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Effects of Low-Level Air Pollution: A Study in Europe

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Background

Uncertainty about associations between air pollution and health at **low concentrations**

Objectives

Investigate **associations** between long-term exposure to **$PM_{2.5}$, NO_2, O_3, BC** and:

- Natural and cause-specific mortality
- Incidence of lung cancer and cardiovascular events

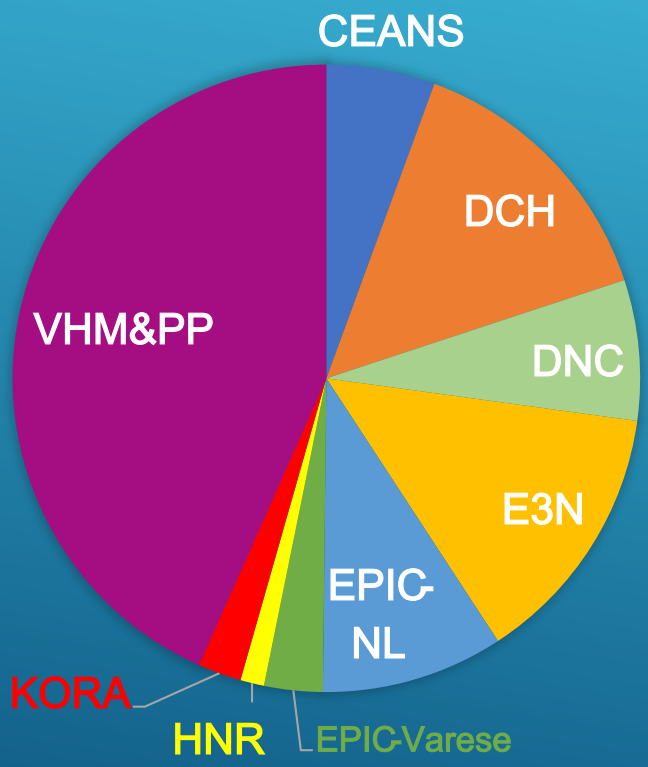
Methods

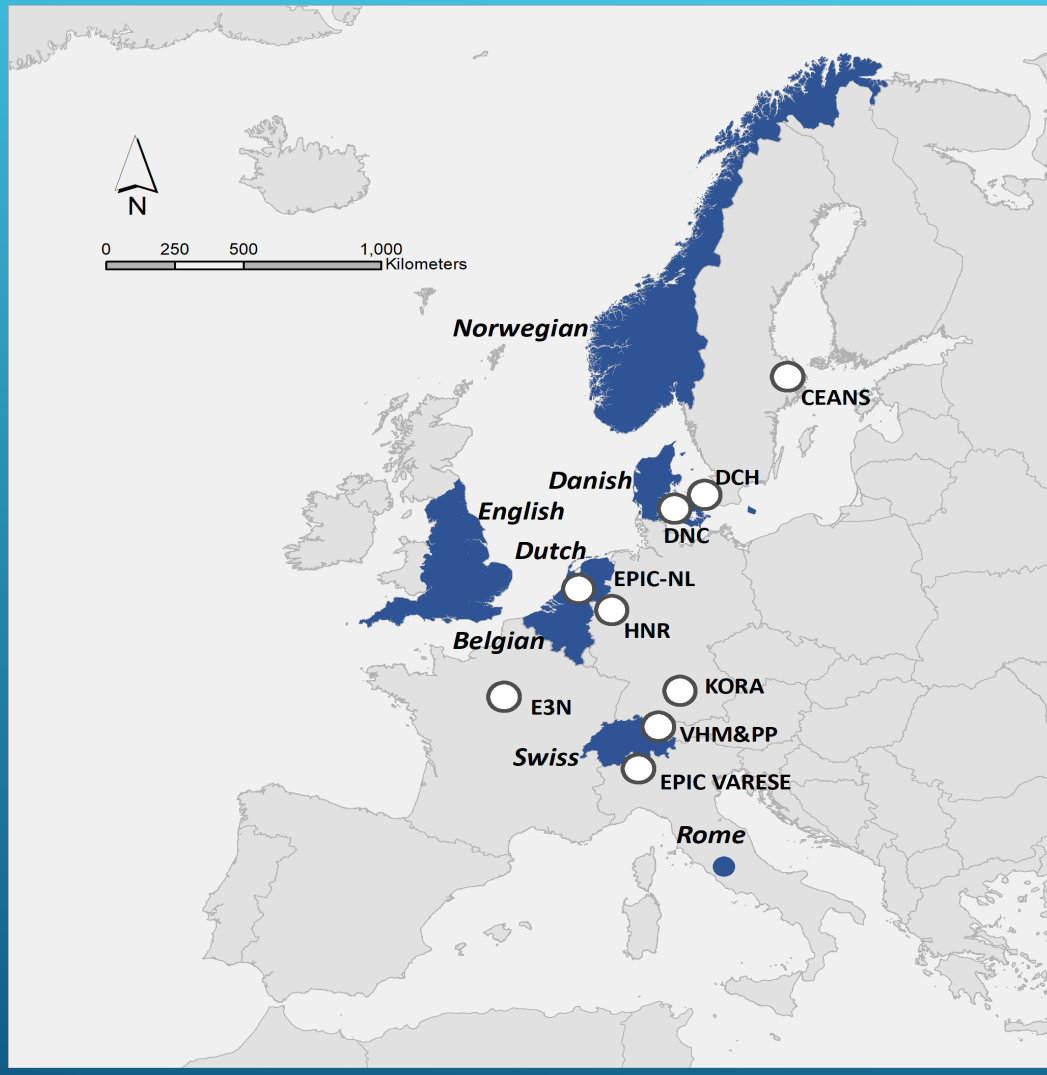
- Low-level defined as below current limit values
- Pooling nine European cohorts (eight ESCAPE and Danish Nurse Cohort) (N = 400 thousand adults)
- Large administrative cohorts from seven countries in Europe (N = 28 million adults)

Standardization of methods

- Definition of endpoints and covariates
- Central exposure assessment of $PM_{2.5}$, NO_2, O_3 and BC at fine spatial scale
- Data analysis (same R script)

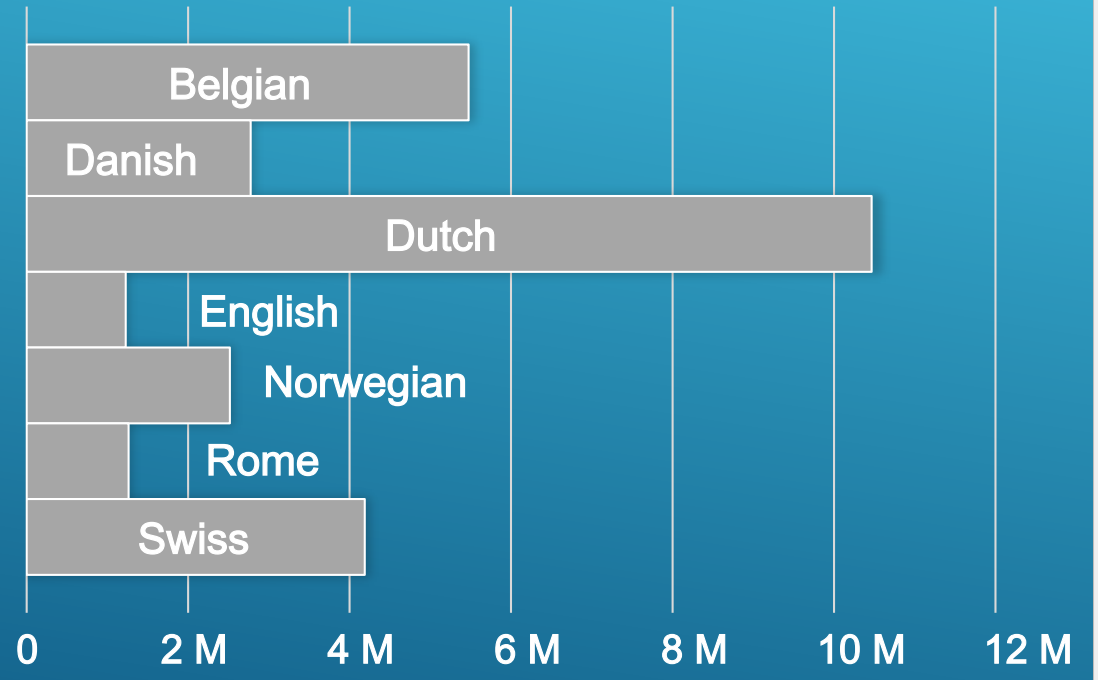
Pooled cohort

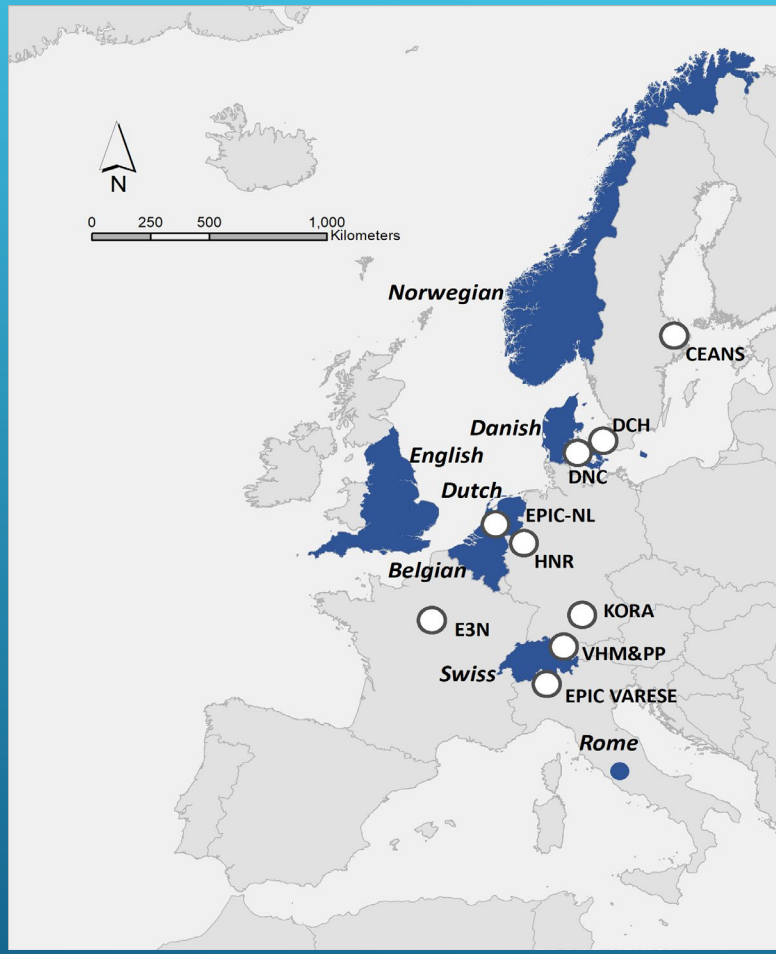




- N = 392,826
- Extensive covariate information

Administrative cohorts





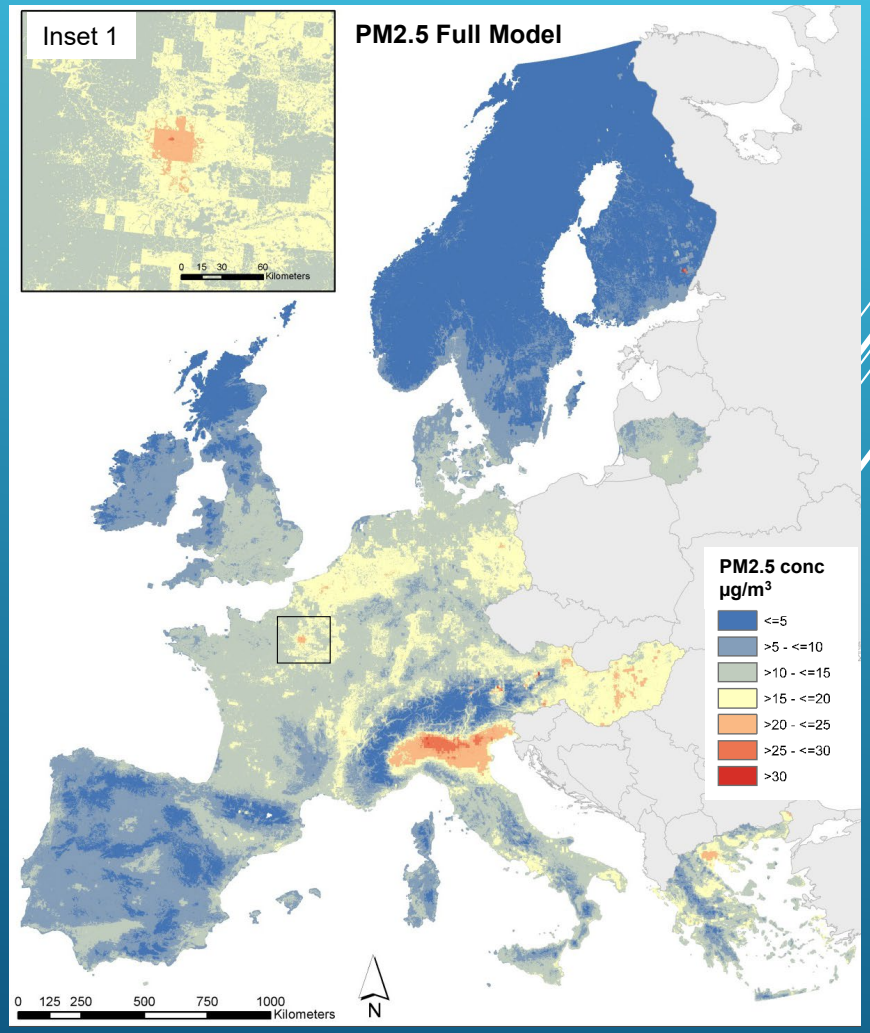
- N = 27,910,693
- Limited covariate info (except English)
- Analyzed individually -> Meta-analysis

Central exposure assessment

Europe-wide **hybrid** land use regression models

Land use and road data, with **satellite** observations and **dispersion model** estimates

Maps of **100x100 m grids**



Local exposure models

Existing LUR and/or dispersion models

Data analysis methods

- Cox proportional hazard models to investigate associations between air pollution and health, adjusting for individual and area -level confounders

- Shape of the concentration -response function
  - Natural and penalized splines
  - SCHIF functions
  - Subset and threshold analysis

POOLED COHORT

RESULTS

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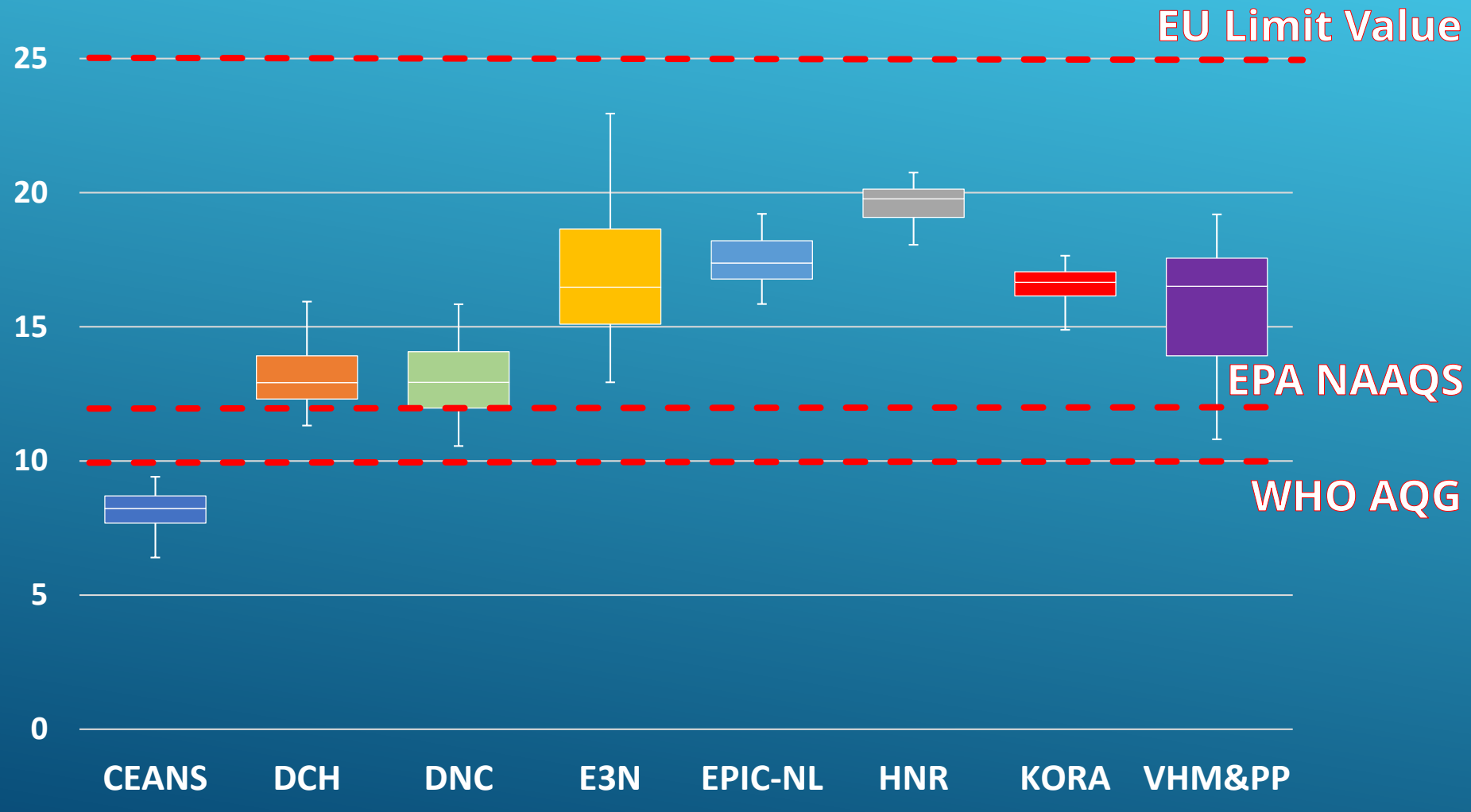
$PM_{2.5}$ ($\mu g/m^3$)



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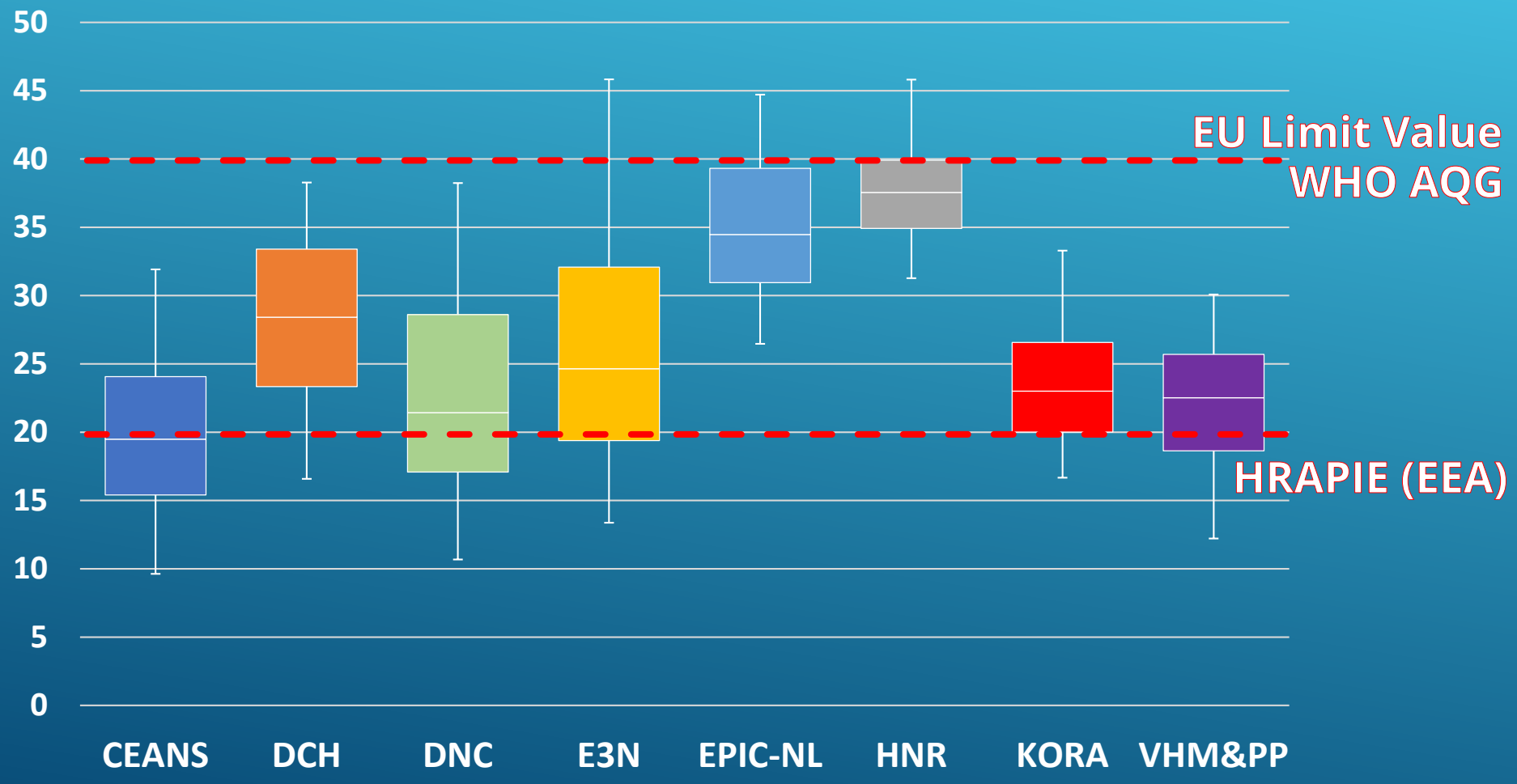
NO_2 ($\mu g/m^3$)



Correlations

Positive between PM2.5, BC and NO_2

Negative between O_3 and PM2.5, BC and NO_2

	NO_2	BC	O_3
$PM_{2.5}$	.51 to .76	.50 to .70	-.41 to -.68
NO_2		.86 to .93	-.67 to -.80
BC			-.64 to -.82

ADMINISTRATIVE COHORTS

RESULTS

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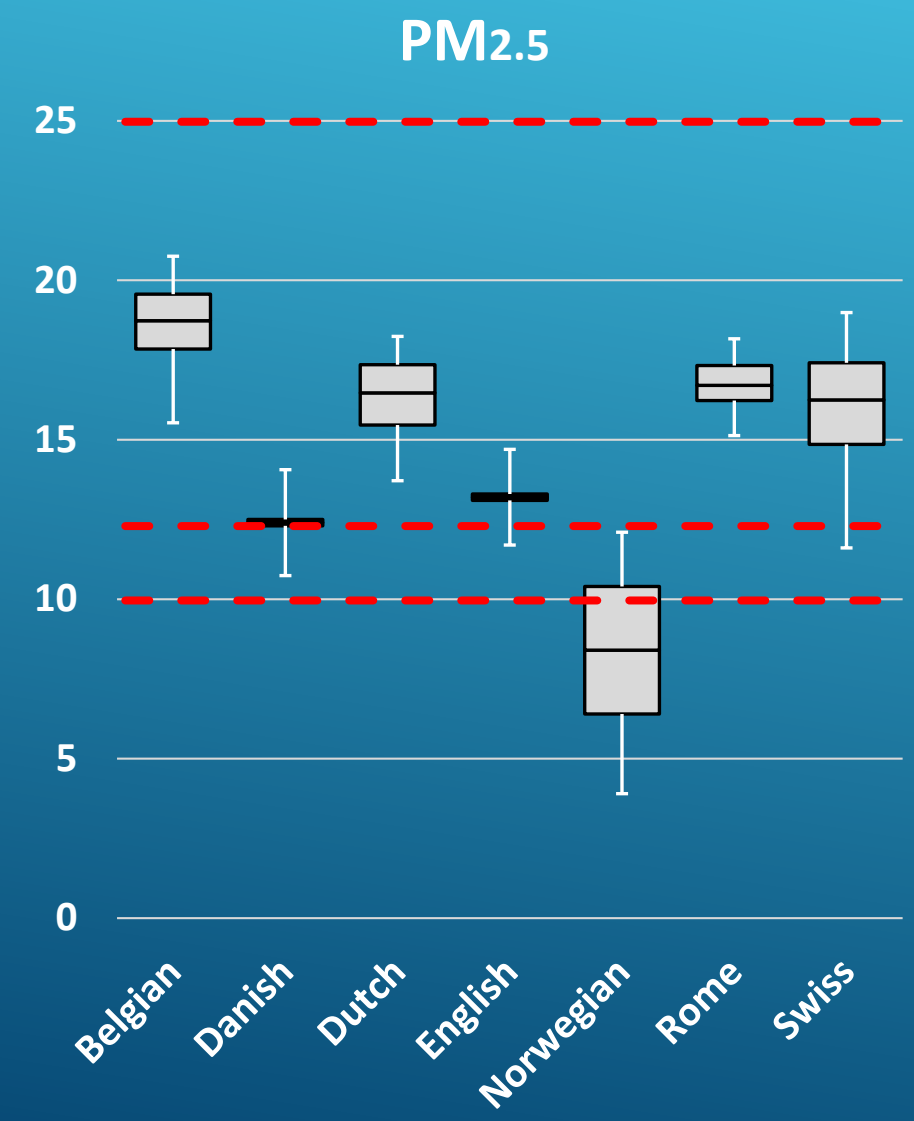
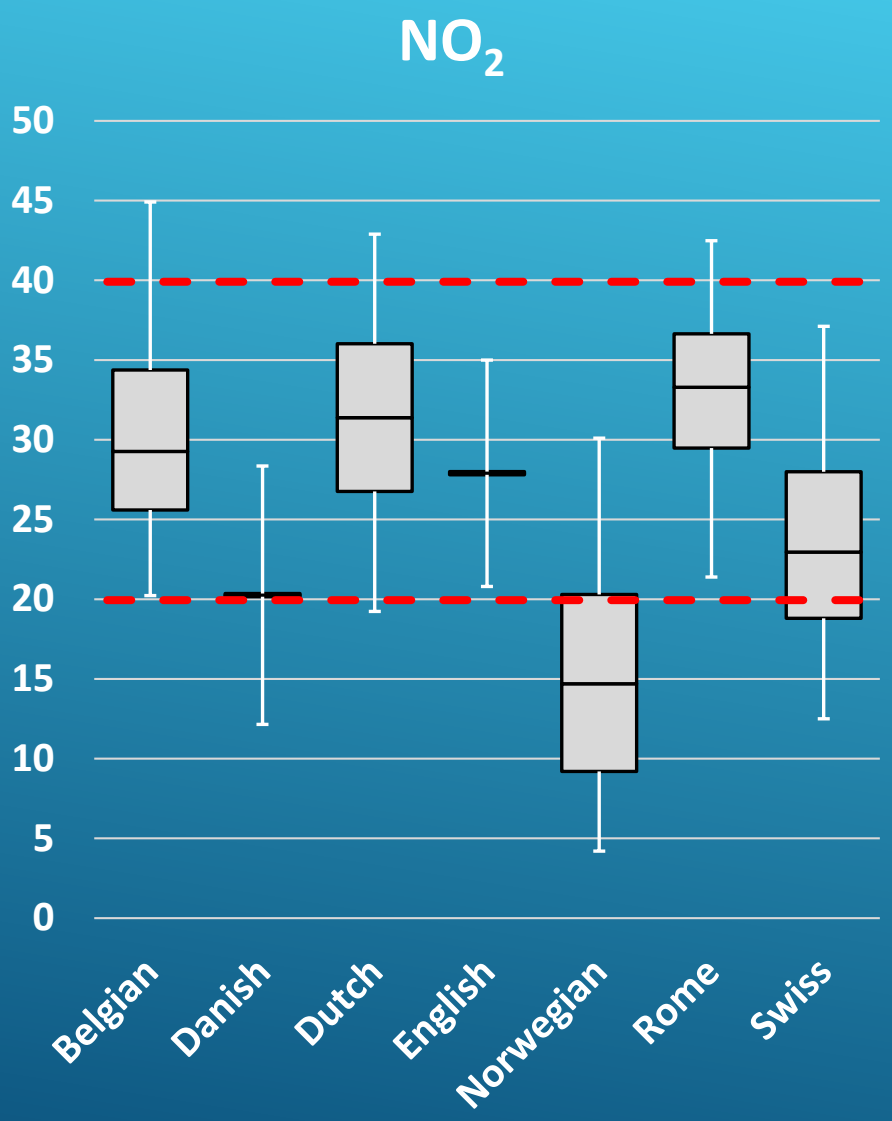

PM2.5
25
20
15
10
5
0
Belgian
Danish
Dutch
English
Norwegian
Rome
Swiss


NO2
50
45
40
35
30
25
20
15
10
5
0
Belgian
Danish
Dutch
English
Norwegian
Rome
Swiss

Take home message

- Long-term exposure to PM2.5, NO_2, BC was positively **associated with morbidity and mortality** in the pooled cohort and seven large administrative cohorts
- HRs for PM2.5 were somewhat larger in the pooled cohort (with detailed individual confounder info) than in the admin cohorts
- Associations **remain at low levels** :
  - $< 10\ \mu g/m^3$ $PM_{2.5}$
  - $< 20\ \mu g/m^3$ NO_2

Next steps

- Associations with particle composition (Cu, Fe, Zn, S)
- PM2.5 estimates from MAPLE (Canadian study)
- Ozone at a larger spatial scale (modelled at 10 by 10 km and more as opposed to 100 * 100 m)

THANK YOU