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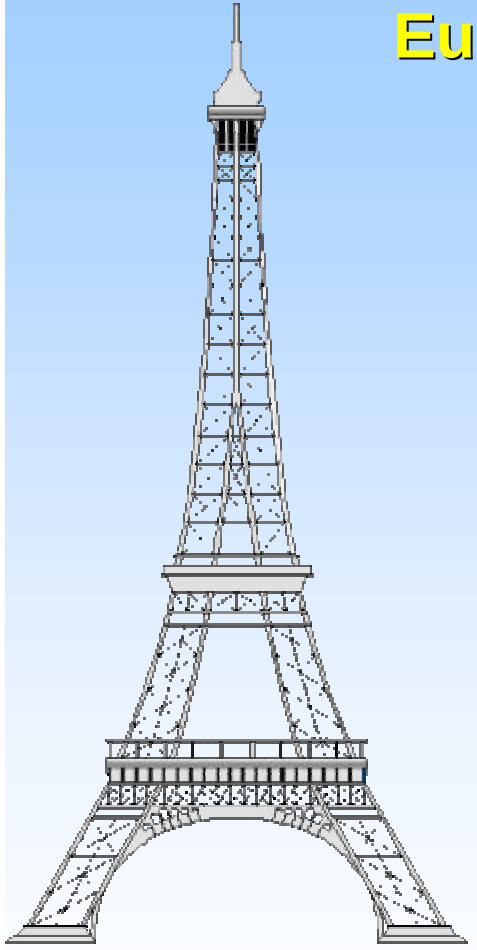

European Council of Applied Sciences and Engineering

Air Quality and Human Health

The air I breathe and my health

Paris April 1998

Organised by:
CADAS and Euro-CASE, Institute de France

Euro-CASE

Agenda

- Emission problems and possible improvements
- Epidemiological issues
- Toxicity of various pollutants
- Particles in the air
- Exposure and responses
- Epidemiological studies and health

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Emissions – energy and fuels

Dr. Pierre Ayzat, Inst Francais du Petrole

Diesel: Particles, NOx and aldehydes

Gazoline: HC, CO, benzene and O_3-pot.

New technology:

Improved combustion chambers

–– less particles and less CO_2

For urban traffic: Use L.P.G.

Improve quality of fuel

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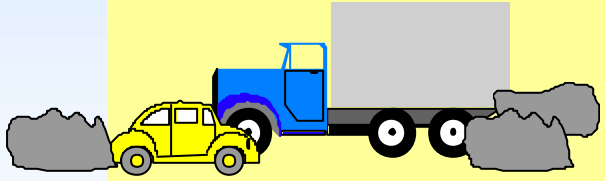
Urban air quality in UK a transport problem ?

Dr Michael Monaghan, Ricardo Consult

About 24 000 deaths in UK caused by effects of SO_2, particulates and ozone

Majority of these people suffering from:

chronic heart or lung disease



Road emissions:

Small part of SO_2

but significant for particles and ozone

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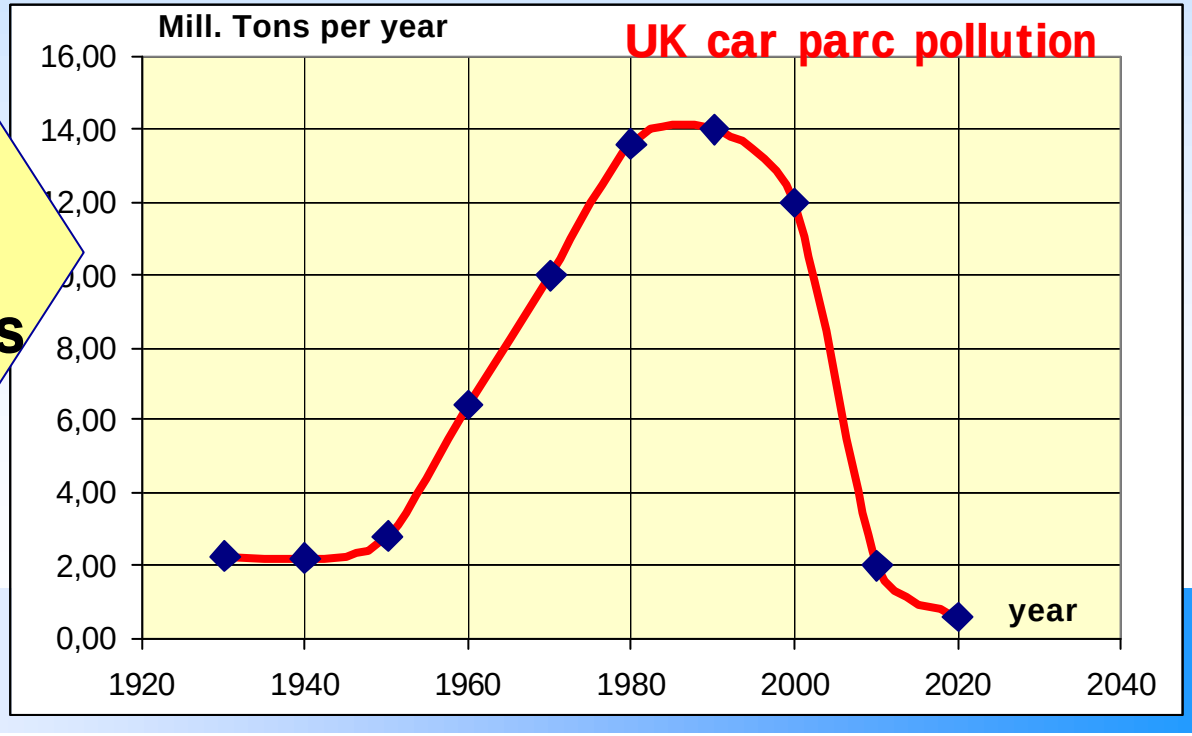
Road traffic emissions in UK

- UK: 25 % of particles
  25 % of CO_2
- Urban: 70 % of PM10
  90 % of NOx

Actions for:
Green vehicles
Clean fuels
Gas powered cars
Diesel taxation



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Epidemiological issues

Dr. Jacques Lambrozo, EDF - GDF

"Details are essentially unobservable"

Some sort of relationships exists:

- **Astma and air pollution**
- **Study methodology and metrology**
- **Consistency in confounding factors**
- **Does an exposure-effect relation exist?**
- **Correlation with experimental data**

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Epidemiological studies need further development

Quantification problems due to:

- Badly placed instruments, representativeness
- Complex environment, synergism, low risks
- Exposure due to indoor air not accounted for
- Exposure models inadequate

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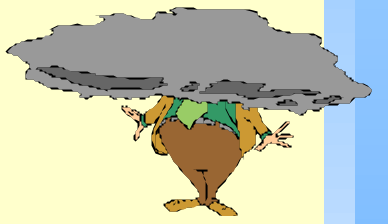
Effects of pollution on Human Health

Dr Thierry Fournier, Hopital Bichat

Studies conducted in Paris show:



- Prevalence of astma has increased in past 20 years
- Air pollution was studied as one contributing factor
- Inhaled gases affect immune and inflammatory response of the pulmonary tract
- Short term exposure to ozone enhance bronchial allergen response
- Indoor aeroallergens (dust, tobacco smoke) important for development of astma
- Ultrafine particles; diesel exhaust (DEP) have been studied

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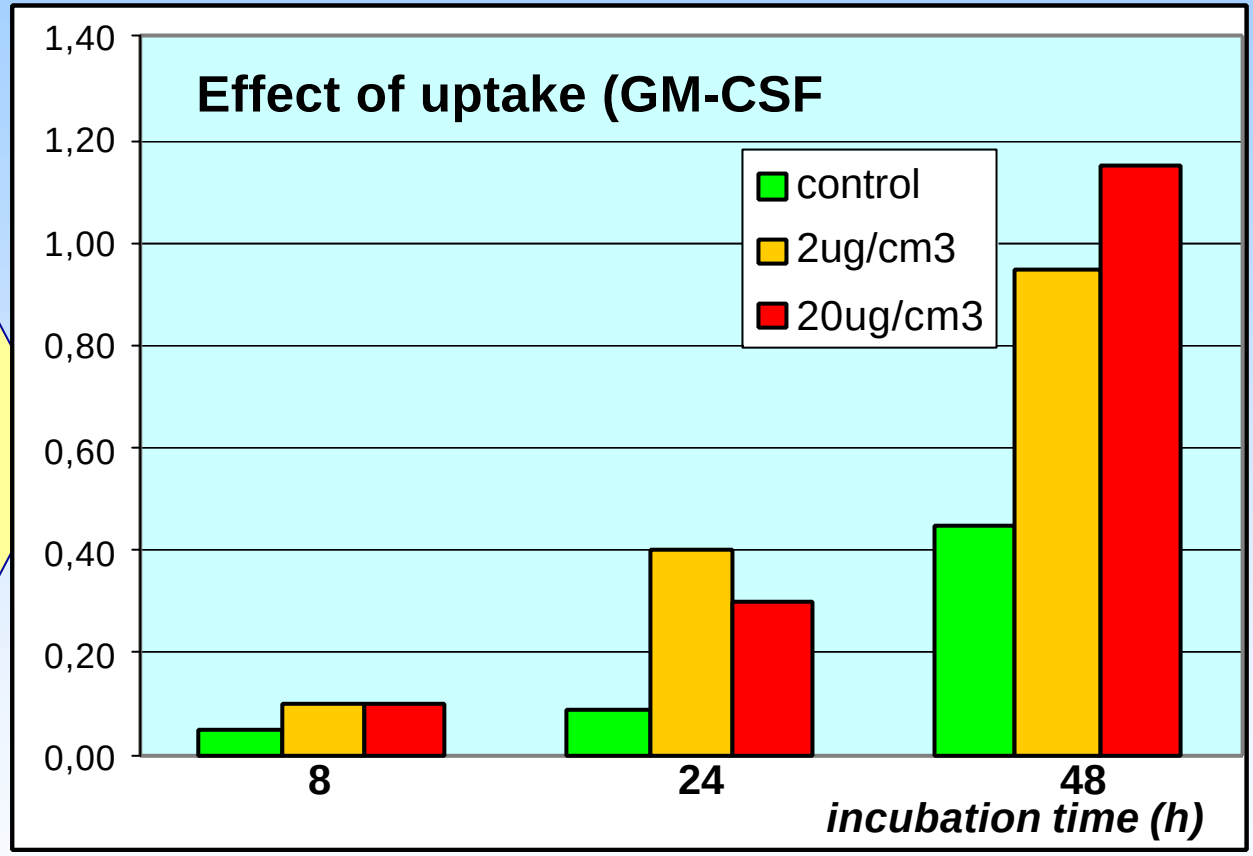
Effects of pollution on Human Health

Dr Thierry Fournier, Hopital Bichat

Exposure of Diesel exhaust particles (DEP) give response on airway cells



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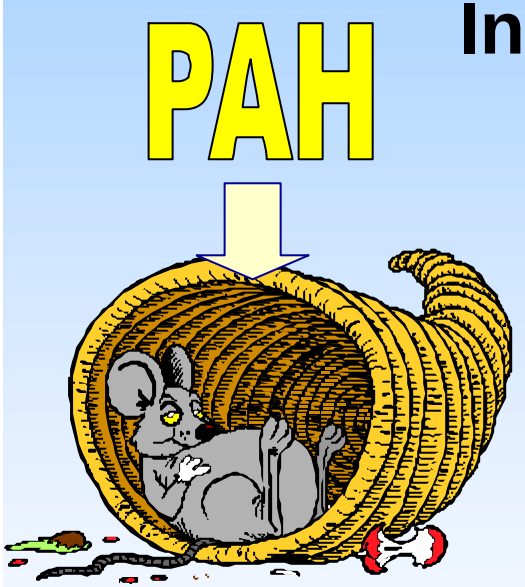
Biotechnology to assess risks of air pollution

Dr J Döhmer

Animal experiments

Invitro/ invivo experiments



Factors influencing the quality:

- ✓ Relevance for humans
- ✓ Control of conditions
- ✓ Identification of causal factors
- ✓ Relevant doses
- ✓ Long term effects
- ✓ Size of population
- ✓ Diognostic assays

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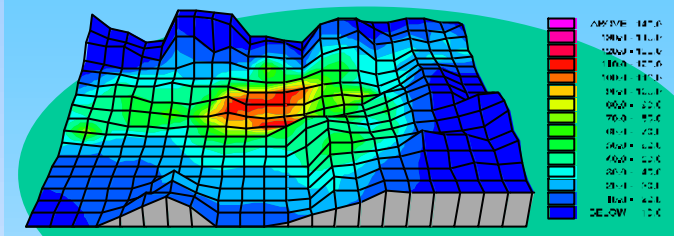
Exposure and Risk Assessment

Bjarne Sivertsen

Exposure Assessment

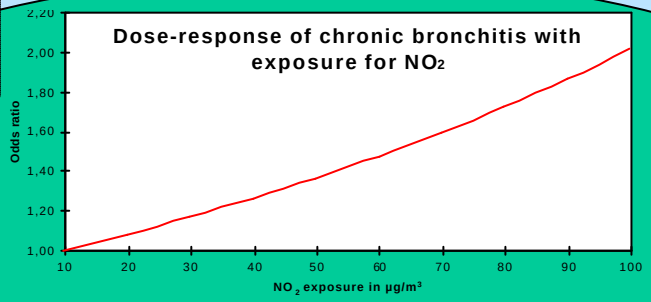


98th percentile of hourly $PM_{2,5}$ concentration in Oslo, 1992

Risk Assessment

Extraneous Risk Factors

Adjusted Dose - Response



Effect identification

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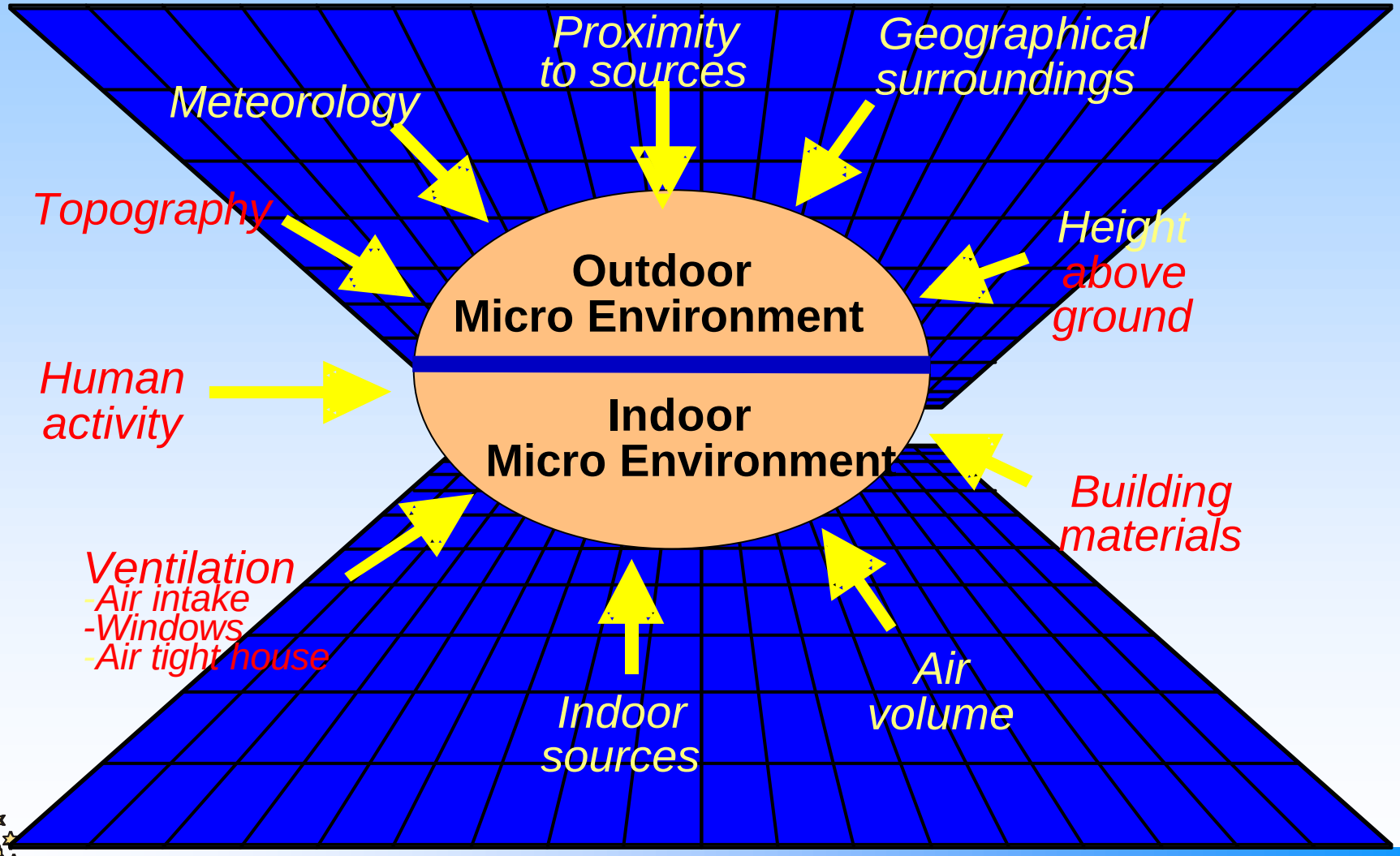
Exposure



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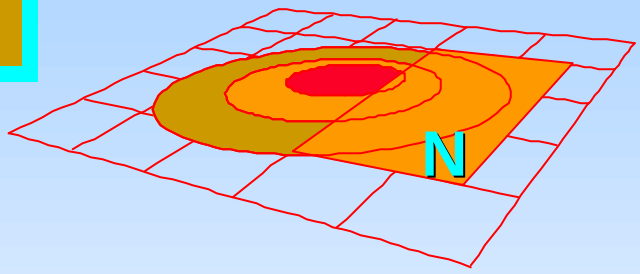
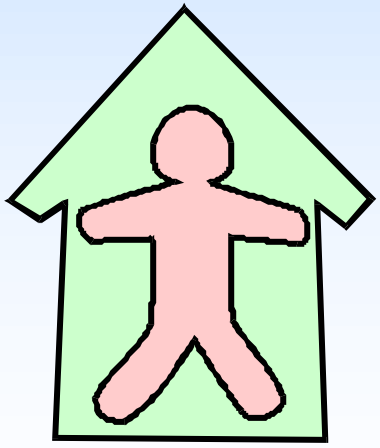
Exposure estimates

1



Integrated number of people within areas

2



Individual exposure estimates in micro environments

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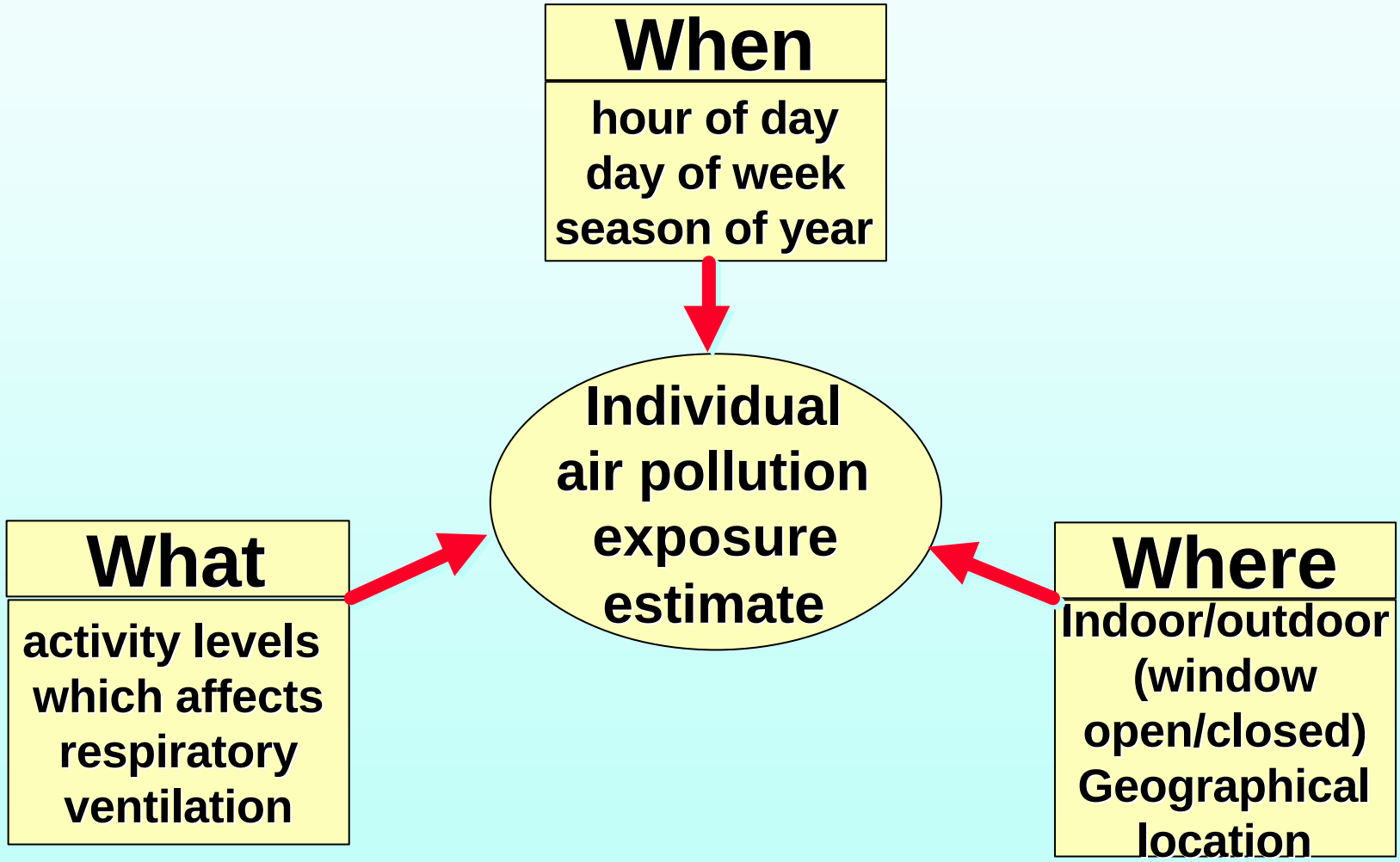
Diary Method



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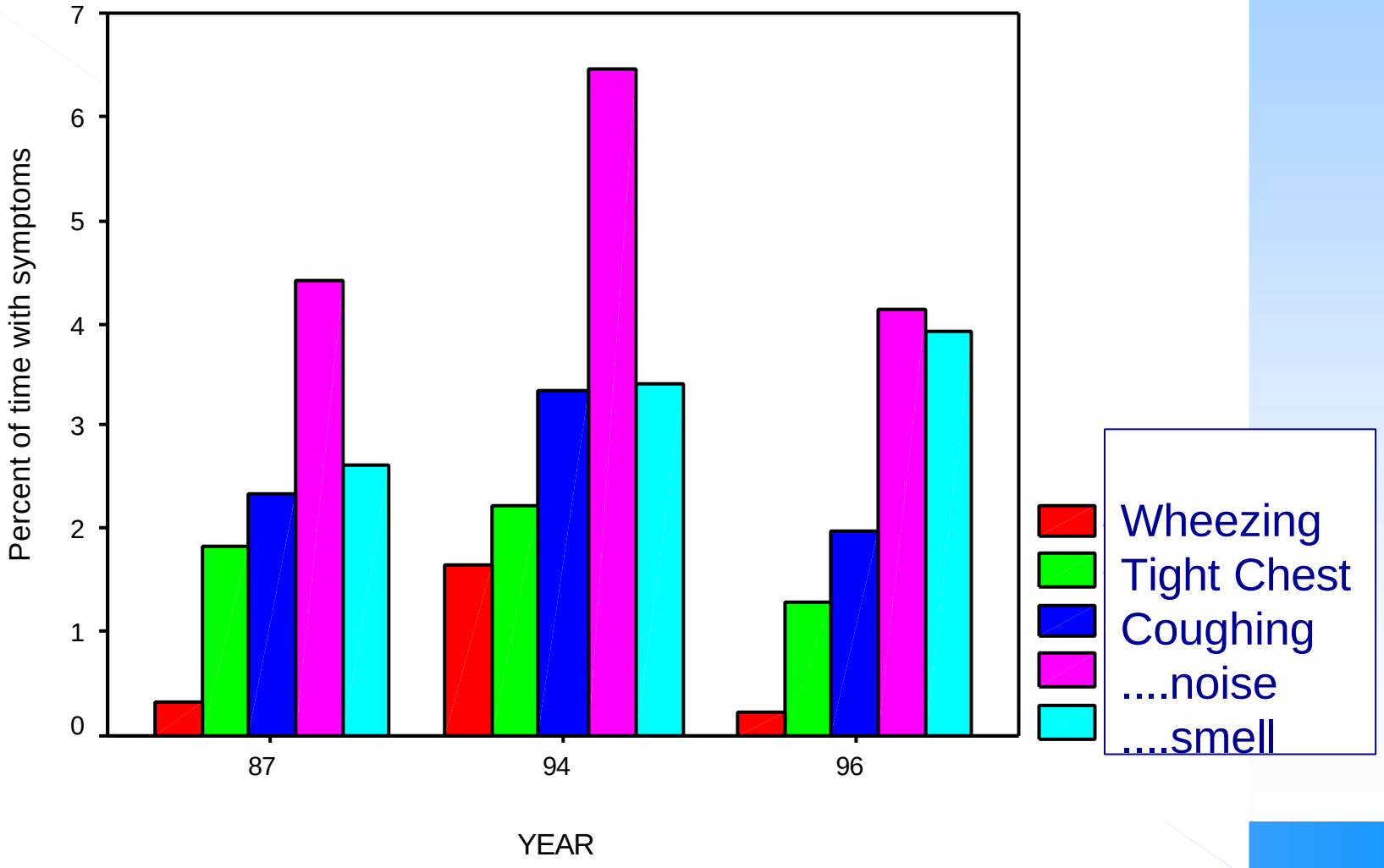
Percent of time reporting symptoms



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Comparison of effect of compound on continuous symptom reporting

	Noise	NO_2	$PM_{2,5}$	$PM_{10-2.5}$
Symptom of reduced health				
Fatigue	(NS)	(0.0014)	(0.0032)	(NS)
Nervous	(0.0066)	(0.0038)	(0.0079)	(NS)
Headache	NS	NS	NS	NS
Nausea	NS	NS	NS	NS
Sneezing	0.0024	*0.0016*	*0.0029*	NS
Feverish	(NS)	(NS)	*(0.0066)*	(NS)
Eye irritation	NS	NS	NS	NS
Throat irritation	(NS)	(NS)	(NS)	(NS)
Wheezing	(NS)	(NS)	(NS)	(NS)
Tightness in chest	(-0.0027)	(-0.0034)	(-0.0042)	(-0.0052)
Cough	(NS)	(NS)	(0.004)	(NS)
Bothersome noise	(0.0057)	(0.0044)	(0.0081)	(0.0053)
Bothersome smell	(0.0049)	(0.0049)	(0.0069)	(0.0072)

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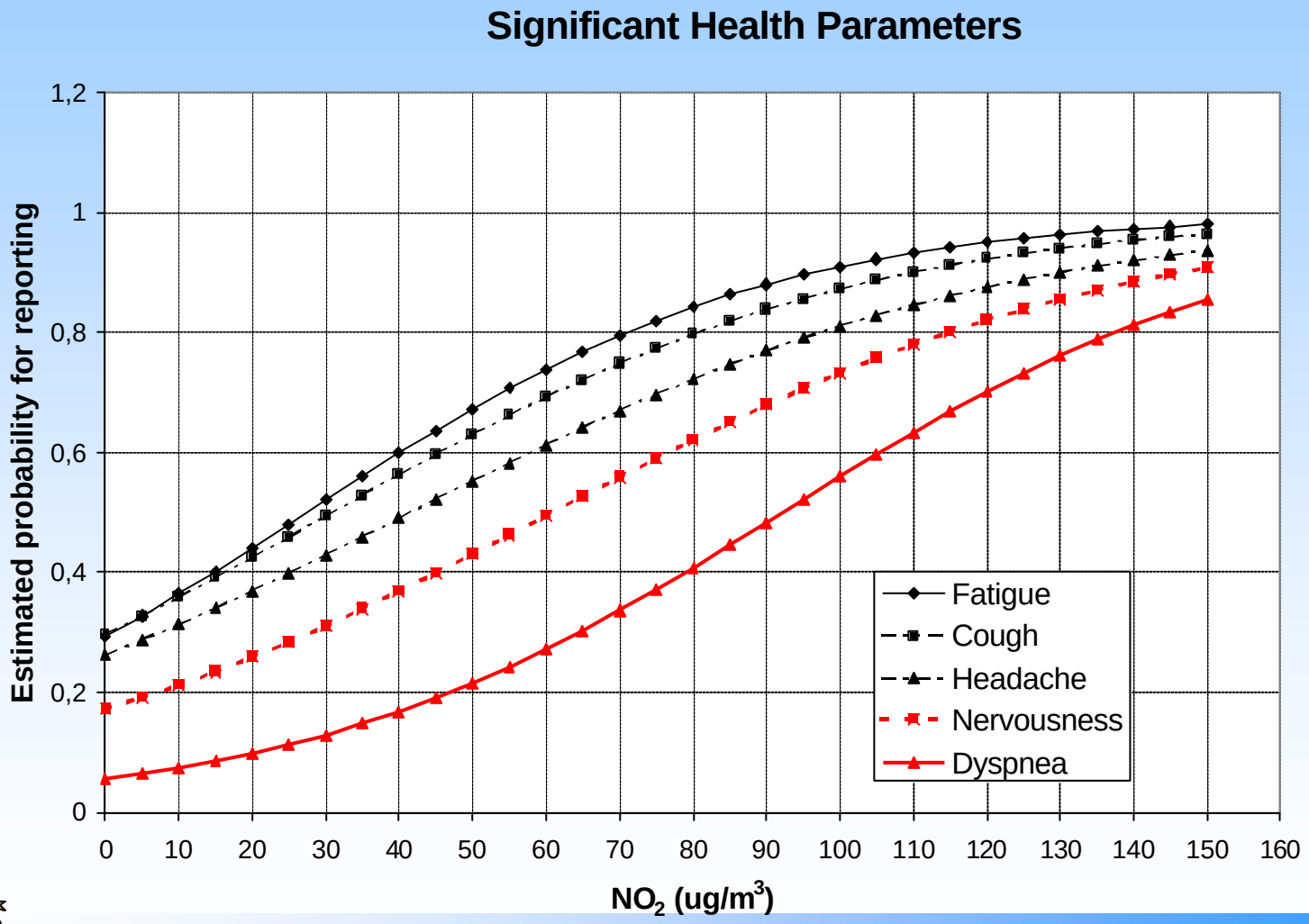
Exposure-effect relationships for symptoms of reduced health and well-being



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Factors that may account for the significant rise in prevalence of airway disease in Western Countries

- Increased sickness in childhood because of use of day care centres
- Nutrition
- Indoor environment
  - Dampness
  - Passive smoking
  - Wall to wall carpeting
  - Pets
- Indoor environment at schools
- Air pollution

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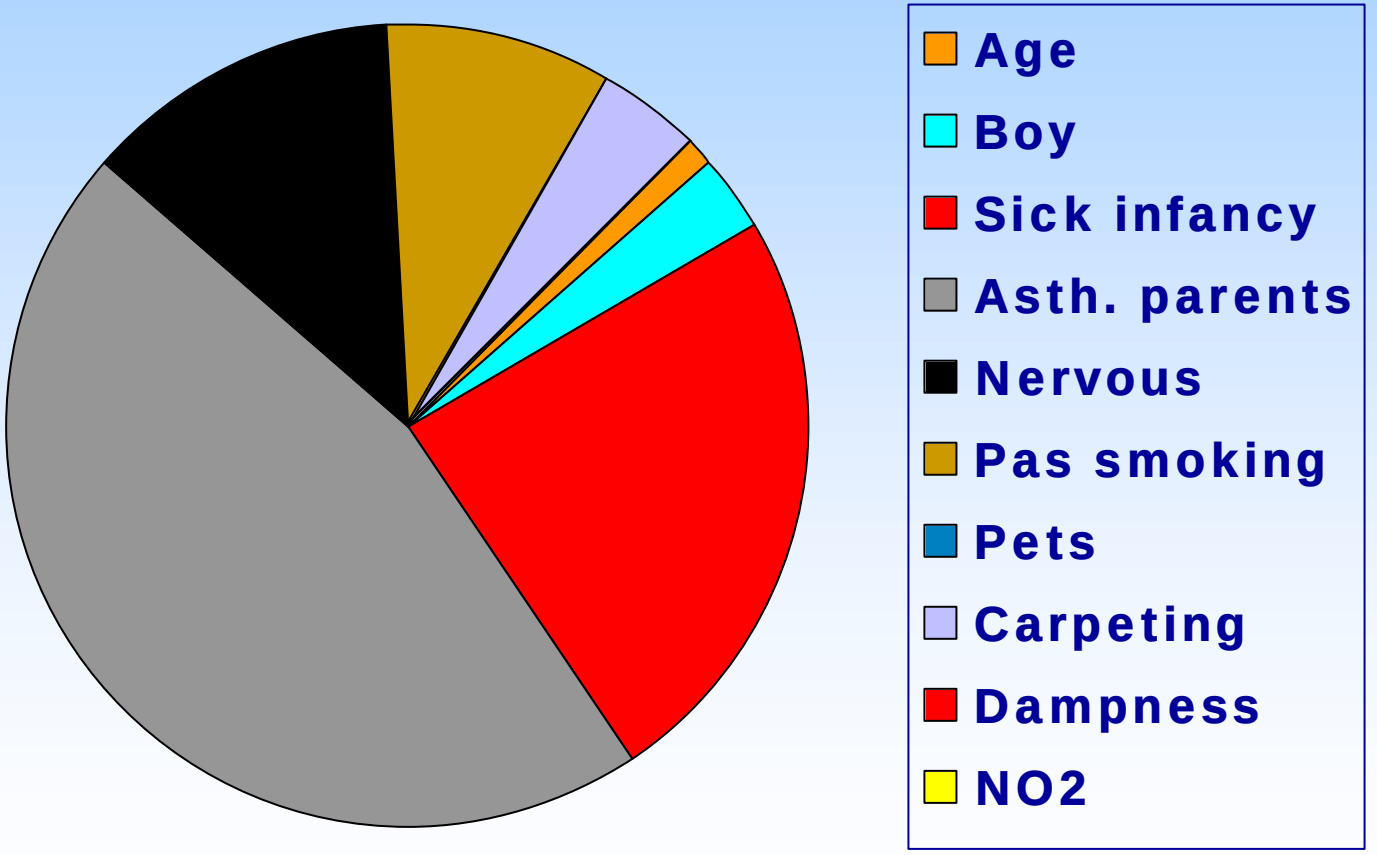
Potential risk factors for diagnosed asthma in childhood



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Indoor Environment currently

- Carpets -
- Smoking -
- Pets -
- Dampness (+)

Indoor Environment during infancy

- Carpets + 1.1
- Smoking + 1.2
- Pets ns
- Dampness + 1.6
- Attends day-care ns

Aggravation of Asthma in children

Urbanization
City Site

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Toxicity of carbonaceous particles

Dr. Hartwig Muhle

Diesel particle studies 1998, health effects:

- Premature mortality
- Aggrevation of respiratory diseases
- Changes in lung functions

What is responsible for effects?

- Acidic particles
- transition metals
- Ultrafine particles
- Ultrafine as carriers
- Bio-aerosols (spores, pollen, bacteria)

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The air I breathe and my Health

The major source: Transportation
Indicators: NO_2 and PM_{10}
Important tool: Epidemiology and toxicology

More research needed on ultrafine particles
Why particle-induced acute pulmonary effects?

- **Acidic particles**
- **transition metals**
- **ultrafine particles**
- **ultrafine as carriers (PAH?)**
- **bio-aerosols; spores, pollen**

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Do the current *air quality guidelines* secure the population against health effects?

- ★ Is there a level of no effect?
- ★ What is the level of acceptable risk?
- ★ Should all members of society be equally protected?

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The research challenges inherent in identifying the effects of air pollution

- Identifying that air pollution has an effect?
- Determining the biological nature of the effect?
- Describing the various aspects of the effect?
- Describing the at risk population?
- Identifying and describing the separate effects of each compound?

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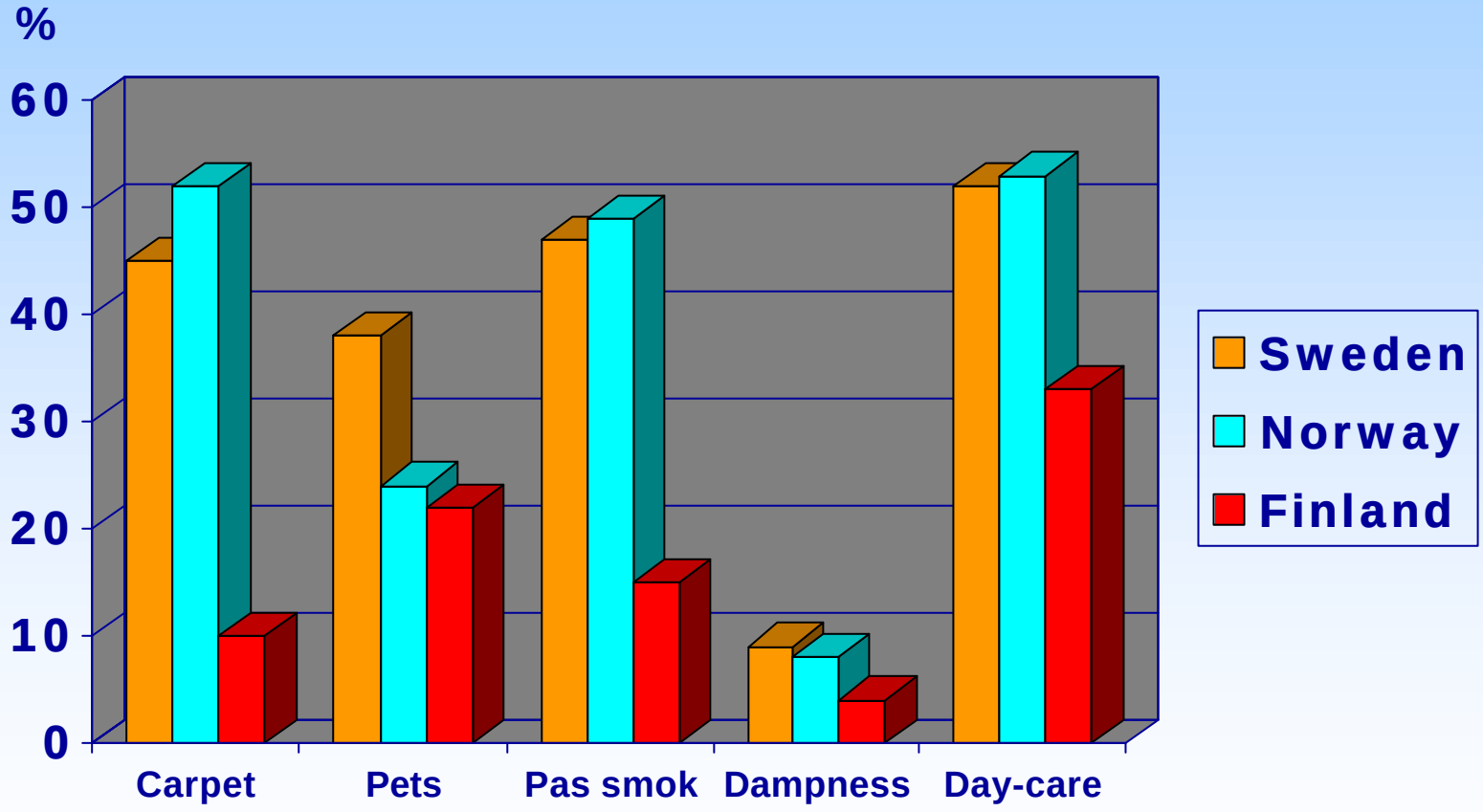
Indoor environment in infancy in Scandinavia



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