

Effects of fine and ultrafine particles on the heart

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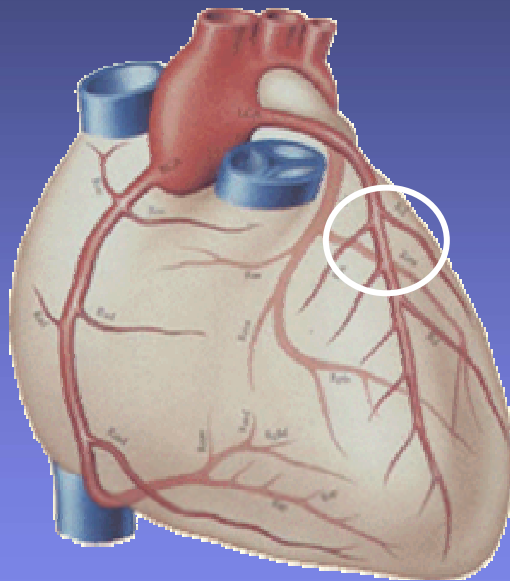
Outline

- What is a heart attack?
- Are times spent in traffic a risk factor for heart attacks?
- Examining the plausibility

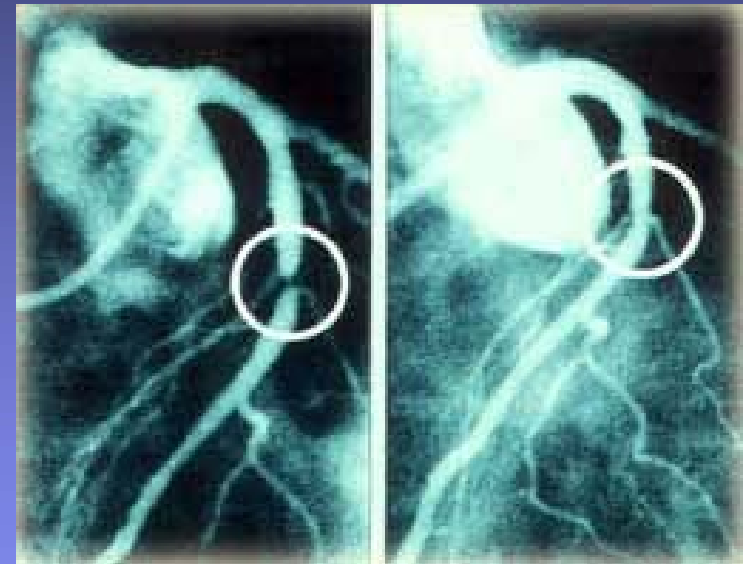
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Heart attack: Occlusion of the Coronary Arteries



Healthy heart



Occlusion

Re-Perfusion

Risk Factors for a Heart Attack

Chronic Risk Factors	Acute Risk Factors
= increase your baseline risk	= increase your risk transiently = Triggers
<ul style="list-style-type: none">x High Cholesterol, Hypertension, Smoking, Sedentary Life-Style, Stressx Age, Gender, Diabetes, Genetic Predisposition	<ul style="list-style-type: none">x Strenuous activities, extreme anger, air pollution, marihuana, cocaine

Outline

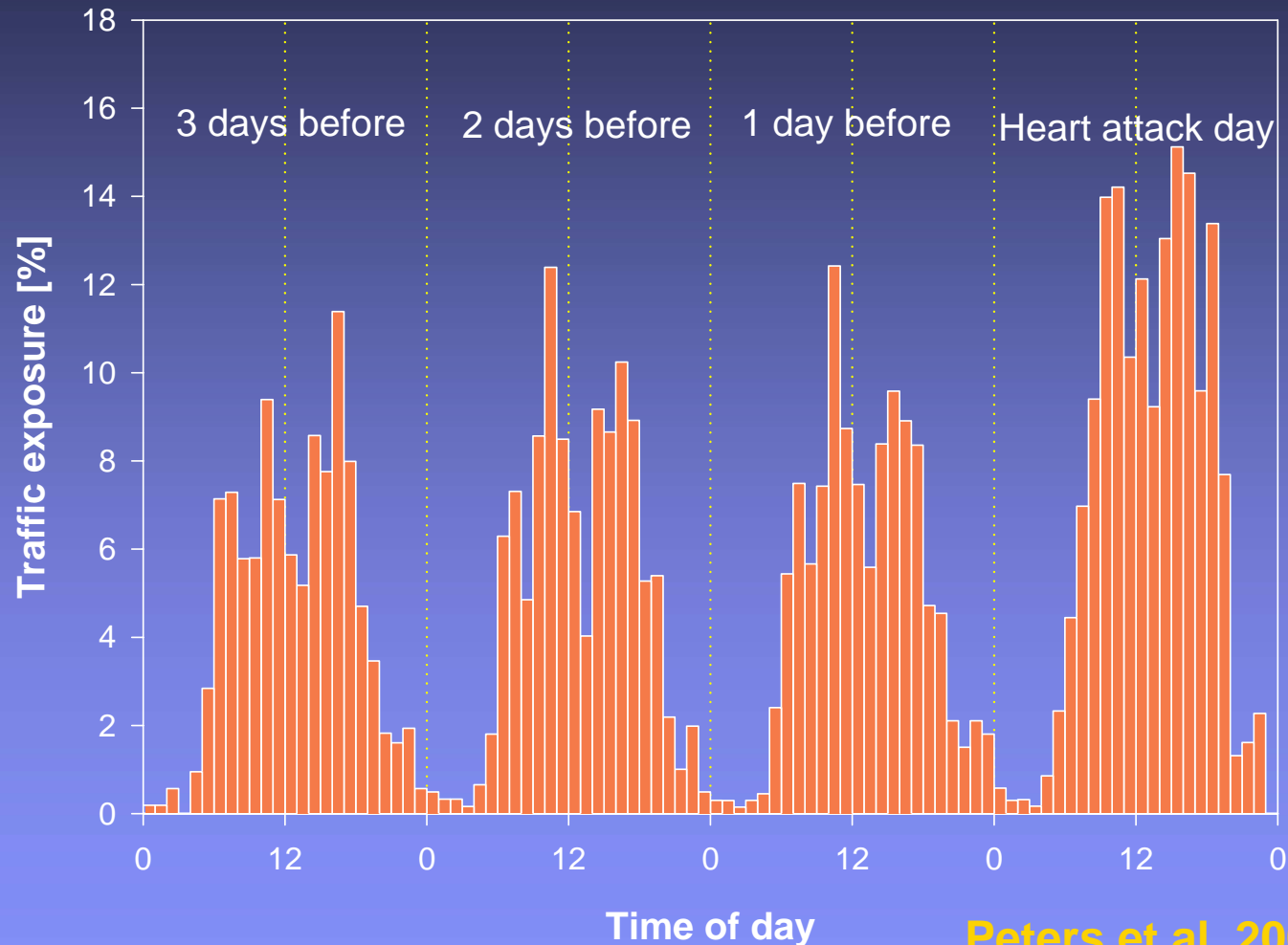
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Study on Heart Attacks

- A study of nonfatal heart attacks age 25 to 74 years based on the Coronary Event Registry Augsburg
- Bedside interview of all cases between 1999 and mid 2001
- Detailed recollection of activities during the 4 days before the event

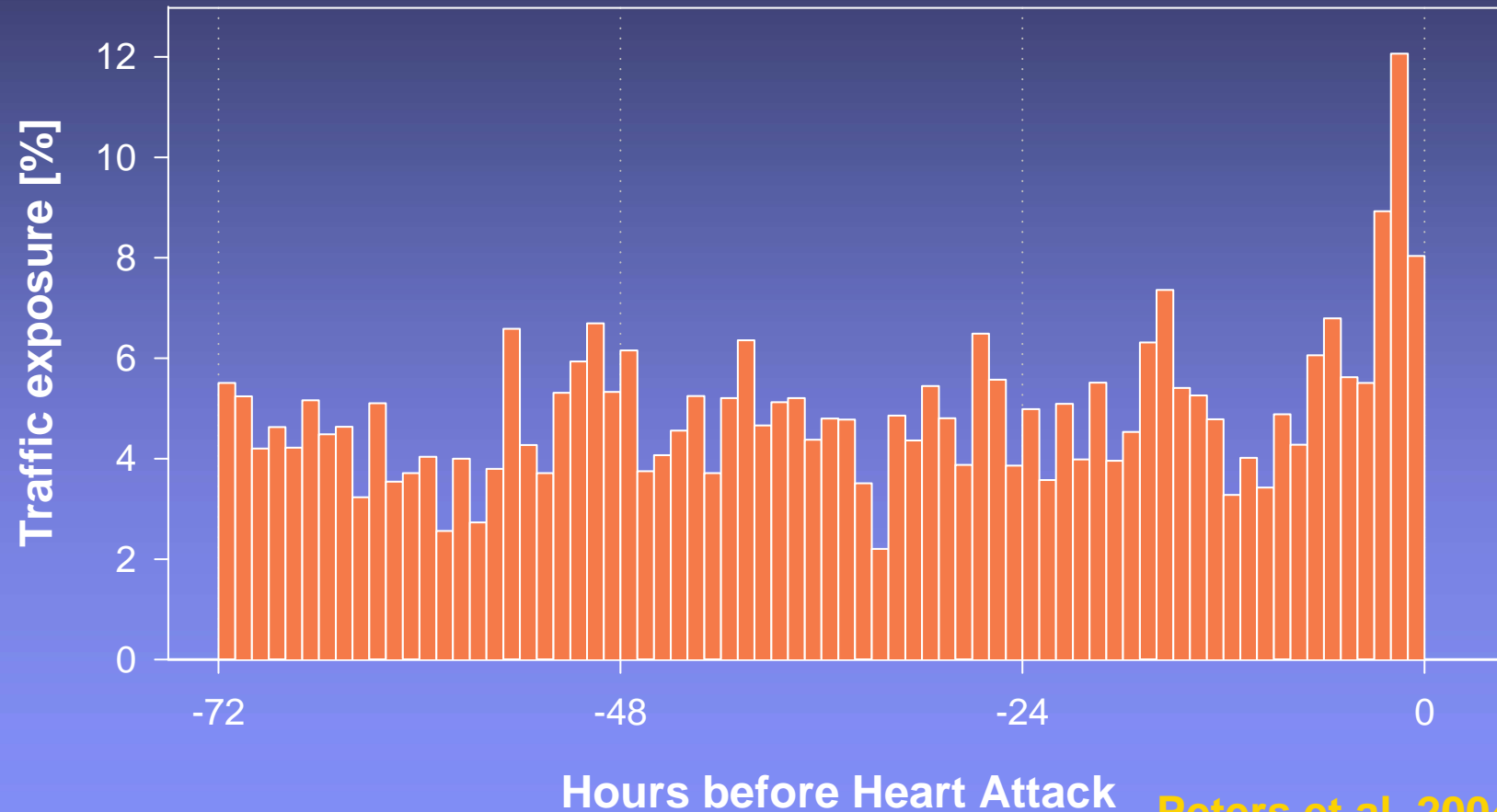


Times Spent in Traffic before Heart Attack (N=691)



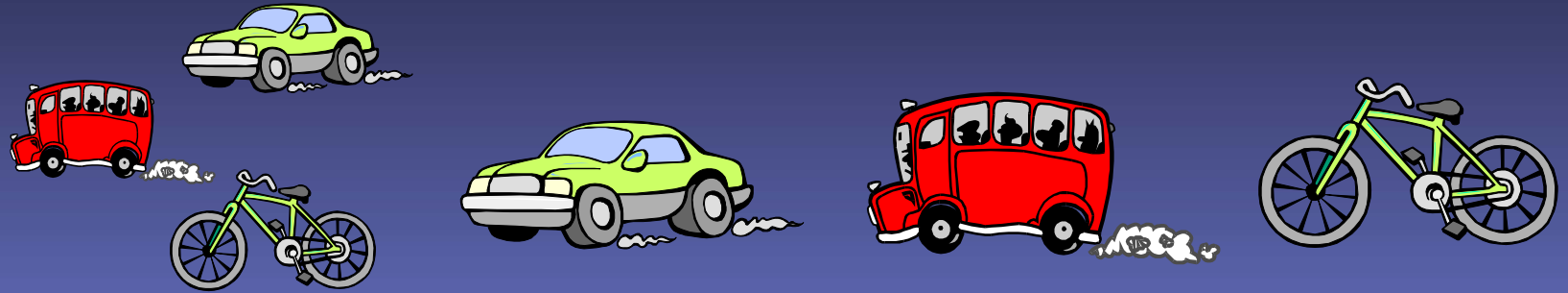
Peters et al. 2004 NEJM
Peters et al. 2005 HEI Report

Times Spent in Traffic in the Hours before Heart Attack (N=691)



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

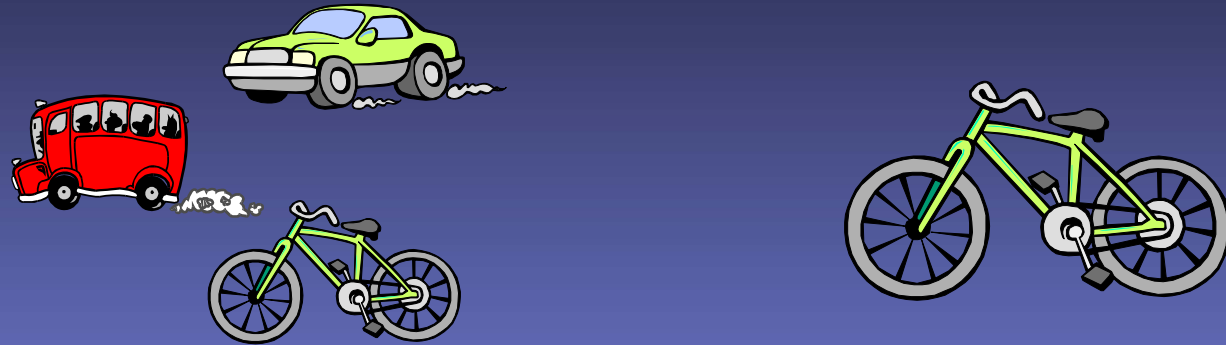
Times Spent in Traffic and Heart Attacks one hour later



	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

Adjustment for Individual Activities: Strenuous Exercise, Outdoors and Getting Up



	Traffic		Bicycles	
		adjusted		adjusted
Odds Ratio	2.9	2.7	3.9	1.8
95% Confidence Interval	2.2 – 3.8	2.1 – 3.6	2.1 – 7.2	0.9 – 3.6

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

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Exertion and the Risk of a Heart Attack had Effects Similar to Other Studies

	Mittleman et al. 1993	Augsburg
Odds Ratio	5.9	6.4
95% Confidence Interval	4.6 – 7.7	3.9 – 10.5



Mittleman et al. 1993 NEJM
Peters et al. 2004 NEJM

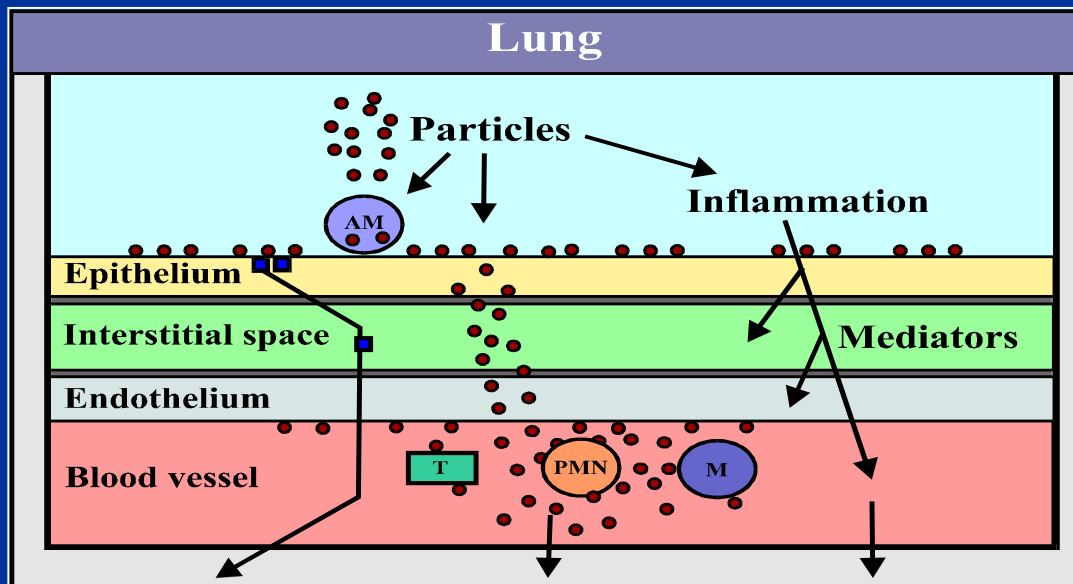
What does a diary tell about traffic related exposures?

- No measured exposure to traffic related particles or traffic related stress
- No information on driving conditions, roads traveled or traffic flow
- Individual level information on a surrogate of exposure for potentially susceptible individuals in a critical time window

PM₁₀ and Heart Attacks

- More than 300,000 cases of hospital admissions due to heart attacks
- 21 US American cities
- Data between 1986 to 1999
- Age 65 and older

	10 µg/m³ PM₁₀
Risk Ratio	0.6%
95% Confidence Interval	0.3% – 1.0%



Systemic effects mediated by

Autonomic nervous system

Translocation of particles

Inflammatory mediators

Heart Attack

Sudden cardiac death

Lung

Inflammation

Allergy - Sensitization

Chronic lung diseases

Cardiovascular Effects of Fine and Ultrafine Particles



Summary

- Ambient particulate matter has been associated with hospital admissions for heart attacks
- Time spent in traffic may be a trigger for heart attacks
- There might be effects of fine and ultrafine particles within hours based on the currently proposed mechanisms

Outlook

- **Traffic as a source of stress and particle exposures needs to be investigated**
- **Different particle properties such as size and chemical composition are currently being investigated**
- **Different pathophysiological pathways are currently being investigated which may induce health effects within hours, days and years**

Thank You to

- **Health Effects Institute**
www.healtheffects.org
- **Rochester Particle Center**
- **GSF-KORA Coronary Event Registry**
H. Löwel, M. Heier, I. Trentinglia, C. Winter,
G. Orlik, P. Friedmann, G. Zimmermann, A.
Hörmann, G. Kaup
- **GSF-Institute of Epidemiology**
St. von Klot, J. Cyrus, M. Heier, I.
Trentinaglia, H.E. Wichmann

Questions?



München, Leopoldstr. 11.08.2005