



Health effects of PM: Results of WHO assessments

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<http://www.euro.who.int/air>



WHO Systematic Review of Health Aspects of Air Quality in Europe, 2001-2004

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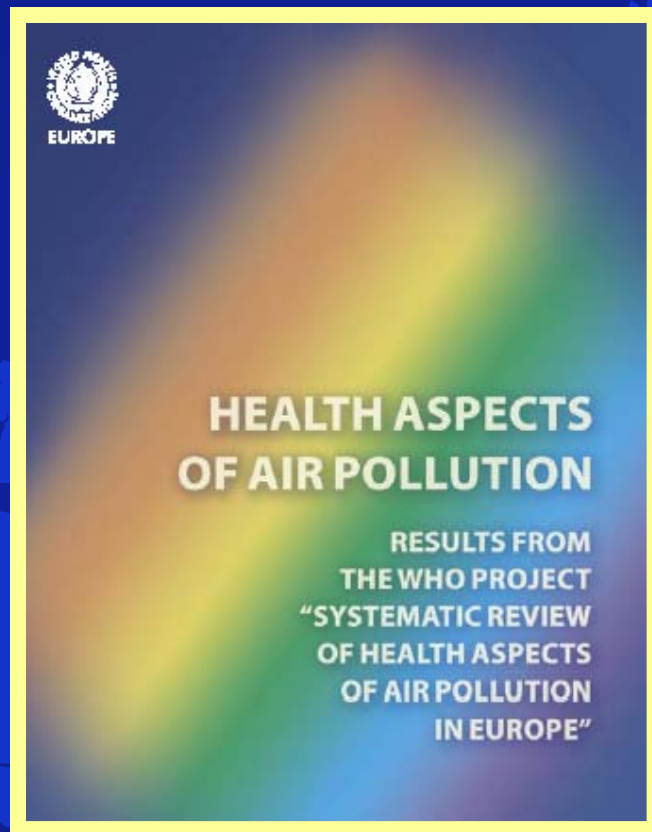
WHO European Centre for Environment and Health

Products of the «Systematic Review of health aspects of air quality in Europe», 2002/4

- Health aspects of air pollution with particulate matter, ozone and nitrogen dioxide <http://www.euro.who.int/document/e79097.pdf>
- Meta-analysis of time-series studies and panel studies of particulate matter (PM) and ozone (O₃) <http://www.euro.who.int/document/e82792.pdf>
- Health aspects of air pollution - answers to follow-up questions from CAFE <http://www.euro.who.int/document/E82790.pdf>
- The effects of air pollution on children's health and development: a review of the evidence <http://www.euro.who.int/document/EEHC/execsum.pdf> (full report: Nov 2004)
- Health aspects of air pollution <http://www.euro.who.int/document/E83080.pdf>



«Systematic Review of health aspects of air quality in Europe», 2002/4 – Summary Report



<http://www.euro.who.int/document/E83080.pdf>



WHO European Centre for Environment and Health

Systematic Review

Q1) Is there new scientific evidence to justify reconsideration of the current WHO Guidelines for the pollutant?

Particulate matter: Yes

- Association of PM exposure with health effects have been strengthened
- Fine PM (measured as PM_{2.5}) strongly associated with mortality and other endpoints
- PM₁₀ is still considered to be a relevant metrics
- BS should be re-evaluated



Systematic Review

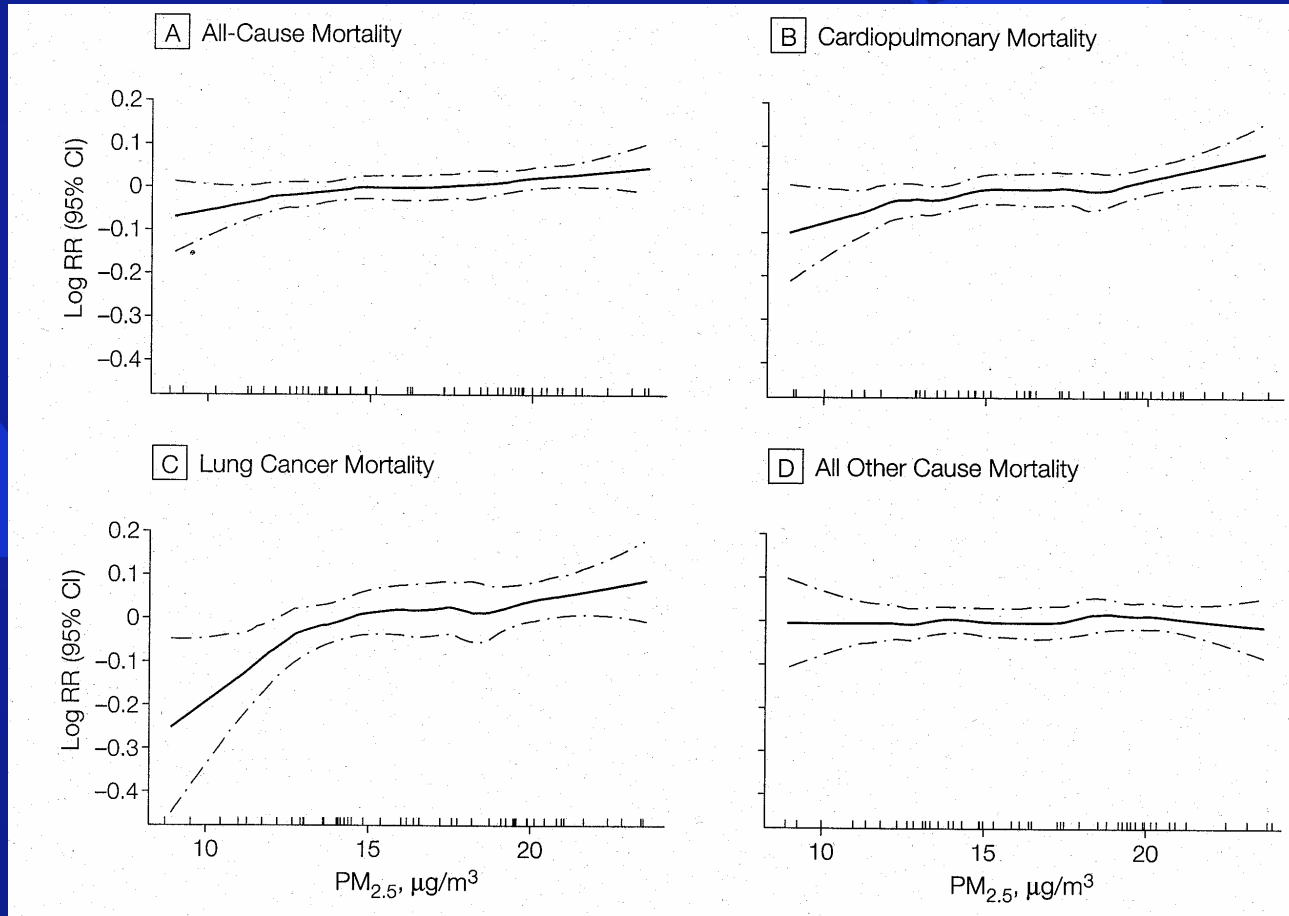
Q3) Is there a threshold below which no effects on health are expected to occur in all people?

For all three pollutants: **No**

- The population distribution of susceptibility may be such that effects are expected at very low levels
- Thresholds differ depending on endpoint selected
- Increasingly sensitive epidemiological study designs have identified adverse effects of air pollution at increasingly lower levels



Long term exposure to PM and risk of mortality in ACS cohort



Long term exposure to PM and risk of mortality in ACS cohort

Cause of mortality	RR per 10 ug/m3 PM2.5*)	95% CI
All causes	1.06	1.02 - 1.11
Cardiopulmonary	1.09	1.03 - 1.16
<i>All CVD & diabetes</i>	<i>1.12</i>	<i>1.08 - 1.15</i>
<i>Dis. of respir.syst.</i>	<i>0.92</i>	<i>0.86 - 0.92</i>
Lung cancer	1.14	1.04 - 1.23
All other causes	1.01	0.95 - 1.06

*)Average PM2.5 estimate

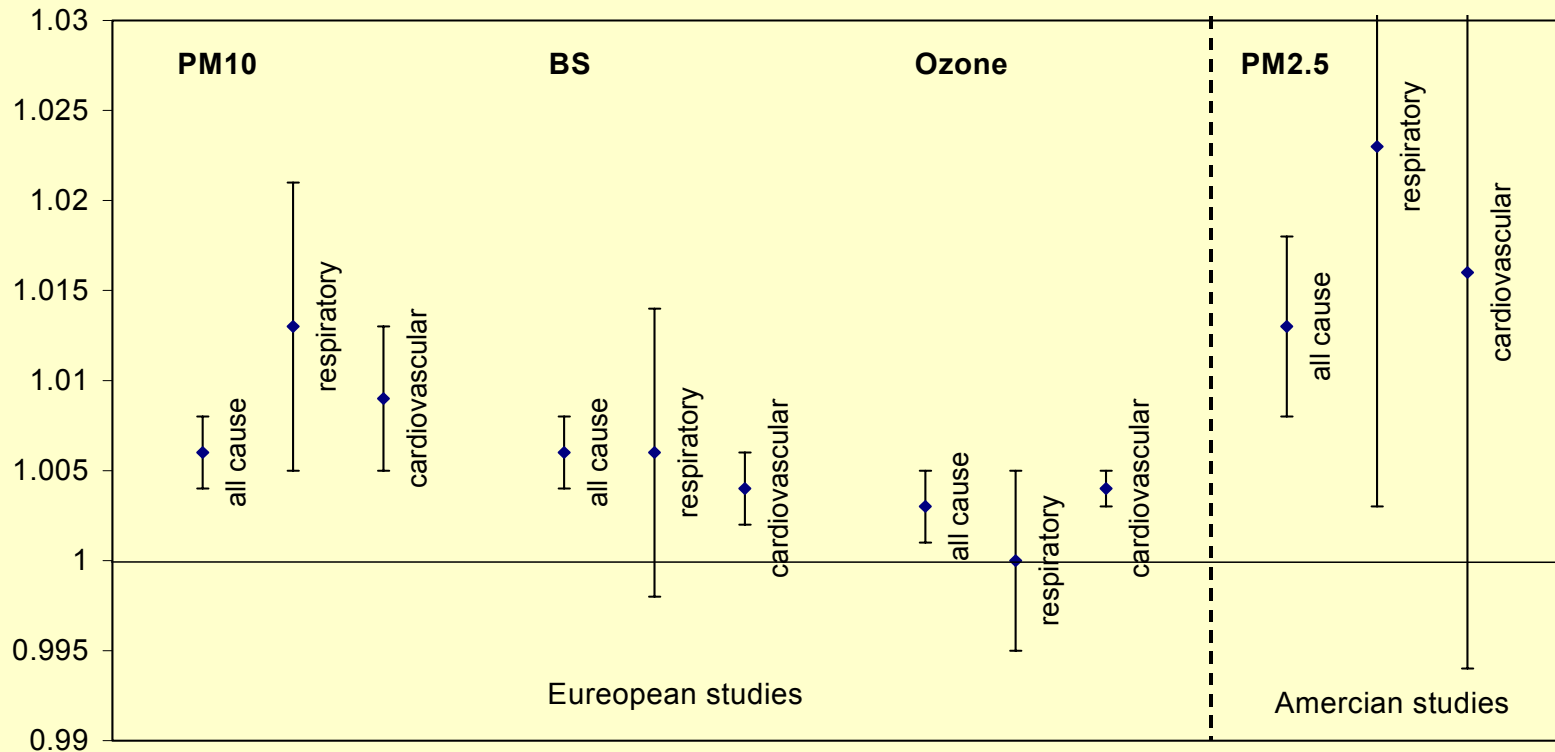
Sources: Pope et al, JAMA 2002; *Circulation* 2004

TFH 2003: "...apply the relative risk for all cause mortality... in the extended American Cancer Society (ACS) cohort study Pope et al. (2002)."

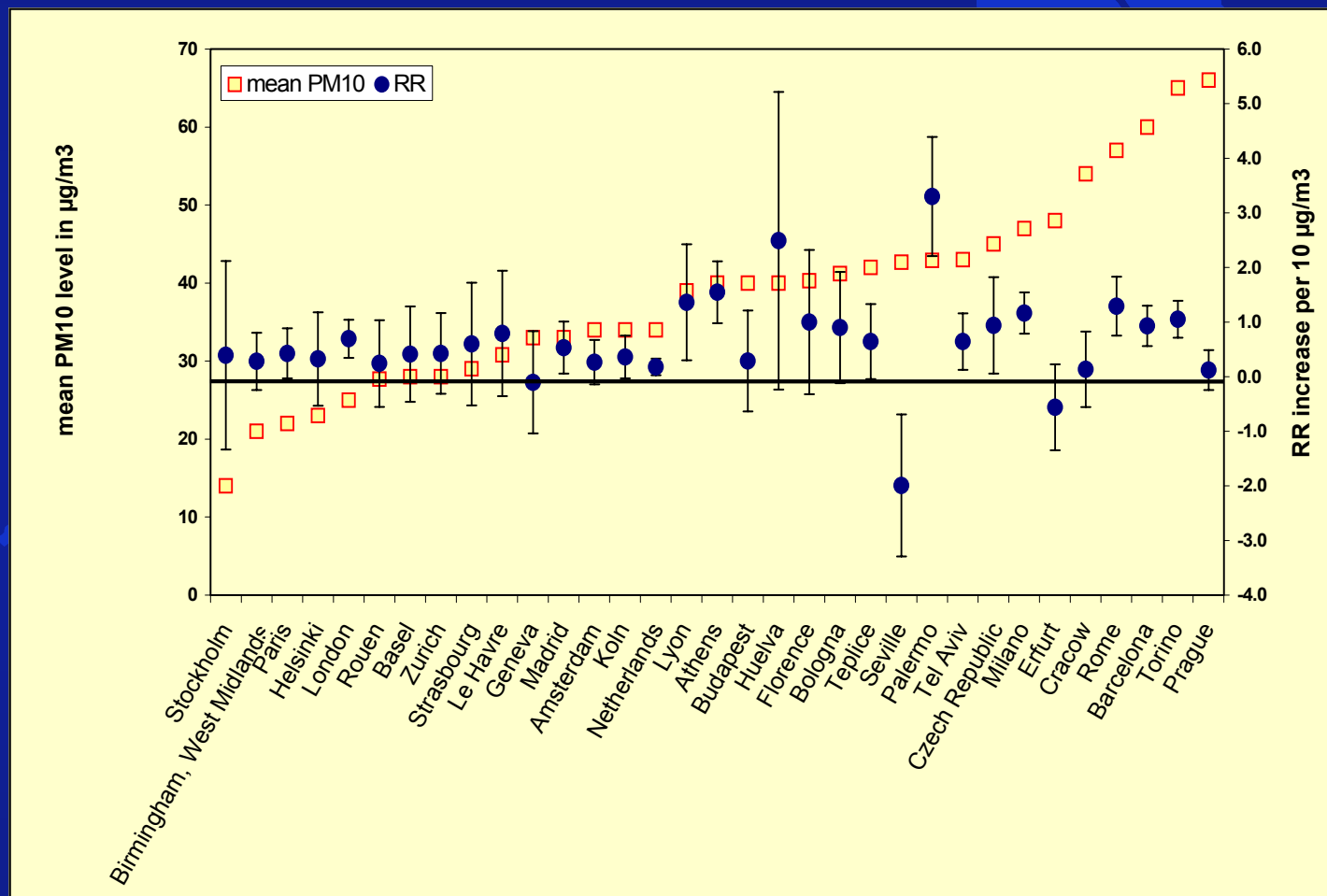


Summary relative risk estimates (95% CI) for 10 $\mu\text{g}/\text{m}^3$ increase in pollutant for all cause and cause-specific mortality (Anderson et al, WHO 2004)

RR for mortality endpoints related to a 10 $\mu\text{g}/\text{m}^3$ increase in pollution including 95 % confidence intervals; left part: PM10, black smoke (BS) and ozone from European studies; right part: PM2.5 from North American studies



Ranking of PM10 estimates for all-cause mortality by annual average levels of PM10 in APHEA study



Systematic Review

Is there a threshold below which no effects on health are expected to occur in all people?

For PM, O₃ and NO₂: **No**

⇒ Replace the threshold concept with exposure-risk functions



Systematic Review: selected results

Which of the physical and chemical characteristics of particulate air pollution are responsible for health effects?

- Fine PM is more hazardous than larger particles
- Metal content
- Organic components such as PAH
- Endotoxins
- Extremely small particles (< 100 nm)



Systematic Review – key findings

Coarse particles and health

- There is limited evidence that coarse particles are associated independently of PM_{2.5} with mortality in time series studies.
- One study has investigated the effect of long-term exposure to coarse particles on life expectancy without producing evidence of altered survival.
- There is evidence that coarse particles are independently associated with morbidity endpoints such as respiratory hospitalizations in time-series studies.

There is sufficient concern about the health effects of coarse particles to justify their control.



The effects of air pollution on children's health and development

Conclusions on causal associations:

- PM and respiratory deaths in post-neonatal period
- Ambient air poll & lung function development (pre & post natal)
- PM and O₃ exposure and asthma aggravation
- Pb and neurobehavioural development

Several suggestions for causal associations in available data



Systematic Review: Conclusions

- Significant health effects occur at pollution levels common in Europe.
- The evidence is sufficient to ... reduce levels of air pollutants including PM, NO₂ and ozone.
- Further substantial reduction of the existing uncertainty will only be achieved by further targeted research and its subsequent systematic evaluation.



Thank you

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