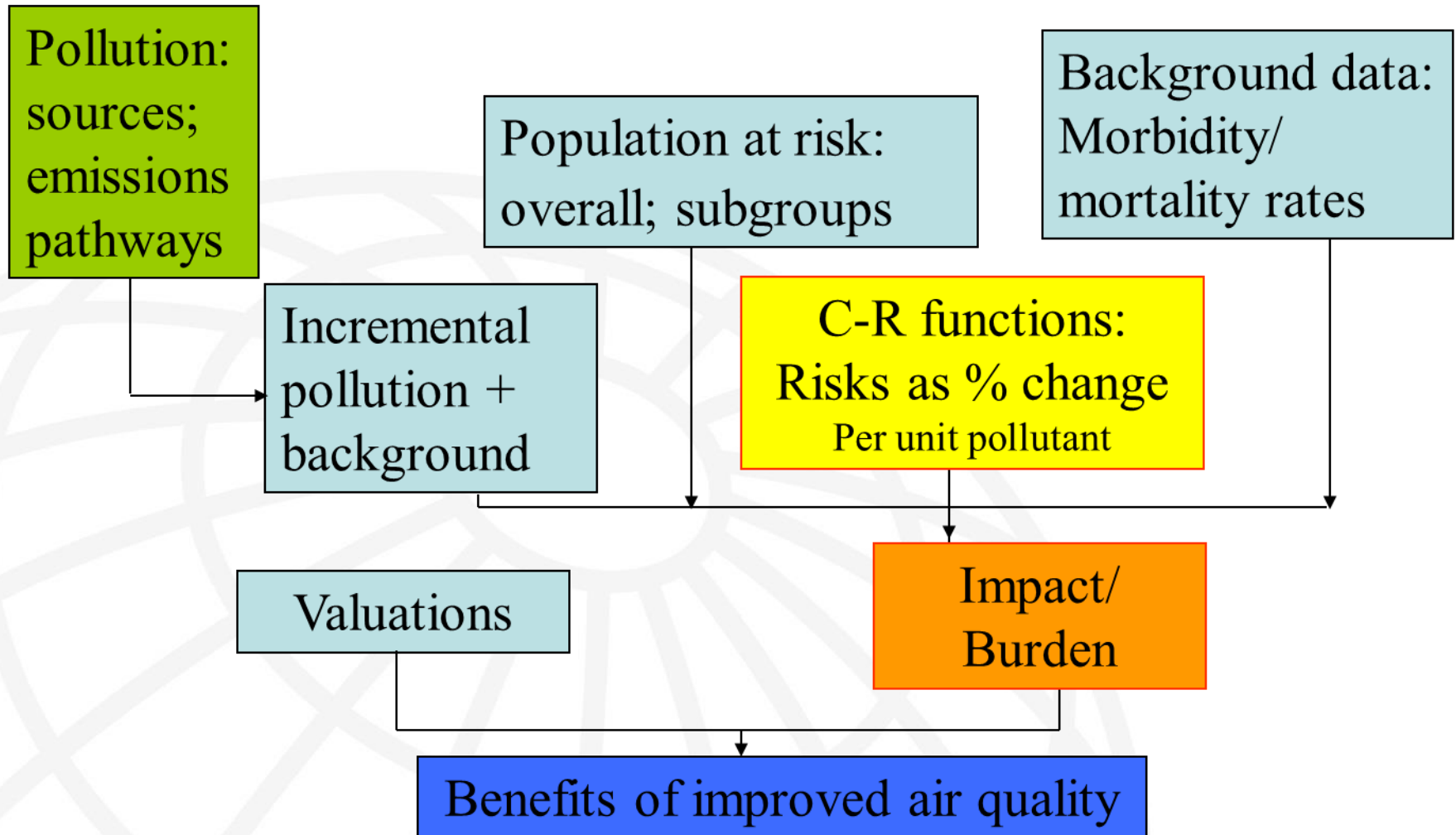




Health Impact Assessment in **TRANSPHORM: city case studies**

Stakeholders meeting
Brussels, 6 May 2014
Brian Miller, IOM & Project team

Health Impact Assessment (HIA) for air pollution: a basic framework



HIA e.g. for mortality: Defining the questions

- **What is the form of the question?**
- **Burden**
 - What is the size of the (health) problem currently?
 - How inflated are current mortality rates?
 - How much potential life are we losing?
- **Impact**
 - If we apply policy X, how much will change?
 - What will be the pattern of mortality rate change?
 - What will be the pattern of changes in total life?
- **Impact on burden**
 - If we apply policy X, how much will (expected) burden change?



Practical considerations for mortality HIA

- **Modelled pollution concentrations for baseline year (2008)**
- **Signature pollutants for mortality? PM2.5, EC, PNC**
- **Modelled concentrations for future scenarios 2020, 2030...**
 - **Scenarios: Agreed Measures, AM+ various extra measures**
- **No modelled values for intermediate years**
- **Can calculate burdens** in modelled years
- Can define **Annual impact = change in burden**
- **Important to report this as *per annum***

Burden calculation inputs and procedures



- **Baseline year**

- Age-specific population and mortality data
- Modelled pollutant concentration(s)
 - Annual, population-weighted: x
- Concentration-response function UR per u

- **Attributable deaths**

- Relative Risk $RR(x) = UR(u)^{x/u}$
- Population Attributable Fraction (of deaths)
- $PAF = (RR - 1) / RR$
- Attributable deaths $AD = PAF * \text{total deaths}$

- **Life-years lost by attributable deaths**

- Sum over age-groups of age-specific remaining life expectancy -> 'YOLL'

Burden calculation procedures (2)

- **Future scenario year**
 - No population and mortality data
 - Presumably lower pollution => lower mortality
 - Modelled pollutant concentration(s)
 - Annual, population-weighted: x'
- **Future attributable deaths**
 - New relative risk $RR'(x') = UR(u)^{x'/u}$
 - Estimate new attributable deaths by scaling on **excess risk**
 - $AD' = AD * (RR'-1) / (RR-1) \approx x'/x$
 - **Life-years lost by attributable deaths**
 - As before, but for AD' : $YOLL'$
 - **$\Delta AD = AD - AD'$; $\Delta YOLL = YOLL - YOLL'$**

HIA: Burdens (attributable deaths) for three pollutants, London



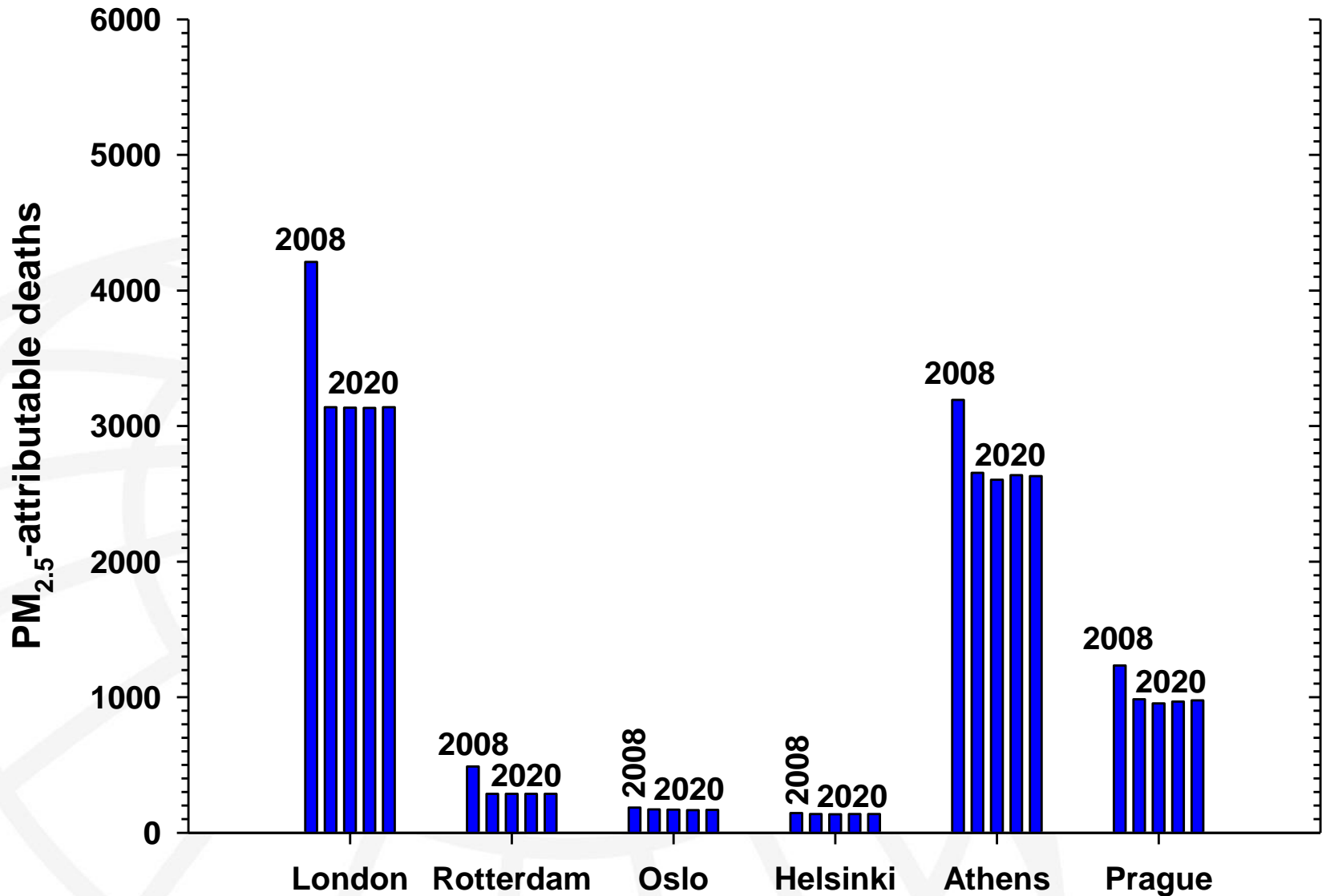
Scenario	PM2.5	Attr Deaths	EC	Attr Deaths	PNC	Attr Deaths
2008	15.40	4,212	2.020	5,451	9,441	1,369
2020 Agreed Measures	11.60	3,139	0.578	1,495	5,558	801
Difference from 2008	3.79	1,072	1.442	3957	3,883	568
2020+measure: 50% electric	11.59	3,136	0.570	1,475	5,531	797
Difference from 2020 AM	0.01	3	0.008	20	27	4
2020+measure: Low Emn Zone	11.59	3,134	0.568	1,467	5,462	787
Difference from 2020 AM	0.02	5	0.010	27	97	14
2020+measure: 10% less traffic	11.60	3,138	0.576	1,489	5,539	798
Difference from 2020 AM	0.00	1	0.002	5	19	3

HIA: Burdens (attributable life-years) for three pollutants, London

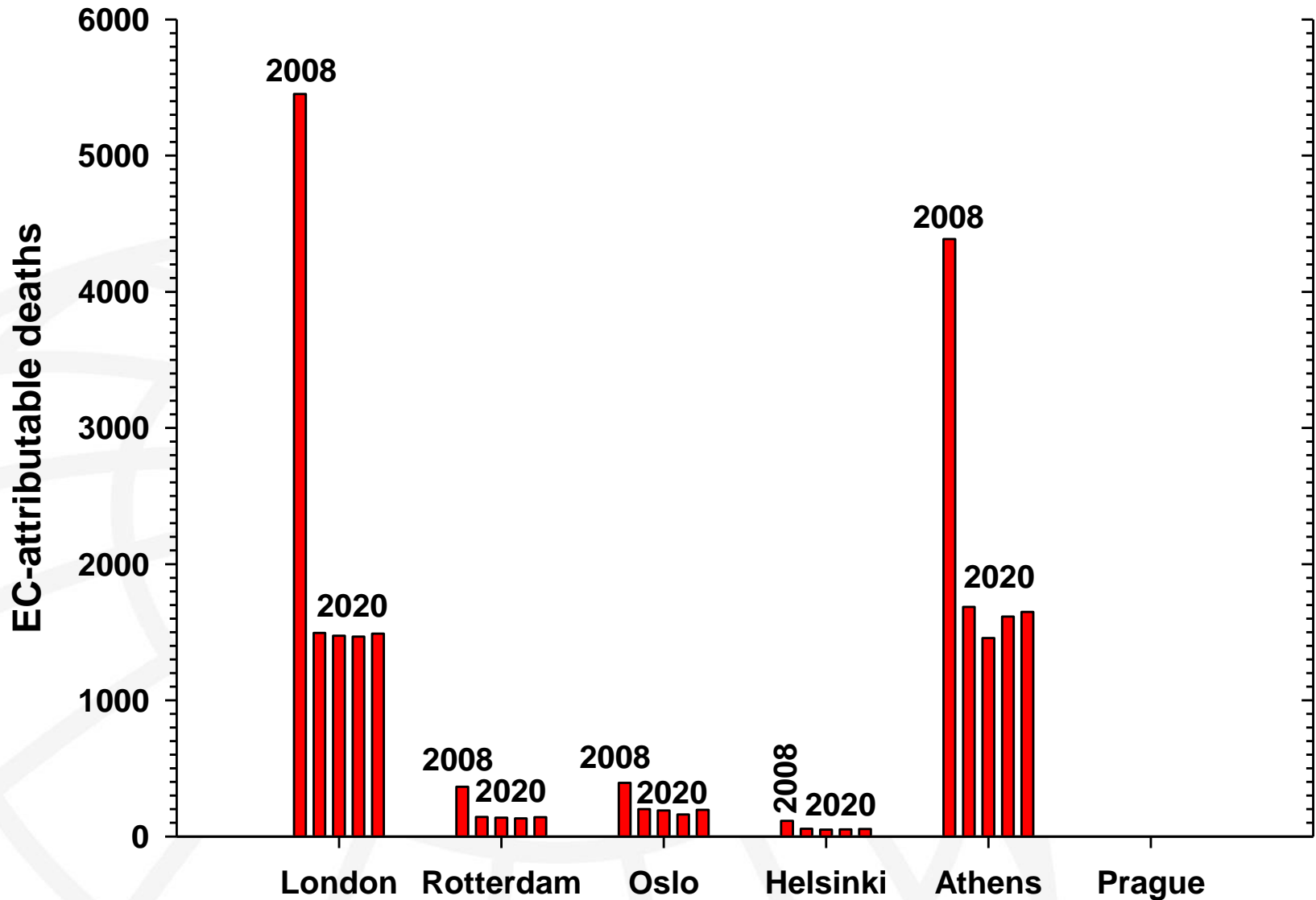


Scenario	PM2.5	Attr Life- years	EC	Attr Life- years	PNC	Attr Life- years
2008	15.40	48,245	2.020	62,447	9,441	15,679
2020 Agreed Measures	11.60	35,961	0.578	17,122	5,558	9,177
Difference from 2008	3.79	12,284	1.442	45,325	3,883	6,503
2020+measure: 50% electric	11.59	35,927	0.570	16,894	5,531	9,132
Difference from 2020 AM	0.01	34	0.008	228	27	45
2020+measure: Low Emn Zone	11.59	35,904	0.568	16,810	5,462	9,016
Difference from 2020 AM	0.02	56	0.010	312	97	161
2020+measure: 10% less traffic	11.60	35,949	0.576	17,060	5,539	9,145
Difference from 2020 AM	0.00	11	0.002	62	19	32

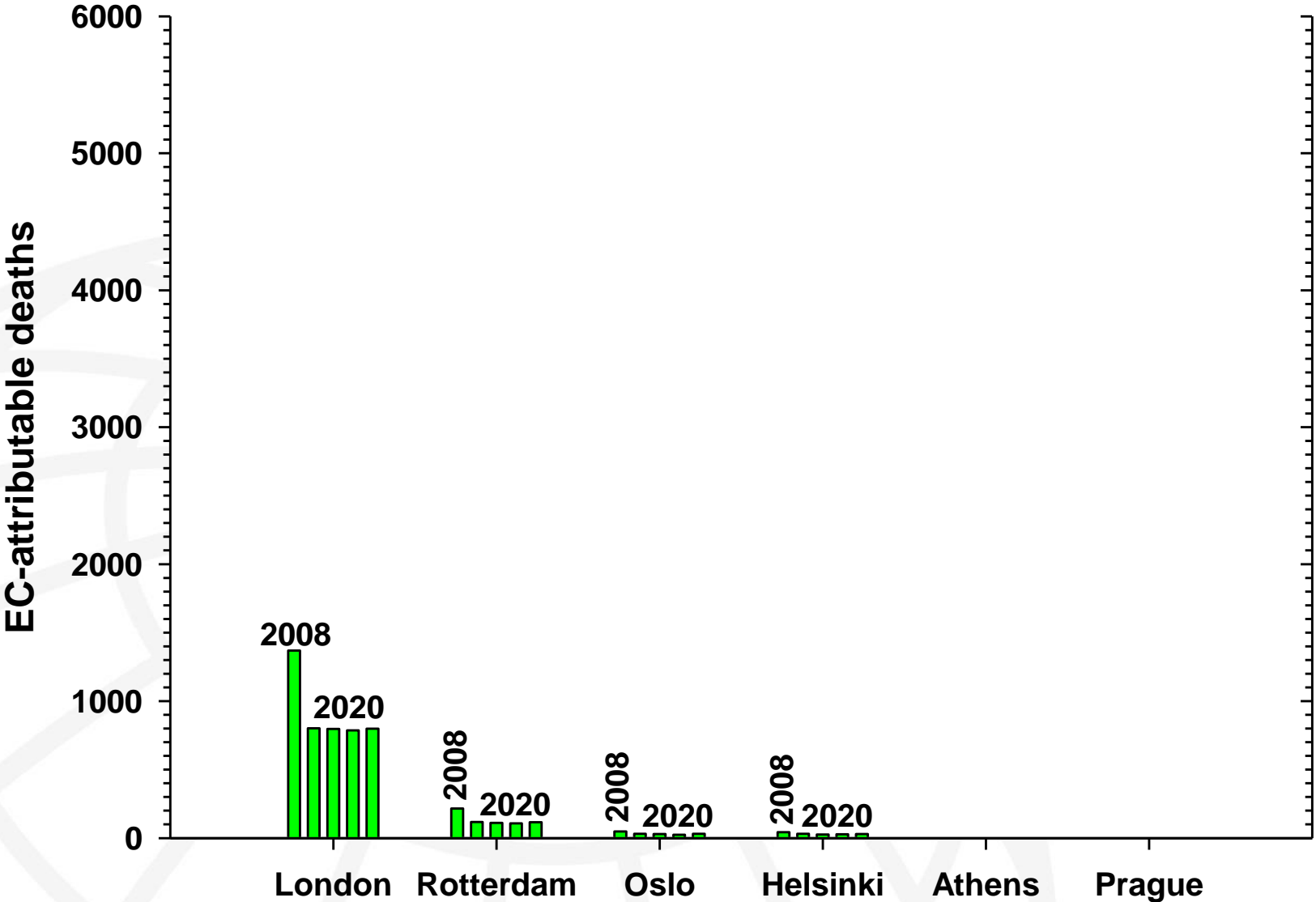
Deaths attributable to PM_{2.5}



Deaths attributable to EC



Deaths attributable to PNC



Further refinements

- Investigate differential risks?
 - E.g. nearer trunk roads, motorways
 - Few people live near motorways
 - => **Little effect on average concentration**
 - => **Little effect on estimated impact**
- Morbidity outcomes need to be included
- Review of coefficients e.g.
 - Escape
 - **HRAPIE**
- Source apportionment
 - For differential risk coefficients

Main messages

- **The measures already agreed, if implemented fully, are predicted to give a large benefit in reduced mortality**
 - **It's therefore important to implement them**
- **Some cities will continue to have problems under current predictions**
- **The additional measures considered (electrics, LEZ, traffic reduction) would provide only a small additional mortality benefit**
 - **(although they may provide other benefits)**

Thank you



Burdens and lags



- Model produces **annual** average concentration
- Burden gives amounts **for one year** (BL, future)
 - Attributable deaths
 - Attributable YOLL
- **How do we interpret with assumption of lagged effects?**
 - COMEAP (2010) : burden in 1 year caused by concentration **(implied)** constant over previous years
 - TRANSPHORM is modelling annual concentrations for target years
 - Can interpret/ envisage total burden as effects in current and future years, distributed as per EPA lags
 - Only slightly affected by economic discount (CBA)
 - TRANSPHORM not doing CBA, only HIA

Annualisation and the 'pulse'



- TR models produce **annual** average concentration
- Burden gives amounts **for one year** (BL, future in TRANSPHORM)
 - Comparisons between years or future scenarios
- HEIMTSA used life-table calculations (with lag) to predict the impact of a **1-year change in pollution**
 - (to compare with annualised costs)
- Both are looking at the effects of a **single year's difference in concentration -> change in hazard**

Annualisation and the 'pulse'



- TR models produces **annual** average concentration
- Burden gives amounts **for one year** (BL, future in TRANSPHORM)
 - Comparisons between years or future scenarios
- HEIMTSA used life-table calculations (with lag) to predict the impact of a **1-year change in pollution**
 - (to compare with annualised costs)
- Both are looking at the effects of a **single year's difference in concentration**
- Both produce **very similar** impact estimates
 - Difference/ attributable deaths
 - (Attributable) years of life lost
- Burden and 'pulse' approaches are **functionally equivalent**