Impact of air pollution on respiratory disease

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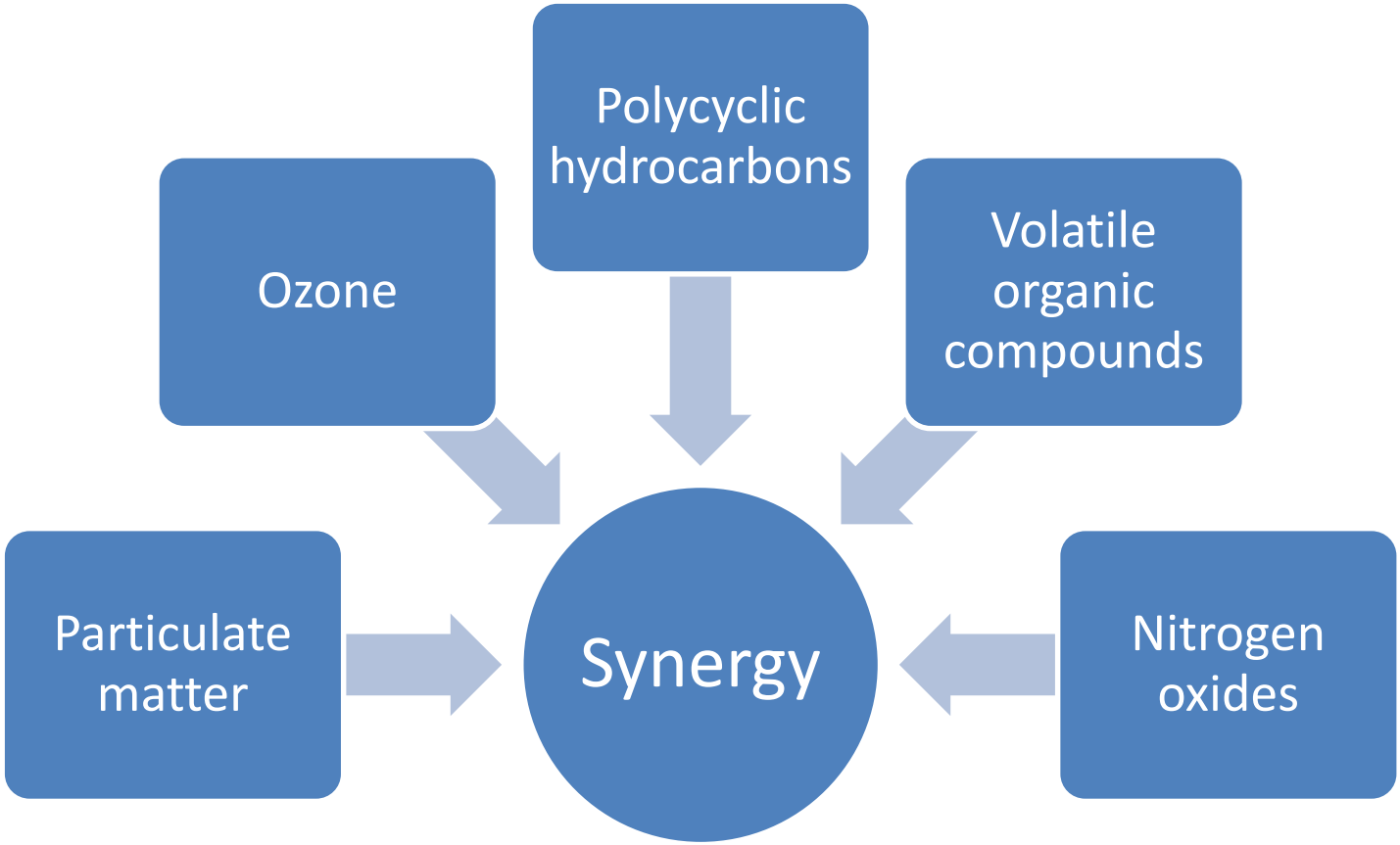
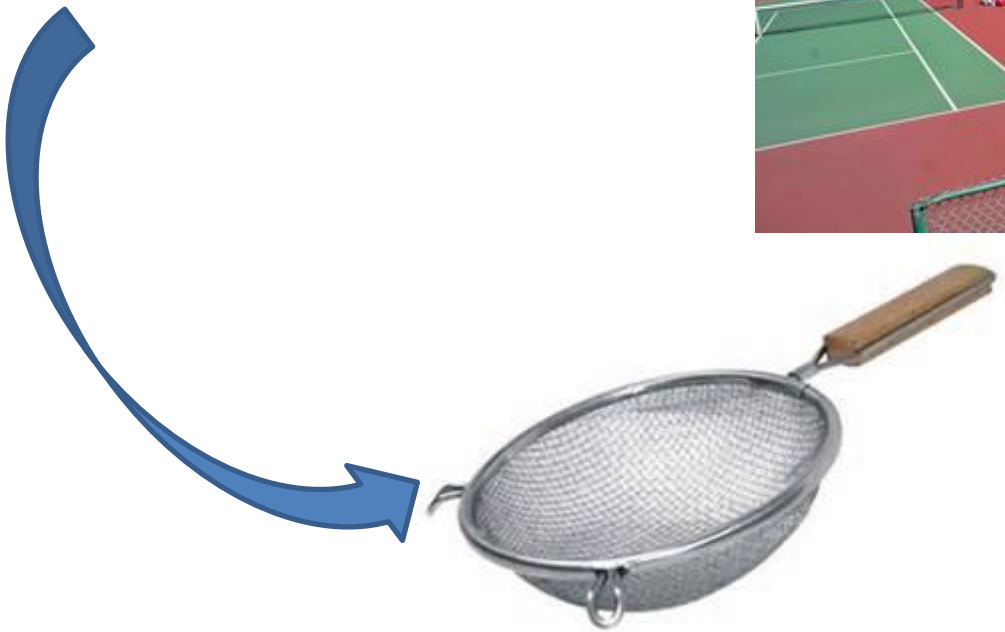
Which pollutants?

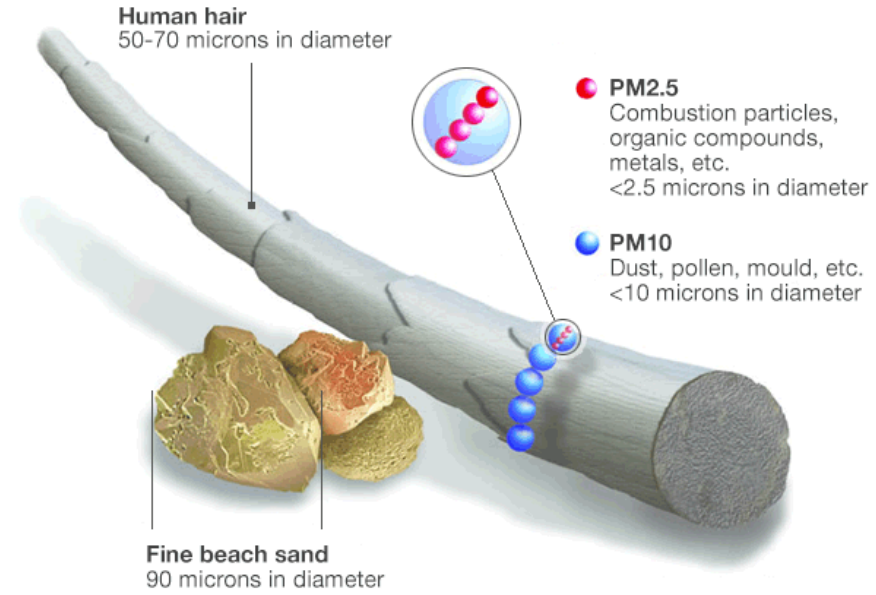


The lung as a sieve

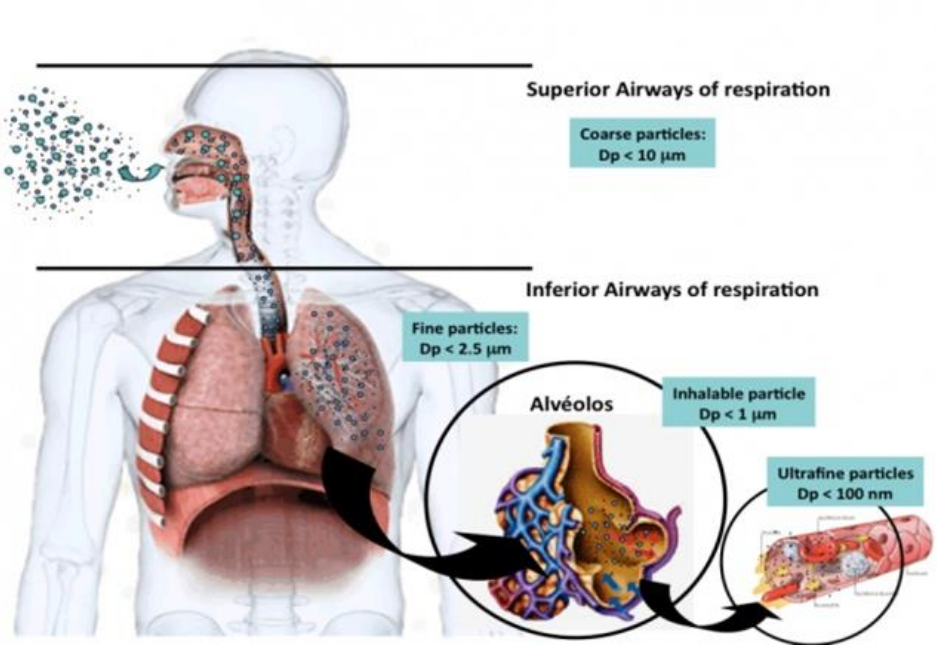
10,000 litres of air/day



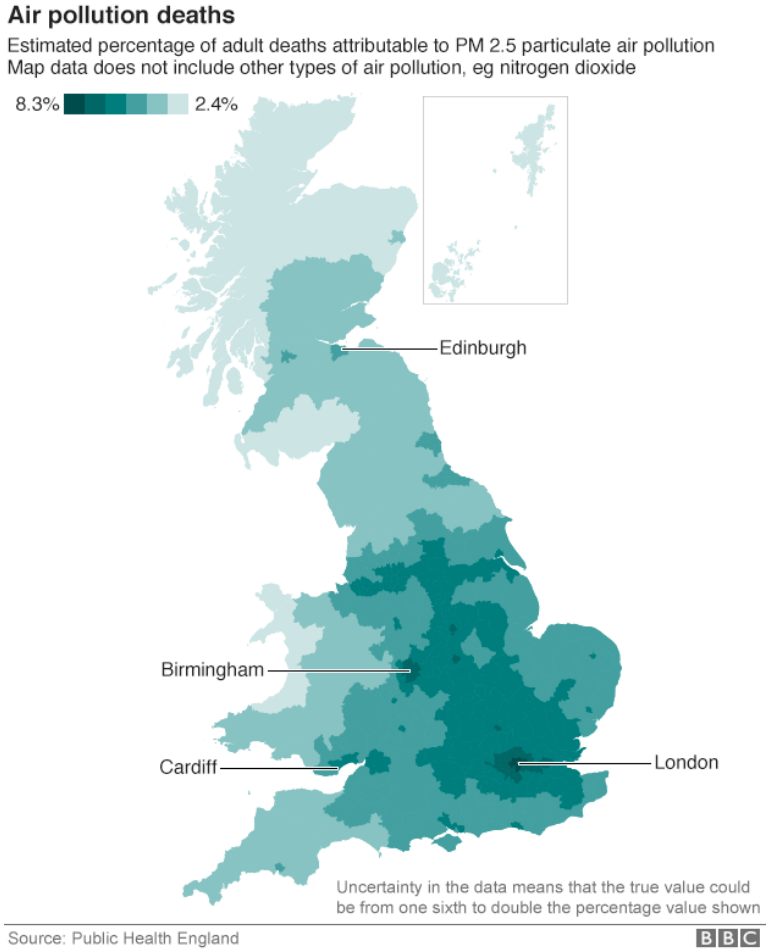
Particulate matter

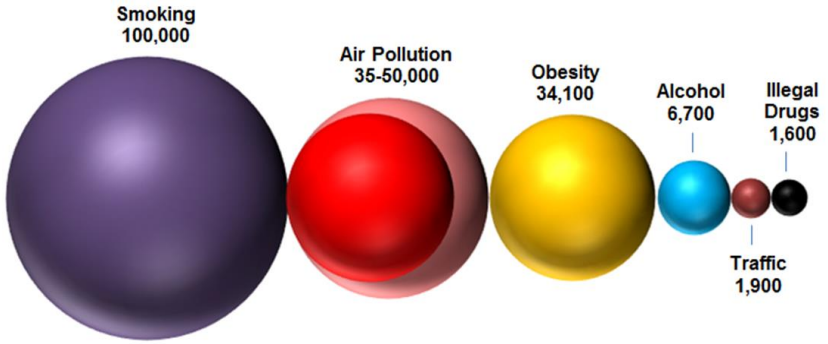


Source: US EPA



Major cause of mortality





Susceptible groups

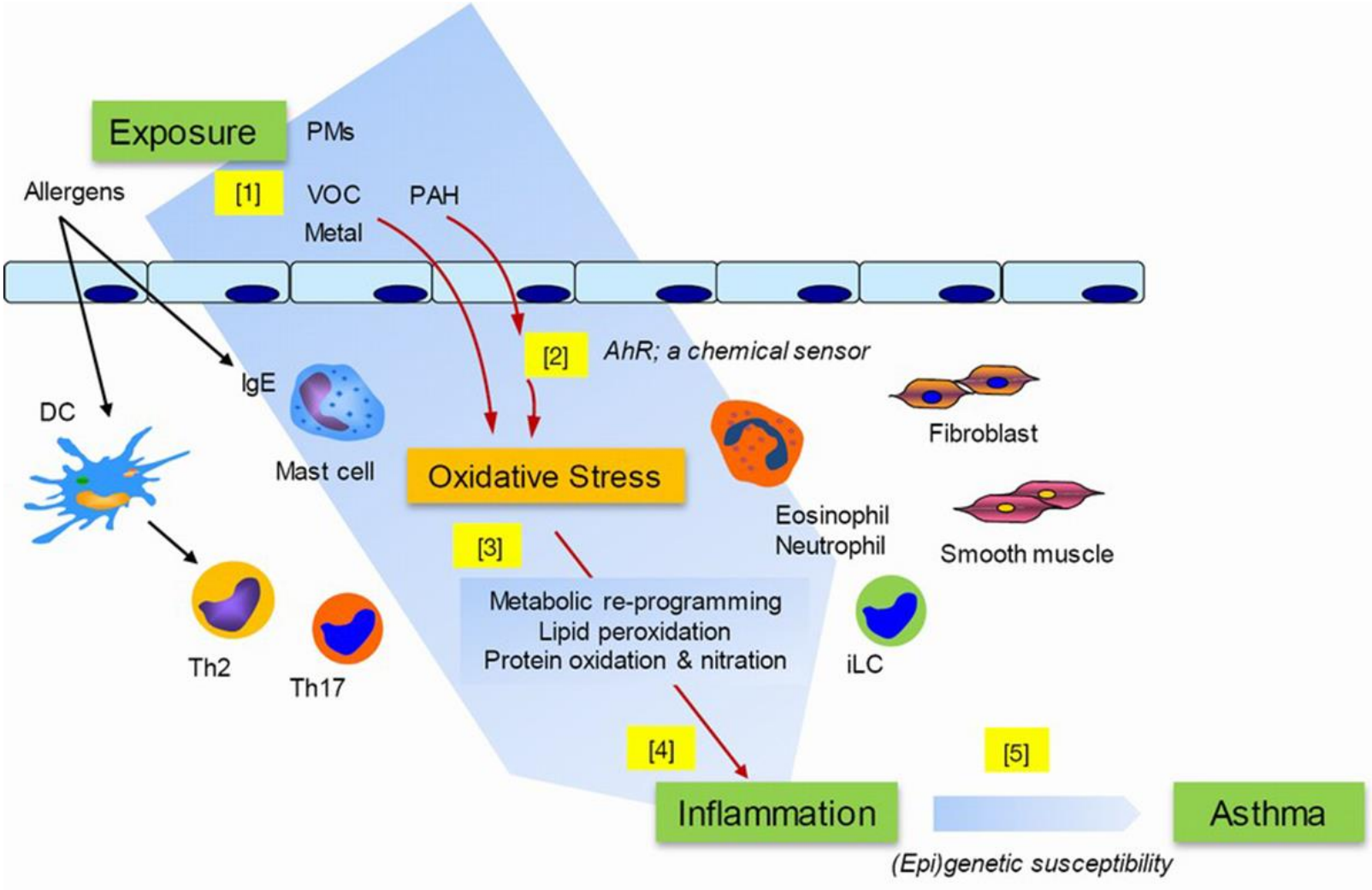
- Children
  - Increased respiratory volume per weight
  - More sensitive to airways irritation and higher risk of developing infections
- Elderly
  - Poorer immune systems and less reserve
- Pre-existing conditions
  - Asthma / COPD
- Pregnancy
  - Reduced birth weight and increased maternal complications

Respiratory symptoms and medication usage

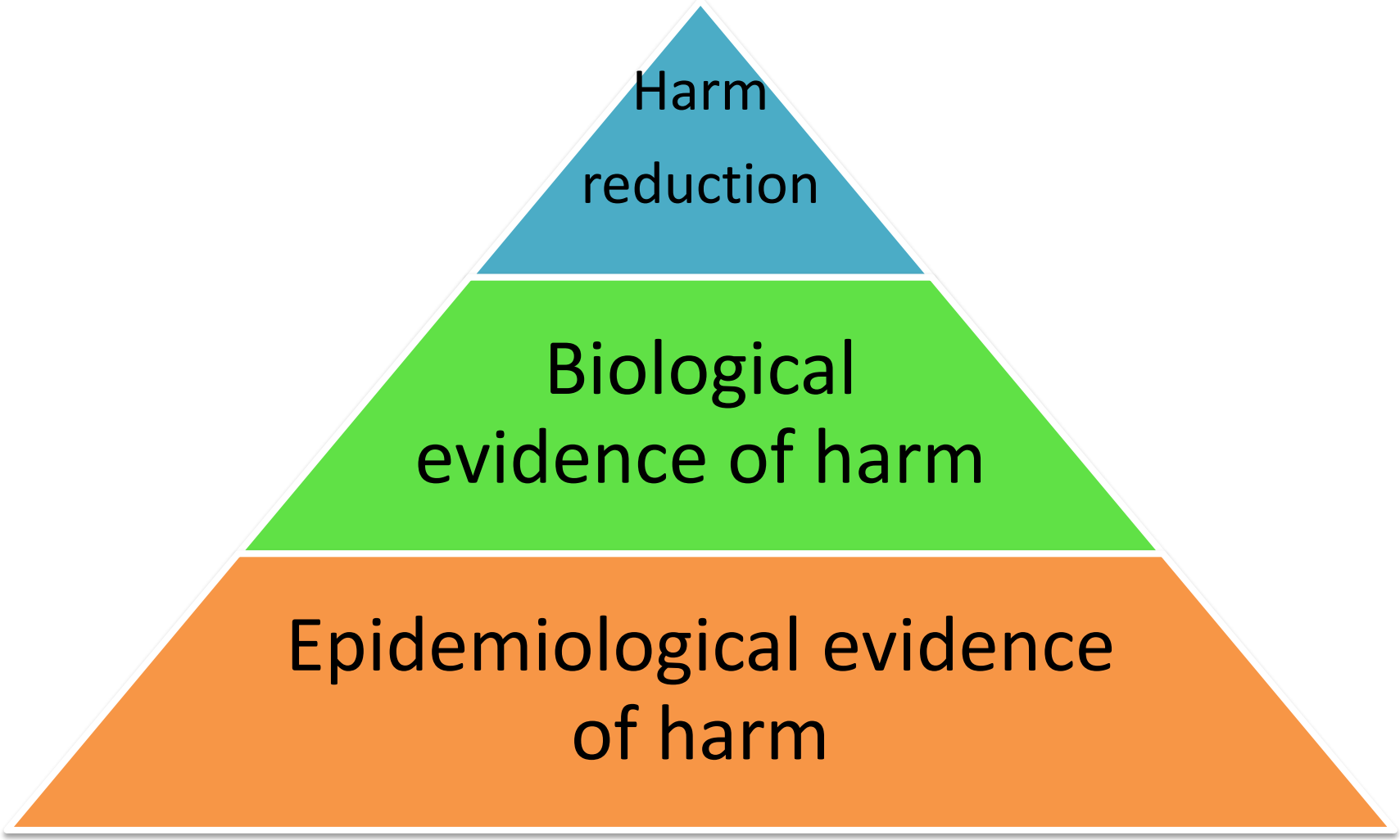
- Increases in particulate matter associated with
  - Severe asthma symptoms
  - Missed school days
  - Increase in adult asthma exacerbations
  - Increased medication usage

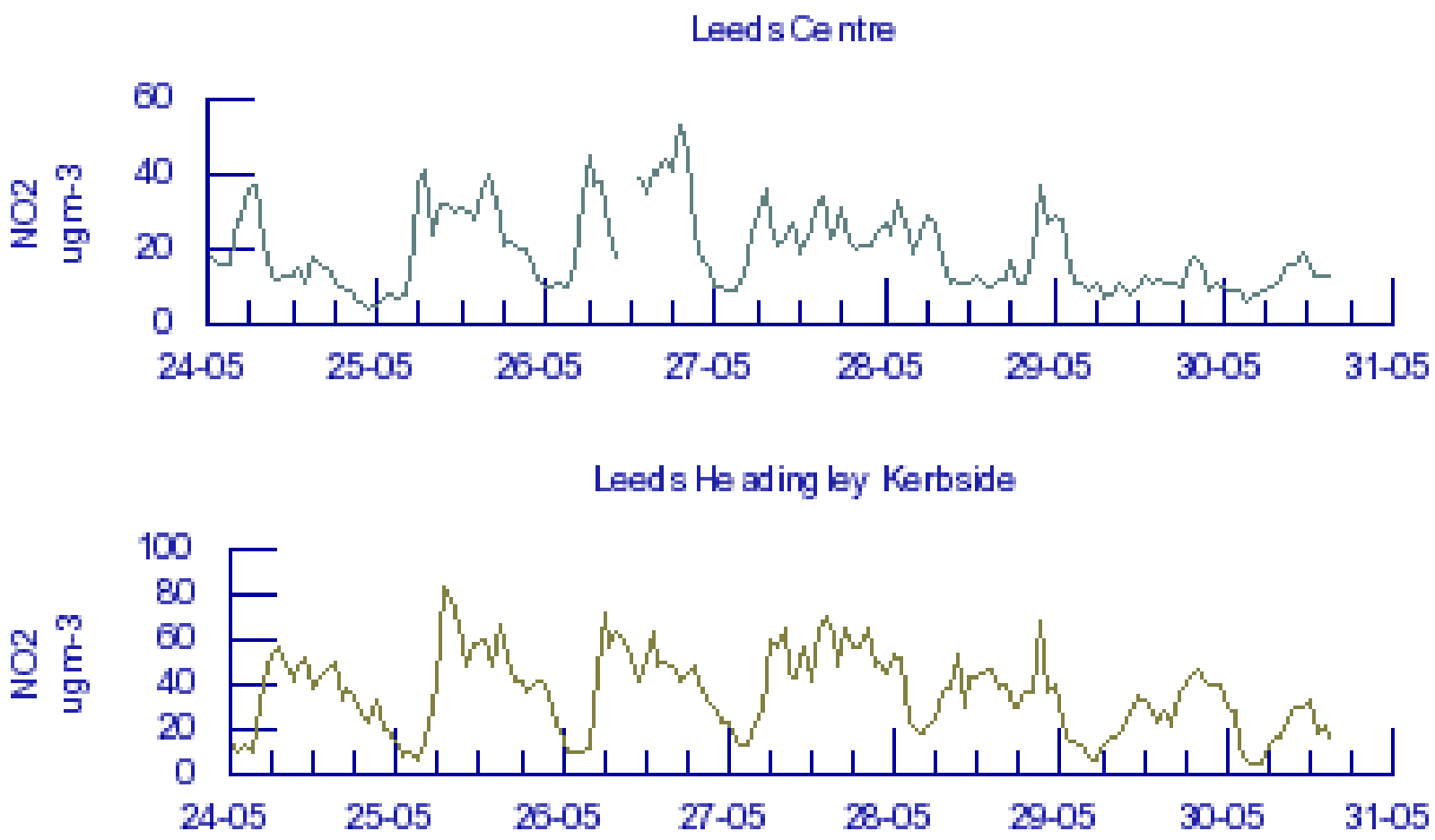
Healthcare utilisation

- Increases in particulate matter associated with
  - Hospitalisation with bronchiolitis in infants
  - Children attending ED with asthma
  - Adult hospitalisation due to respiratory symptoms


Exposure
PMs
Allergens
[1]
VOC
PAH
Metal
[2]
AhR; a chemical sensor
IgE
DC
Mast cell
Oxidative Stress
Fibroblast
Eosinophil
Neutrophil
Smooth muscle
[3]
Metabolic re-programming
Lipid peroxidation
Protein oxidation & nitration
iLC
Th2
Th17
[4]
[5]
Inflammation
Asthma
(Epi)genetic susceptibility

Does intervention work?



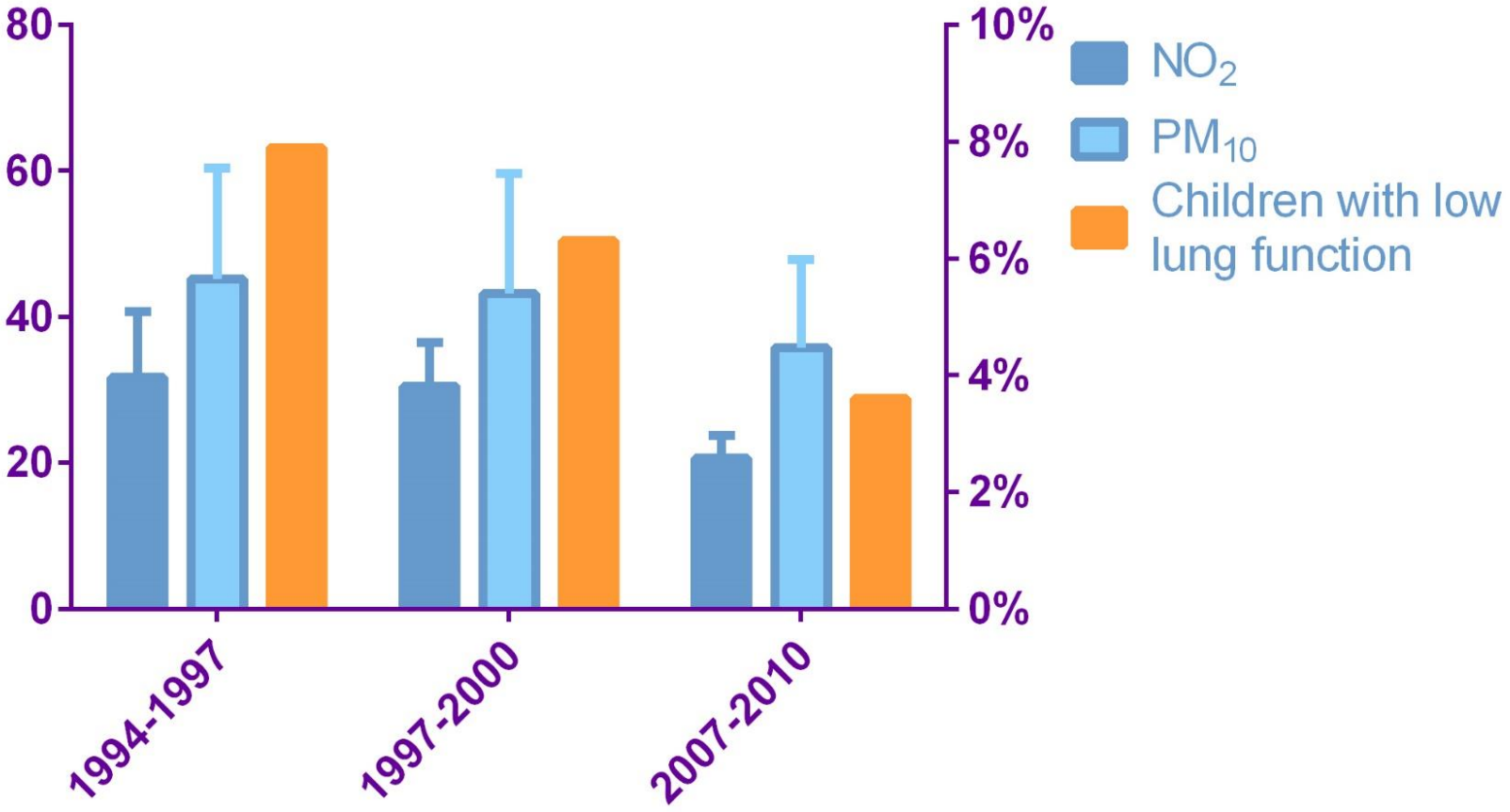

Leeds Centre
NO2 ug m-3
60
40
20
0
24-05
25-05
26-05
27-05
28-05
29-05
30-05
31-05
Leeds Headingley Kerbside
NO2 ug m-3
100
80
60
40
20
0
24-05
25-05
26-05
27-05
28-05
29-05
30-05
31-05

Southern California experience

- Historically plagued by high pollution levels
- Number of interventions to reduce air pollution
- Air pollution trending downwards

N Engl J Med 2015;372:905-13.

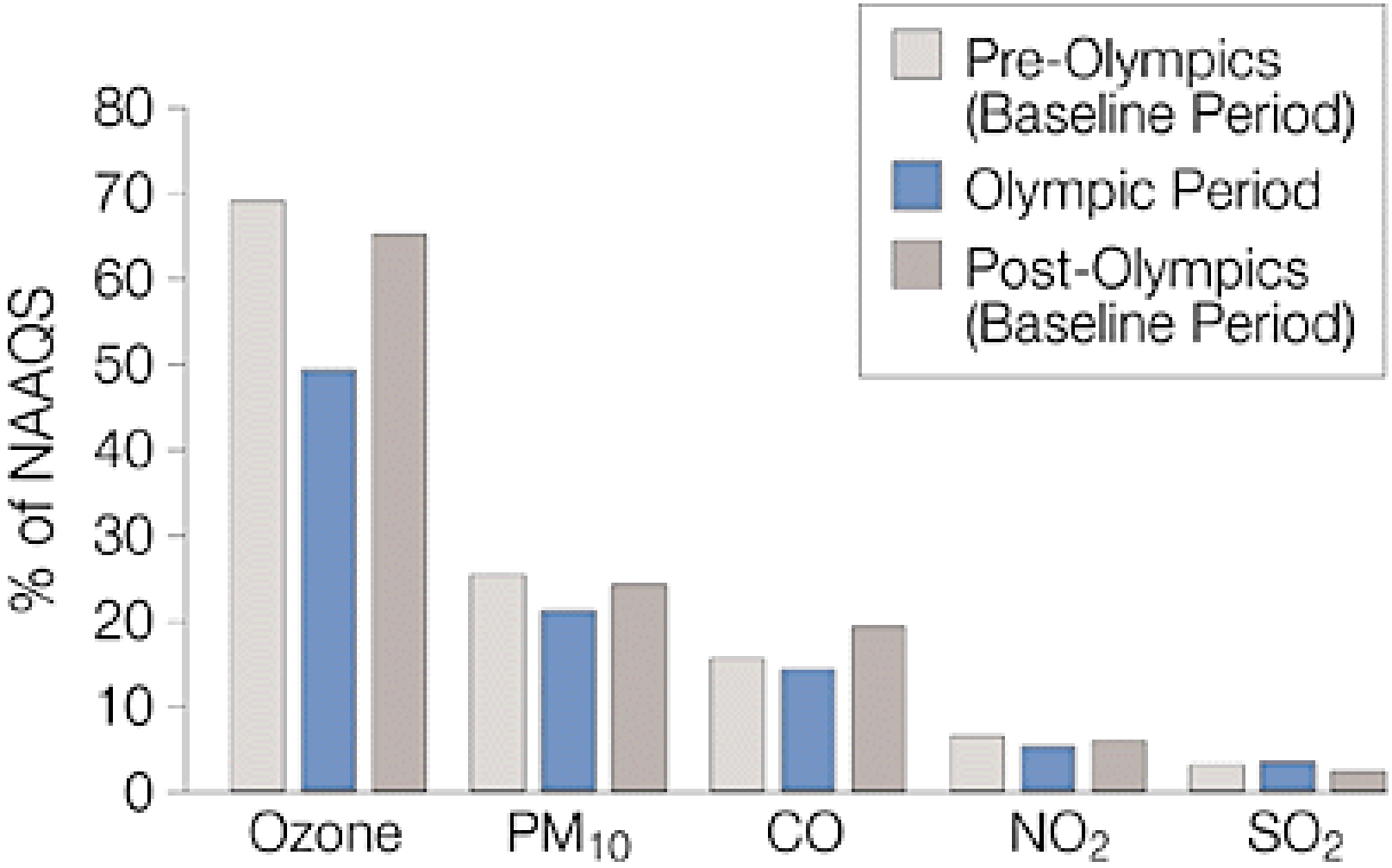
Improvements in pollution and lung function



Can traffic congestion measures help?

- At Atlanta Olympics strategies introduced to minimise increase in traffic congestion
  - Integrated public transpot
  - Park and ride schemes
  - Alternate working hours
  - Teleworking
  - Closure of downtown to private cars
  - Altered delivery schedules

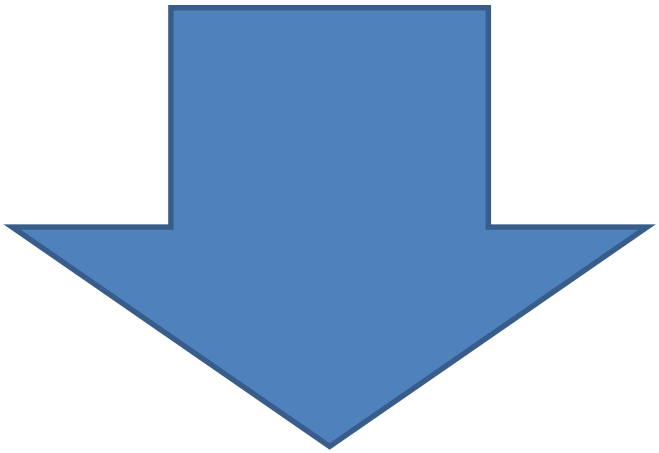
JAMA. 2001;285(7):897-905



JAMA. 2001;285(7):897-905

Effect on asthma admissions

- 40% decrease in asthma admissions during17 days of Olympic compared to 4 weeks pre- and post- event



JAMA. 2001;285(7):897-905

A model for public health

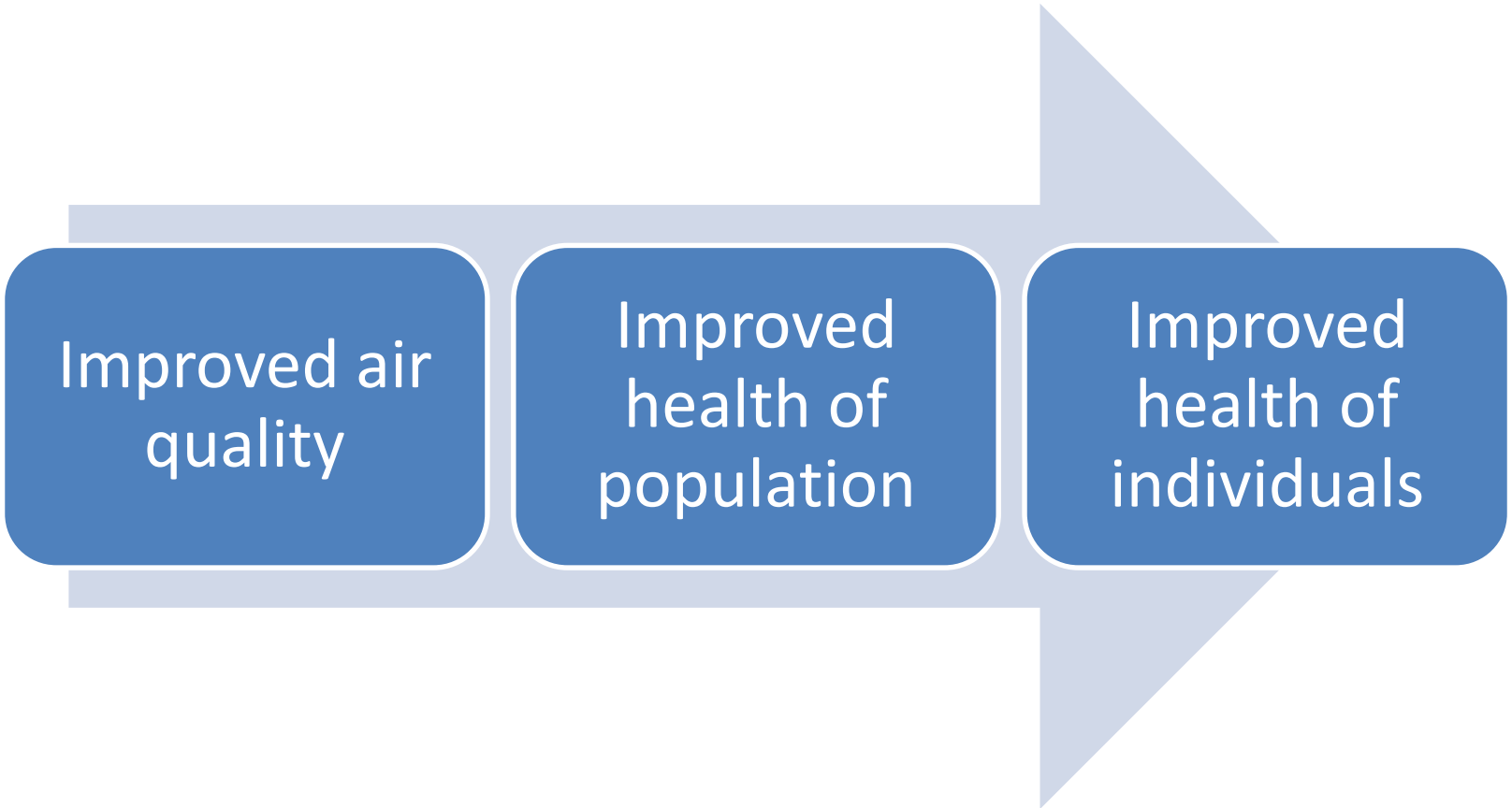
Impact of smoking ban

- Reduced respiratory symptoms in bar-workers
- Reduction in second-hand smoke exposure
- Reduction in heart attacks

Source:

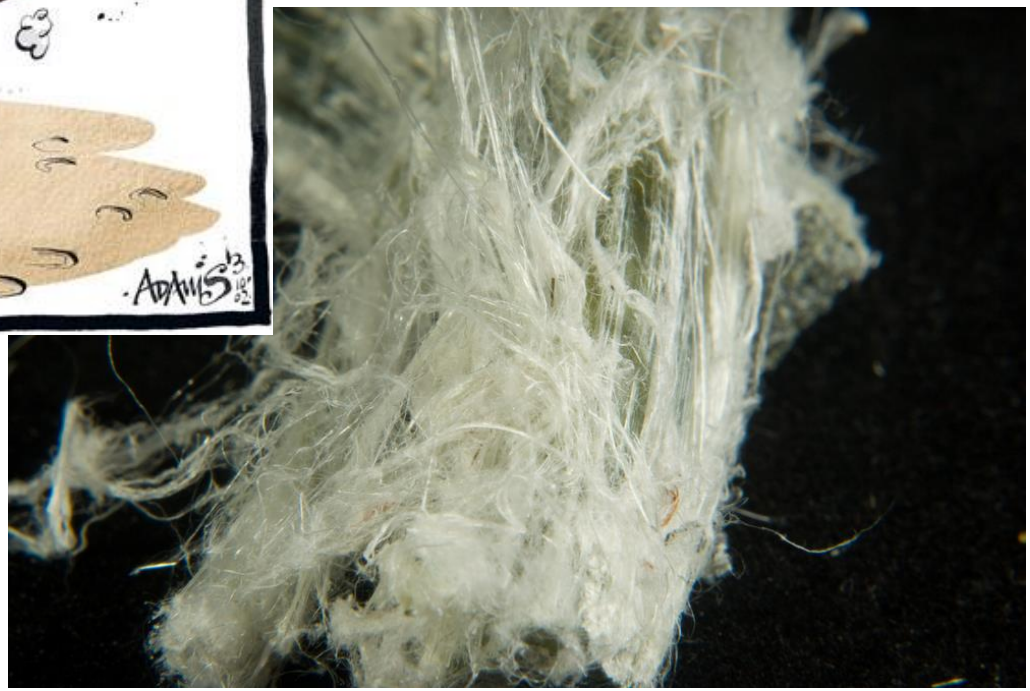
Ayers et al. Occ environmental med; 66: 339-346 Haw. BMJ; 2007; 335 Goodman et al. Int J Pub Health 2009; 54: 367-378

A more productive city?



Harm from asbestos exposure first recognised during early 20th Century

Asbestos producers well aware of dangers in the 1930s



Asbestos use restrictions only really in place at the end of 20th Century despite strong evidence of harm!