



## The Health Effects of Air Pollution in Bangkok

**N Vichit-Vadakan, N Vajanapoom, B Ostro**

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*Presented by*  
Nitaya Vajanapoom, Ph.D



### Objectives

- The main objective of this study was to investigate the mortality risk from air pollution in Bangkok

## Background Information



Population 6.8 millions  
Area 1600 km<sup>2</sup>  
Hot and humid weather



## Daily Mortality Data from 1999 to 2003

- Natural causes**
  - All ages, 0-4, 5-44, 45-64, 65+, 75+
  
- Cardiovascular mortality**
  - Ischemic heart diseases
  - Stroke
  
- Respiratory mortality**
  - COPD
  - LRI (all ages, <5)
  - asthma

## Summary of the Mortality data

Mortality category	Deaths/day
natural causes	95
cardiovascular	13
Ischemic heart disease	4
stroke	5
respiratory	8
LRI (all ages)	4
LRI <5	1
COPD	2
asthma	1

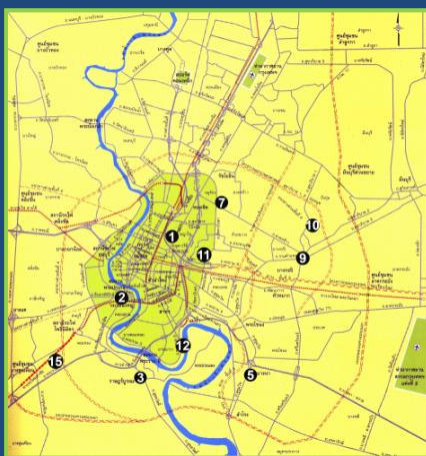
## Air Pollution and Weather Data from 1999 to 2003

- **Air pollution data**

- 24-hr PM<sub>10</sub>
- 24-hr NO<sub>2</sub>
- 24-hr SO<sub>2</sub>
- 8-hr ozone

- **Weather data**

- Daily mean temperature
- relative humidity



Air Monitors in Bangkok

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## Summary of the Air pollution and Weather Data

Air pollutants and weather	Daily mean	SD
PM <sub>10</sub> (µg/m <sup>3</sup> )	52.1	20.1
SO <sub>2</sub> (µg/m <sup>3</sup> )	5.0	1.8
NO <sub>2</sub> (µg/m <sup>3</sup> )	23.8	9.2
O <sub>3</sub> (µg/m <sup>3</sup> )	30.3	13.5
Temperature (C°)	28.9	1.7
Humidity (%)	72.8	8.3

## Statistical Analysis

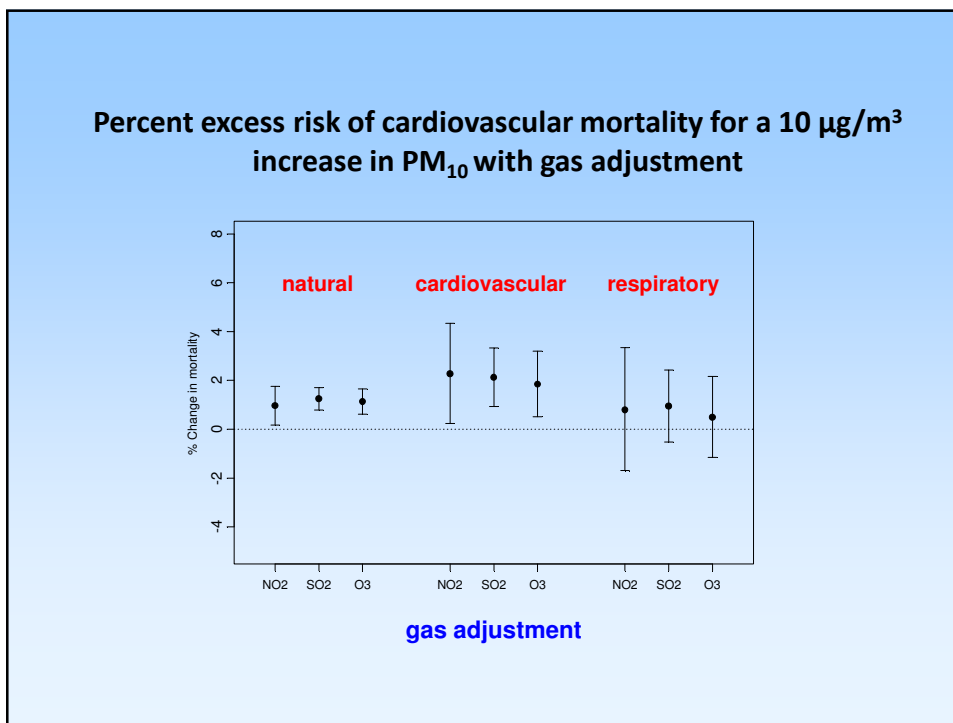
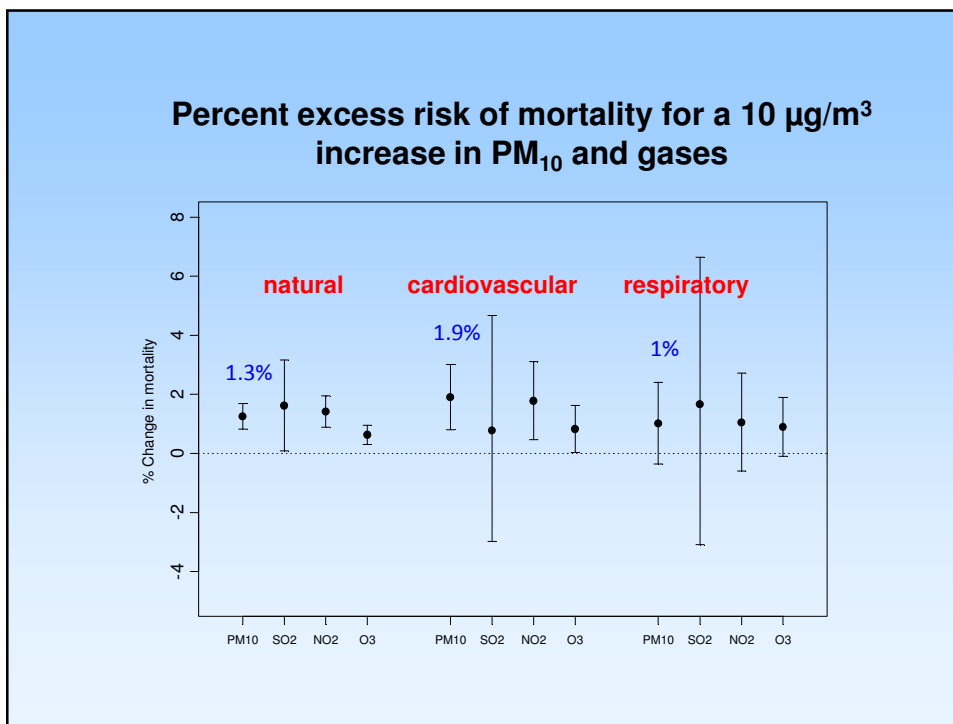
- Followed the PAPA common protocol
- Generalized Linear Model with Poisson regression
- Core model using natural cubic spline
  - time trend
  - temperature and relative humidity
  - days of week and holiday

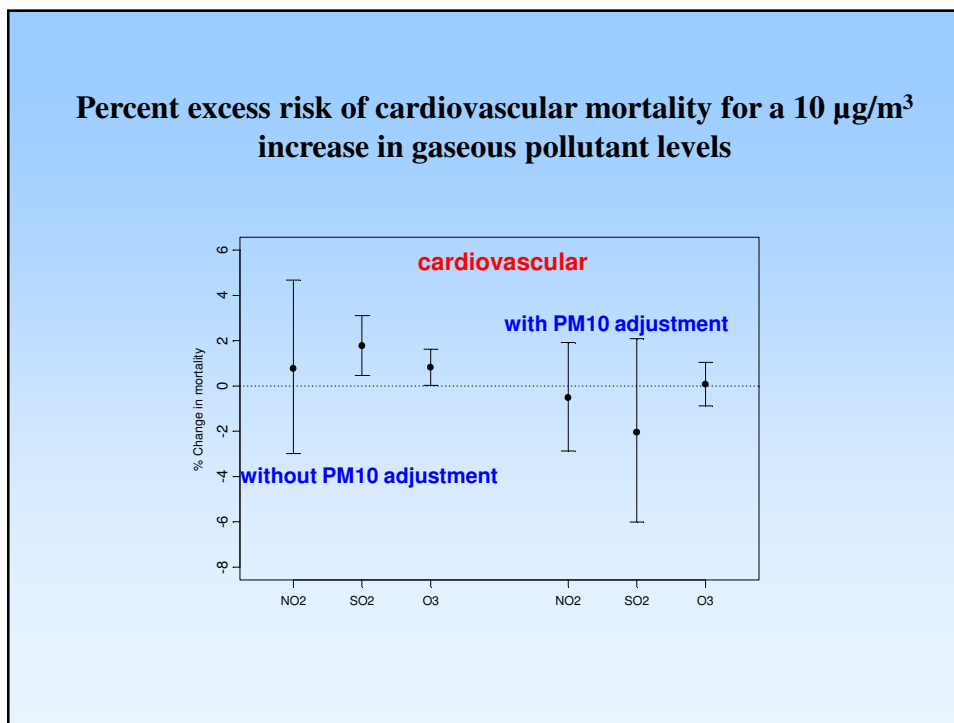
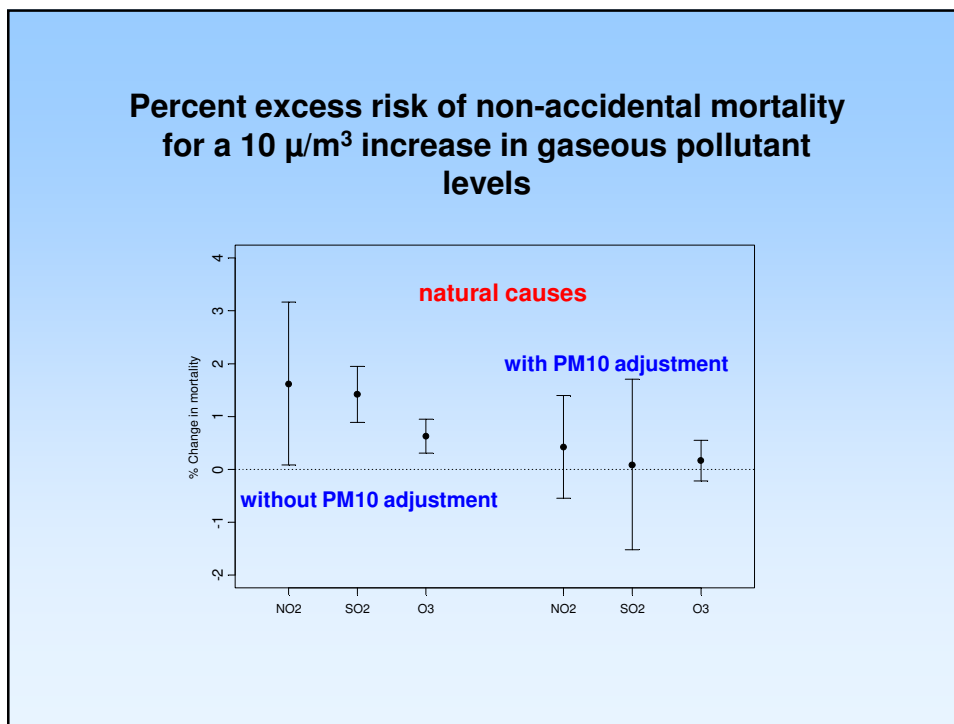
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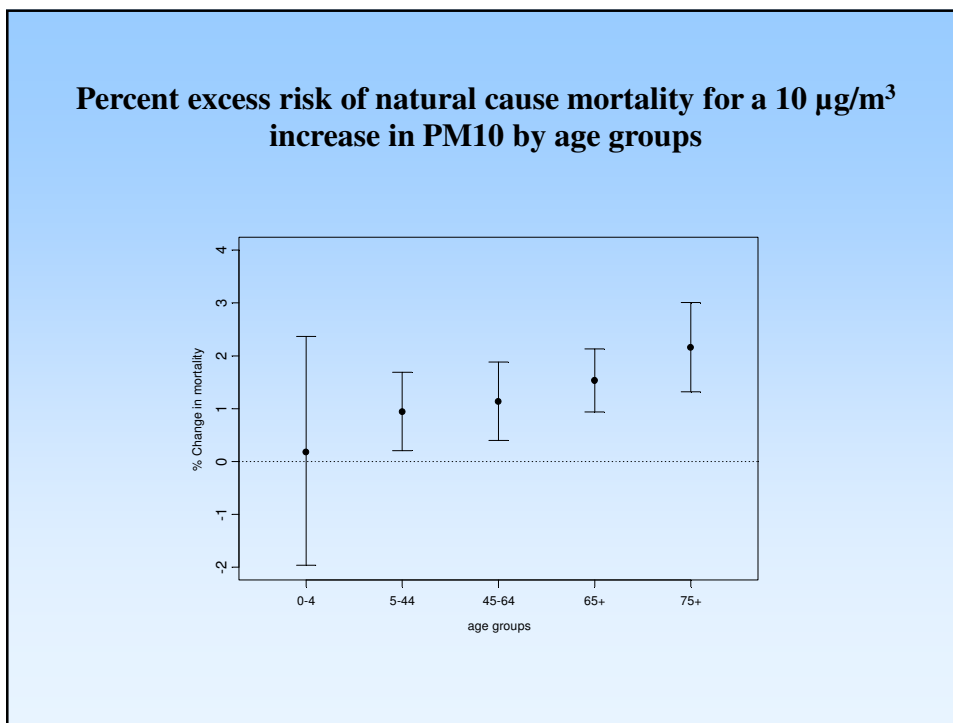
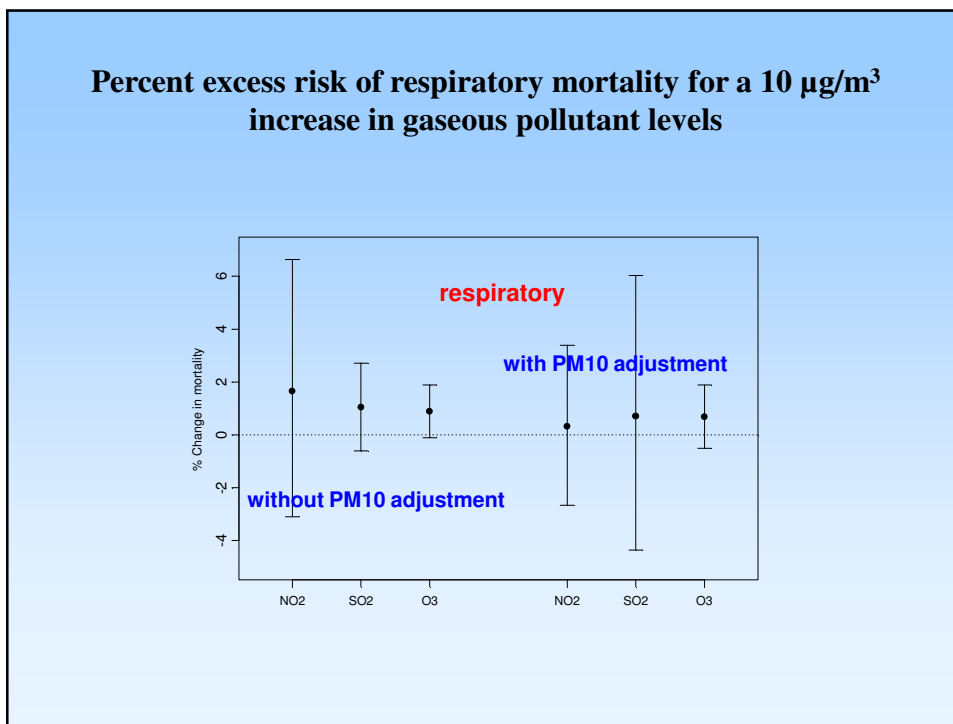
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### Effects PM<sub>10</sub> on Cardiovascular Mortality

Mortality Category	% excess risk (95% CI)
Cardiovascular	1.9 (0.8, 3.0)
–Ischemic heart diseases	1.5 (-0.4, 3.5)
–Stroke	2.3 (0.6, 4.0)

- Greater effect on stroke

### Effects of PM<sub>10</sub> on Respiratory Mortality

Respiratory category	% excess risk (95% CI)
Respiratory	1.0 (-0.4, 2.4)
–LRI (all ages)	0.5 (-1.4, 2.5)
–LRI <5 yr	7.7 (-3.6, 20.3)
–COPD	1.3 (-1.8, 4.4)
–asthma	7.4 (1.1, 14.1)

- Elevated risk for asthma with wide CI



### Comparison of PM<sub>10</sub> Health Effects in Bangkok

	% excess risk per 10 µg/m <sup>3</sup> PM <sub>10</sub> (Natural Causes)	Daily mean PM <sub>10</sub> Level
Vichit-Vadakan et al, 1996	1.0 %	65 µg/m <sup>3</sup>
Vajanapoom et al, 2002	0.8%	68 µg/m <sup>3</sup>
Vichit-Vadakan et al, 2004 (PAPA)	1.3%	52 µg/m <sup>3</sup>

### Summary of Results

- Significant effects of PM<sub>10</sub> on several mortality outcomes
- Elevated excess risks on the elderly and cardiovascular mortality especially for stroke
- Slightly higher effects of PM<sub>10</sub> than the previous studies in Bangkok,
- Greater effects of PM<sub>10</sub> than other PAPA cities

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