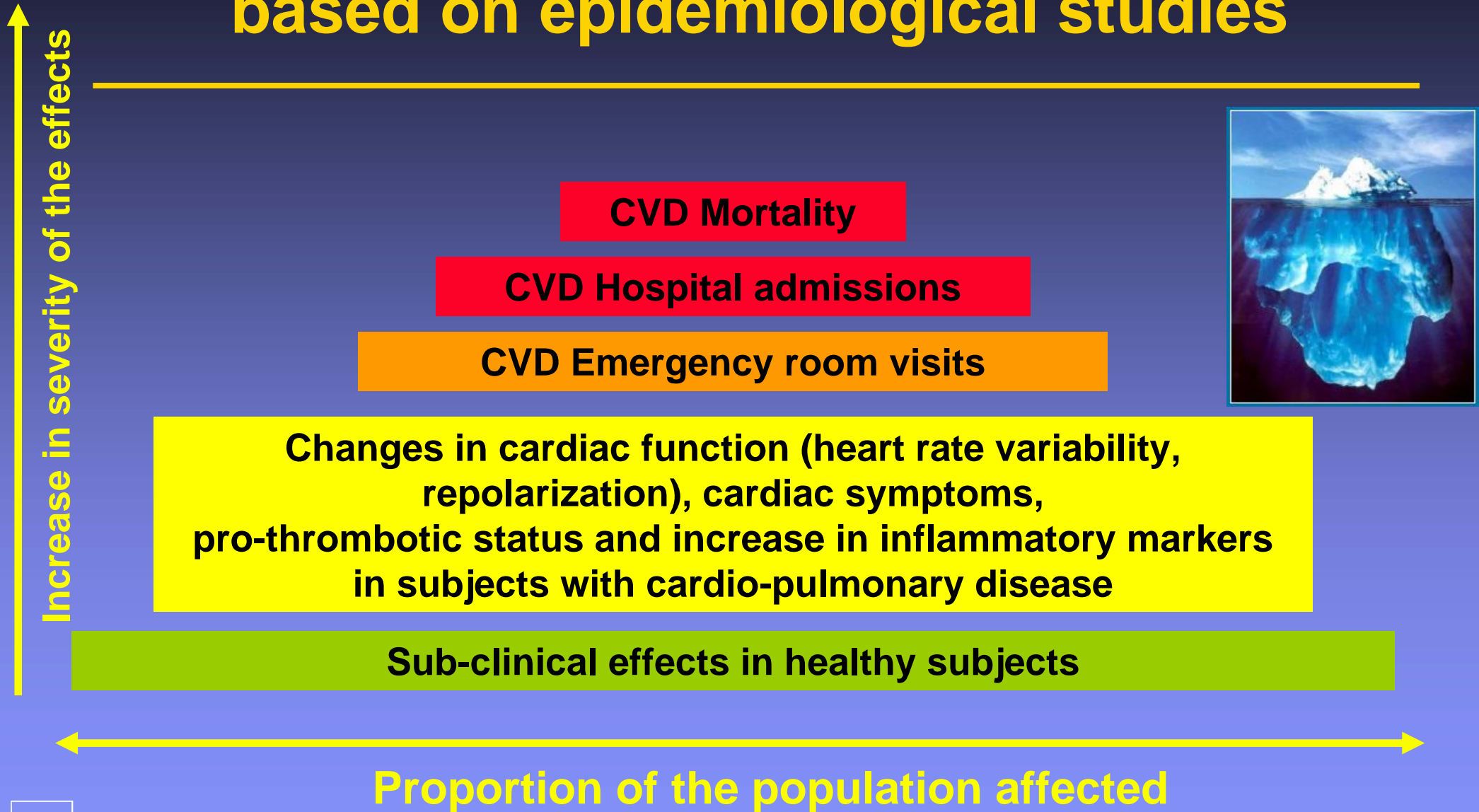
Inflammation

Allergy - Sensitization

Chronic lung diseases

Cardiovascular Effects of Fine and Ultrafine Particles

Health effects of particulate air pollution based on epidemiological studies



Summary

- **Fine ambient particles are associated with increased mortality predominately due to cardiovascular diseases**
- **Subjects with underlying disease are at higher risk for subsequent hospitalisation**
- **Further research is needed to guide the measures to most effectively protect public health in Europe**

Thank you to

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Questions?



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