



Quantifying the air quality and health co-benefit of local mitigation actions: the case of the Covenant of Mayors

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Objective

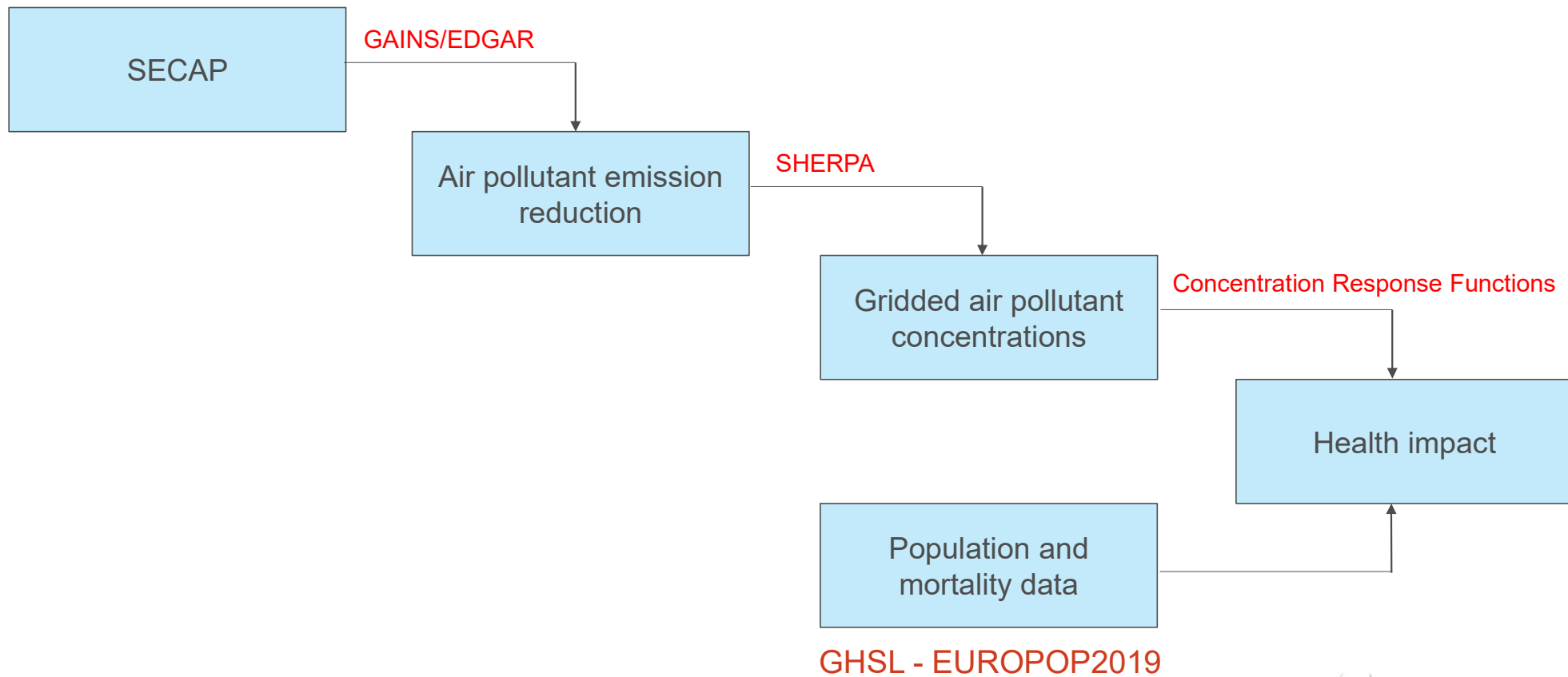
To estimate the number of avoided premature deaths and the gained years of life lost (YOLL) as co-benefit of the application of climate change mitigation actions (Sustainable Energy and Climate Action Plans - SECAP) in a sample of cities belonging to the «Covenant of Mayors» alliance

Time period considered for the assessment of co-benefits
2019-2030 (all plans in force for the entire period)

Modelling approach to estimate health impact

- Estimates of **reduction of air pollutants emissions** associated with climate mitigation actions in GNFR3 (residential sector) and GNFR6 (transport/traffic) sectors
- Run of Sherpa model to estimate **PM_{2.5} concentration change**
- **Health impact** based on EEA approach (2024) to assess health impacts considering static and dynamic population

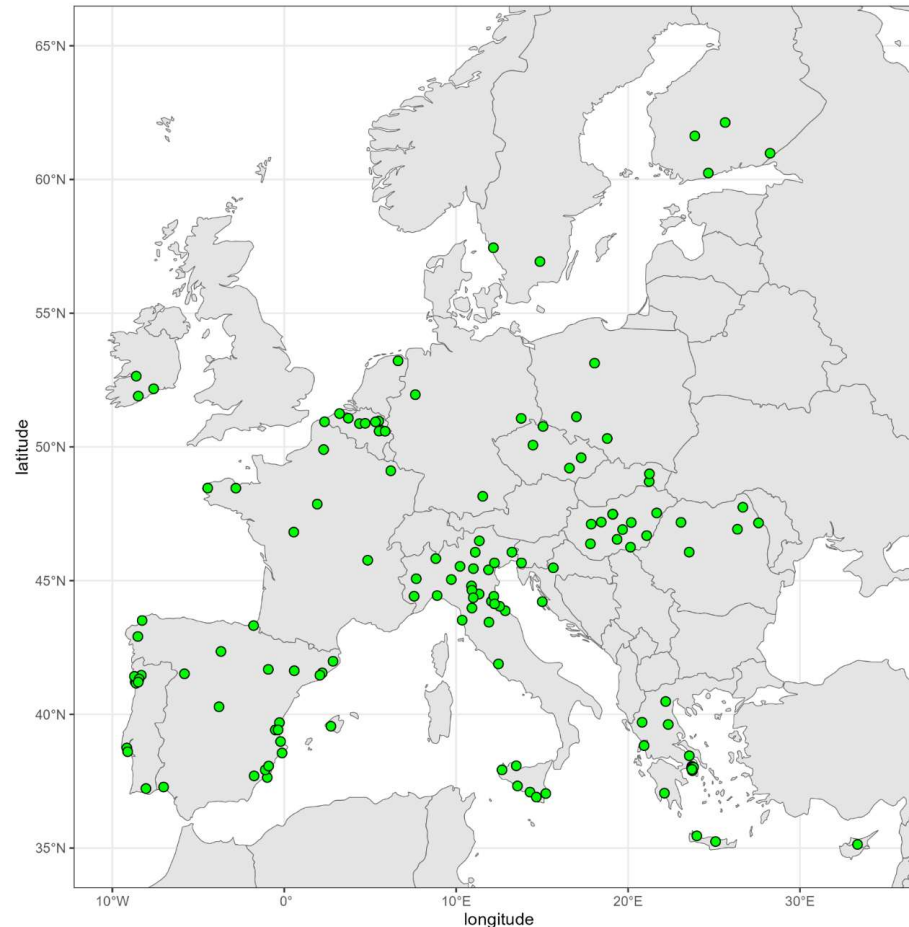
Modelling approach to estimate health impact



Cities included in the analyses

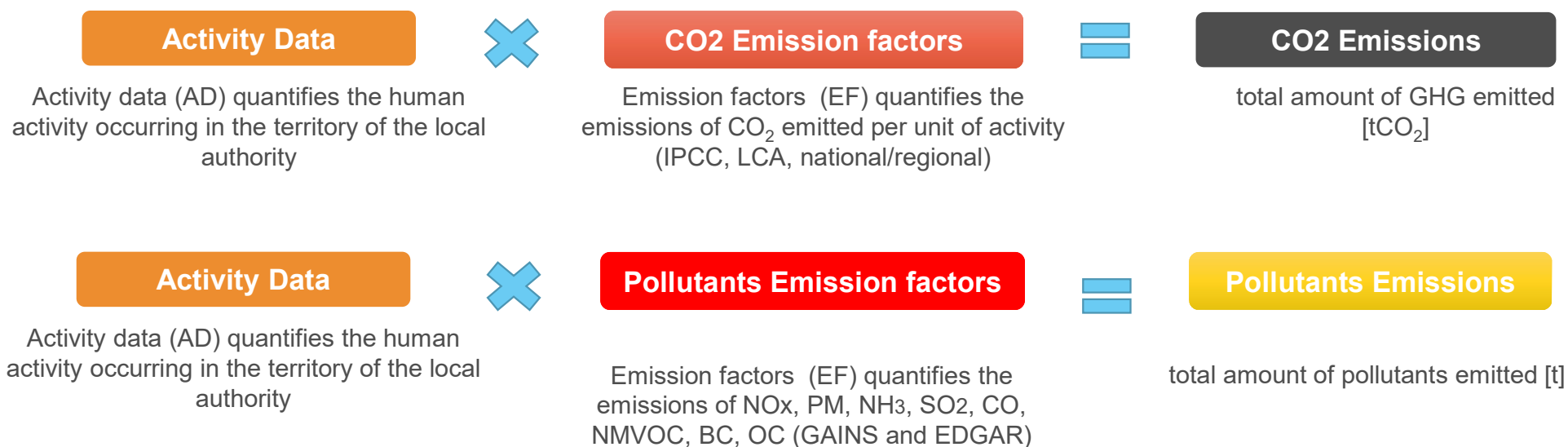
Cities with SECAP plans in force for the entire period 2019-2030

Cities with available information about the territory (Local Administrative Units) affected by the SECAP actions.



136 cities
28 MI people

Emission reductions



Impact on concentrations

PM_{2.5} concentration changes associated with the calculated emission reductions have been estimated using the Sherpa model

Sherpa input data

- CTM model: EMEP V4.45 (res. 0.1° x 0.05°)
- Emission inventory: CAMS V6.1 (2019)
- Meteorological data: IFS 2015

Health impact assessment method

$$\text{Relative Risk (RR)} = e^{\beta(C-C_0)}$$

$$\text{Population Attributable Fraction (PAF)} = \frac{RR - 1}{RR}$$

$$\text{Attributable deaths (AD)} = PAF \cdot \sum_{s,a} DR_{s,a} \cdot Pop_{s,a}$$

$$\text{Attributable deaths (YOLL)} = PAF \cdot \sum_{s,a} DR_{s,a} \cdot Pop_{s,a} \cdot Le_{s,a}$$

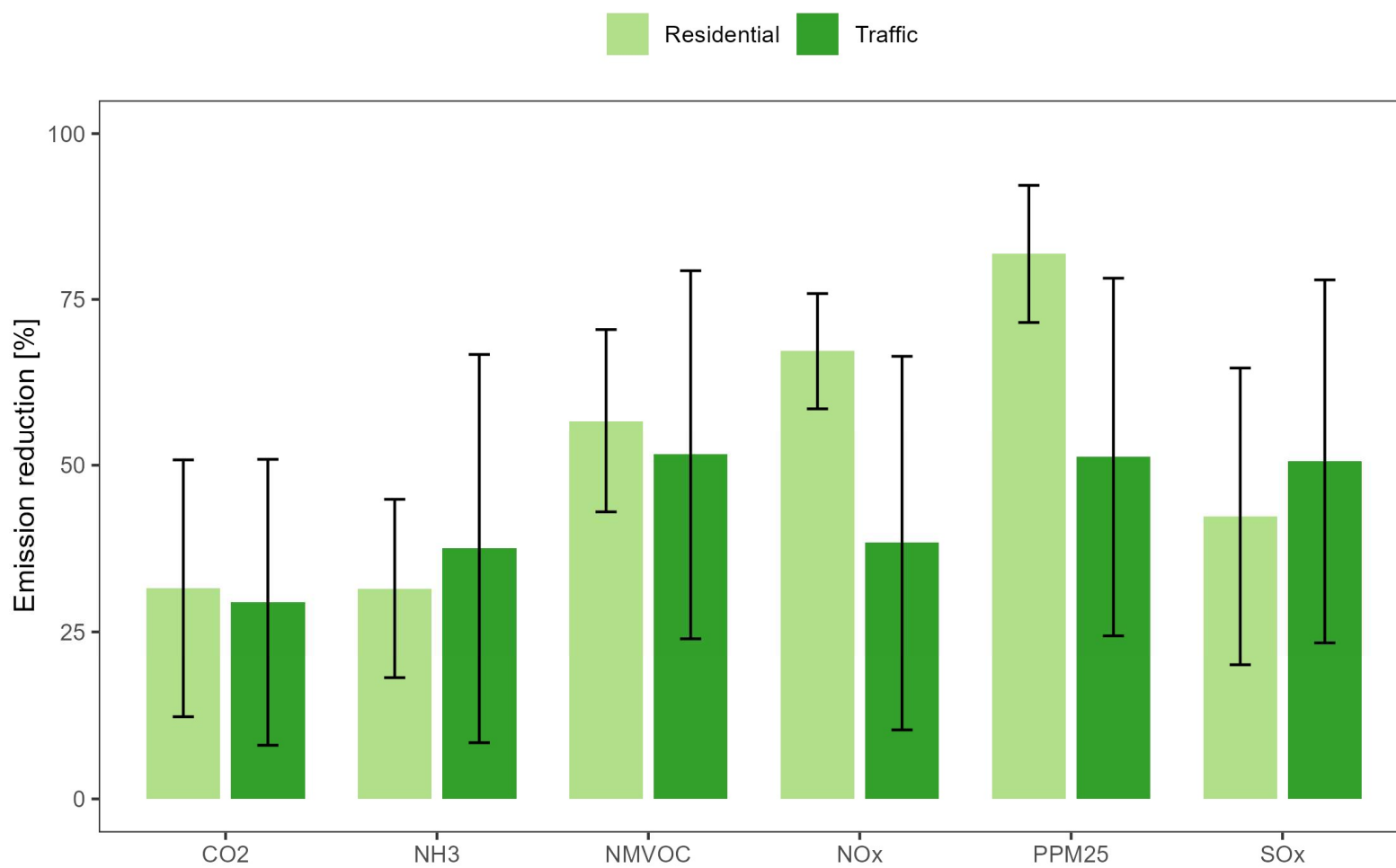
Relative risk (RR): 1.062 (1.040 – 1.083)

Reference concentration (C_0 - no effect threshold): 0 $\mu\text{g}/\text{m}^3$

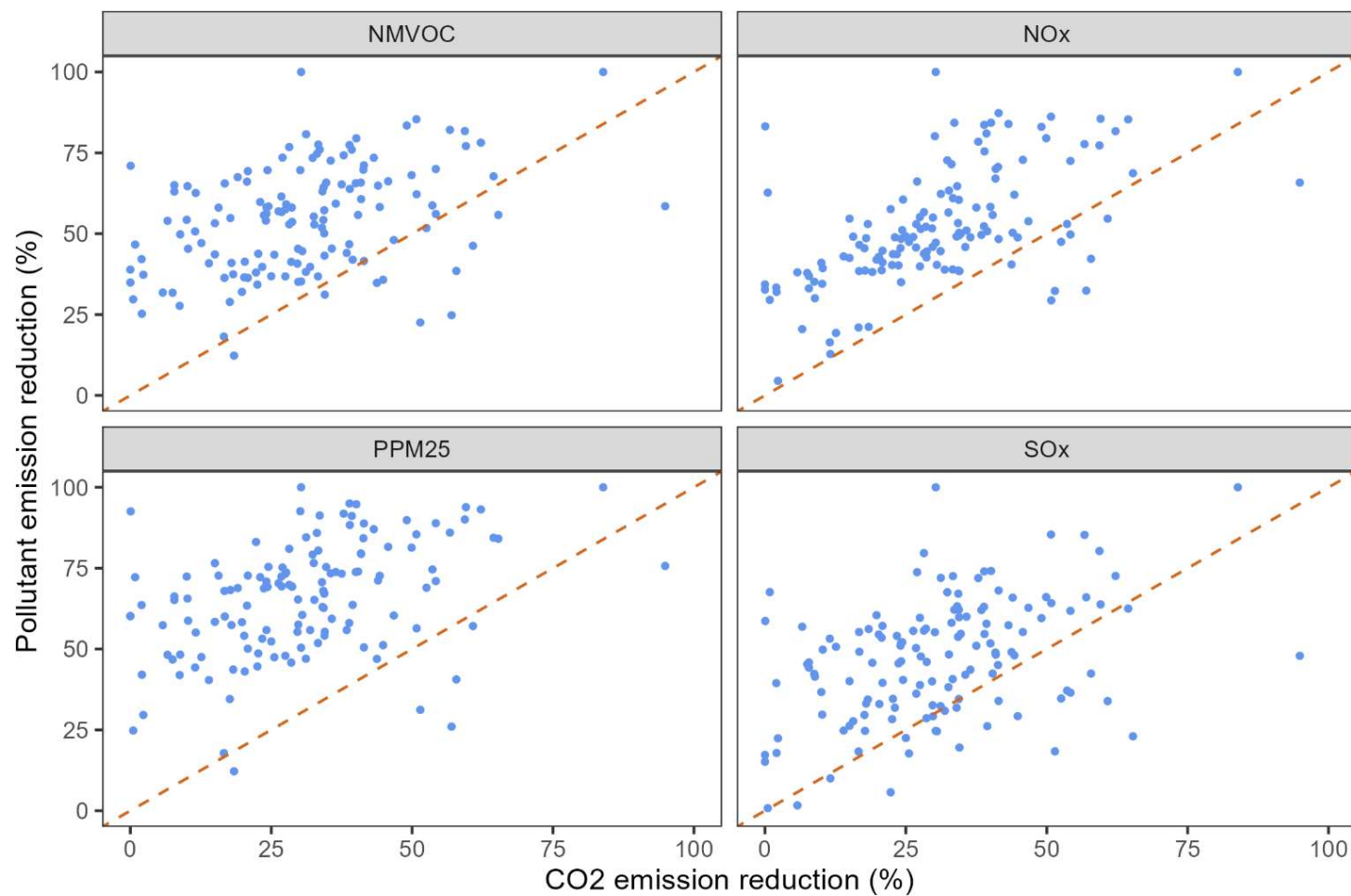
Age: >30 years-old

Demographic scenarios: Static and dynamic

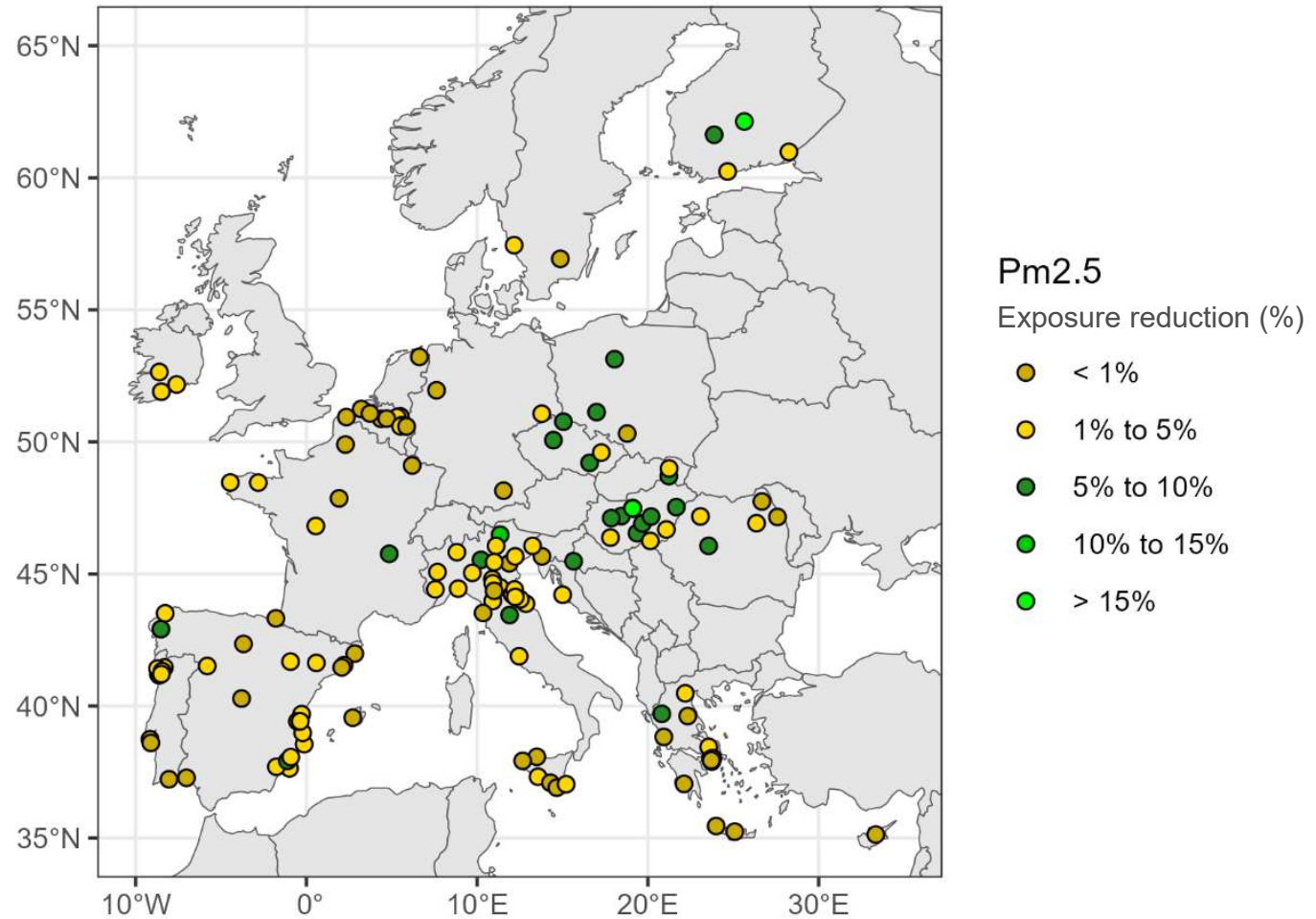
Emission reductions by city



Emission reductions by city

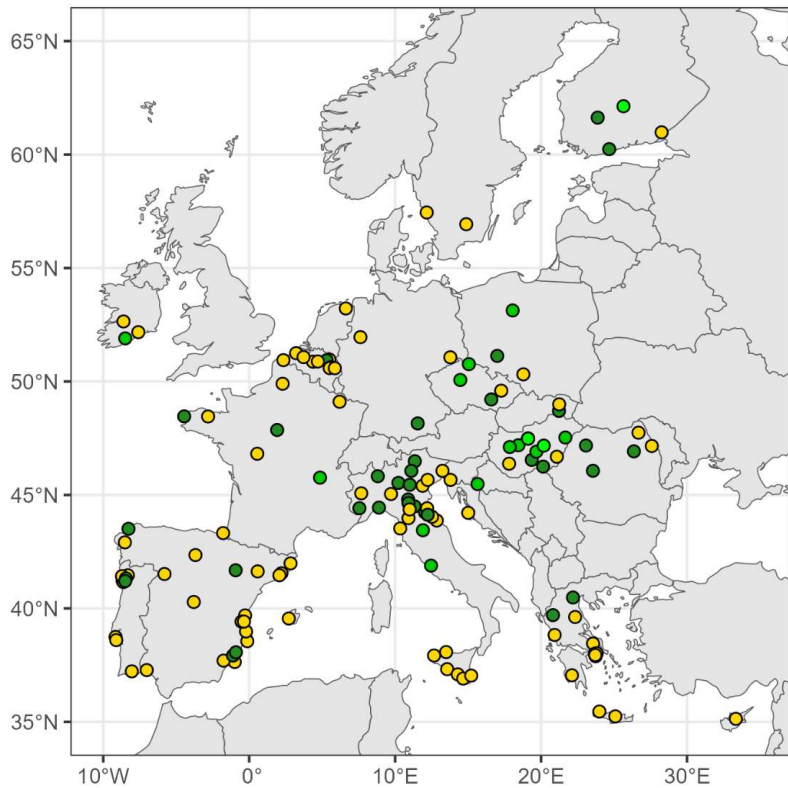


PM_{2.5} exposure reduction

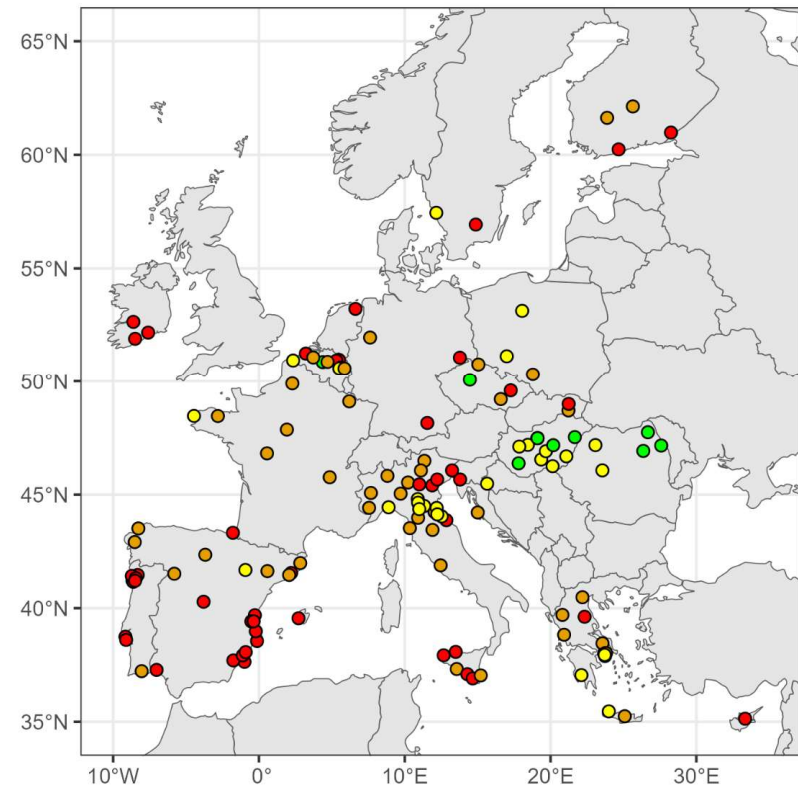


Attributable deaths (AD)

AD change (%) - Static population

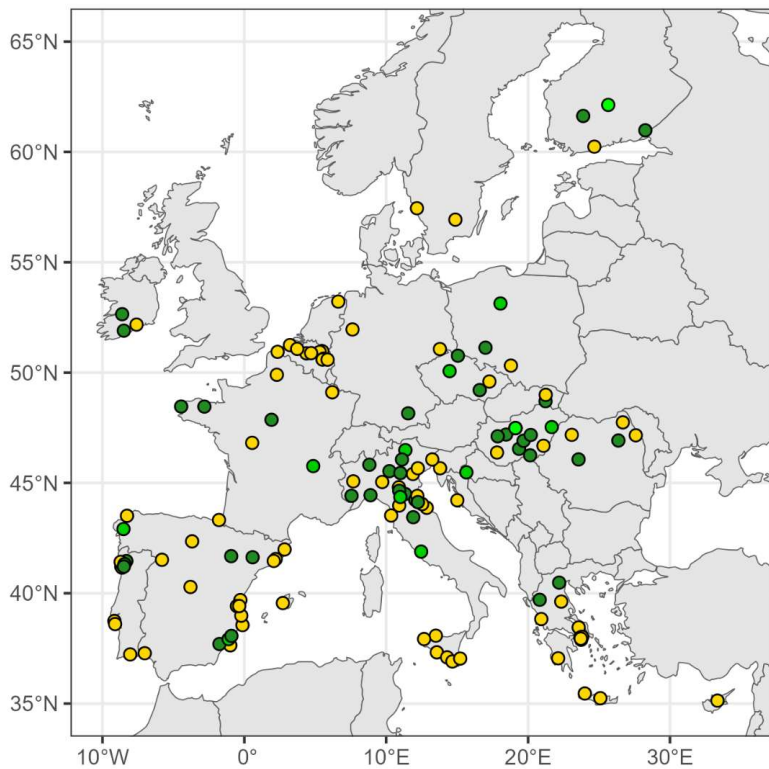


AD change (%) - Dynamic population



Year of Life Lost (YOLL)

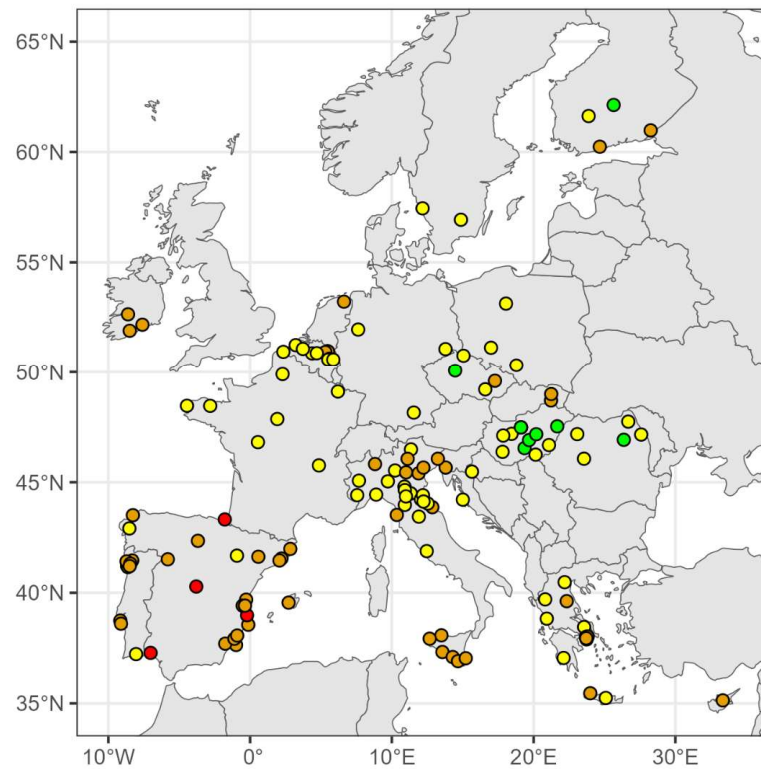
YOLL change (%) - Static population



YOLL change (%)

- < -6%
- -6% to -4%
- -4% to -2%
- > -2%

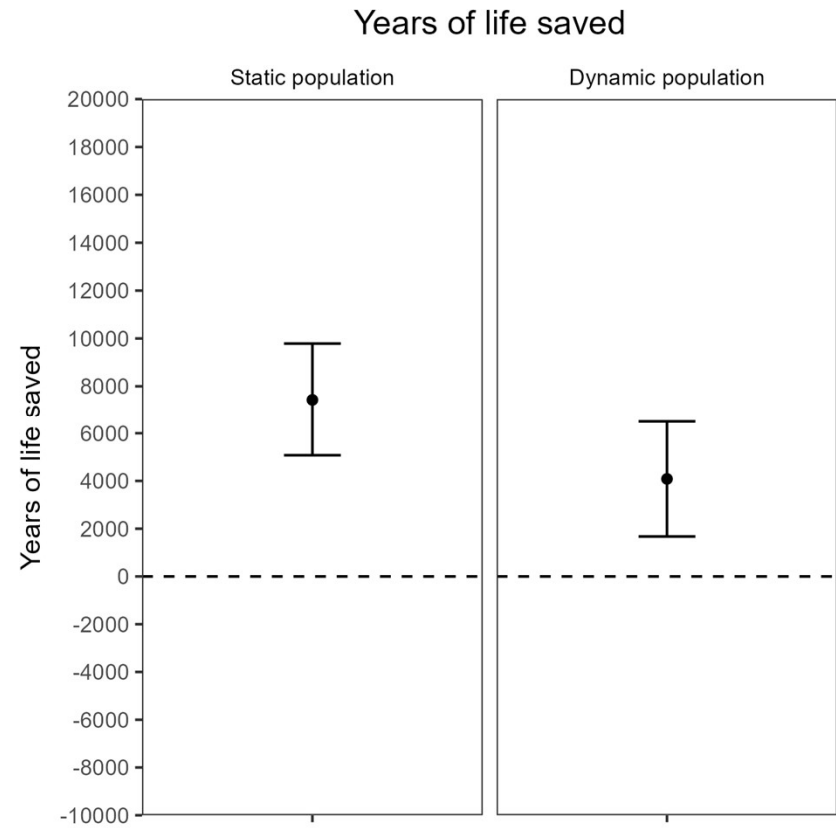
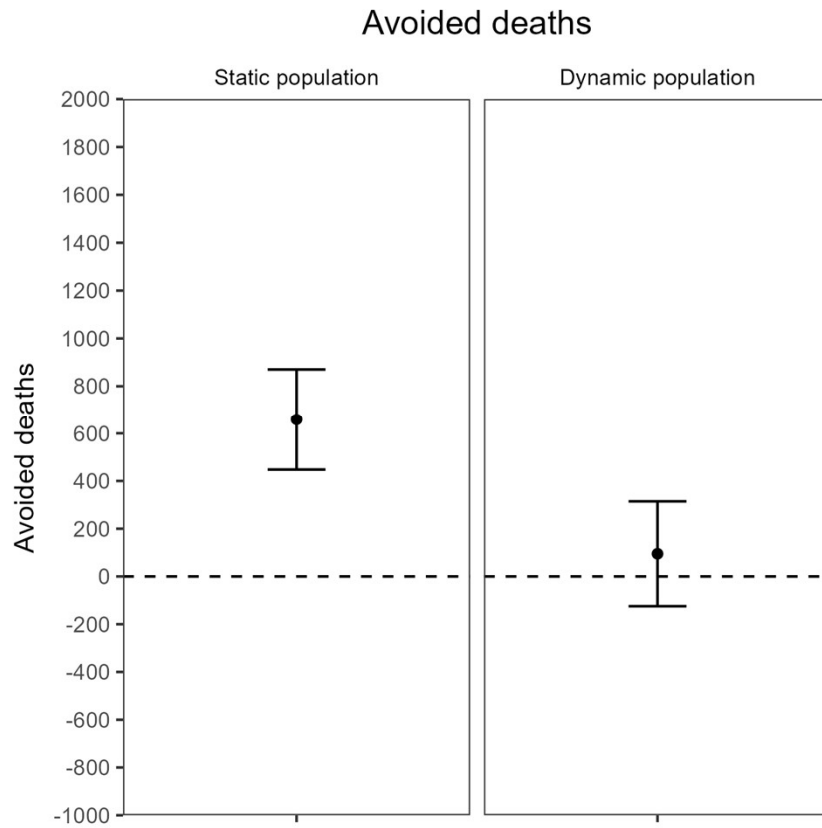
YOLL change (%) - Dynamic population



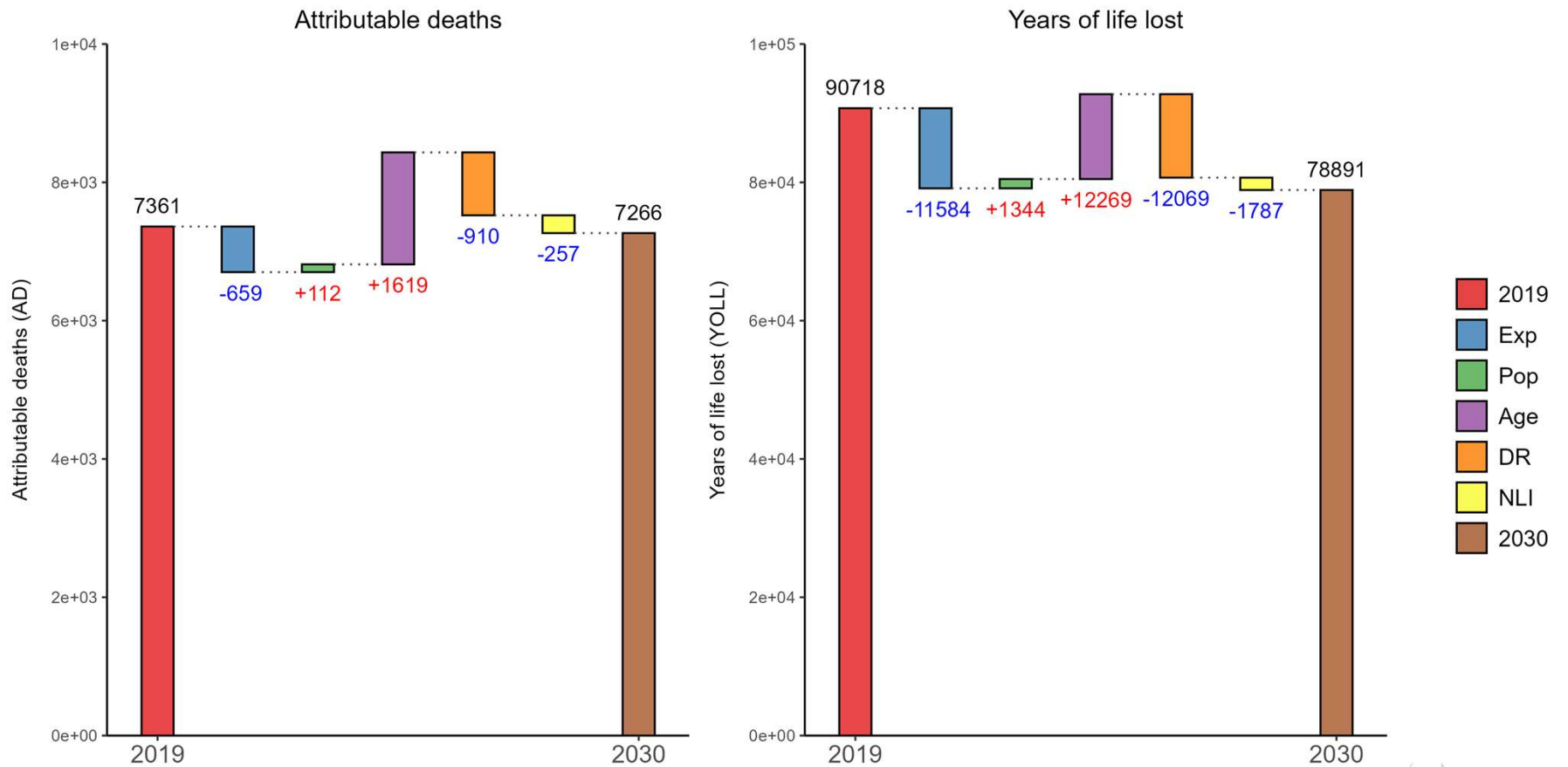
YOLL change (%)

- < -6%
- -6% to 0%
- 0% to 6%
- > 6%

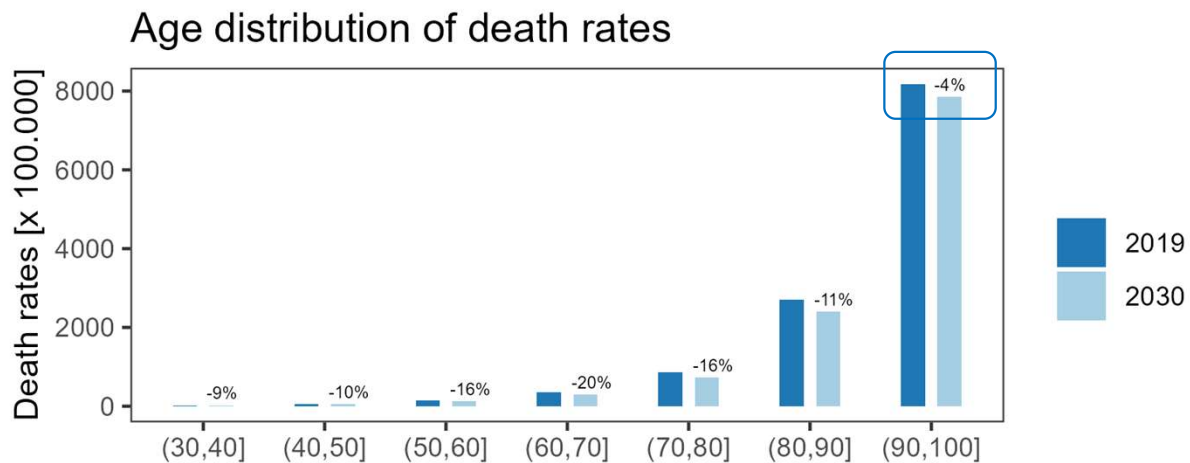
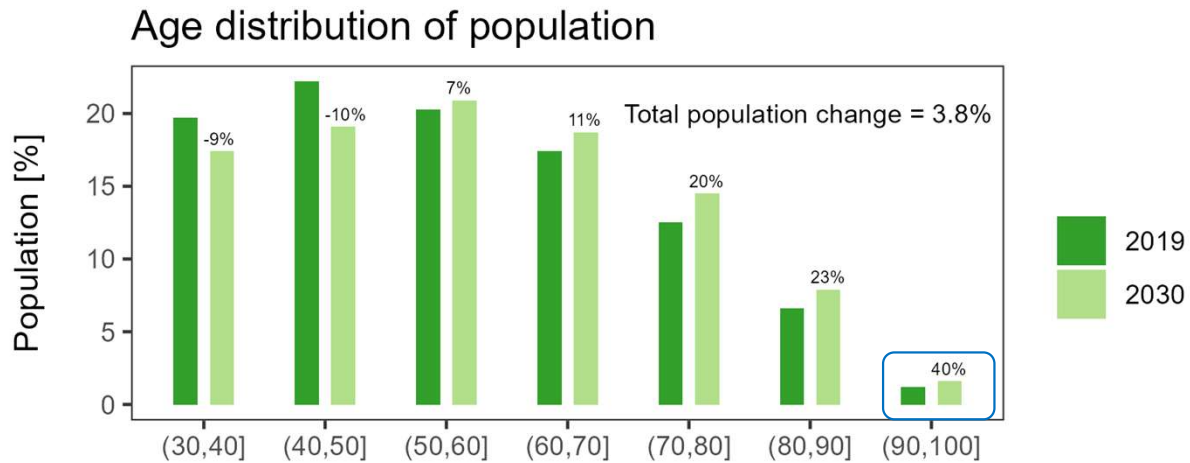
Overall health impact



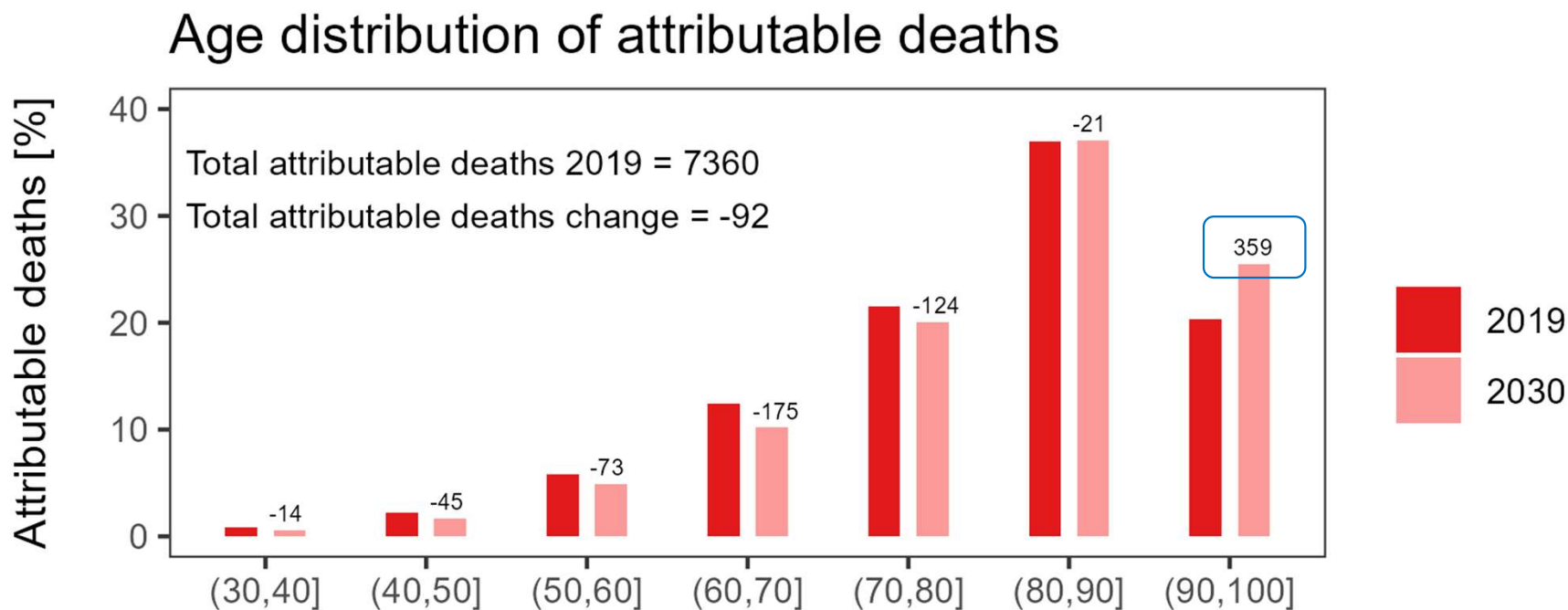
Factors affecting overall impact on AD and YOLL



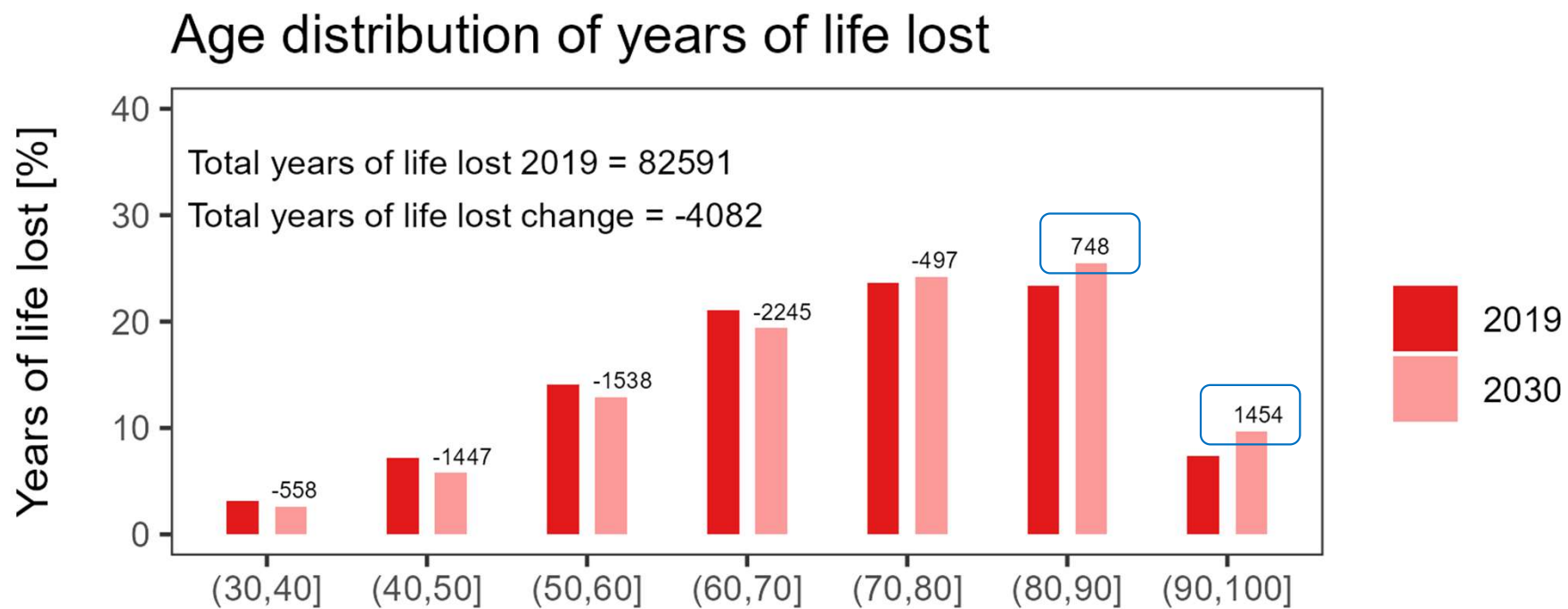
Age distribution of population and death rates



Age distribution of attributable deaths



Age distribution of years of life lost



Main conclusions

- Significant impact on air quality and health of emission reduction associated with CoM climate mitigation actions
- Large differences among cities in reductions of pollutant emission for both residential and traffic sector
- Large differences of health impact among cities due to both effectiveness of actions in terms of exposure and population dynamics
- Large differences between static and dynamic population scenarios with opposite impacts of population/death rates and exposure trends
- Large impact of population and death rates changes over time (decrease from death rates changes, increase from population and age structure changes)
- AD and YOLL impacts are of the same sign

Thank you



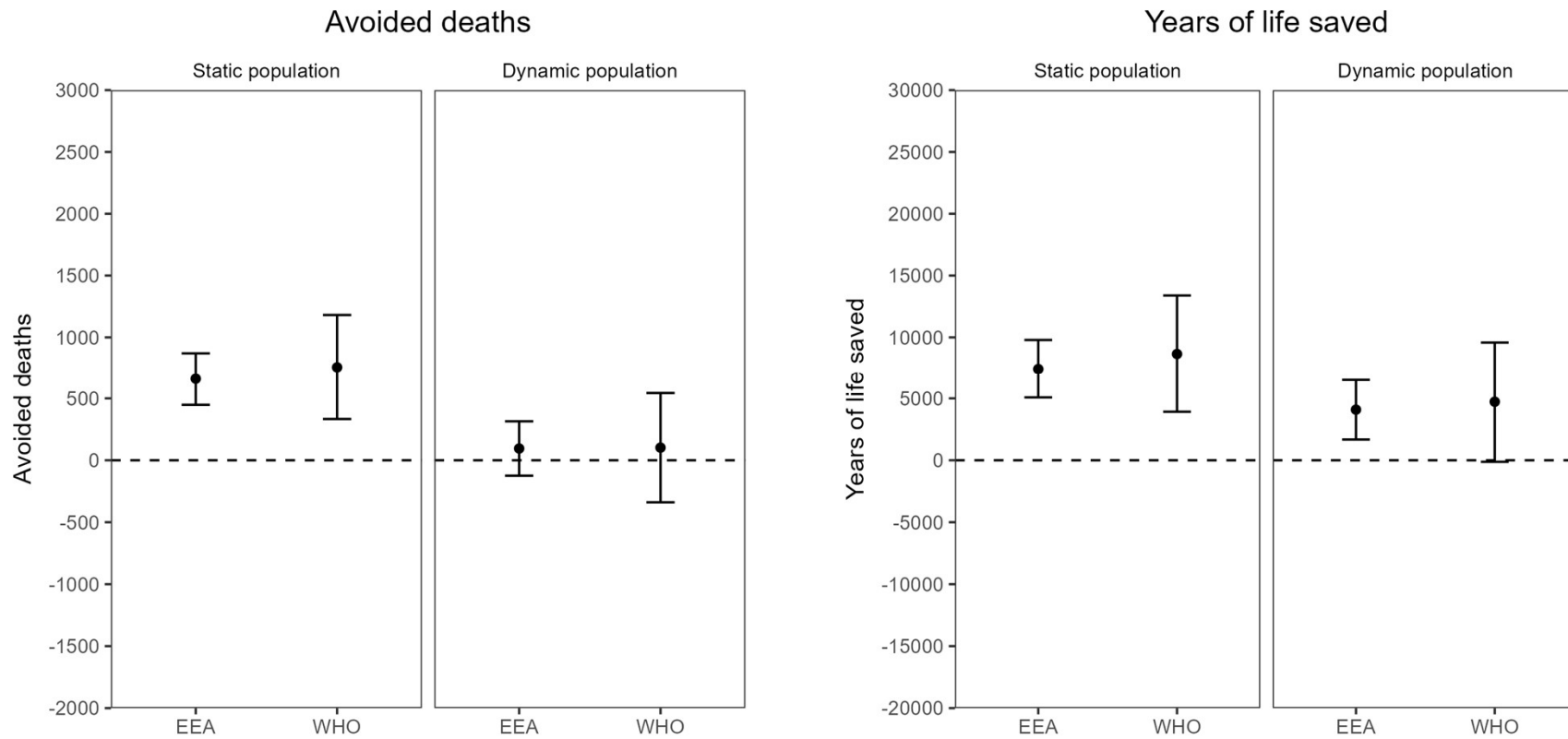
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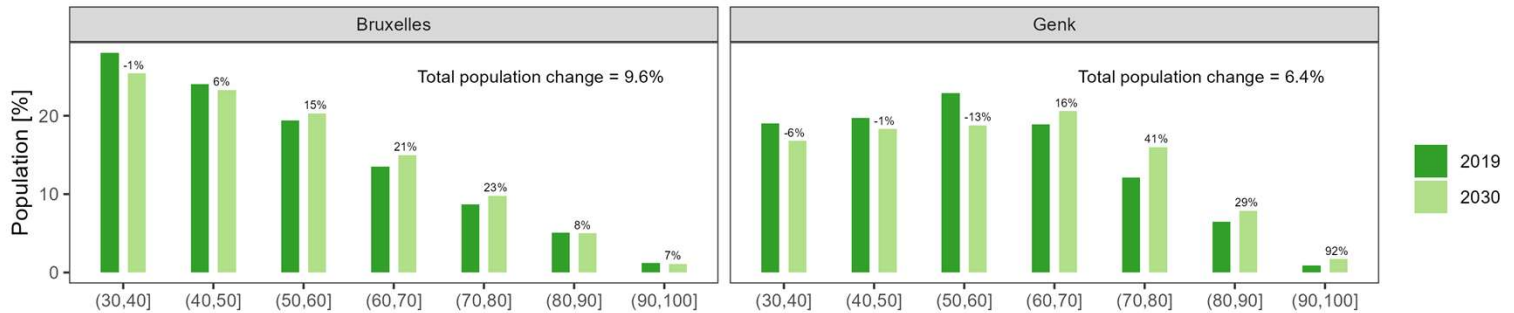


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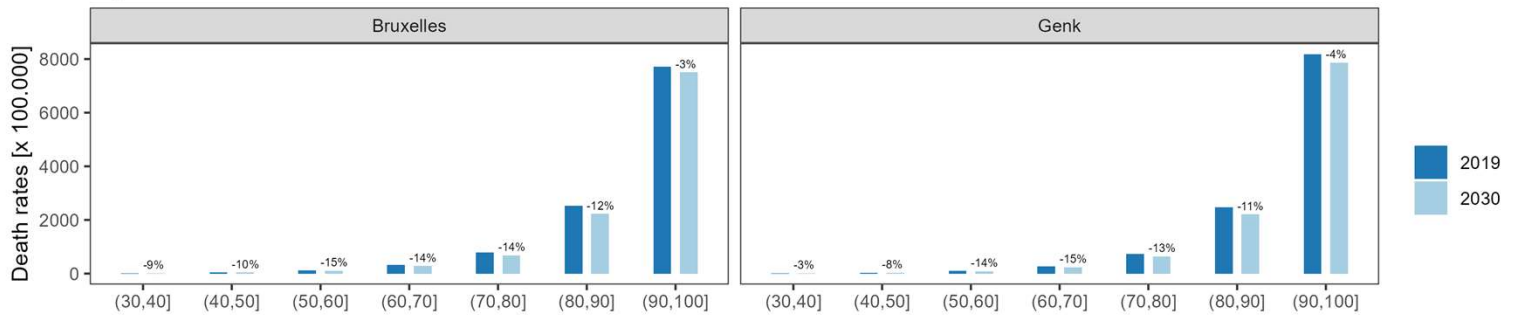
Sensitivity analysis – Impact of Relative Risk choice



Age distribution of population



Age distribution of death rates



Age distribution of attributable deaths

