

WHO Guidelines & How

The Air We Breathe: a public
health dialogue

Hong Kong 10th January 2009

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Some questions

- What are the guidelines?
- How were they developed?
- Why have they been updated?
- What are their uses and limitations?
- Implications for policy in Hong Kong?

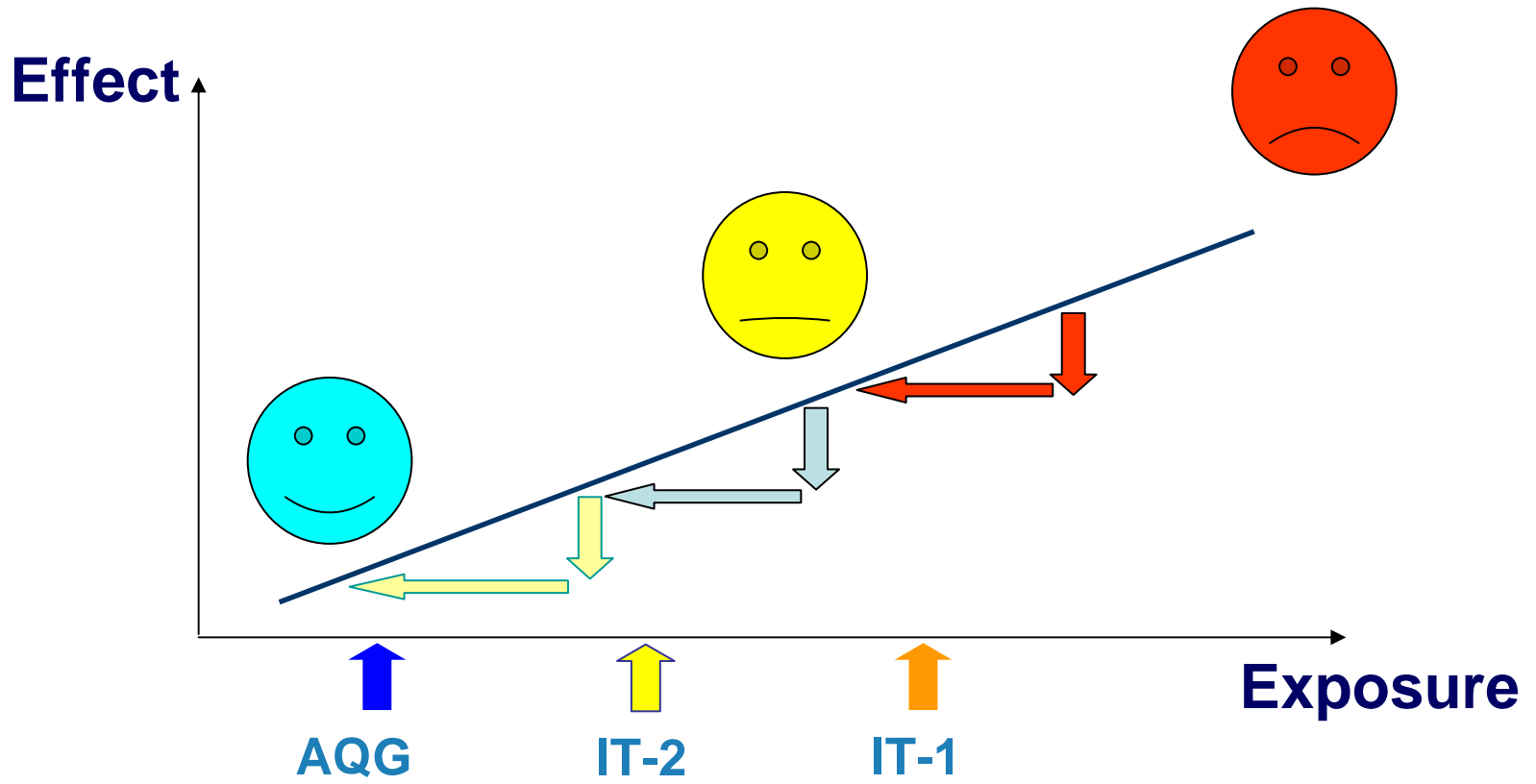
WHO AQG: Global update 2005

Pollutant	Averaging time	AQG value
Particulate matter PM_{2.5}	1 year 24 hour (99 th percentile)	10 µg/m ³ 25 µg/m ³
PM₁₀	1 year 24 hour (99 th percentile)	20 µg/m ³ 50 µg/m ³
Ozone, O₃	8 hour, daily maximum	100 µg/m ³
Nitrogen dioxide, NO₂	1 year 1 hour	40 µg/m ³ 200 µg/m ³
Sulfur dioxide, SO₂	24 hour 10 minute	20 µg/m ³ 500 µg/m ³

WHO AQG: Global update 2005

Annual mean level	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	Basis for the selected level
Interim target-1 (IT-1)	70	35	Levels associated with about 15% higher long-term mortality than at AQG
Interim target-2 (IT-2)	50	25	Risk of premature mortality decreased by approximately 6% compared to IT1
Interim target-3 (IT-3)	30	15	Mortality risk reduced by approximately 6% compared to IT2 levels.
Air quality guideline (AQG)	20	10	Lowest levels at which total, CP and LCA mortality have been shown to increase (Pope et al., 2002). The use of PM _{2.5} guideline is preferred.

Passing interim targets on the way towards AQG



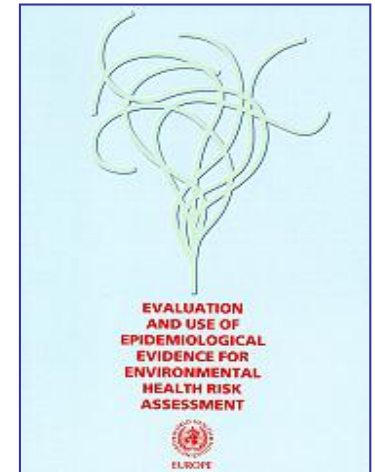
WHO AQG Working Group



Systematic evaluation of epidemiological evidence. WHO guideline document

Recommendations on Health Hazard Characterization:

- 1) Develop protocol for the review
- 2) Identify relevant studies
- 3) Systematically assess the validity of each study
- 4) Conduct systematic overview of evidence from multiple studies: the use of meta-analysis
- 5) Draw conclusions from epi evidence
 - critical scientific thinking
 - document the process of scientific reasoning



<http://www.euro.who.int/document/e68940.pdf>

Updates of WHO guidelines

Year	PM measure	Guideline Annual mean $\mu\text{g}/\text{m}^3$	Notes
1970s	SPM	60-90	Threshold (Lowest observed level for health effects ~ 150 + Safety factor of 2)
1987	Black Smoke	50	Threshold (linked to SO ₂ , also 50)
2000	PM10	Dose-response	No threshold
2006	PM10	20	No threshold
2006	PM2.5	10	No threshold.

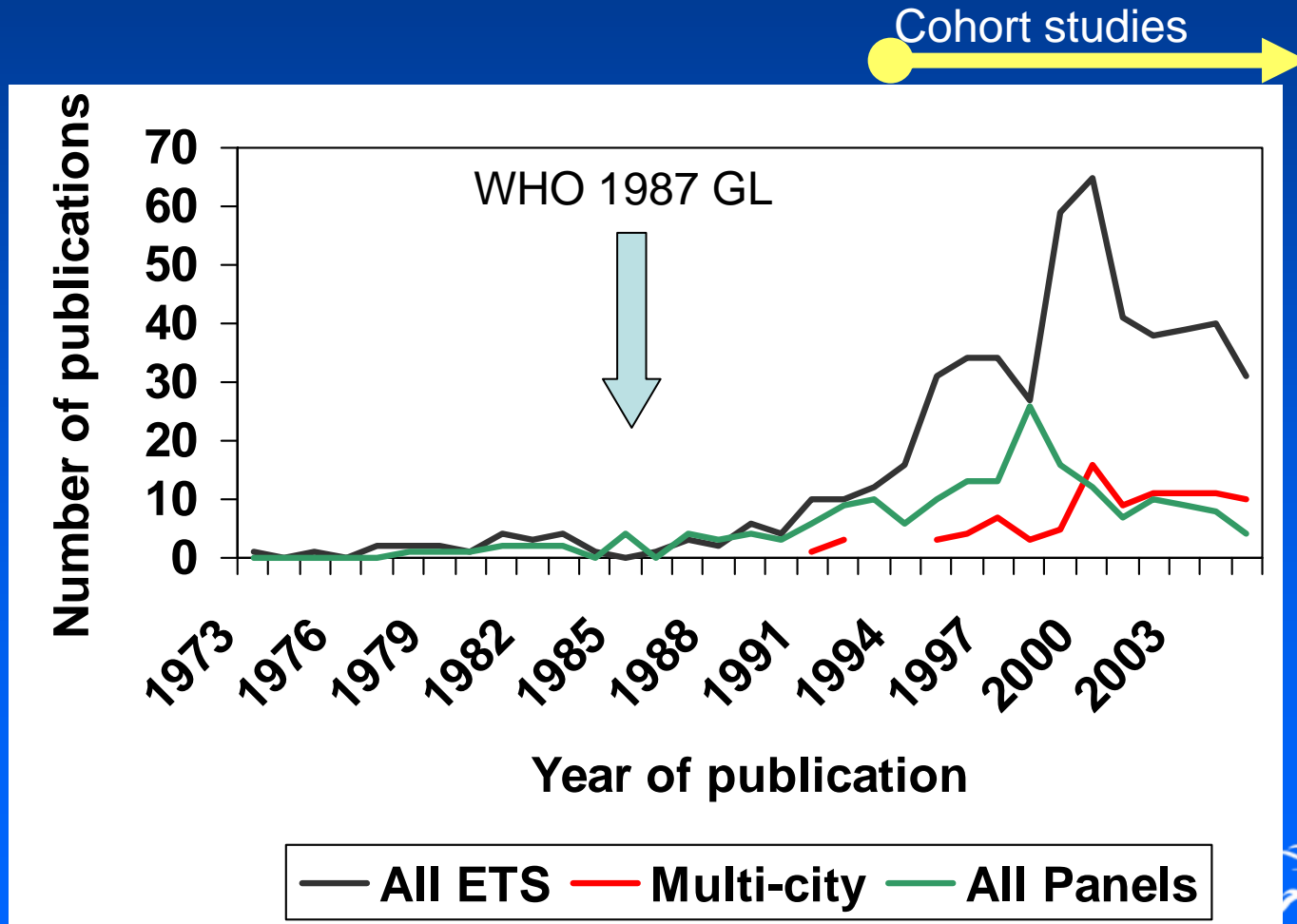
Hong Kong RSP
1987

55

Threshold

PM10 = RSP ~0.5 x SPM; 2 x BS; 1.3 x PM2.5

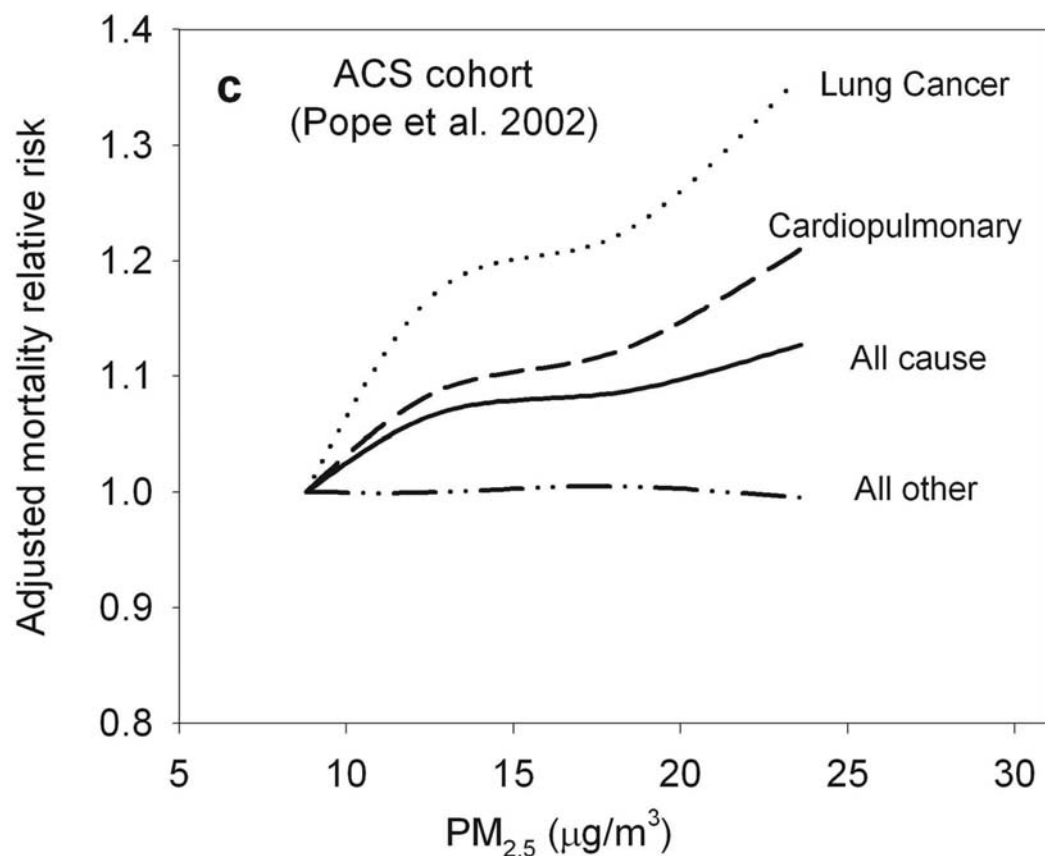
Published time-series studies of air pollution up to 2006 (Source: APED)



Shifts in knowledge since the 1980s

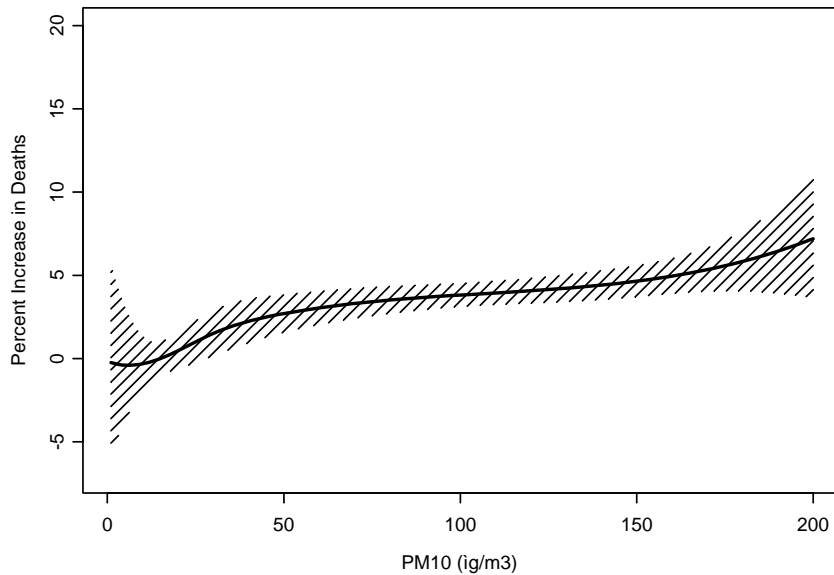
- No threshold for health effects in the ambient range
- Effects extend beyond the respiratory system.
- Cardiovascular effects may be the most important.

Long term exposure to PM and risk of mortality in ACS cohort (~ 0.5 million people in a large number of US cities followed for 16 years)



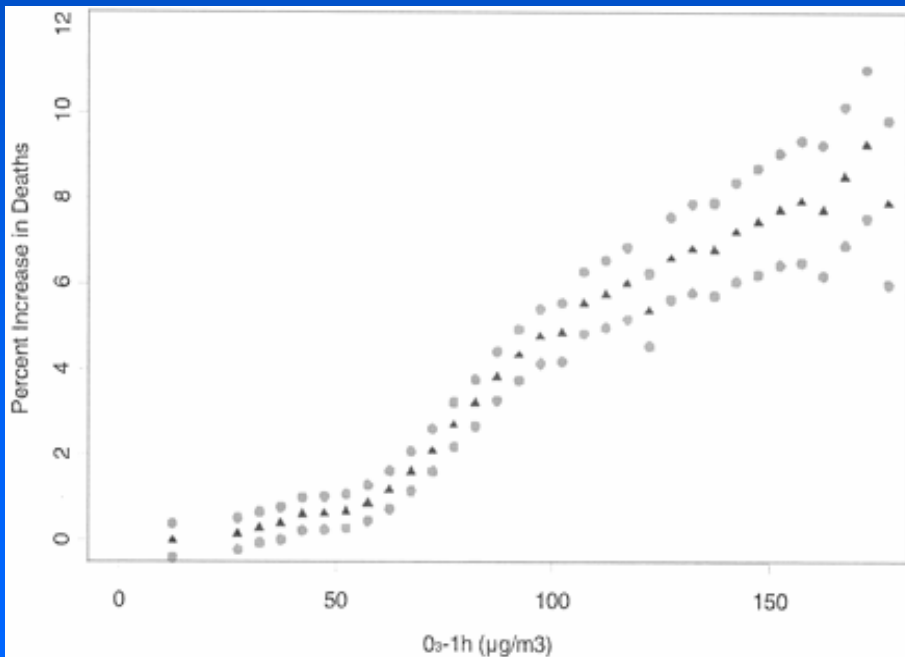
Adapted from
Pope et al 2002

Dose Response between Total Mortality and PM10



PM₁₀ and daily mortality: 22 European cities.

Samoli et al 2005



Ozone and daily mortality: 21 European cities.

Gryparis et al 2004

How should the guidelines be
used?

Guidelines are not enforceable standards/limit values

- **Guidelines:**

- Recommendation on protection of health or environment from adverse effects of pollutants

- **Standard:**

- Concentration (exposure level) of the pollutant determined by the regulatory authority as enforceable
- Instruments for implementation (monitoring and reporting requirements, consequences of non-compliance, ...)

Threshold assumption is a critical issue

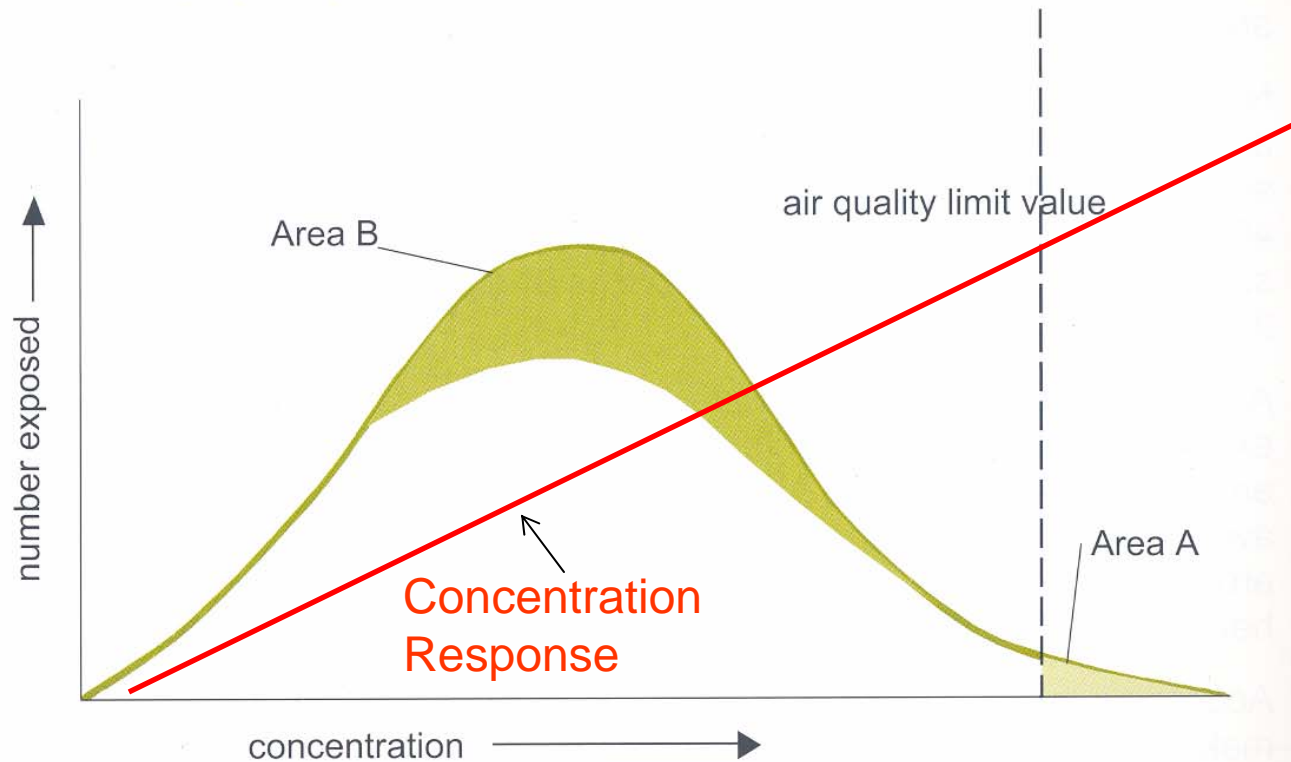
Threshold: Implies safe level. Suited to standards, limit values.

Non-threshold: Implies no safe level.
Suited to population exposure reduction.

Implications of no threshold

Figure 4.1

Annual number of people exposed vs. concentration of particles



Implementation of exposure reduction concept for PM_{2.5} in the UK (within the European framework)

Health based, and quantified by CBA

1. 15% reduction in average annual urban background concentrations 2010 - 2020
2. Backstop objective (concentration cap) of 25 µg/m³ applicable to all areas. To provide minimum protection.

Implications for Hong Kong

Q 1. Does the evidence underlying the GL apply to Hong Kong?

Q 2. Should Hong Kong adopt these GL as standards?

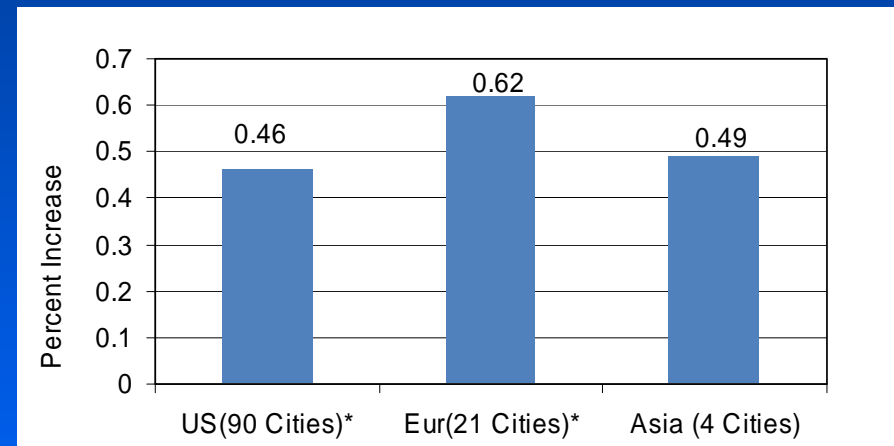
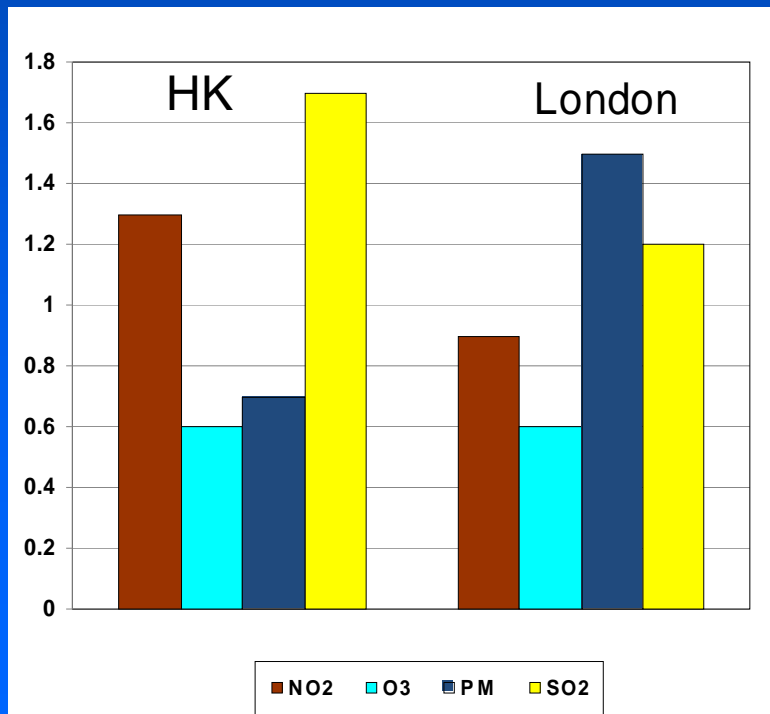
Q 3. If not, why not?

A Tale of Two Cities: Effects of Air Pollution on Hospital Admissions in Hong Kong and London Compared

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% increase in hospital admissions for respiratory disease ages 65+ associated with a 10 $\mu\text{g}/\text{m}^3$ increase in pollutant (Wong et al, 2002)



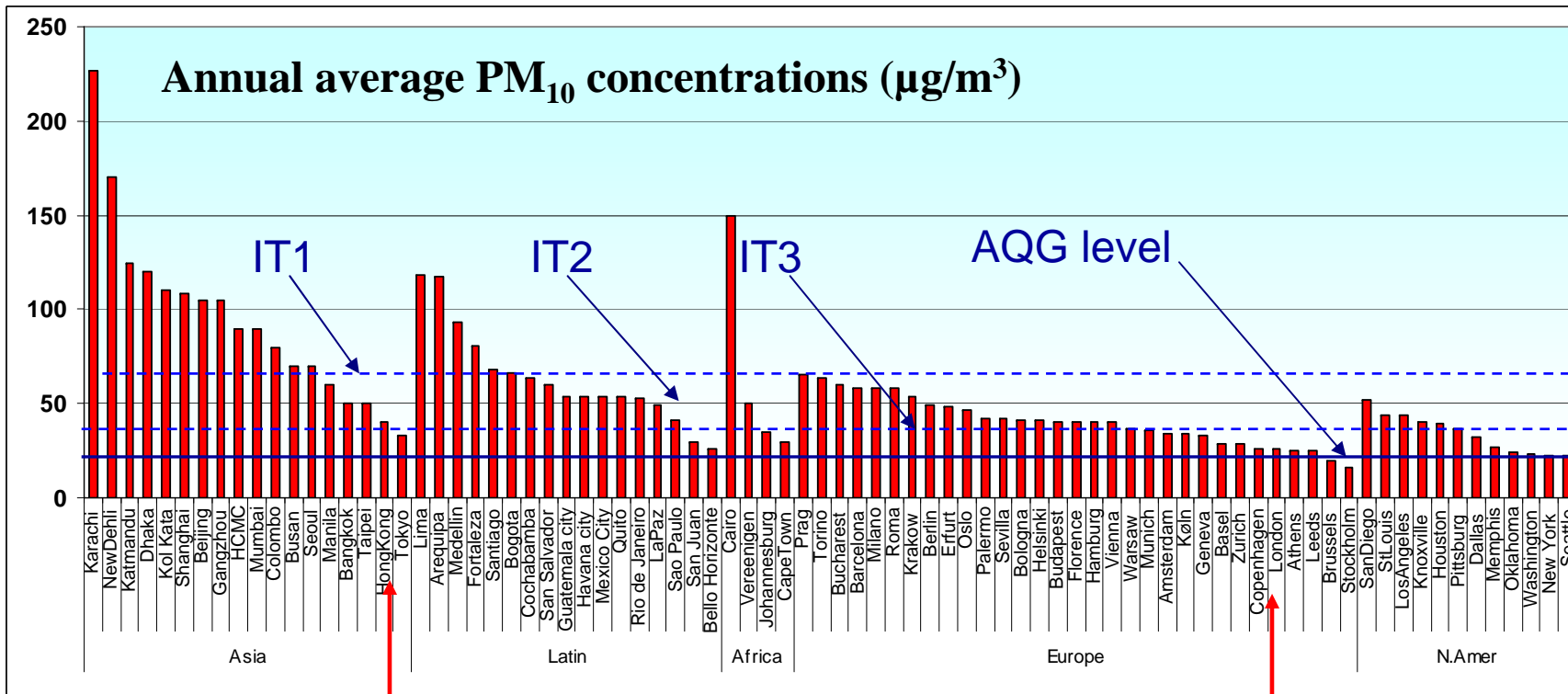
% increase in daily mortality associated with 10 $\mu\text{g}/\text{m}^3$ PM_{10} (HEI 2004)

Hong Kong and London

Some similarities

- Size and population
- Toxicity of pollution
- Large regional contribution to pollution
- Baseline health status
- Wealth, education and technical capacity

Annual average PM₁₀ concentrations observed in selected cities worldwide



Hong Kong

London

Hong Kong differs from London

- Sources:
 - Local: e.g. more power generation and marine sources
 - Greater regional component
- Not embedded in a regional strategy
- Objectives are not based on adequate protection of public health
- It is not setting a challenging standard which is possible based on best current knowledge and technology
- No effective legal framework to enforce compliance with standards

Summary (1)

- The GL comprise recommendations for the protection of health from adverse effects of pollutants.
- They are a basis for the development of national health-based standards.
- Updated evidence suggests that air pollutants should now be considered as non-threshold hazards.
- This means that reductions in exposure across the whole population will bring the greatest health benefits.

Summary (2)

- The effects of air pollution in Hong Kong are likely to be similar to those in other cities.
- National or Local strategies must take individual circumstances into account, and Hong Kong is no exception
- For local and regional strategies to work, political will and appropriate enforcement are required.

Thanks