The Health Effects of Air Pollution

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Overview

- What is air pollution?
- What are the health effects of air pollution?
- What are the health impacts of ship emissions?
- What are we doing to quantify the effects of ships in NSW?

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Air pollution

- A complex mixture of particles (PM) and gases
  - $PM_{2.5}$ and PM_{10}
  - SO_2
  - NO_2
  - Ozone
  - Toxics (mainly related to specific sources)
- Important sources include cars, trucks, industrial processes, wood heaters and ships
- Inevitably, urban exposure is to pollutants from multiple sources

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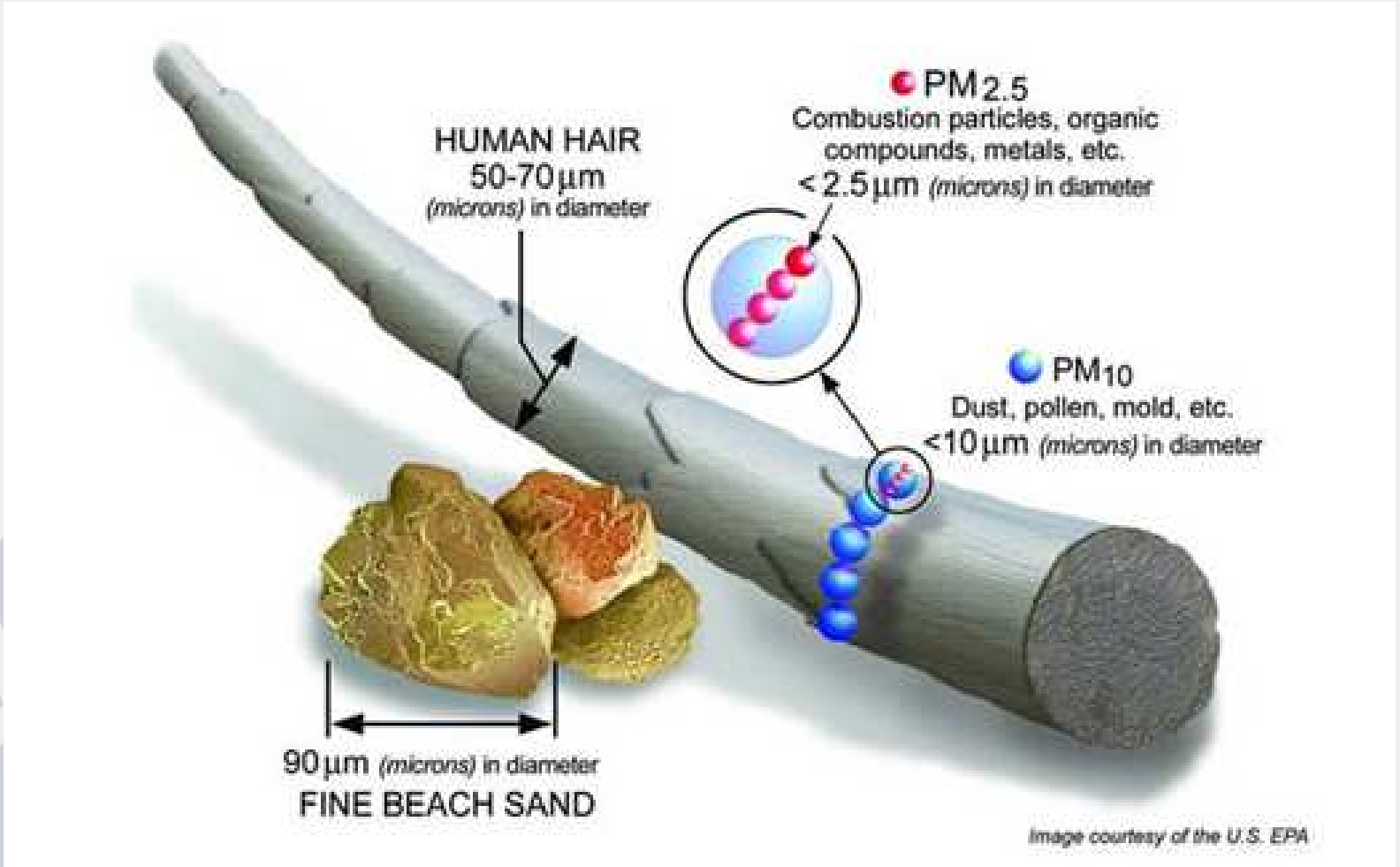

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Health Effects

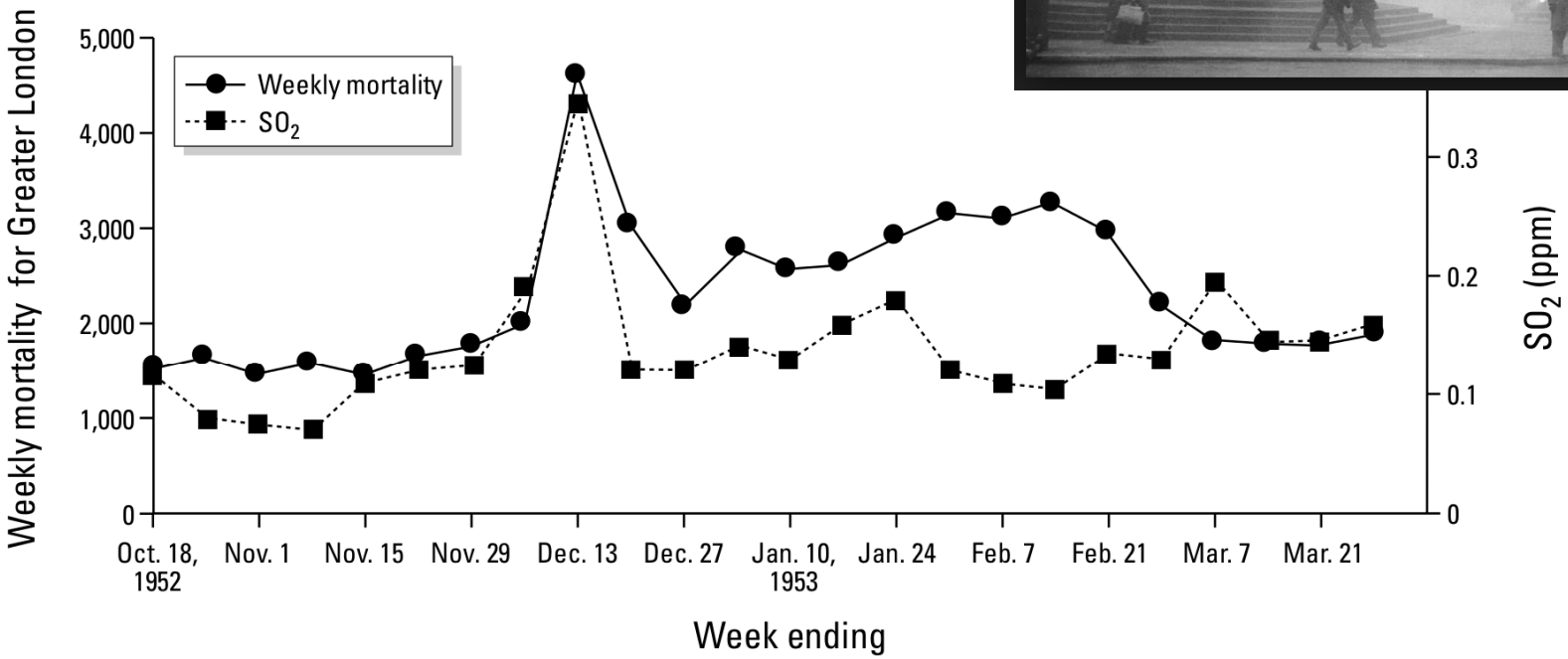

Figure 1. Approximate weekly mortality and SO_2 concentrations for Greater London, 1952–1953.

London smog

Bell and Davis 2001

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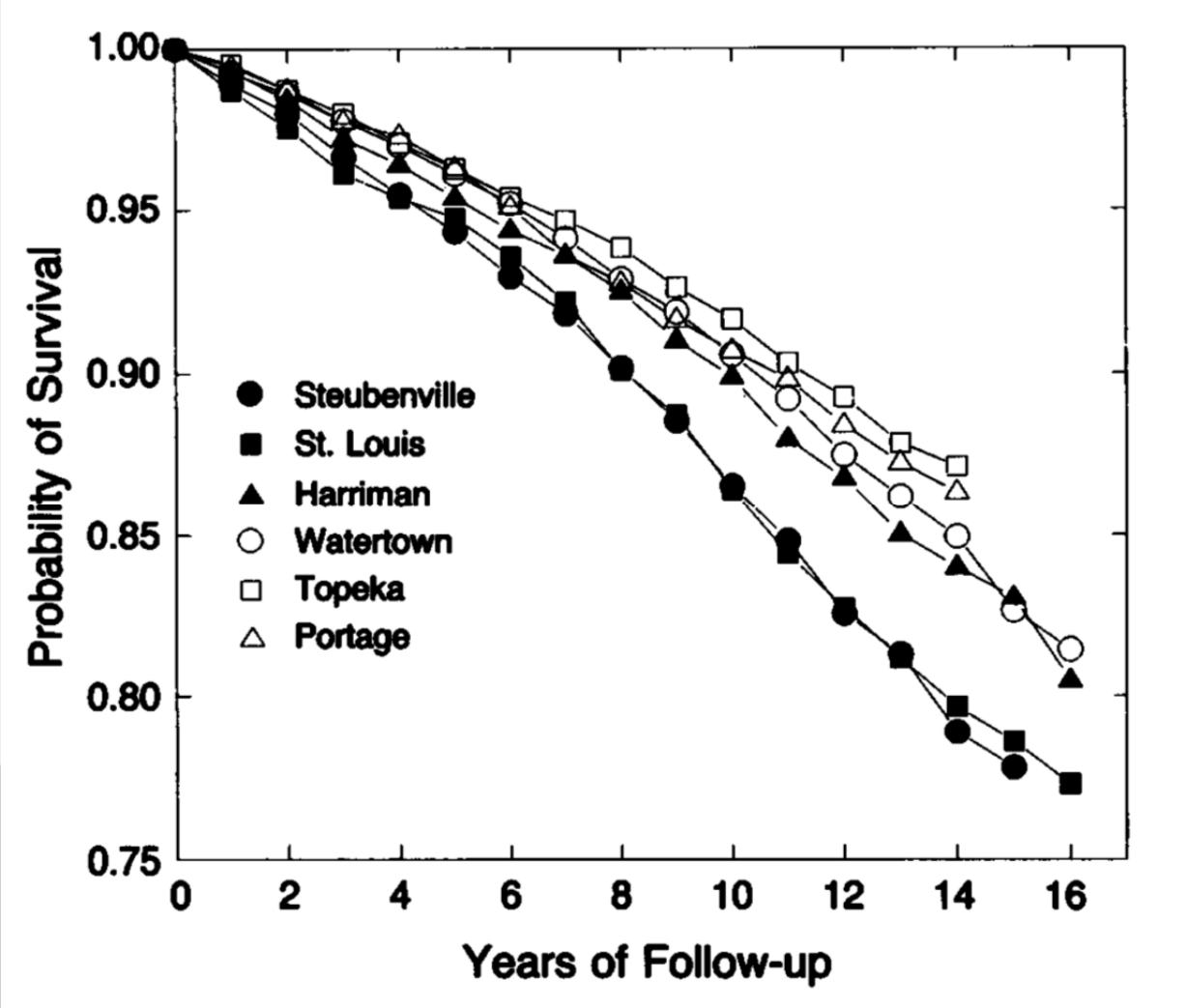

6 Cities Study – Dockery *et al.* 1993

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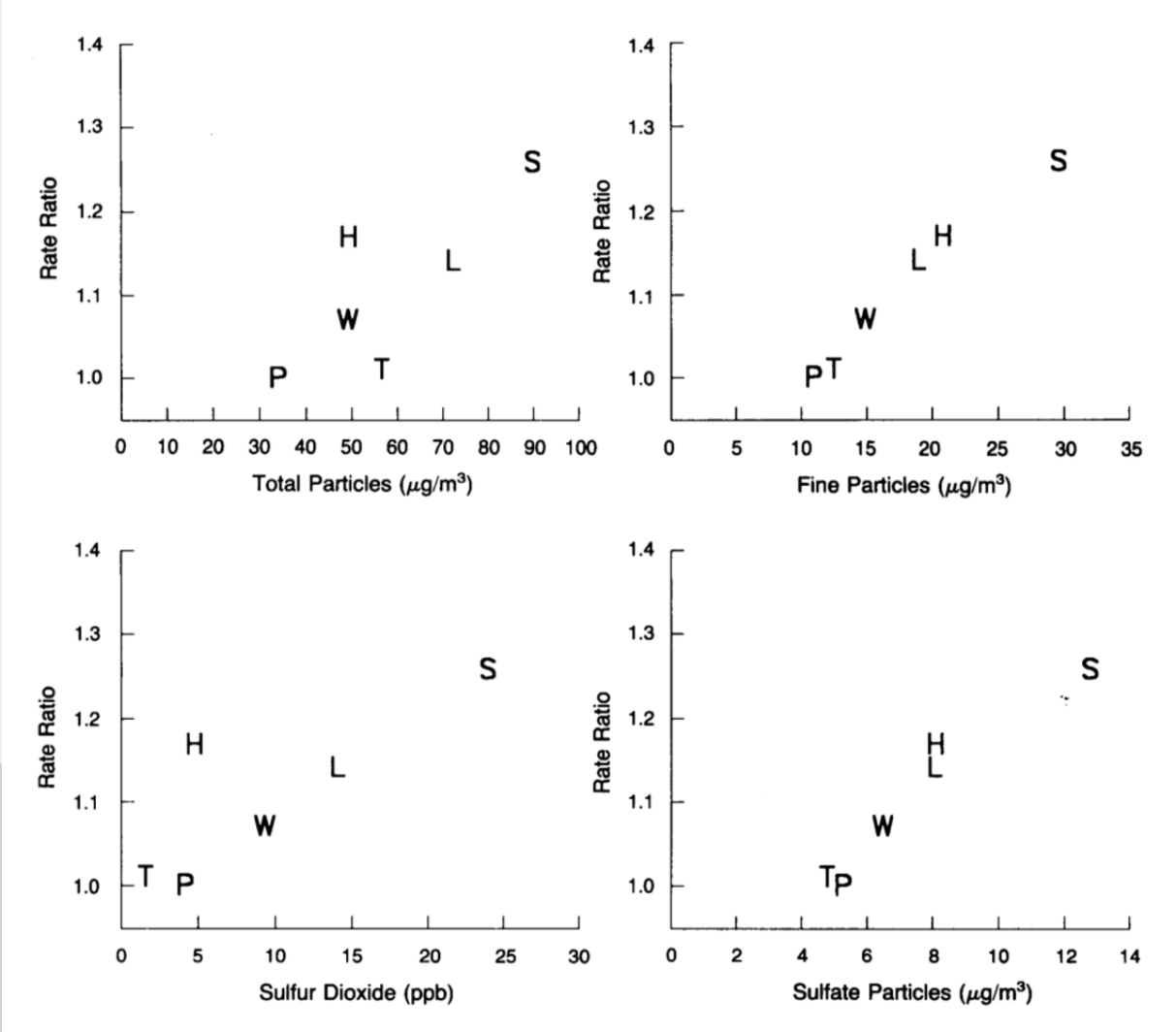

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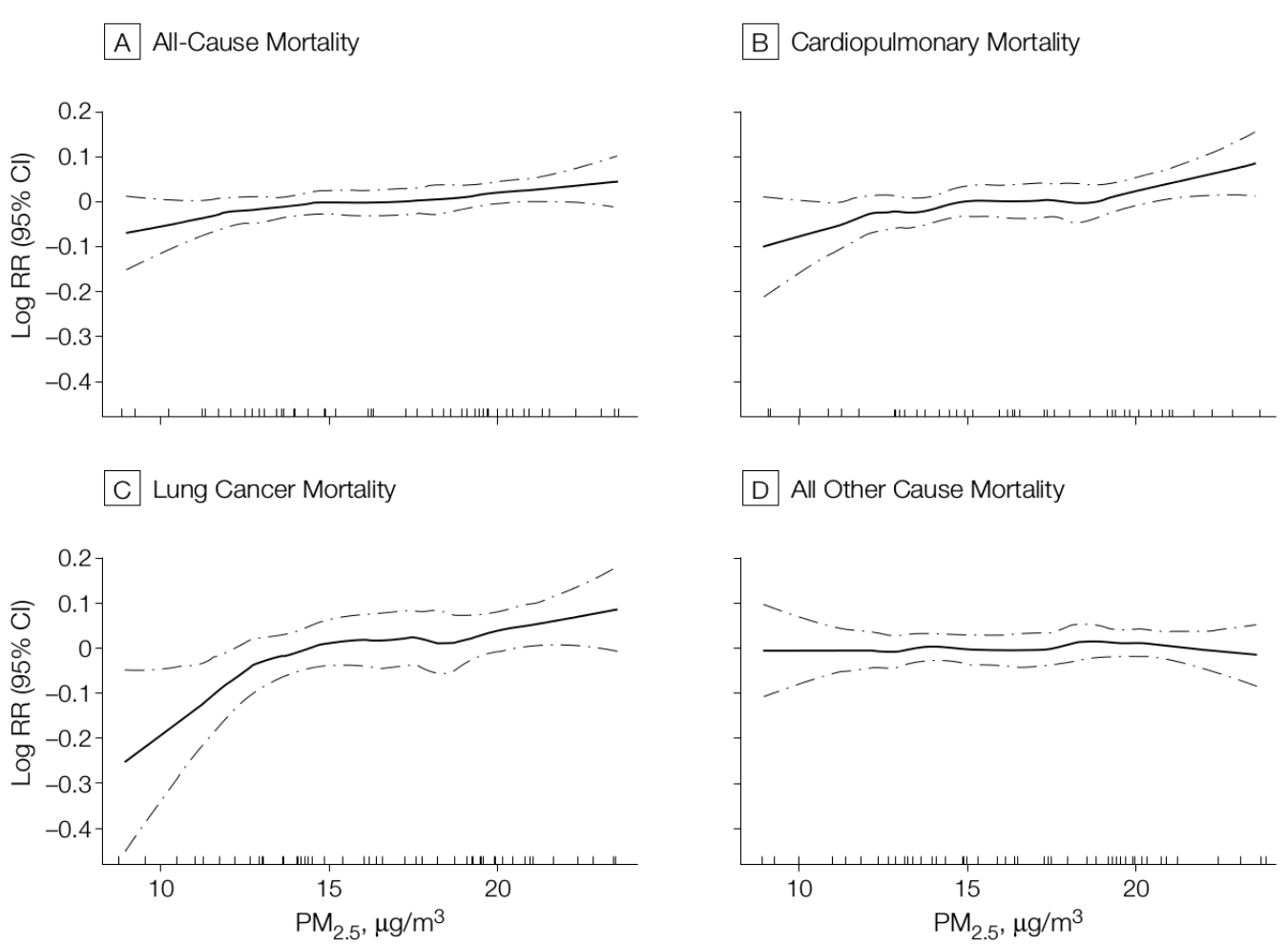

ACS study

Pope *et al.* 2003

51 US cities, ~500,000 participants

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Lung function in children in 12 California towns

Gaudermann *et al.* 2004

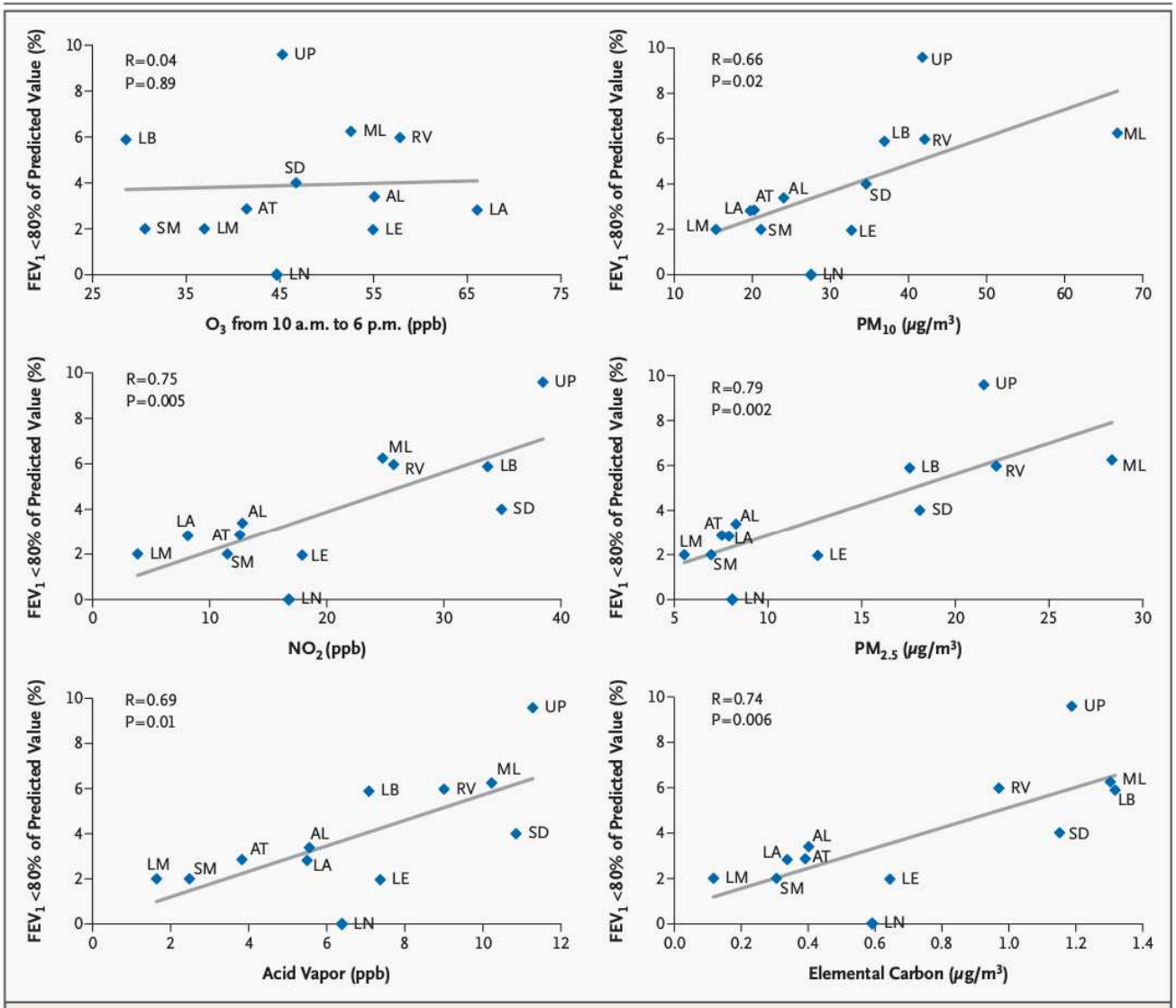

Figure 3. Community-Specific Proportion of 18-Year-Olds with a FEV_1 below 80 Percent of the Predicted Value Plotted against the Average Levels of Pollutants from 1994 through 2000.

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Health effects

- $PM_{2.5}$ causes cardiopulmonary disease
- Exposure to SO_2 and NO_2 are also associated with mortality, respiratory and cardiovascular disease
- IARC has recently said outdoor air pollution and diesel exhaust are “Group 1” carcinogens (ie carcinogenic to humans).

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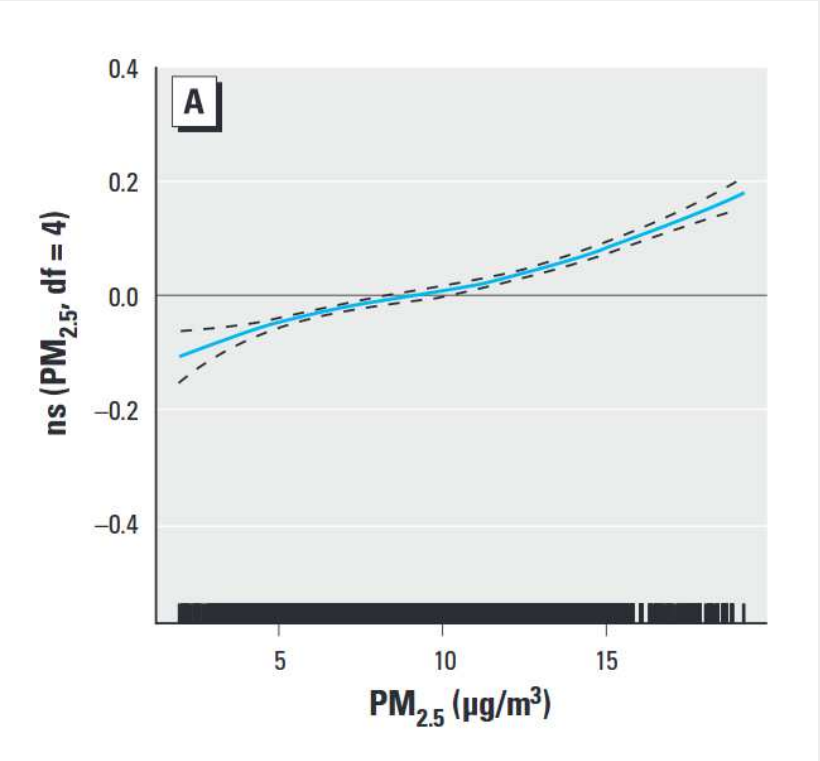
Thresholds

- No evidence of a threshold
- Recent studies have demonstrated $PM_{2.5}$ has health effects at levels below those measured in NSW
- Any reduction in exposure will produce benefit



Crouse *et al.* 2012

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Particle size, type and source

- Current evidence supports management of PM on the basis of particle size (e.g. $PM_{2.5}$ and PM_{10}) and duration of exposure (ie 24hr average levels and annual average).
- There is some evidence that particles of different types (e.g. black carbon, transition metals) have different effects. This evidence is currently insufficient to inform management.
- Any reduction in exposure will produce benefit

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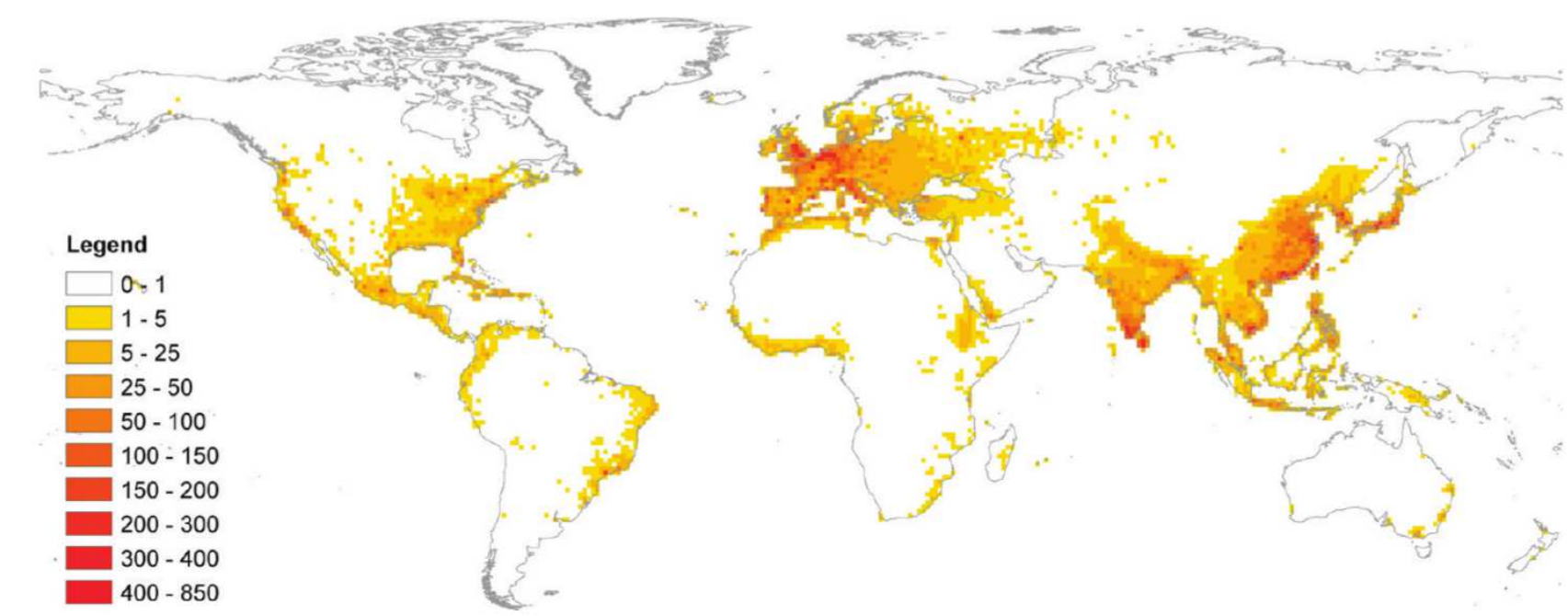
The health impact of ships



~ 83,500 premature deaths from cardiopulmonary causes worldwide (Winebrake *et al.* 2009)

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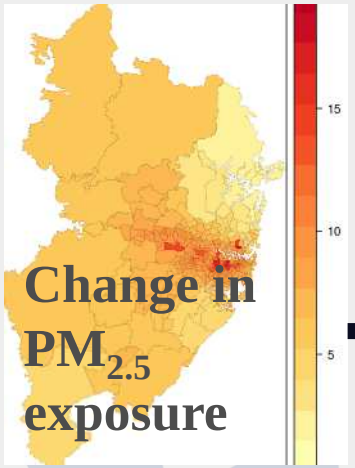
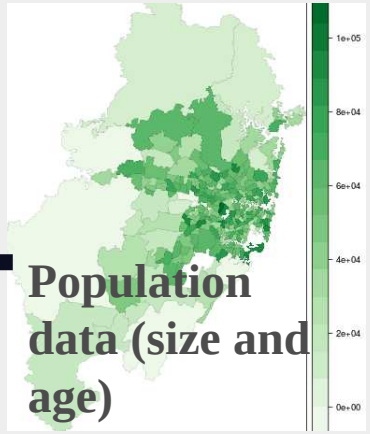
Quantify emissions from ships

Calculate dispersion

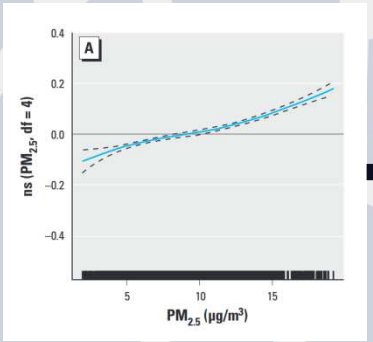


Change in $PM_{2.5}$ exposure

Quantify exposure



Population data (size and age)



Apply concentration response functions to estimate health risks

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Questions

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