



Republic of Tunisia
Ministry of Public Health
Directorate of hygiene and Environmental Protection



Health benefits of cleaner fuels

Unleaded gasoline and low sulfur Fuel

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CITET, 15th August 2008



Introduction

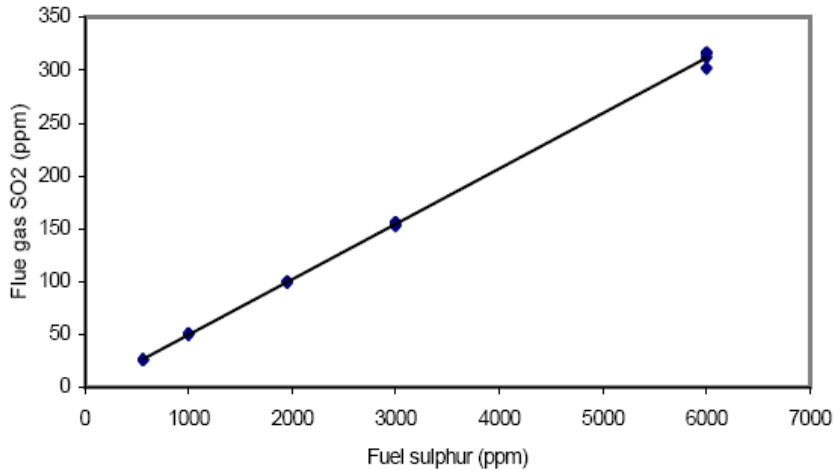


- ◆ Current scientific evidence, derived largely from studies in North America and Western Europe, indicates that urban air pollution, which is derived largely from combustion sources especially means of transport, causes a spectrum of acute and chronic [health effects](#) on human ranging **from eye irritation to death**.
- ◆ Recent assessments suggest that the impacts on public health may be considerable and WHO estimates that **800,000** Premature Deaths Each Year are attributable to Urban PM; Diesels One are the Major Source.
- ◆ There are many urban air pollutants: Carbon Monoxide CO, PM10, PM2.5, SO_x, NO_x, Heavy metals (Pb,..), organic persistent pollutants Formaldehyde
- ◆ The fuel composition influences largely the emission of pollutants (Sulfur and Lead)

Impact of fuel sulfur on pollutant emission ?

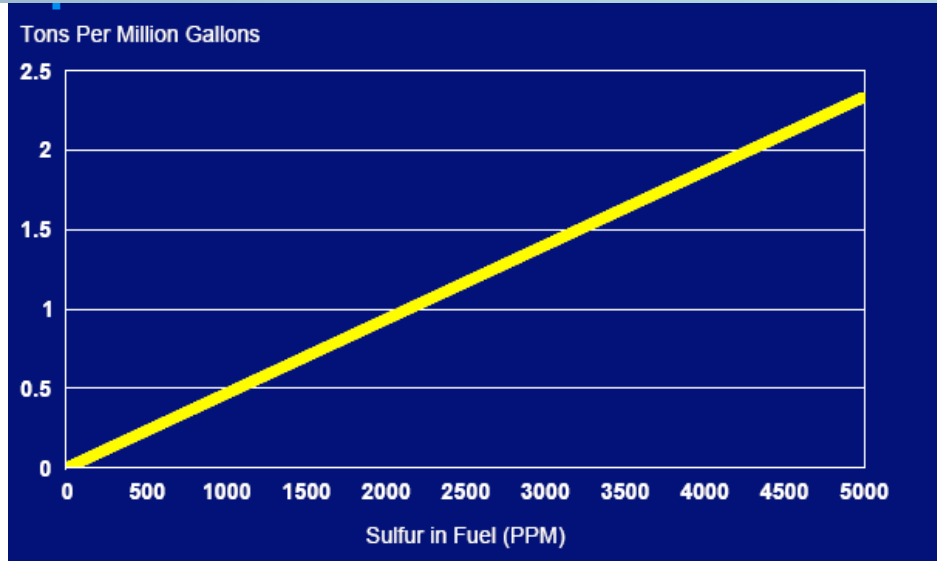
Sulfur in Fuel have many incidence on pollutant emissions:

- SO_x, PM₁₀, PM_{2.5}, nanoparticles, NO_x



Source: Batey and McDonald

Oil Sulfur Content and SO₂ Emissions



Tons of Directly Emitted PM From Diesel Fuels Sulfur

Derived From US EPA Data

Many researchers select PM₁₀ and PM_{2.5} as the indicators of exposure to urban air pollution from combustion sources

Health impacts related to sulfur in fuel?

from Gaseous SO₂ : Peak levels of SO₂ in the air can cause temporary breathing difficulty for people with asthma who are active outdoors. Longer-term exposures to high levels of SO₂ gas cause respiratory illness and aggravate existing heart disease.

Health impacts related to PM

Particulate Matters are the most harmful air pollutants and the evidence of the relation « **Exposure and Response** » is determined by many « **Health Impact Assessment** » **studies such as the American cancer society:**

🌐 **Short term exposure (PM10) : Child Mortality (less than 5years) by IRA (Acute respiratory infection)**

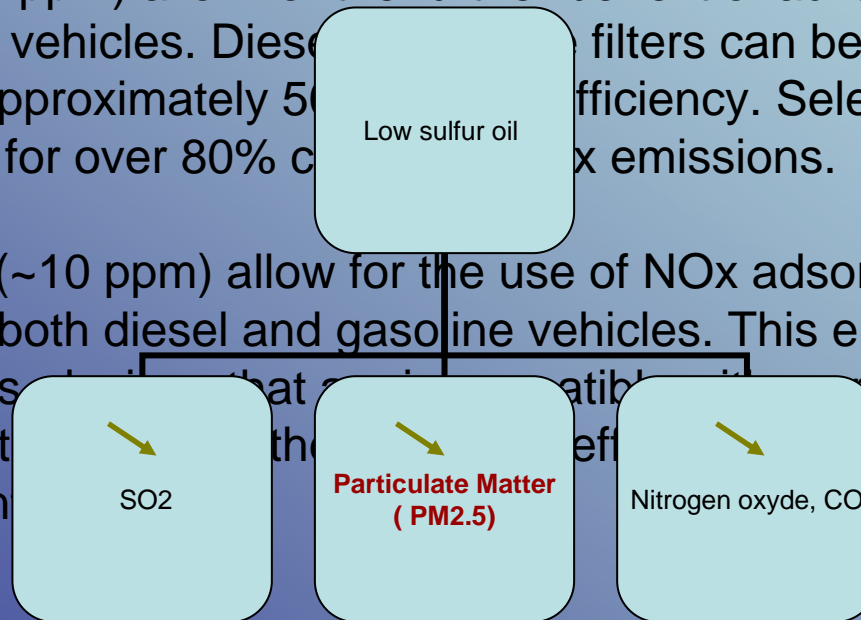
🌐 **Long term exposure (PM2.5) : Mortality by Lung Cancer and Cardiopulmonary diaseses (more than 30 years old)**

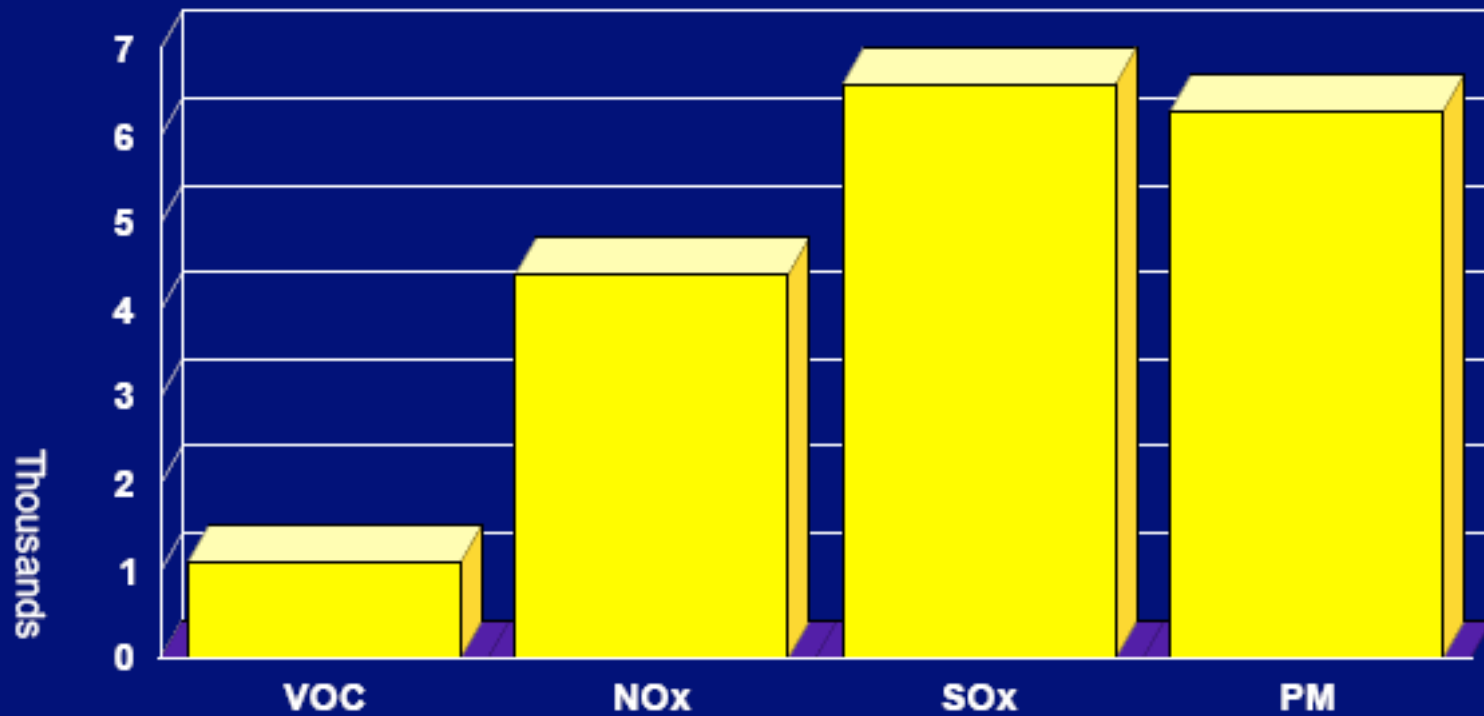
Impact of the reduction of Sulfur on Vehicle Emissions

Evidence so far points strongly to the conclusion that low-sulfur fuel oil emits substantially fewer air pollutants such as sulfur oxides (SO_x), nitrogen oxides (NO_x), and particulate matter (PM). Reduced sulfur fuel decreases emissions of CO, HC, and NO_x from catalyst-equipped gasoline vehicles and PM emissions from diesels, with and without oxidation catalysts.

Low sulfur fuels (~50 ppm) allow for the further benefit of advanced control technologies for diesel vehicles. Diesel particulate filters can be used with low sulfur fuel but only achieve approximately 50% efficiency. Selective catalytic reduction can be used for over 80% of NO_x emissions.

Ultralow sulfur fuels (~10 ppm) allow for the use of NO_x adsorbers, increasing NO_x control to over 90% in both diesel and gasoline vehicles. This enables more fuel-efficient engine designs that are compatible with current emissions control systems. Particulate filters with the efficiency of diesel particulate filters, approaching 100% conversion, are also used with ultralow sulfur fuels,





Tons Per Year

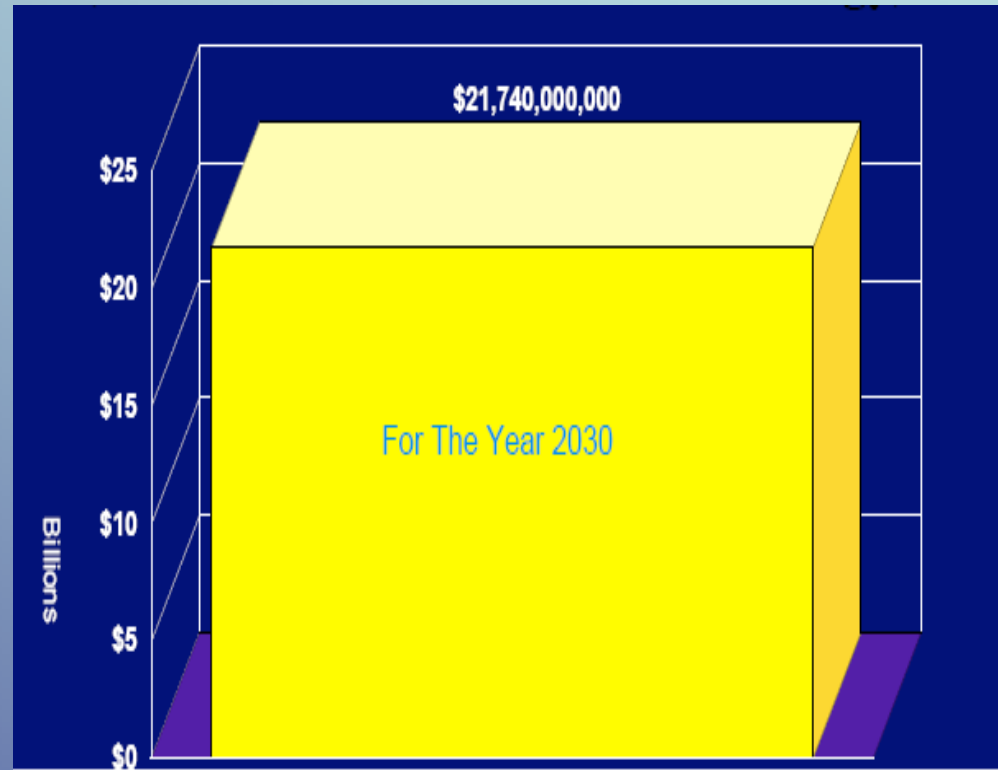
Source: Nicole Davis, Jim Lents
UC Riverside

**Tons of Emissions Reduced By
Adopting ULS Fuels**

Annual Adverse Health Impacts Quantified in Mexico

Premature mortality	2,068
Chronic bronchitis	1,370
Hospital Admissions Pneumonia	274
Hospital Admissions COPD	224
Hospital Admissions Asthma	224
Hospital Admissions Cardiovascular	673
Emergency Room Visits for Asthma	523
Asthma Attacks (Thousands)	44
Acute bronchitis	4,385
Lower respiratory symptoms (Thousands)	48
Upper respiratory symptoms (Thousands)	48
Work loss days (Thousands)	384
Minor restricted activity days (Millions)	2

Total Value of Health Benefits From PM Reductions Resulting From ULS Fuels in Mexico



The EPA found that reduction of sulfur in fuel would have grate results on emission reductions withch would have great health benefits for Americans:

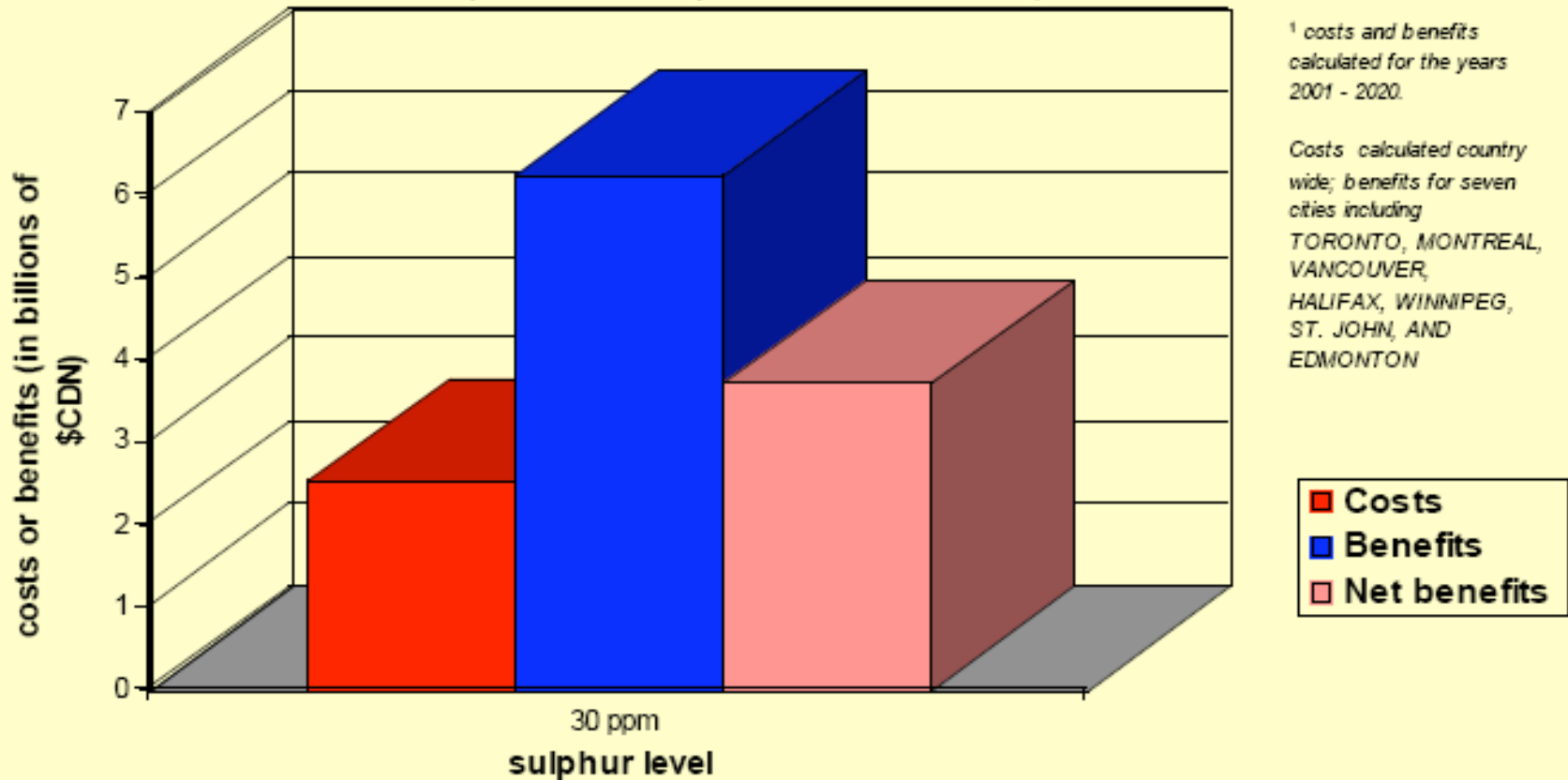
Reduction in Incidence of PM-related Adverse Health Effects	
<i>Health effect</i>	<i>Reduction in annual number of PM related cases when program is fully implemented (c. 2030)</i>
<i>Premature mortality</i>	9,600
<i>Chronic bronchitis</i>	5,700
<i>Non-fatal heart attacks</i>	16,000
<i>Hospital admissions (respiratory & cardiovascular)</i>	8,300
<i>Emergency room visits for asthma</i>	5,700
<i>Acute bronchitis attacks in children</i>	14,000
<i>Lower respiratory symptoms in children</i>	150,000
<i>Upper respiratory symptoms in children (asthmatic)</i>	110,000
<i>Work days lost</i>	960,000
<i>Adult restricted activity days</i>	5,700,000

The EPA's valuation of these health benefits is approximately **\$550 billion (USD-2004)** for the period 2007 to 2030. The annual benefits are approximately \$80.6 billion (USD) by 2030

Costs and benefits of reduced-sulphur gasoline

(in terms of *net present value* ; 1994\$)

1



Net Benefits related to reducing Sulfur in fuel are so important!!
Justification of the investment!!!



Health effects related to Lead exposure

Many health effects have been associated with lead exposure including :

- Systemic effects (e.g. gastrointestinal effects, anaemia, hypertension and hearing loss),
- Effects on the nervous system (e.g. on behaviour),
- Development, and on the reproductive system,
- Genotoxicity, carcinogenicity and social effects (ATSDR 1999).

But: The strength of evidence supporting the association of these health effects with exposure to lead varies, and not all of these effects have been investigated sufficiently to permit quantification of their consequences in terms of disease burden.

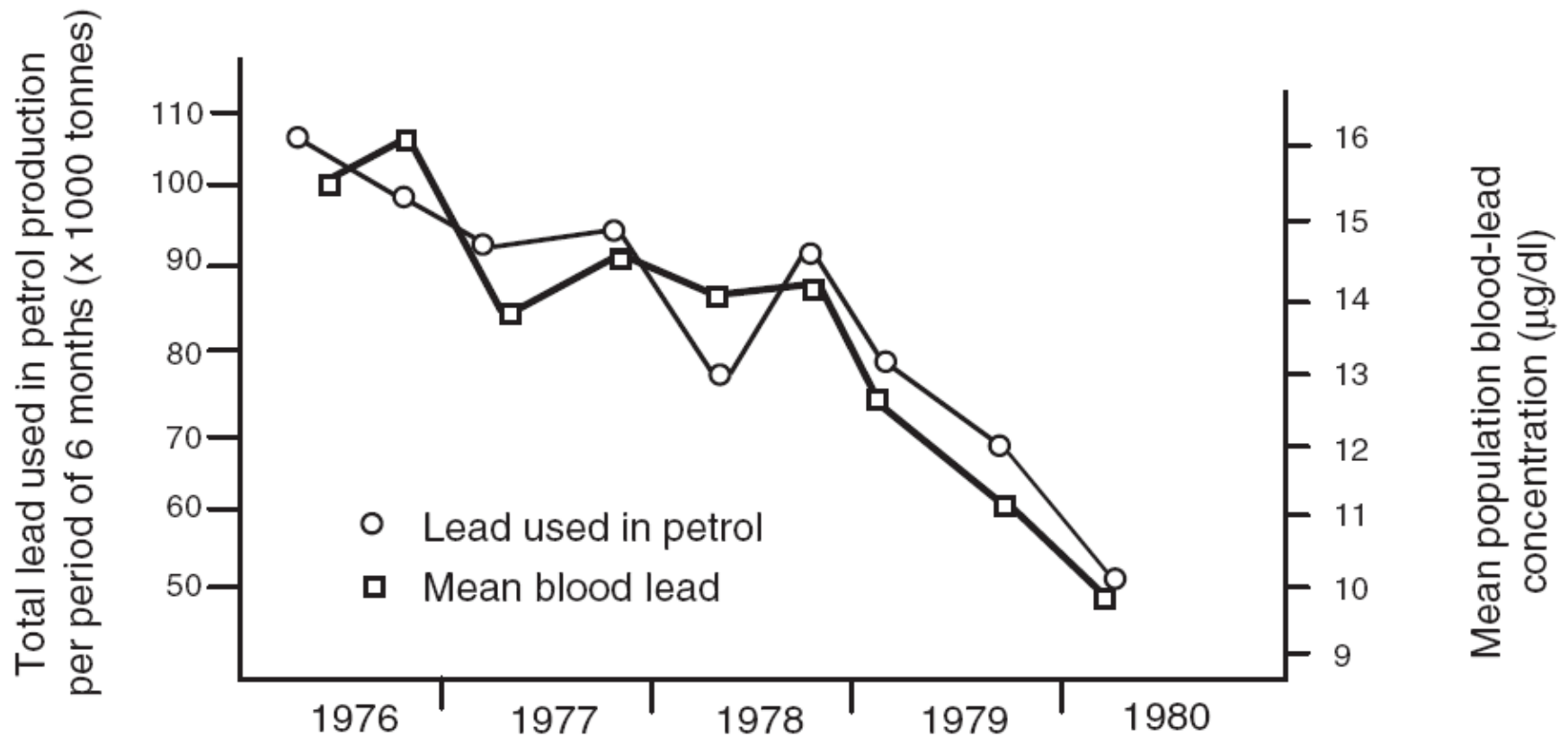
The most important analysis of exposure is characterized by the population mean and the population distribution of blood-lead concentrations

Table. Lead-related health effects in children and adults in relation to B-Pb concentrations (i.e. concentration range associated with each effect).

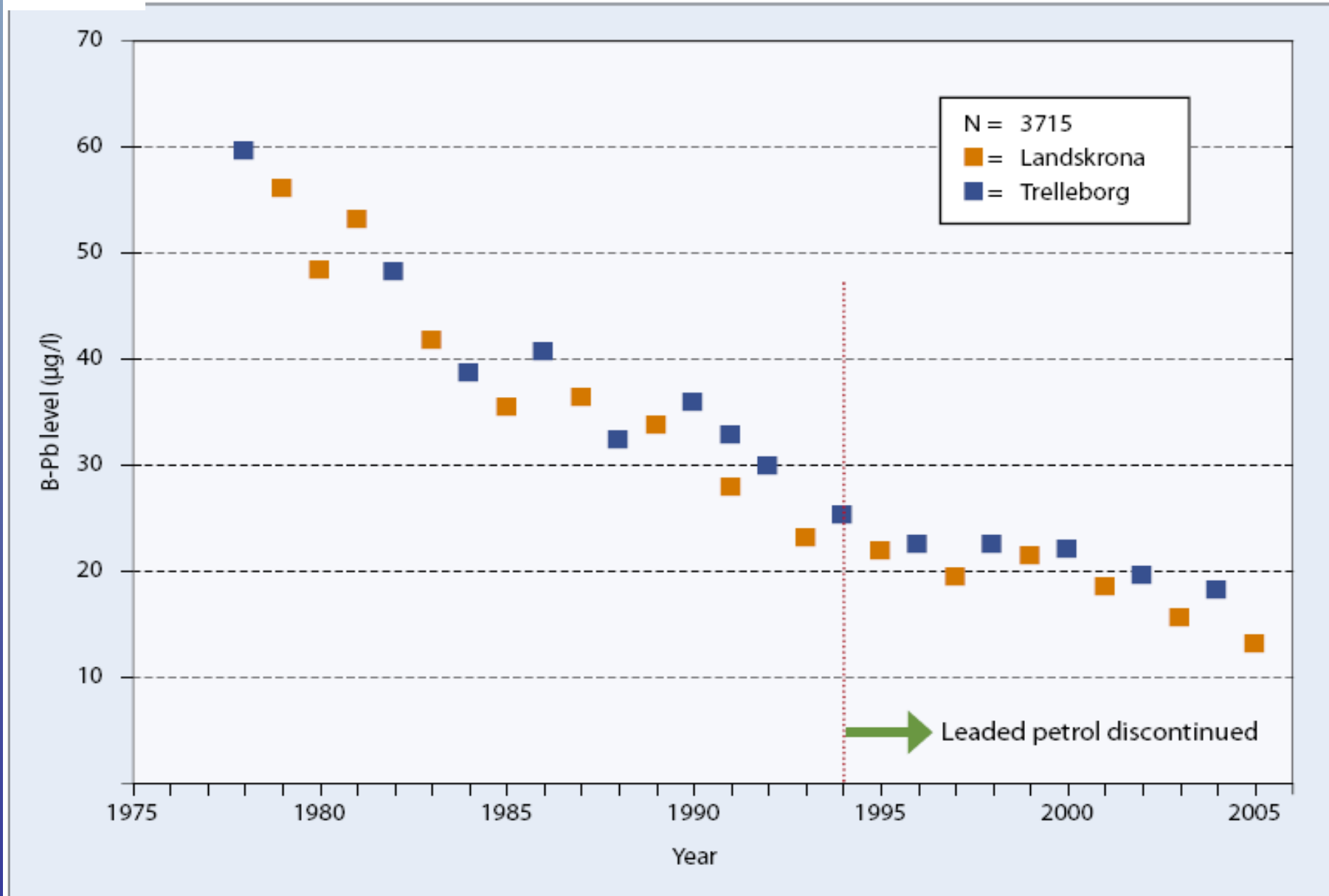
Effect	B-Pb ($\mu\text{g/l}$)	
	Children	Adults
Depressed ALAD	<50	<50
Neurobehavioural		>40 (in the elderly)
Neurodevelopmental	<100	
Sexual maturation	<100	
Depressed glomerular filtration rate		<100
Elevated blood pressure		<100
Depressed vitamin D levels	>150	
Elevated erythrocyte protoporphyrin	>150	>200 (in females)
Depressed nerve-conduction velocity	>300	
Enzymuria/proteinuria		>300
Depressed haemoglobin	>400	>500
Neurobehavioural, altered thyroid function, reduced fertility, peripheral neuropathy		>400
Colic	>600	
Death	>1 000	>1 500

The importance of health impacts related to exposure to lead, encouraged many countries to reduce lead in fuel through important programmes, and the health impacts of this reduction seems to be shown.

Decrease in mean population blood-lead concentrations in relation to reduction of lead in petrol,^a in the United States



B-Pb levels (geometric means) in 3715 Swedish children for 1978–2005.



Source: Strömberg et al. (2003); Strömberg et al., unpublished data.

Conclusion & Recommendations

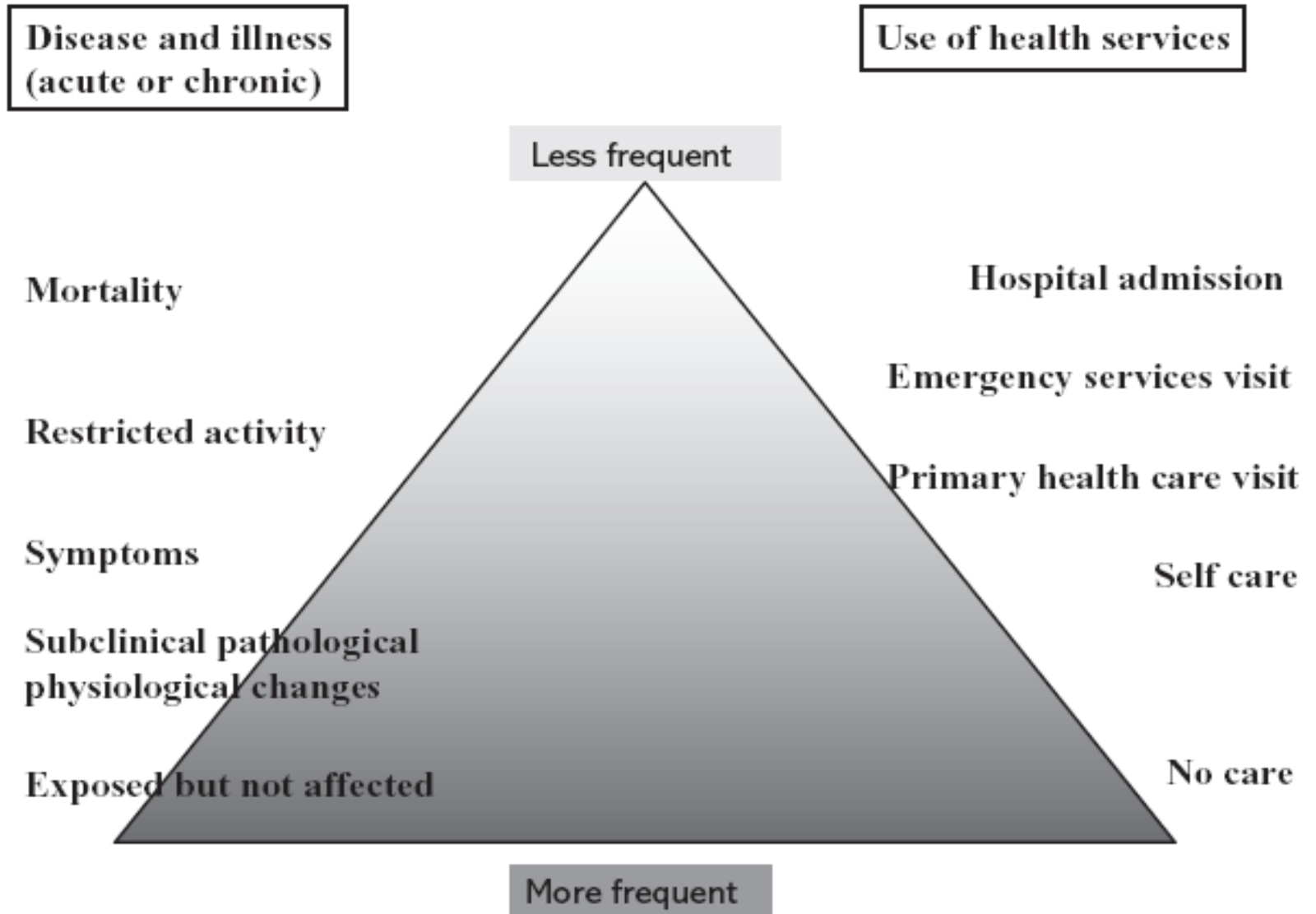
- ▶ Health benefits related to reduction of sulfur and Lead are so important (prevention)
- ▶ This health benefits have an important economic outcome (Billion Dollars),
- ▶ Integrative approach: Transport, Health, Environment, Industry, Economy Sustainable Development
- ▶ Necessity to quantify Health impacts related to urbain air pollution for Tunisia:
 - ❖ Health impact Assessment related to air pollution as a tool to quantify impacts of air pollution on health, espetially that with the phenomena of climate change, air pollution may increase
 - ❖ Health impact assesment as a tool to evaluate benefits of national programmms of sulfur fuel reduction, Lead..
 - ❖ HIA as a tool for Environmental Helth monitoring
 - ❖ HIA as a tool to excute National Law on air quality

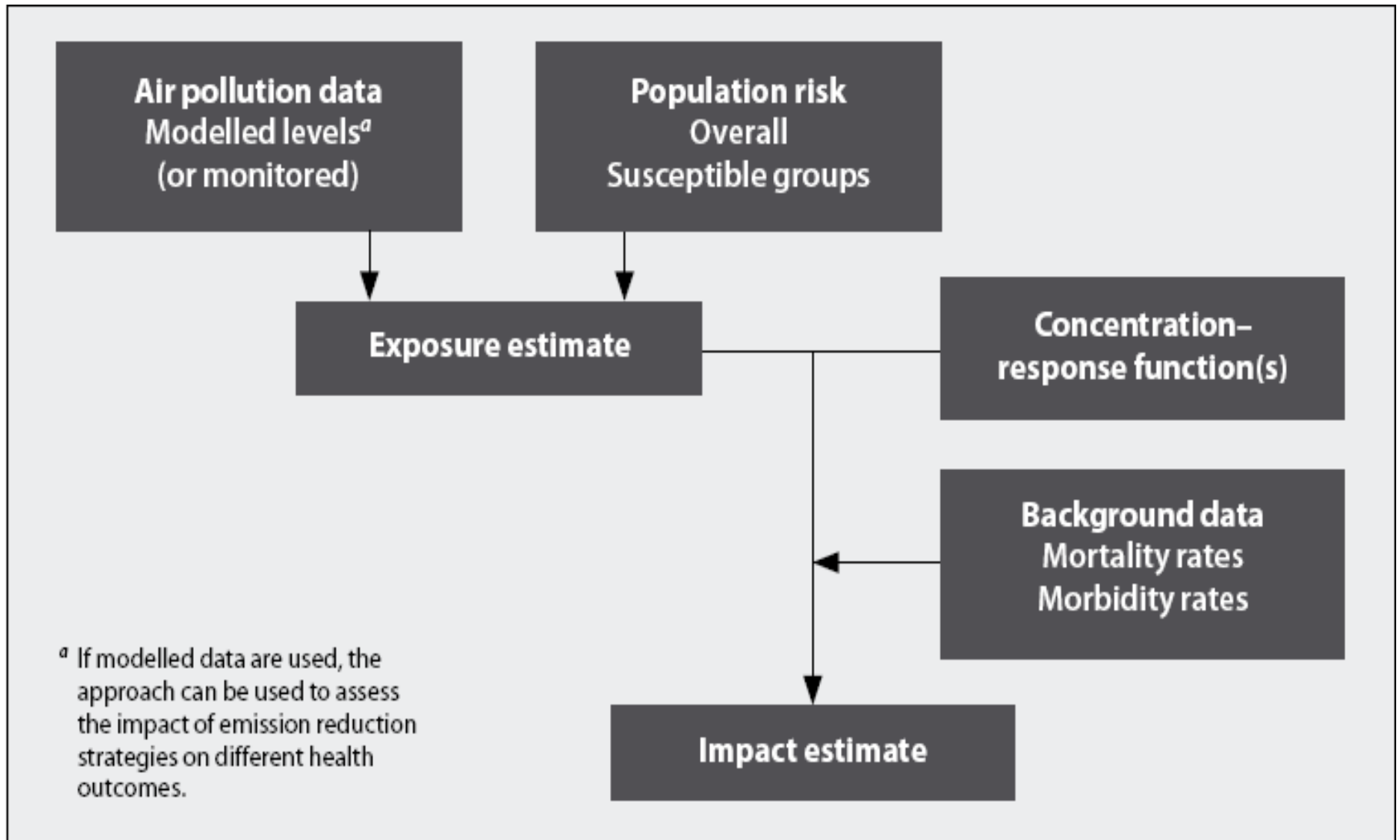


Real Need for support: Technical and fundings

Thank you

The relative frequencies of health events associated with exposure to air pollution





Health Impact Assessment Studies : High level of knowledge, Much Money , restricted to Europe and America and developed countries ..