# Review of evidence on health aspects of air pollution- REVIHAAP
# WHO Regional Office for Europe

## Key new findings and impact of evidence review for EU policies and WHO guidelines

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# From *scientific evidence* to *guidelines* and *standards*

Scientific investigations provide quantitative associations between exposures and helath outcomes, often accompanied with uncertainties and limitations

These get "translated" into information more directly useful for setting guidelines and standards through the application of Health Impact Assessment (HIA) and Cost Benefit Analysis (CBA).

# Issues to be considered

- Simplicity vs complexity in the legislation (i.e. can we have few standards for pollutants/metrics & few reference times)
- Legislation (or guidance) in the absence of a safe level (threshold). Is there an "acceptable" level of risk?
- Balance between precaution/ proactive action vs post-hoc interventions

# Important aspects of the REVIHAAP review which will influence policy decision making processes

- Which pollutants or indices of mixtures/ metrics or sources are independently important?

- Which time periods of exposure are independently important?

# Key findings: $PM_{2.5}$ Existing Regulation and context

- EC regulation: Only annual limit value of 25µg/$m^3$, implemented in 2008.

- Context:
  - few EU studies assessing $PM_{2.5}$ effects (since there were no measurements!)
  - There were adequate studies from the U.S.

# Key findings: $PM_{2.5}$
# Long-term effects- annual limit value

- REVIHAAP concludes that the evidence base is now very much stronger indicating effects from studies in the U.S., E.U. countries and other countries in the World, from levels lower than 10µg/$m^3$.
- The additional evidence concerns the known (respiratory & cardiovascular) and new (reproductive, atherosclerosis, neurodevelopment, cognitive function) health outcomes

# Key findings: $PM_{2.5}$
## Short-term effects: need for a value over a shorter period?

- More evidence on the effect of high concentrations with short duration
- May concern different individuals
- Will allow for emergency protective actions

# Percent change (95%CIs) in mortality associated with 10µg/m$^3$ increase in particles (Samoli et al, EHP 2013)

| Health outcome | $PM_{2.5}$ | $PM_{10}$ |
|---|---|---|
| All-cause mortality (lag 0-1) | 0.55 (0.27, 0.84) | 0.32 (0.13, 0.52) |
| Cardiovascular mortality (lag 0-1) | 0.57 (0.07, 1.08) | 0.31 (-0.01, 0.62) |
| Respiratory mortality (lag 0-5) | 1.91 (0.71, 3.12) | 1.12 (0.29, 1.95) |

*MED-PARTICLES Project 2011-2013*
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# Percent change (95% CIs) in hospital admissions associated with 10μg/m³ increase in $PM_{2.5}$ and 6.3 μg/m³ in $PM_{2.5-10}$ (Staffogia et al, EHP 2013, in press)

| | Cardiovascular admissions | Respiratory admissions |
|---|---|---|
| $PM_{2.5}$ (lag 0-1) | 0.51 (0.12, 0.90) | 0.49 (-0.12, 1.09) |
| $PM_{2.5}$ (lag 0-5) | 0.49 (0.03, 0.95) | 1.36 (0.23, 2.49) |
| $PM_{2.5-10}$ (lag 0-1) | 0.46 (0.10, 0.82) | 0.60 (0.08, 1.13) |
| $PM_{2.5-10}$ (lag 0-5) | 0.05 (-0.68, 0.78) | 1.24 (-0.32, 2.82) |

# Key findings: PM
## physical and chemical characteristics which may be additional air quality metrics

- Black carbon particles (metric for evaluating health risks of primary combustion particles).
- Secondary inorganic particles (sulfates, nitrates)
- Coarse particles
- Ultrafines

# Key findings: $PM_{2.5}$ and $PM_{10}$

- Coarse particles appear to have independent effects on partly different health outcomes and act via different mechanisms than $PM_{2.5}$.

- They originate from different sources, deposit at different locations in the respiratory system.

# Key findings: Ozone

- The short-term effects evidence strengthened from epidemiological and toxicological studies
- Now also substantial evidence for ozone long-term effects, particularly on respiratory mortality. The most important exposure appears to be exposure during the warm period.
- Evidence for a threshold not consistent, but effects observed below 90µg/$m^3$

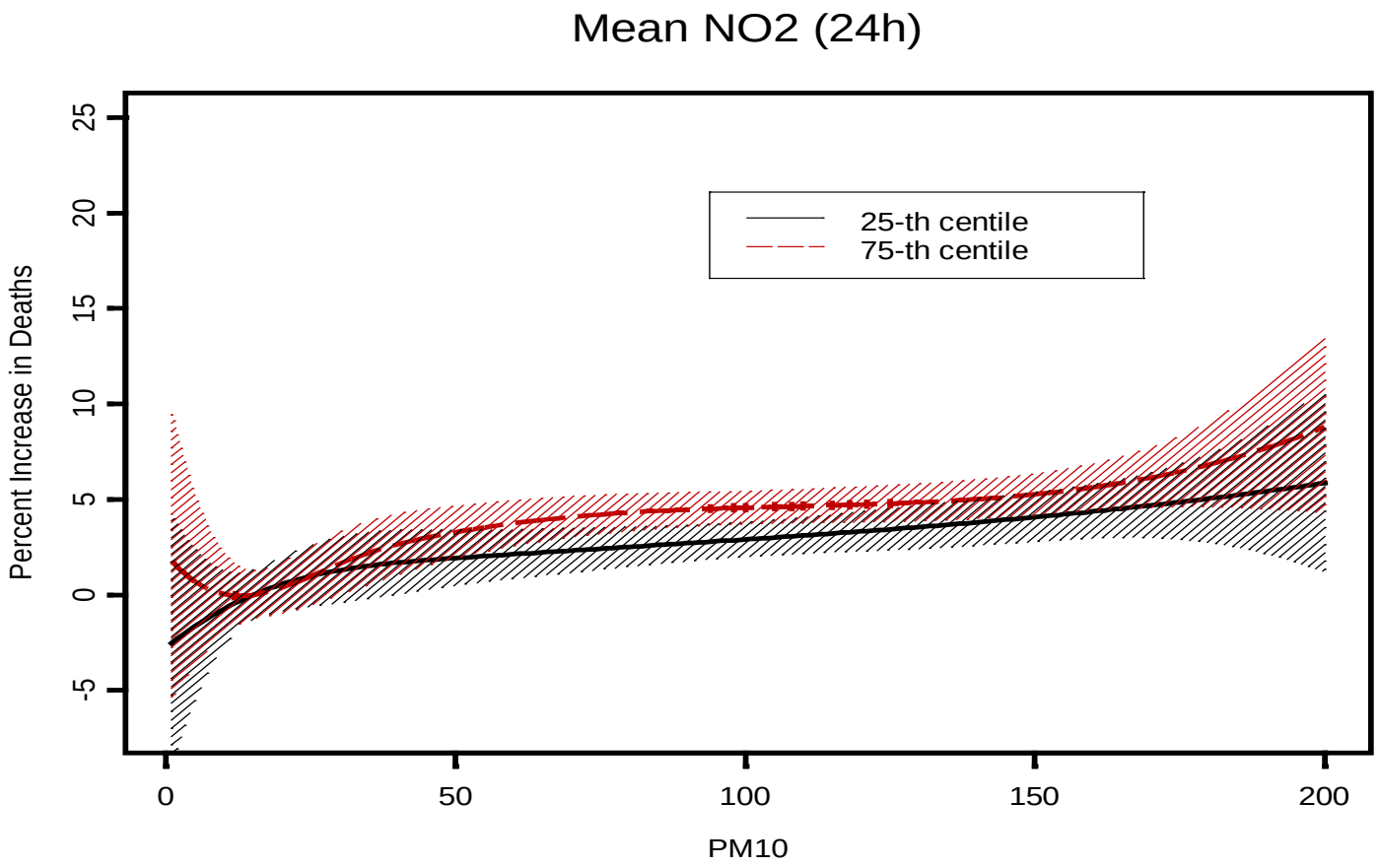
# Key findings: $NO_2$

- Additional evidence both for short and long-term effects, suggesting causal role.

- Necessity for a 1-hour limit value

# Exposure-response curves of the PM – mortality association for cities with high and low $NO_2$

(from Samoli et al EHP 2005; 113: 88-95)



# Key findings: Proximity to roads

- Near roads: higher levels of ultrafine particles, CO, $NO_2$, BC, PAHs, metals ($PM_{2.5}$ more homogeneously distributed across space)

- Evidence linking proximity of residence to roads with health outcomes even when other important pollutants are taken into account

- How can this be reflected in regulations??

# Conclusions- important messages

- The regulated standards should target the protection of public health. They cannot be oversimplified.

- The absence of an identified threshold does not mean effects are evident from zero concentrations. The lower limits of the concentrations studies should be identified.

- The evidence on the health effects of air pollution is accumulating and is remarkably consistent and persuasive. Therefore a more proactive policy is justified.

- The efficiency of legally binding standards and targets should be evaluated. Do the latter pose any pressure on national governments??

# Future considerations (1)

- In Europe the lack of evidence on the health effects of particular pollutants is often due to lack of measurements (regulations and requirements are introduced late).

- A more flexible system of measurements can be adopted by DG Environment, including e.g. short-term targeted campaigns, establishing super-sites, introduce validated modeling (see recommendations of the AirMonTech project presented on June 6).

- The design of the requirements for measurements should be done in collaboration with the health research community- new institutions should be introduced (see also recommendations of the AirMonTech project presented on June 6).

# Future considerations (2)

- Evaluating air pollution as a whole (i.e. a mixture of pollutants) may lead to a shift in the paradigm of how pollutants may be regulated. There is scope in starting to think along these lines.

- Similarly, the identification of sources of hazardous pollution (e.g. traffic) leads to possible policies to protect public health that may be related to other disciplines (such as urban planning).