Health Impact Assessment following HRAPIE

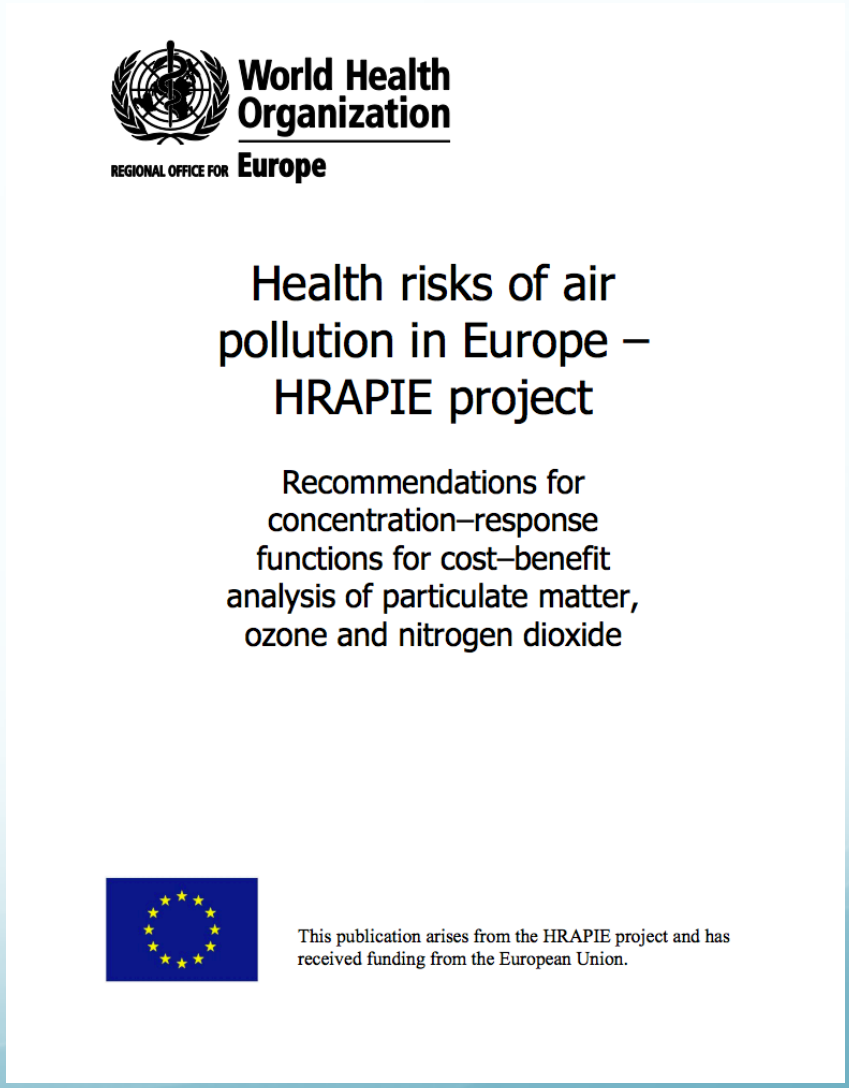
Mike Holland, EMRC
mike.holland@emrc.co.uk

TFIAM, Helsinki, May 2014

HRAPIE

- Health Risks of Air Pollution in Europe
- Led by WHO-Europe
- Informed analysis of the review of the Thematic Strategy on Air Pollution and the Clean Air Policy Package

- http://www.euro.who.int/__data/assets/pdf_file/0006/238956/Health-risks-of-air-pollution-in-Europe-HRAPIE-project,-Recommendations-for-concentrationresponse-functions-for-costbenefit-analysis-of-particulate-matter,-ozone-and-nitrogen-dioxide.pdf?ua=1



This presentation

- Reports on use of the HRAPIE recommendations for the CBA of the Clean Air Policy Package within the APHA-Riskpoll model
- Considers outstanding questions
- Looks at possible additions to the analysis

What has not changed ?

- Mortality functions for chronic PM and acute ozone
  - Effects used in health optimisation by IIASA
- Valuations for mortality
- No threshold for $PM_{2.5}$
- Use of SOMO35 for ozone
- Non-inclusion of chronic ozone impacts

- Collectively, these assumptions dominate the health impact assessment for the CBA

Why no change for these effects ?

- Mortality response functions: New epidemiology studies largely confirm the old studies
- New valuations for mortality
  - Suggestion that new valuations would increase damage estimates, but Commission's position is unchanged since CAFE
- No threshold for $PM_{2.5}$
  - Crouse (2012) study from Canada and others
- Some new insights on ozone cut-point
  - Suggestion to use SOMO10 as well as SOMO35
  - But no data on SOMO10
- Collectively, these assumptions dominate the health impact assessment for the CBA

What has changed in HRAPIE?

- Update of morbidity functions
  - Some effects added
    - Bronchitis in children (PM), cardiac hospital admissions (ozone)…
  - Some effects no longer included
    - Respiratory medication use, upper and lower respiratory symptoms…
  - Some effects included with expanded scope
    - RADs, mRADs applied to all ages
- Inclusion of functions for NO_2
  - Mortality (acute and chronic)
  - Morbidity (respiratory hospital admissions, bronchitis)

NO_2 functions

- Mortality
  - Acute with no threshold
  - Chronic with 20ug.m^{-3} threshold annual mean
- Morbidity
  - Respiratory hospital admissions (no threshold)
  - Bronchitis in children

- Are we describing exposure in a way that matches with the epidemiology studies ?
- Should same threshold apply to all effects ?
- Addition across pollutants ?

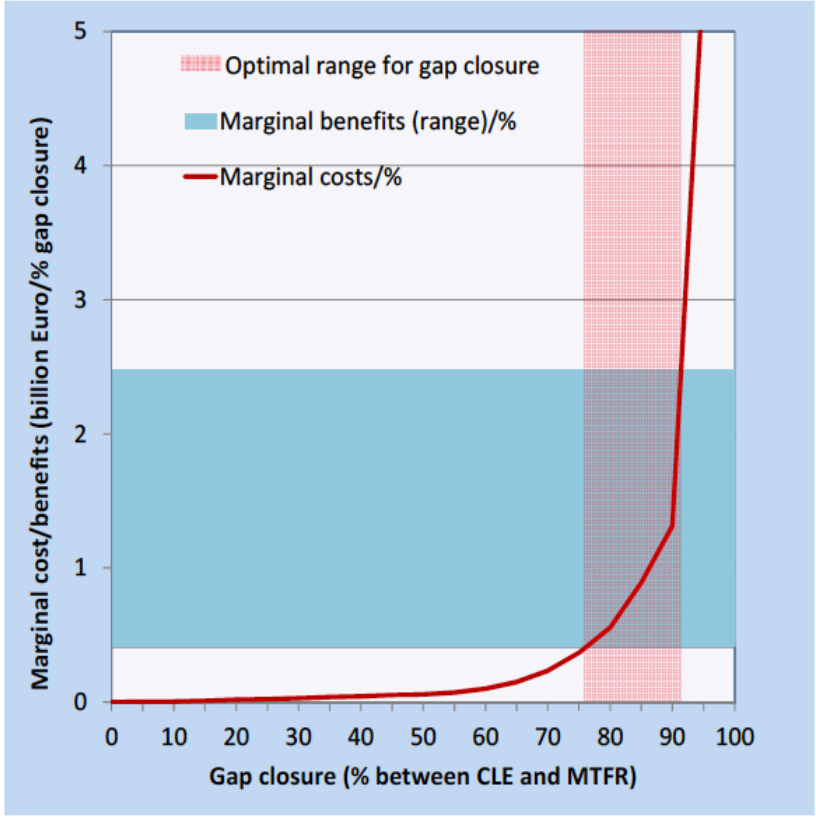
Effect of changes on outcome of the EU Clean Air Policy Package

- Reduction in health damage by 5% for effects included in the analysis (vs CAFE) for most conservative position (median VOLY)
- Very little effect on outcomes (next slide)
- However:
  - Excludes some HRAPIE recommendations
    - NO_2 effects
    - Use of SOMO10 metric (sensitivity ?)

- CBA report available at:
- http://ec.europa.eu/environment/air/pdf/review/TSAP%20CBA%20corresponding%20to%20IIASA11%20v2.pdf

Process for identifying ambition level

- Shows marginal cost and benefit in Euro per % gap closure
- Range for marginal benefits considered only mortality
- Linear, no threshold position leads to constant marginal benefits
- Range shows effect of alternative assumptions on mortality valuation



EU Clean Air Policy Package scenarios

- Mapping scenarios to gap closure

Table 1. Policy scenarios considered in this report for 2025 and 2030.

			Gap closure		
Year	**Scenario**	**IA Option Label**	**Mortality**	**Ozone**	**Eutrophication**
2025	CLE	1	0%		
2025	B1	6A	25%		
2025	B2	6B	50%		
2025	B6		70%		
2025	B3	6C	75%		
2025	B4	6C*	75%	46%	80%
2025	MTFR	6D	100%		
2030	CLE		0%		
2030	B7	Commission proposal	67%		
2030	MTFR		100%		

CBA CAPP results for 2025

Table 2. Net health benefits of the scenarios for 2025, €M/year - EU28.

Net benefits, EU28	CLE - B1	B1 - B2	B2 - B6	B6 - B3	B3 - B4	B4 - MTFR
Costs	222	979	2,138	1,289	51	42,327
Net benefits						
Total with median VOLY	14,176	13,344	9,482	1,609	-42	-27,579
Total with mean VOLY	28,987	28,056	21,444	4,559	-35	-12,638
Total with median VSL	25,864	25,513	18,794	4,044	-58	-15,907
Total with mean VSL	48,994	49,070	37,340	8,762	-72	7,277

CBA CAPP results for 2030

Table 3. Net health benefits of the scenarios for 2030, €M/year - EU28.

Net benefits, EU28	CLE - B7	B7 - MTFR
Costs	3,334	47,347
Net benefits		
Total with median VOLY	35,140	-28,063
Total with mean VOLY	74,437	-8,606
Total with median VSL	70,012	-11,059
Total with mean VSL	135,371	21,002

Relative magnitude of mortality and morbidity effects

Table 1. Benefits from moving from the CLE to the MTFR scenario, EU28, €million/year, 2005 prices.

Endpoint	CLE – MTFR, 2025	CLE – MTFR, 2030
Particulate matter		
Chronic Mortality (All ages) median VOLY	42,605	41,623
Infant Mortality (0-1yr) median VSL	198	185
Morbidity	16,187	16,388
Ozone		
Acute Mortality (All ages) median VOLY	161	160
Morbidity	595	599
Total health benefits		
Mortality only (median VOLY, median VSL for infant mortality)	42,424	41,968
Mortality and morbidity (median VOLY, median VSL for infant mortality)	57,996	57,759
Range	57,966 – 198,377	57,759 – 207,054

Different outputs

- Total health damage
- Healthcare costs
- Direct costs to employers of lost work days

Valuation of healthcare costs

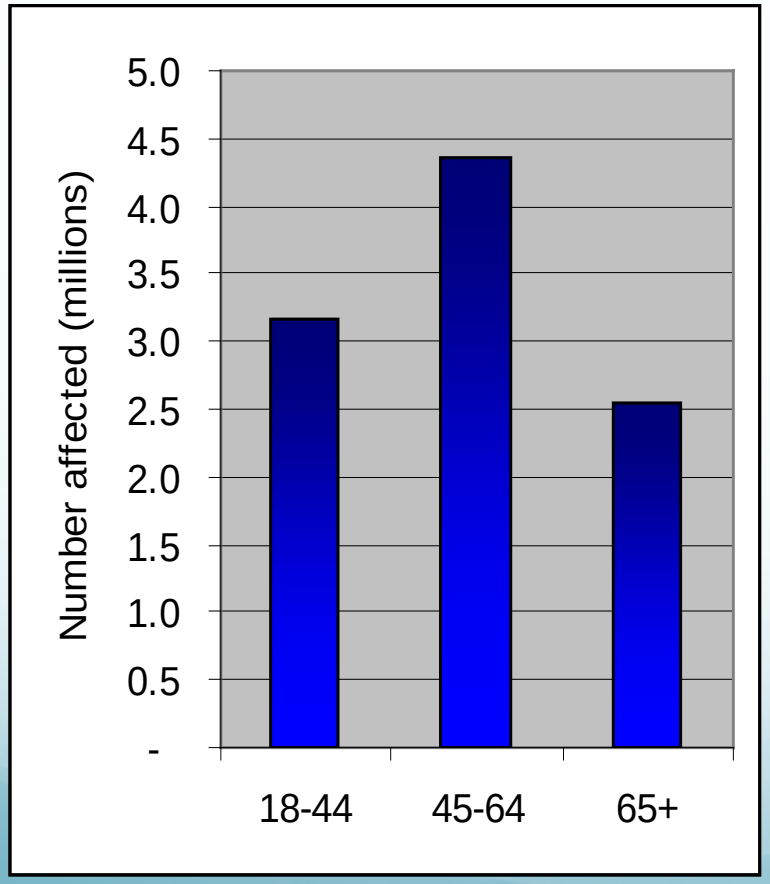
- Reviewed all effects
- Excluded those without additional healthcare costs
  - Mortality
  - (minor) restricted activity days
- Factored in healthcare costs from WHO and various studies from recent literature
- Dominated by effects of chronic bronchitis

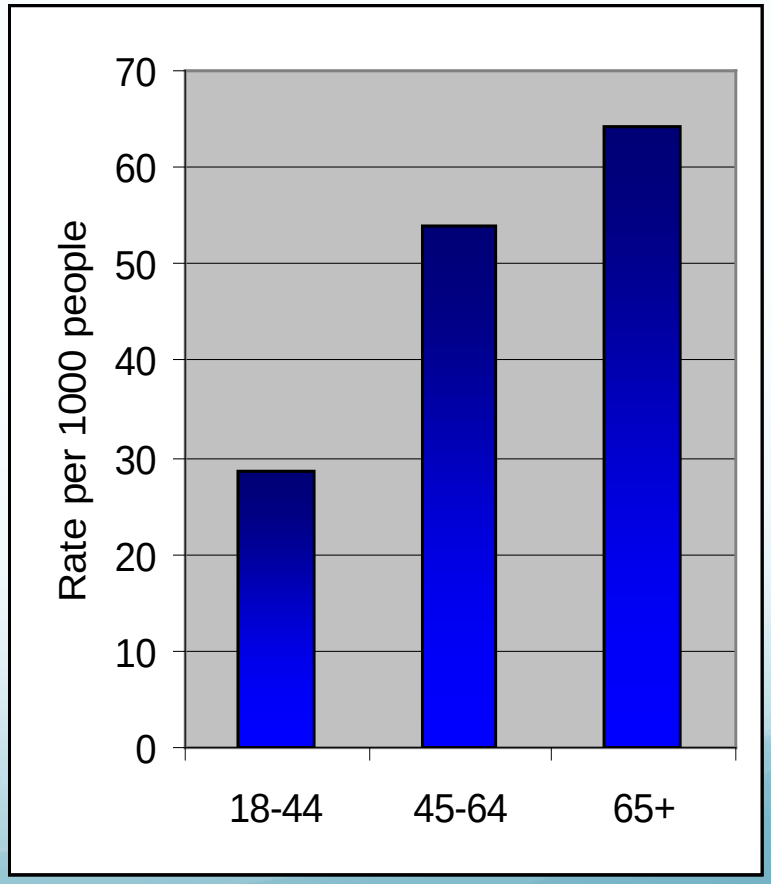
Valuation of healthcare costs

IMPACTS		CLE	B7	MTFR
Respiratory hospital admissions (>64)	O_3	17	16	14
Cardiovascular hospital admissions (>64)	O_3	20	19	17
Chronic Bronchitis (adults)	PM	2,679	2,171	1,922
Bronchitis in children aged 6 to 12	PM	33	27	24
Respiratory Hospital Admissions (All ages)	PM	101	82	72
Cardiac Hospital Admissions (>18 years)	PM	77	63	55
Asthma symptom days (children 5-19yr)	PM	8	6	6
Effects assumed to have negligible healthcare costs	Acute mortality (NO_2, O_3) Minor restricted activity days (O_3)			
Unquantified effects that ***may*** have significant healthcare costs	Chronic morbidity (in addition to chronic bronchitis) (NO_2, O_3 and $PM_{2.5}$) Infant morbidity ($PM_{2.5}$) Restricted activity days ($PM_{2.5}$) Child bronchitis (NO_2) Respiratory hospital admissions (NO_2)			
Total where quantified		2,935	2,384	2,110

Chronic bronchitis – incidence and persistence

- American Lung Association data





Valuation of lost workdays

- Focus on direct costs to employers
- CBI survey on absenteeism
- Excluded effects
  - Presenteeism
  - Indirect costs
- Alternative approach: GDP/workday

Costs to employers of lost workdays, 2030 (€million)

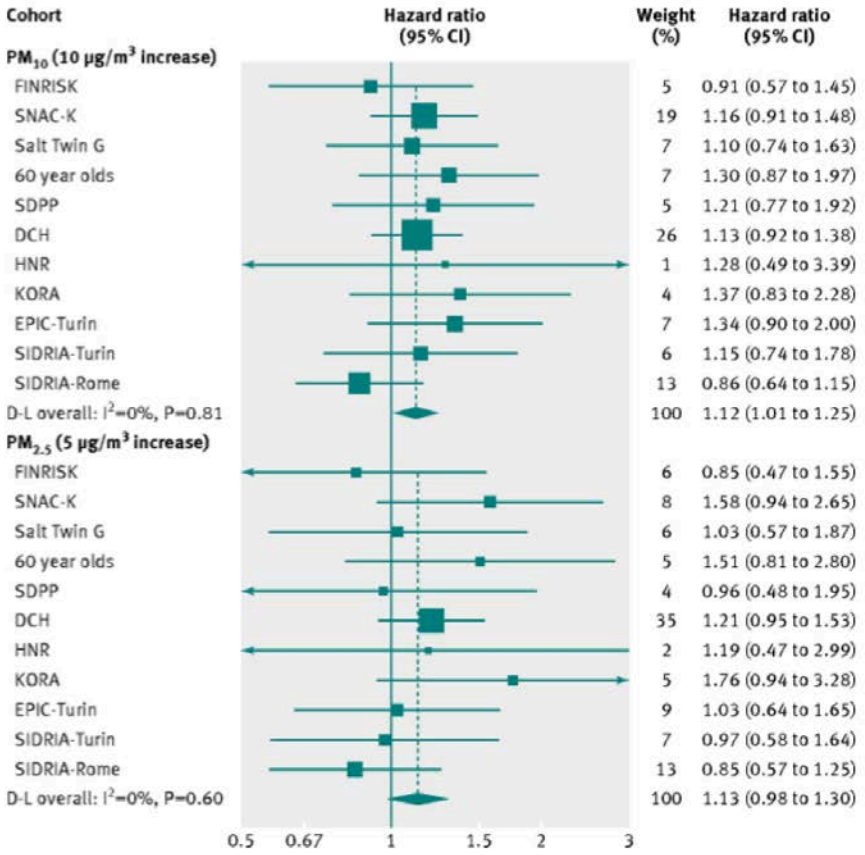
EU28 2030	CLE	B7	MTFR
Lost working days (million)	76	62	55
Value of lost working days	9,893	8,019	7,096

Omitted effects ?

- NO_2: all effects
- Ozone and chronic mortality
- NO_2 and ozone – issue of double counting for chronic mortality impacts ? Does the same apply to morbidity impacts ?
- Low birth weight (Dadvand et al, 2013) potentially linked to later productivity in the workforce (Isen et al, 2014)
- Changes in lung function
- Restriction of some impacts to a subset of the population
- Effects of other air pollutants
- Chronic effects on morbidity beyond those identified for quantification

Long term exposure to ambient air pollution and incidence of acute coronary events: prospective cohort study and meta-analysis in 11 European cohorts from the ESCAPE Project

Hazard ratios of incident coronary events per 10 µg/m3 PM10 and 5 µg/m3 PM2.5.



Cesaroni G et al. BMJ 2014;348:bmj.f7412

Long term exposure to ambient air pollution and incidence of acute coronary events: prospective cohort study and meta-analysis in 11 European cohorts from the ESCAPE Project

- Results 5157 participants experienced incident events. A 5 μg/m^3 increase in annual mean $PM_{2.5}$ associated with a 13% increased risk of coronary events, and a 10 μg/m^3 increase in annual mean PM_{10} associated with a 12% increased risk of coronary events.
- Positive associations detected below current annual European limit value of 25 μg/m^3 for $PM_{2.5}$ and below 40 μg/m^3 for PM_{10}. Positive but non-significant associations found with other pollutants.
- Conclusions Long term exposure to particulate matter is associated with incidence of coronary events, and this association persists at levels of exposure below the current European limit values.

Conclusions

- Quantified health damage little different in total between CAFE and Clean Air Policy Package
- Some potentially significant impacts omitted from the analysis
- Large healthcare costs
- Large costs of lost working days
- Potential for more effects to be added in