Health and Environment an unfinished agenda: challenges for research and action in the 21st century

Roberto Bertollini
Chief Scientist and WHO representative to the EU

Ambiente e Salute:
Verso la Valutazione dell'Esposizione
Terni, 18 Febbraio 2015

World Health Organization
REGIONAL OFFICE FOR Europe

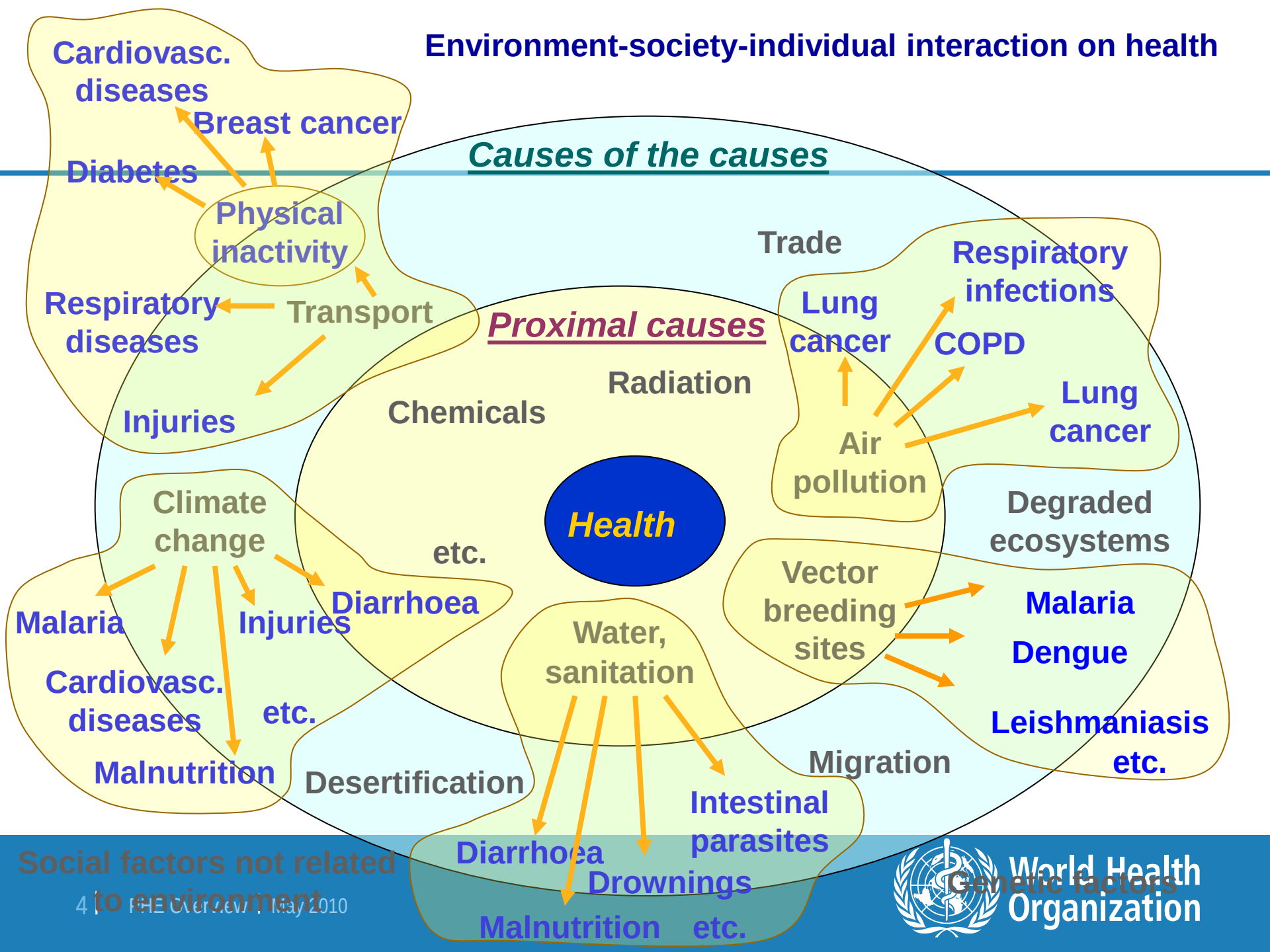
Outline

- Is the environment responsible for a significant proportion of ill-health?
- How did the environment and health situation evolved over the last decades?
- Is our knowledge improved over recent years?
- Which are the new environmental health challenges which the public health community has to face?
- Is there a vision and a strategy to move the public agenda forward?

Outline

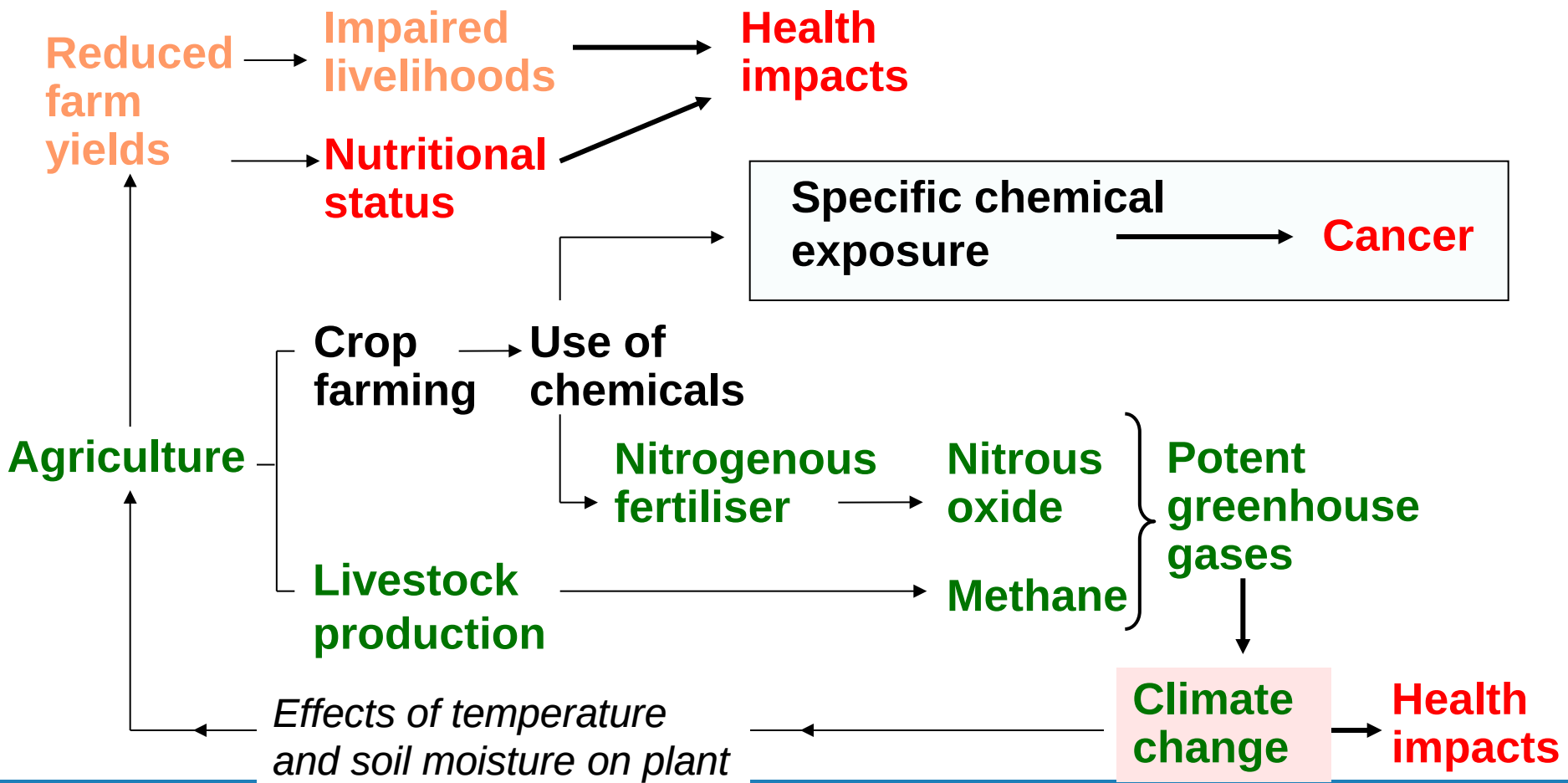
- Is the environment responsible for a significant proportion of ill-health?
- How did the environment and health situation evolved over the last decades?
- Is our knowledge improved over recent years?
- Which are the new environmental health challenges which the public health community has to face?
- Is there a vision and a strategy to move the public agenda forward?

Environment-society-individual interaction on health



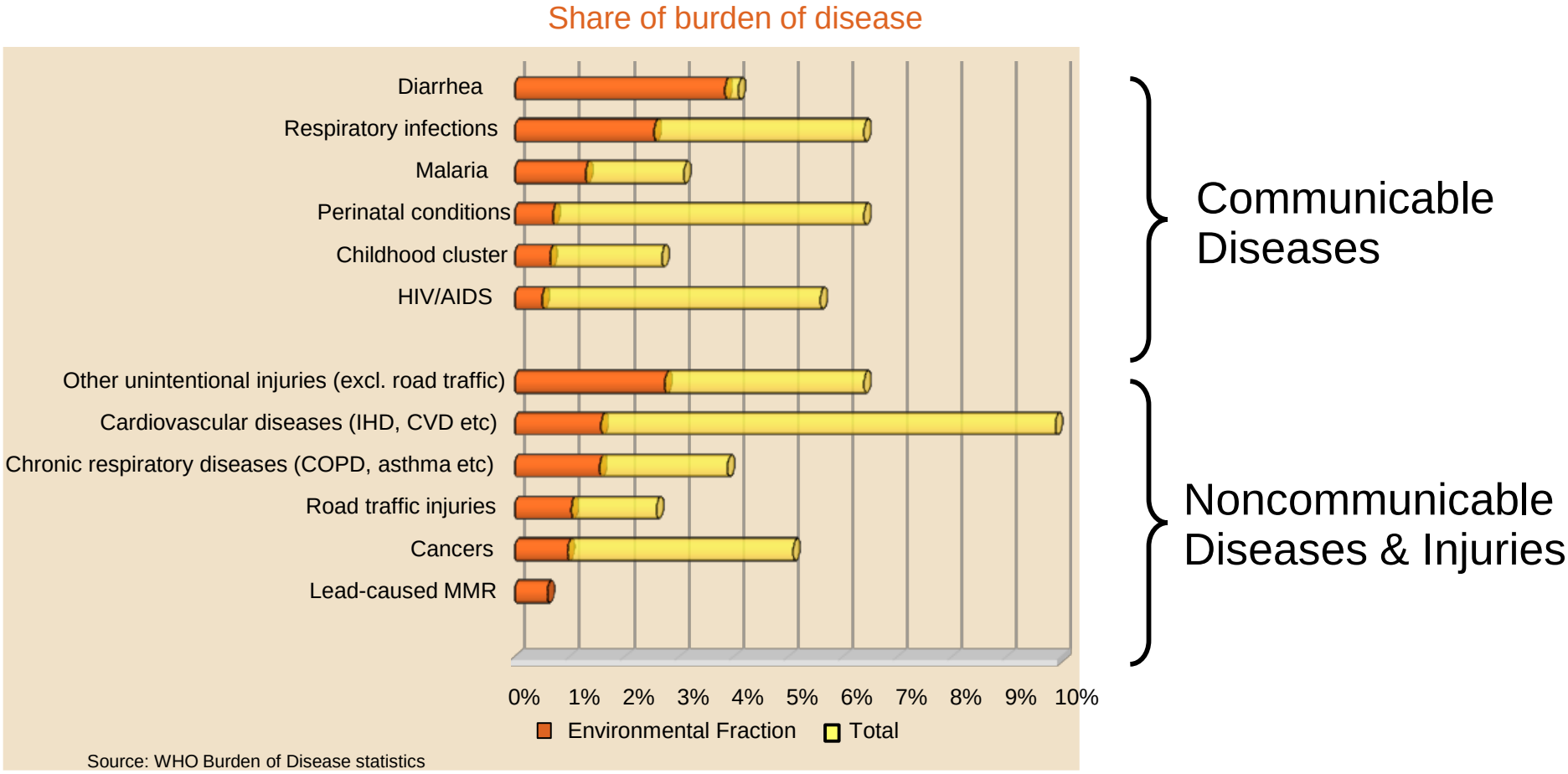
World Health Organization

"Environmental Health" Risks Widening our field of vision



World Health Organization

25% of disease could be prevented by modifying the environment

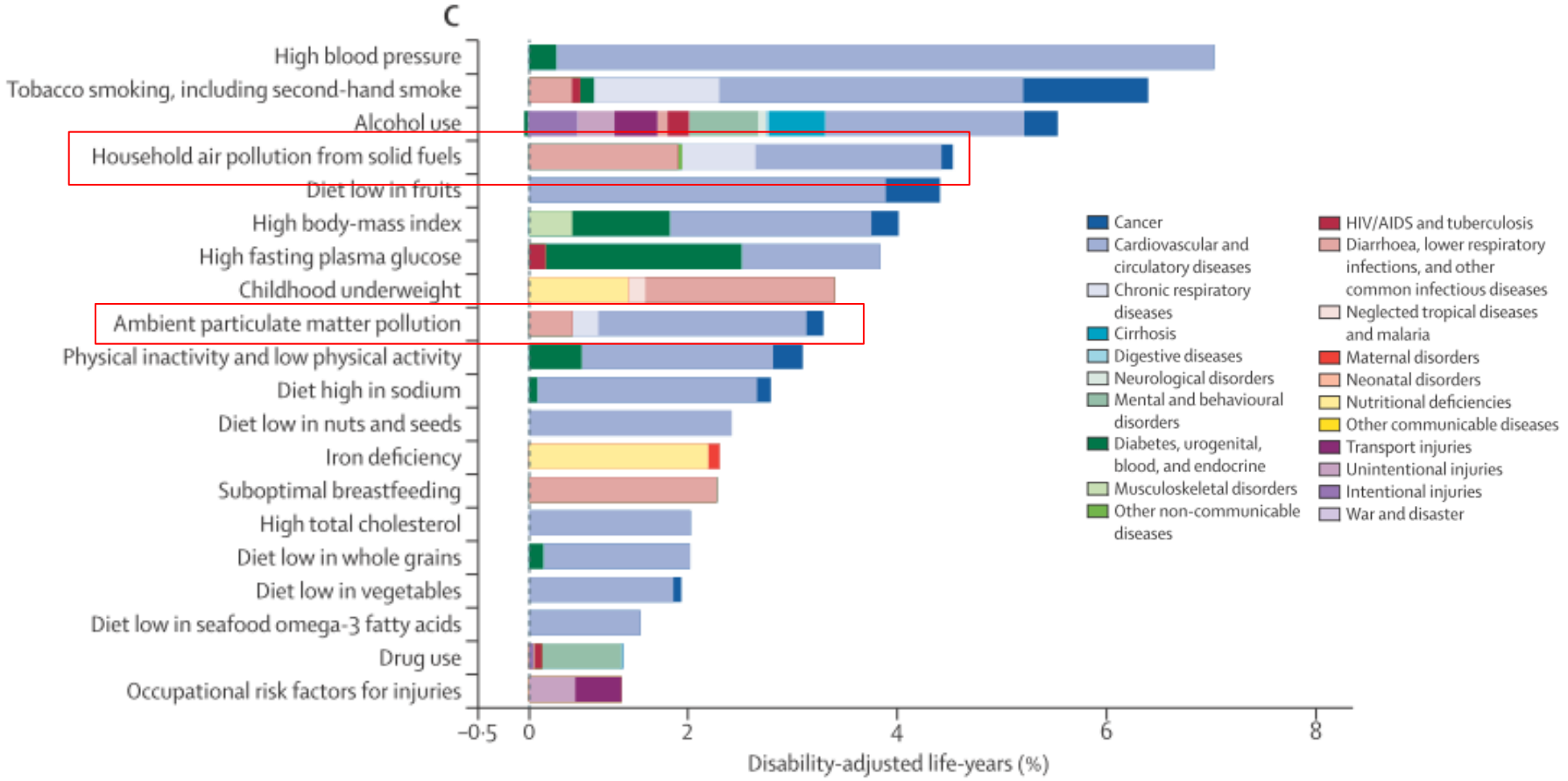


World Health Organization

What is the modifiable environment ?

- Pollution
- UV and ionizing radiation, noise, EMF
- Occupational risks
- Built environment, incl. housing, land use, roads
- Agricultural methods, irrigation schemes
- Man-made climate change, ecosystem change
- Related behaviour, e.g. hand-washing

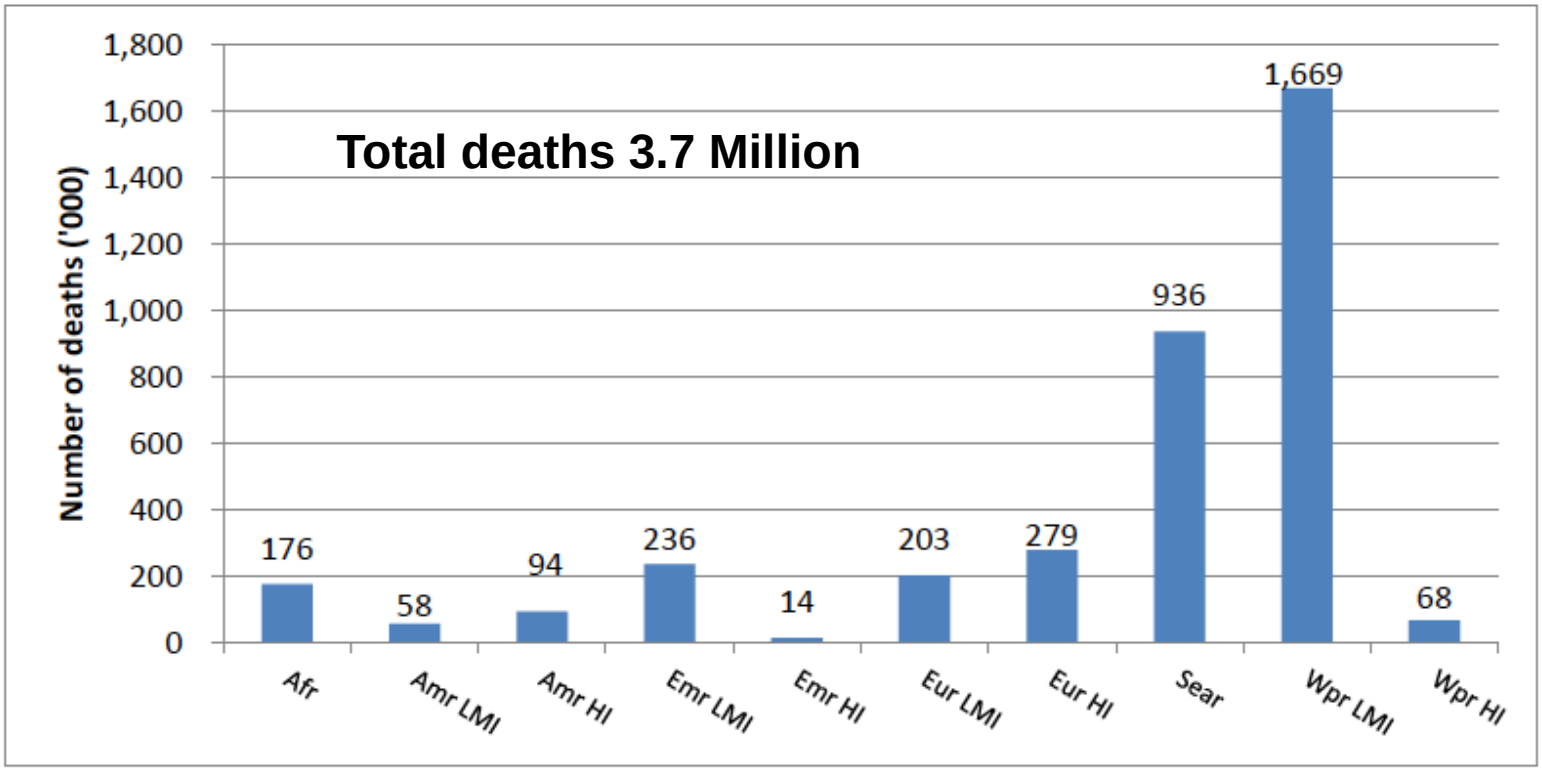
Air pollution is a leading risk factor for disease – the Global Burden of Disease project



Lim et al. LANCET (2012)

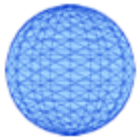
World Health Organization
REGIONAL OFFICE FOR Europe

Burden of Disease from Ambient Air Pollution, 2012



AAP: Ambient air pollution; Amr: America, Afr: Africa; Emr: Eastern Mediterranean, Sear: South-East Asia, Wpr: Western Pacific; LMI: Low- and middle-income; HI: High-income.

Reviewing health impacts from chemicals at global population level



ENVIRONMENTAL HEALTH

Open Access

Knowns and unknowns on burden of disease due to chemicals: a systematic review

Environmental Health 2011, 10:9, Published: 21 January 2011

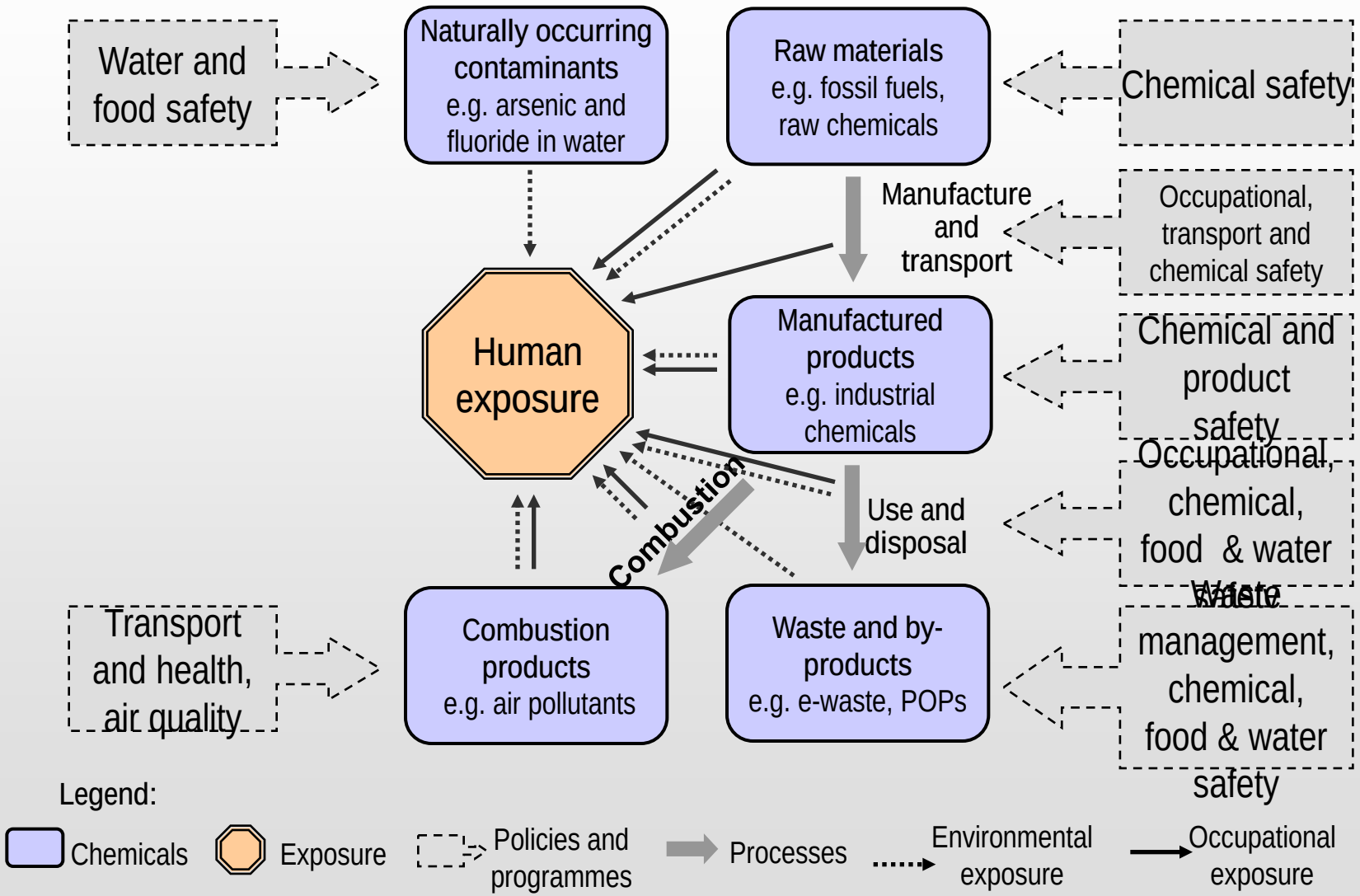
http://www.ehjournal.net/content/10/1/9

Combination of:

- Systematic review of available data on burden of disease from chemicals
- WHO database on disease burden from environmental risks

World Health Organization

Human exposure to chemicals throughout their life-cycle and selected programmes relevant to their prevention



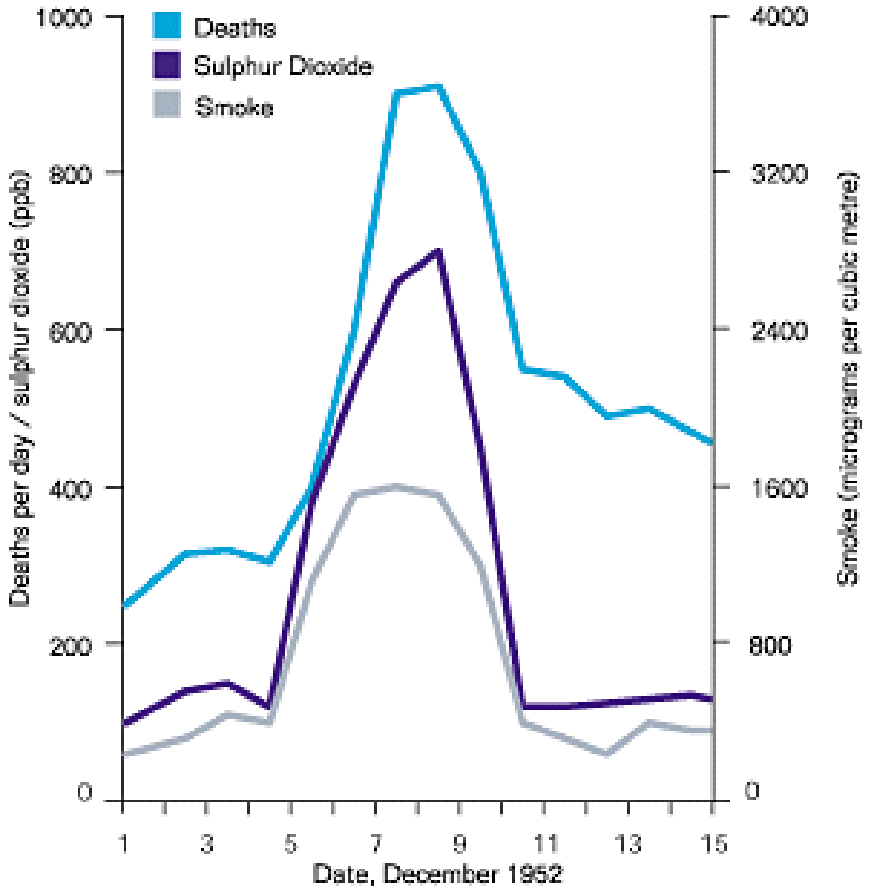
Results

- 2.0% of global deaths (1.7% of DALYs) from for industrial and agricultural chemicals, and accidental poisonings.
  - Comparable to all malaria cancers or all TB
- 8.3% of global deaths (5.7% of DALYs) when including also chemicals in air pollution and natural occurring chemicals.
  - More than all unintentional injuries
  - Total of 4.9 million deaths per year
  - 54% of disease burden (in DALYs) in children under 15 years
- The results underestimate the total burden from chemicals, as the burden from most chemicals has not yet been assessed.

Outline

- Is the environment responsible for a significant proportion of ill-health?
- How did the environment and health situation evolved over the last decades?
- Is our knowledge improved over recent years?
- Which are the new environmental health challenges which the public health community has to face?
- Is there a vision and a strategy to move the public agenda forward?

Smog in London, 1952



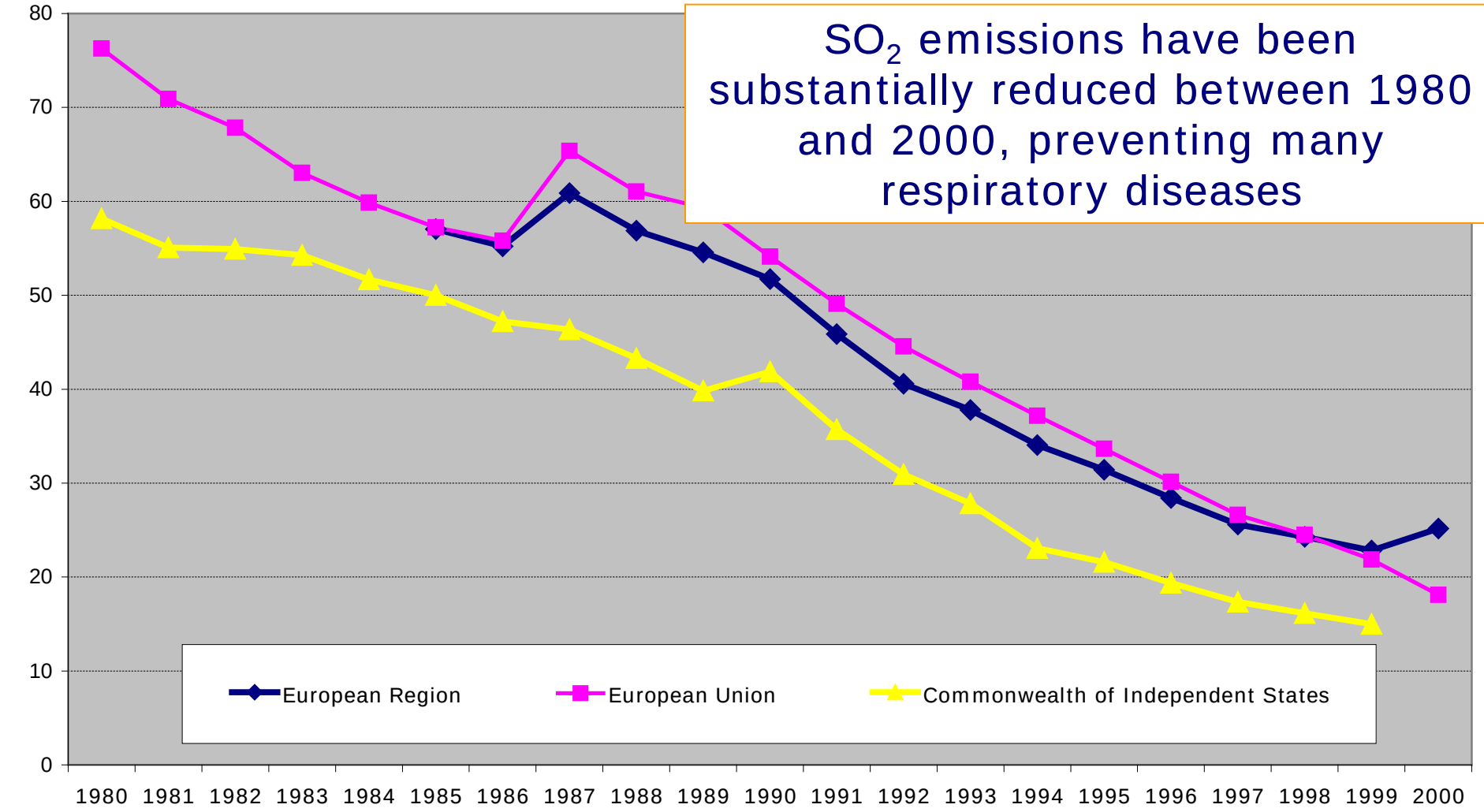
Beijing, January 15, 2015

15/1/2015 14:00; PM2.5 = 568.0 µg/m3 peak value, 430 µ/m3 daily average
Jason Samenow,
The Washington Post, 16/1/15

WHO Guidelines 10 µg/m3 annual average; 25 µg/m3 24 h average

Reduced exposures

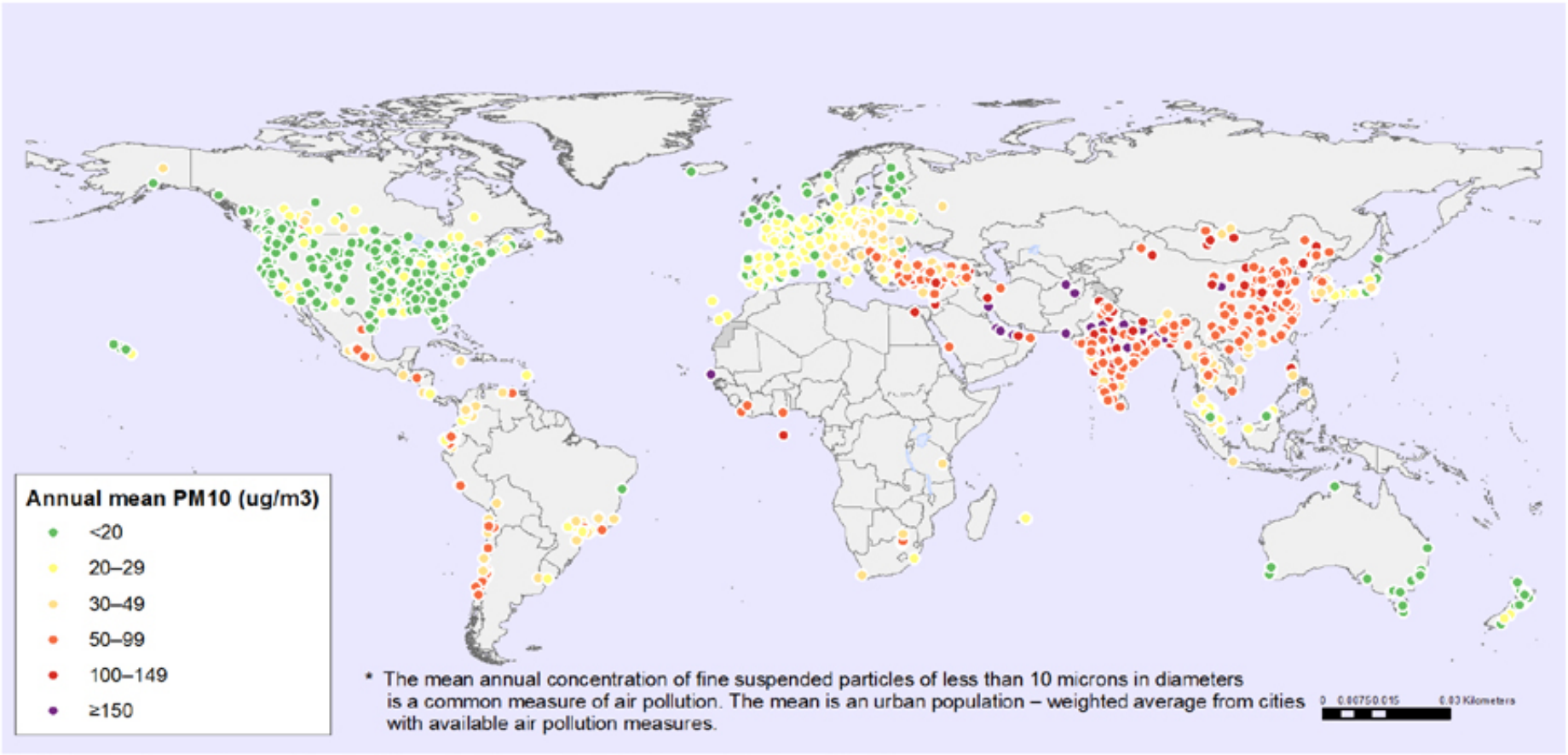
SO_2 emissions have been substantially reduced between 1980 and 2000, preventing many respiratory diseases



Sulphur dioxide emissions, kg per capita per year

WHO Health for All database

Exposure to particulate matter with an aerodynamic diameter of 10 µm or less (PM10) in 1600 urban areas*, 2008–2013

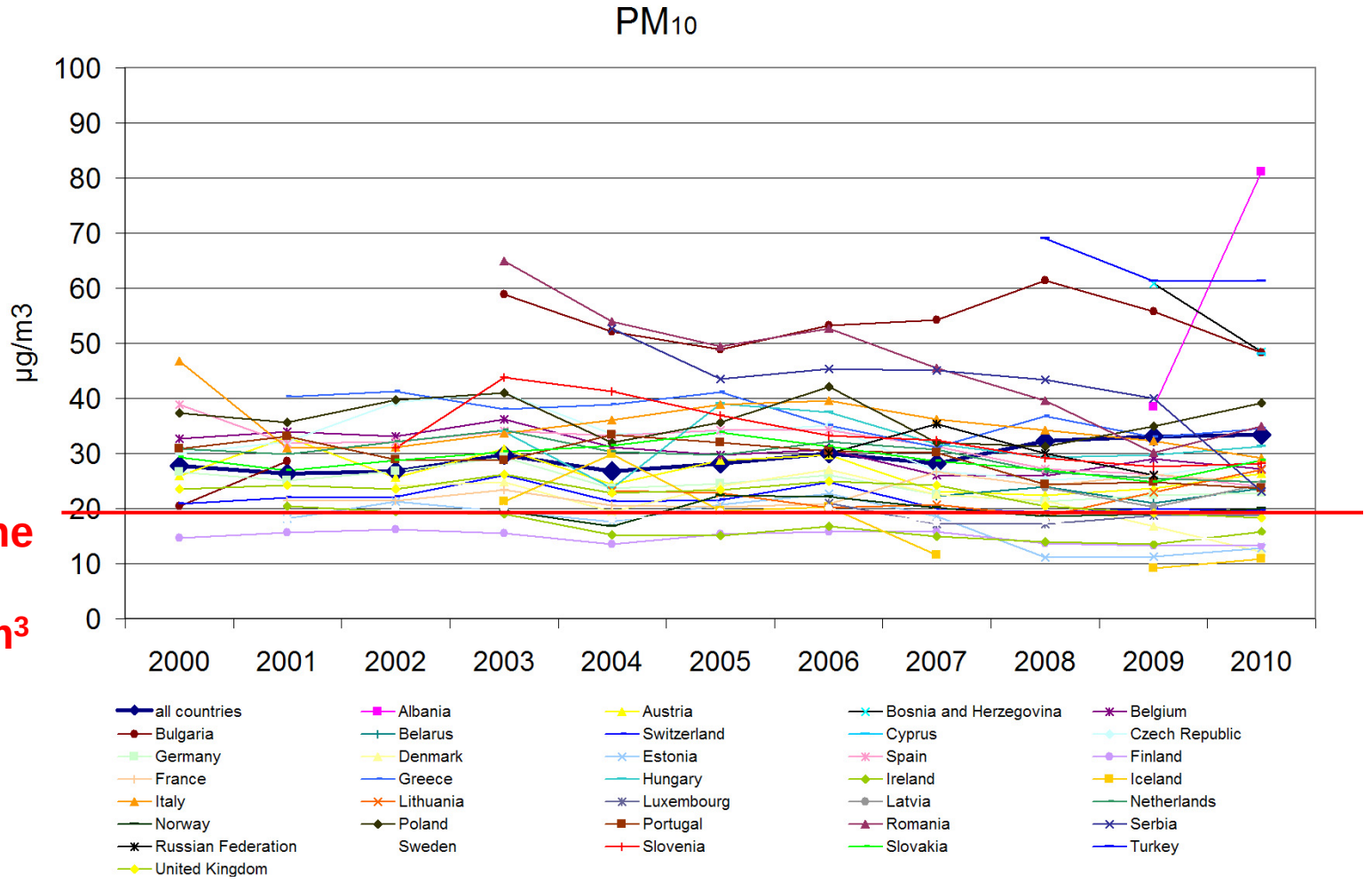


Data Source: World Health Organization
Map Production: Health Statistics and Information Systems (HSI)
World Health Organization

World Health Organization

Over the last decade, PM levels have remained overall stable and above WHO guidelines...

WHO Guideline = 20 µg/m³

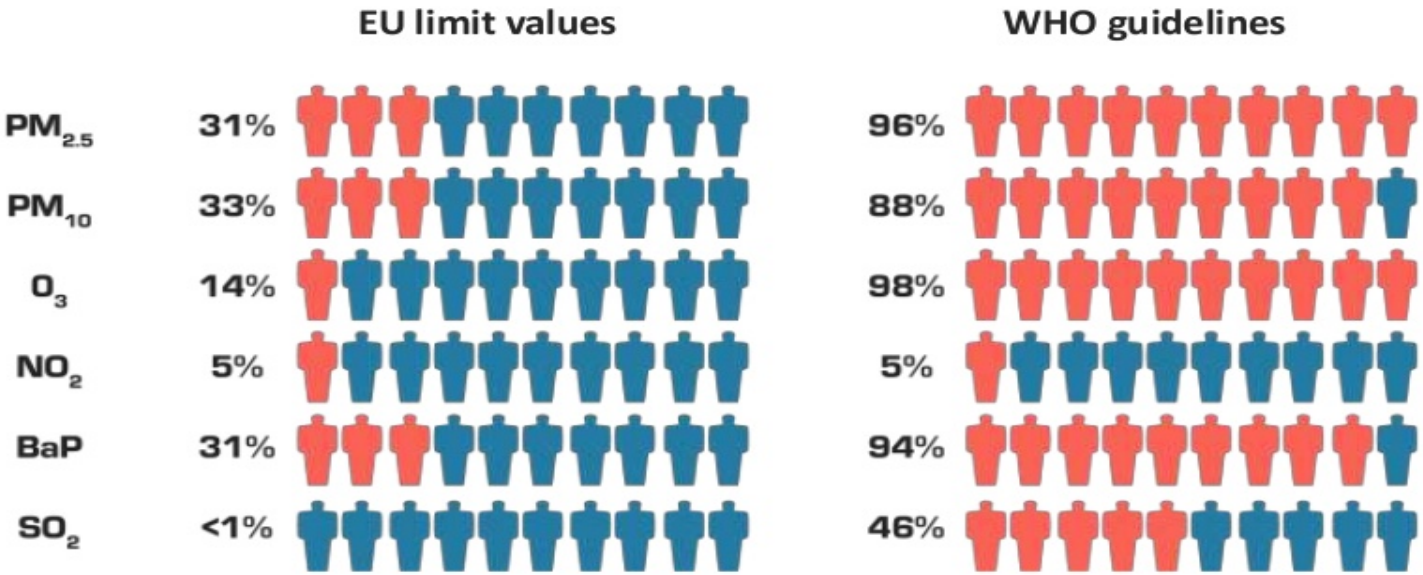


PM_{10} levels in European Region of WHO

Source: Airbase/EEA

Exposure to harmful levels of air pollution

EU urban population exposed to harmful levels of air pollution, according to:

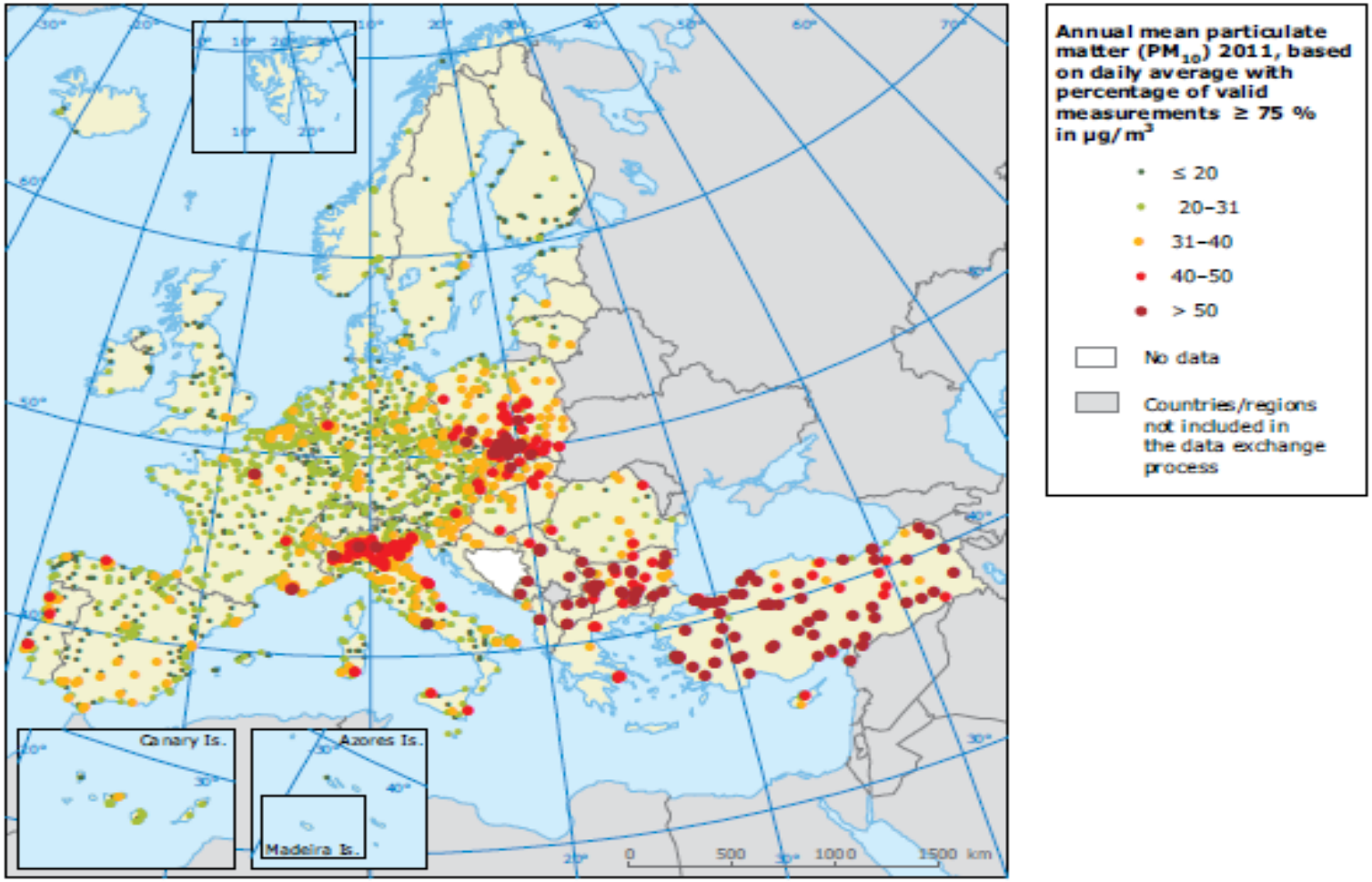


Up to a third of Europeans living in cities are exposed to air pollutant levels exceeding EU air quality standards. And around 90 % of Europeans living in cities are exposed to levels of air pollutants deemed damaging to health by the World Health Organization's more stringent guidelines.

European Environment Agency

World Health Organization
REGIONAL OFFICE FOR Europe

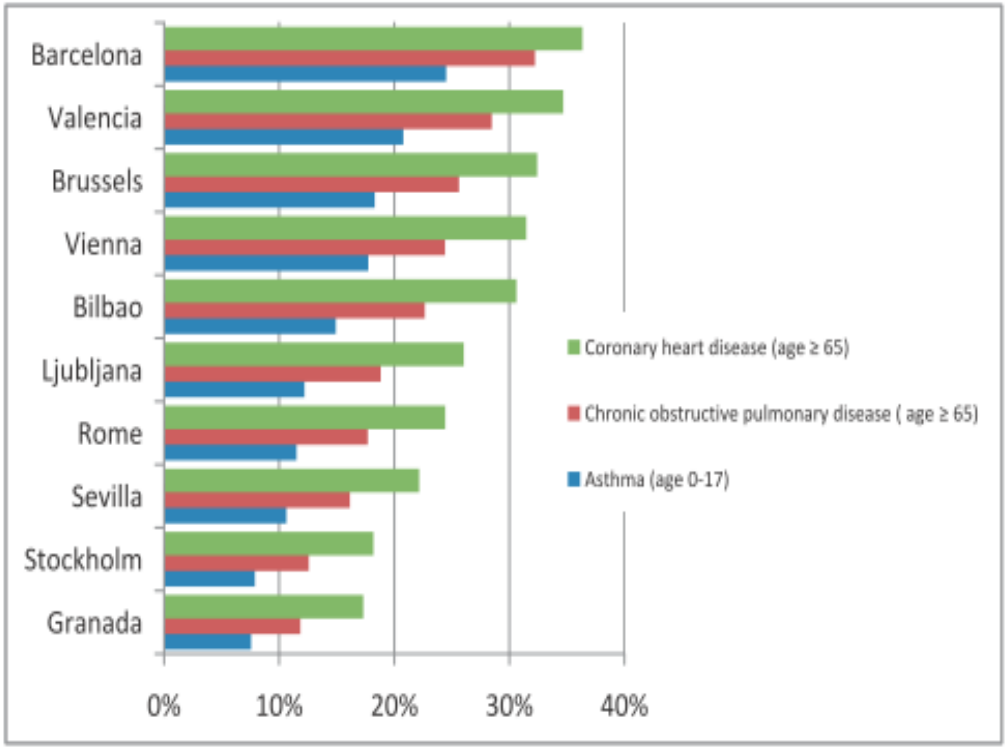
Annual mean concentration of PM10 in 2011



EEA, 2013

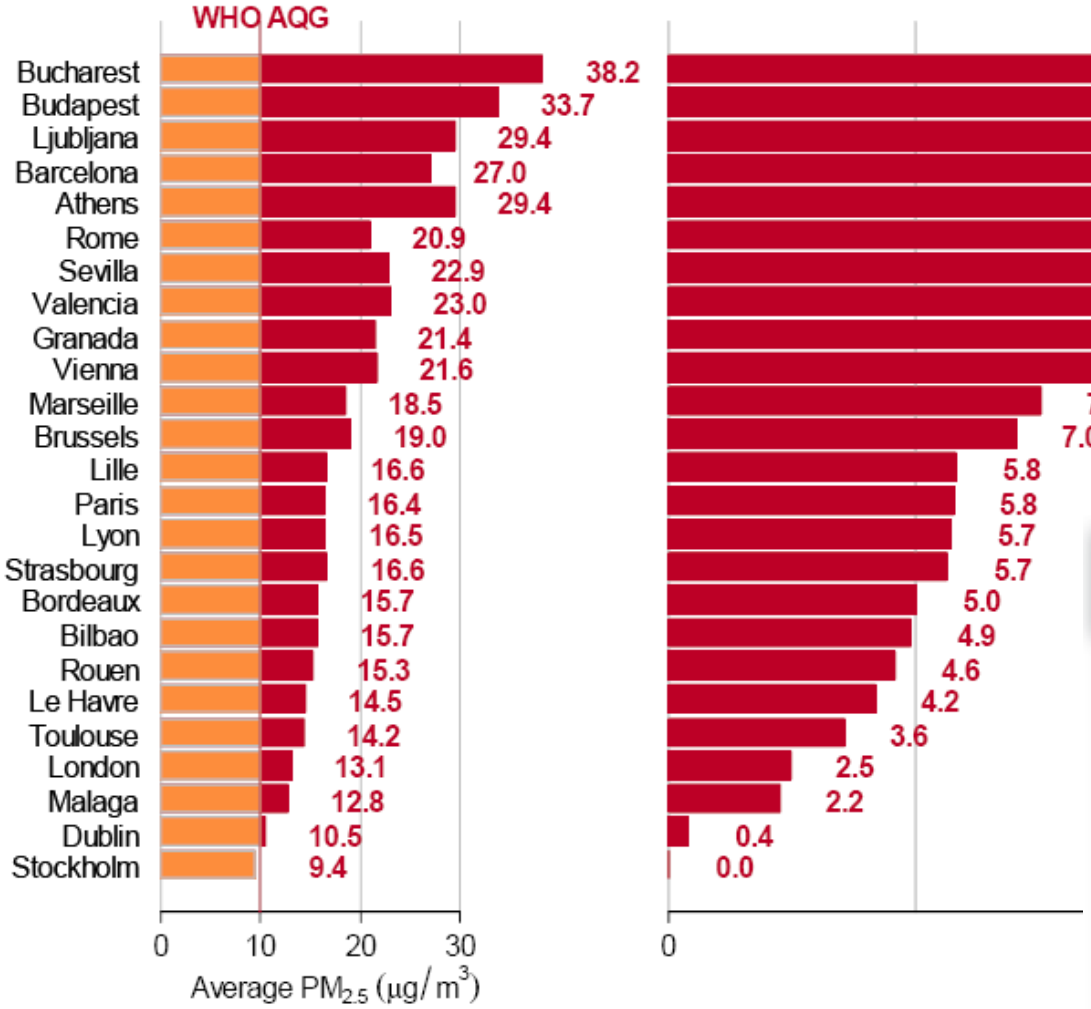
A significant fraction of NCDs is attributable to exposure to traffic-related air pollution

Percentage of population with chronic diseases whose disease could be attributed to living near busy streets and roads in 10 Aphekom cities



Source: APHEKOM

Gain in life expectancy (months) in 25 Aphekom cities for a decrease in $PM_{2.5}$ to WHO AQG (10 µg/m^3) (age 30+)



Key Aphekom numbers

Exceeding WHO Air Quality Guidelines on $PM_{2.5}$ in 25 European cities with 39 million inhabitants results annually in:

- 19,000 deaths
- 15,000 of them from cardiovascular diseases
- €31.5 billion in health and related costs

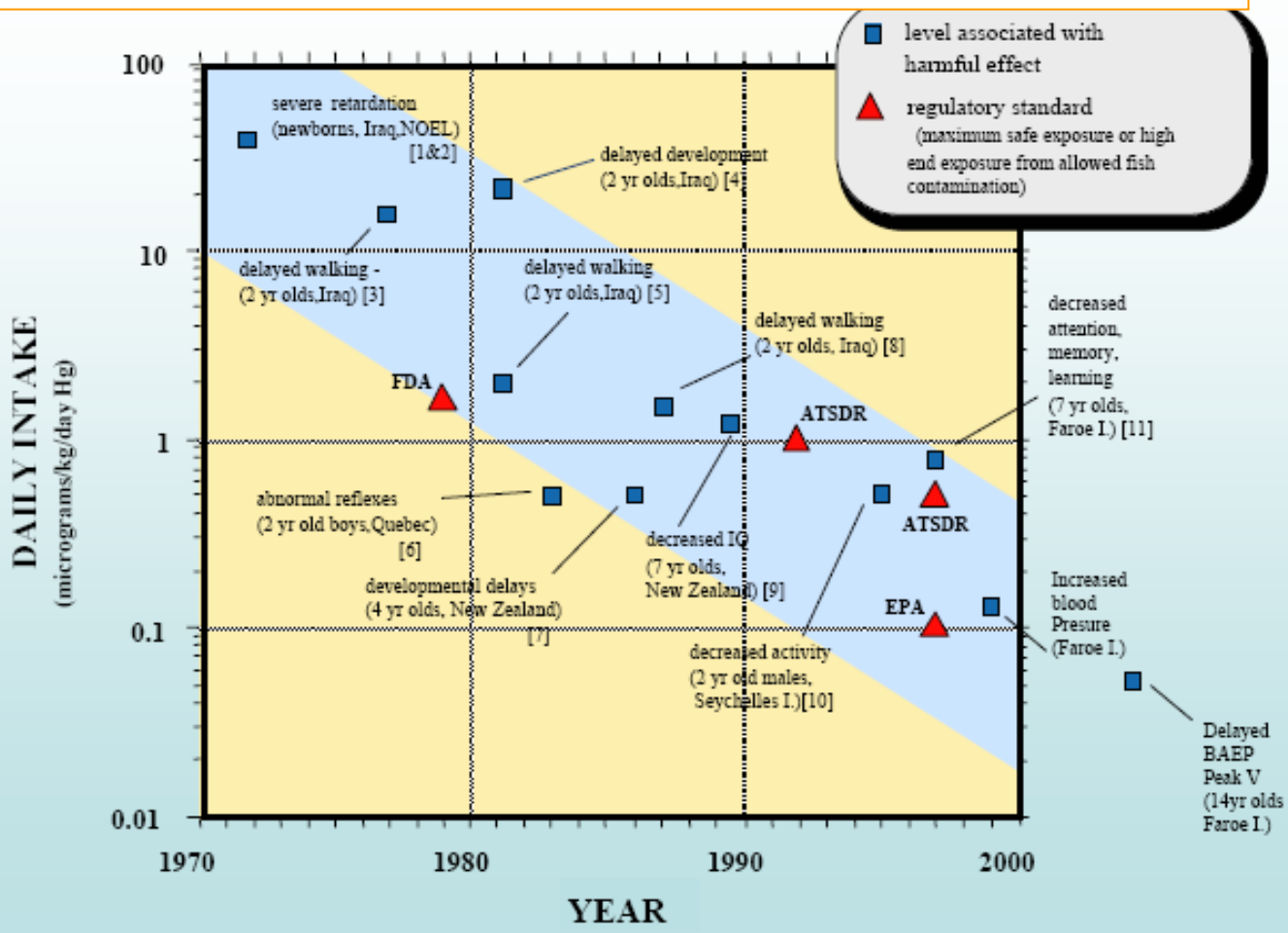
World Health Organization
REGIONAL OFFICE FOR Europe

Outline

- Is the environment responsible for a significant proportion of ill-health?
- How did the environment and health situation evolved over the last decades?
- Is our knowledge improved over recent years?
- Which are the new environmental health challenges which the public health community has to face?
- Is there a vision and a strategy to address these challenges and move the agenda forward?

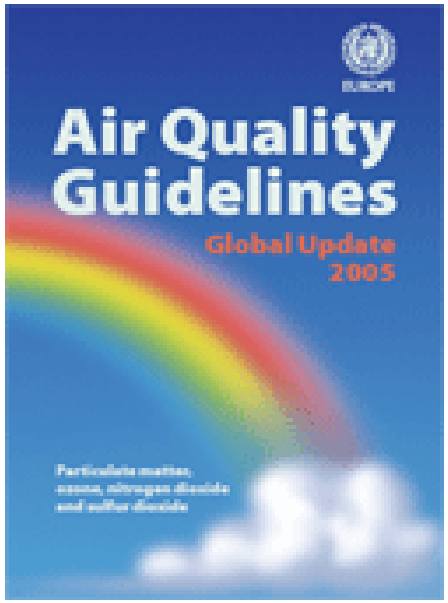
Improved knowledge

Changes in threshold values and corresponding regulatory standards following increased knowledge on health effects of lead



From: In Harm's Way, 2002

Improved knowledge



Air quality guideline values 2000 vs 2005

	2000	2005
PM10		
Daily mean	**No value**	**50**
Annual mean	**No value**	**20**
SO2		
10 minutes mean	500	500
Daily mean	**125**	**20**
Annual mean	50	Not needed
NO2		
Daily mean	200	200
Annual mean	40	40
Ozone		
Daily maximum 8 hour mean	**120**	**100**

WHO air quality guidelines, 2005

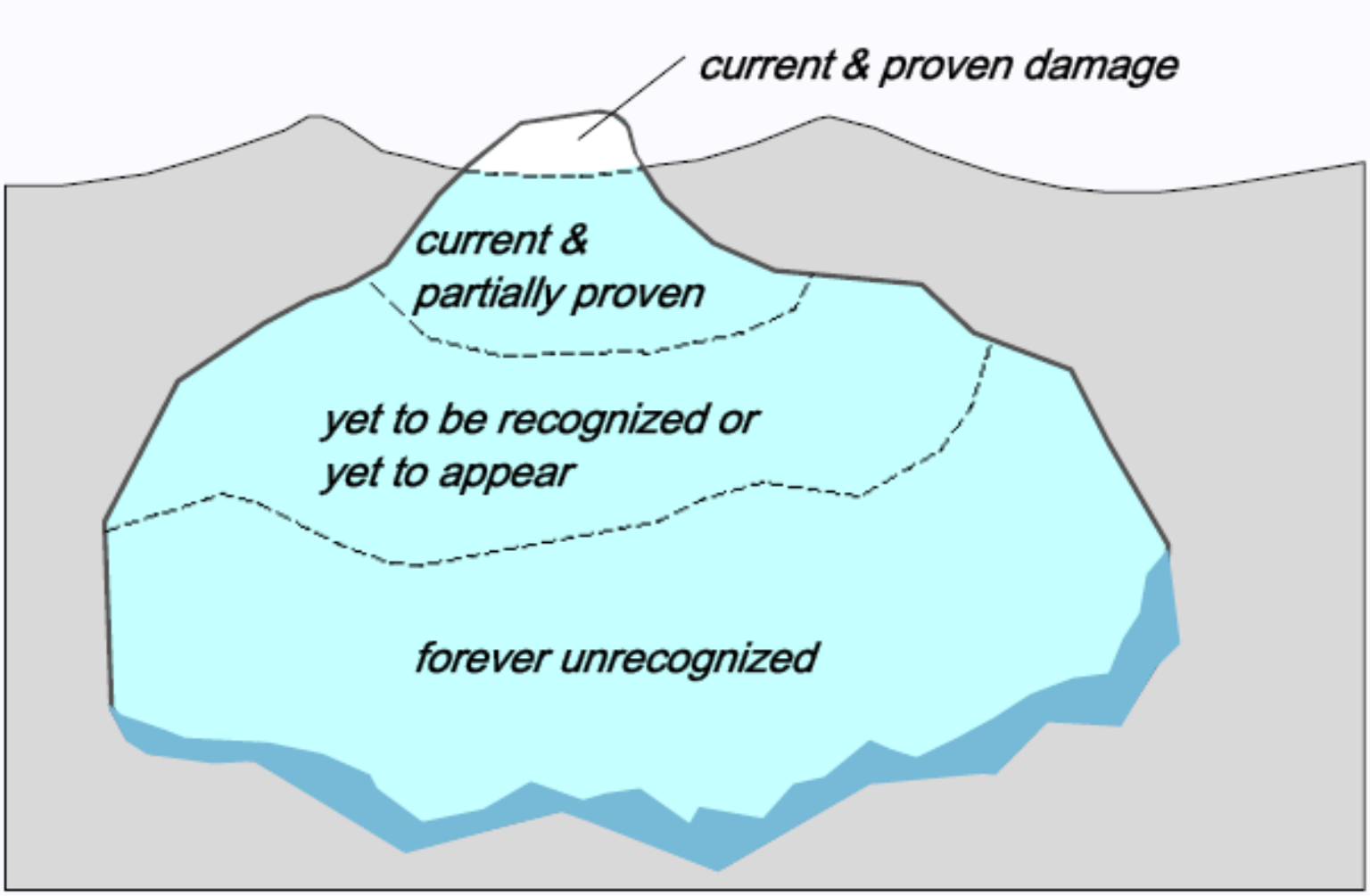
REVIHAAP Main conclusions

- Considerable amount of new scientific information on health effects of PM, ozone and NO_2 has been published in the recent years
  - Evidence has *strengthened*
  - Effects observed *at levels commonly present in Europe*
  - Supports the scientific conclusions of the WHO Air Quality Guidelines, last updated in 2005
  - Indicates that the *effects can occur at air pollution concentrations lower* than those serving to establish the 2005 Guidelines
- Provides scientific arguments for the decisive actions to improve air quality and reduce the burden of disease associated with air pollution in Europe.

Outline

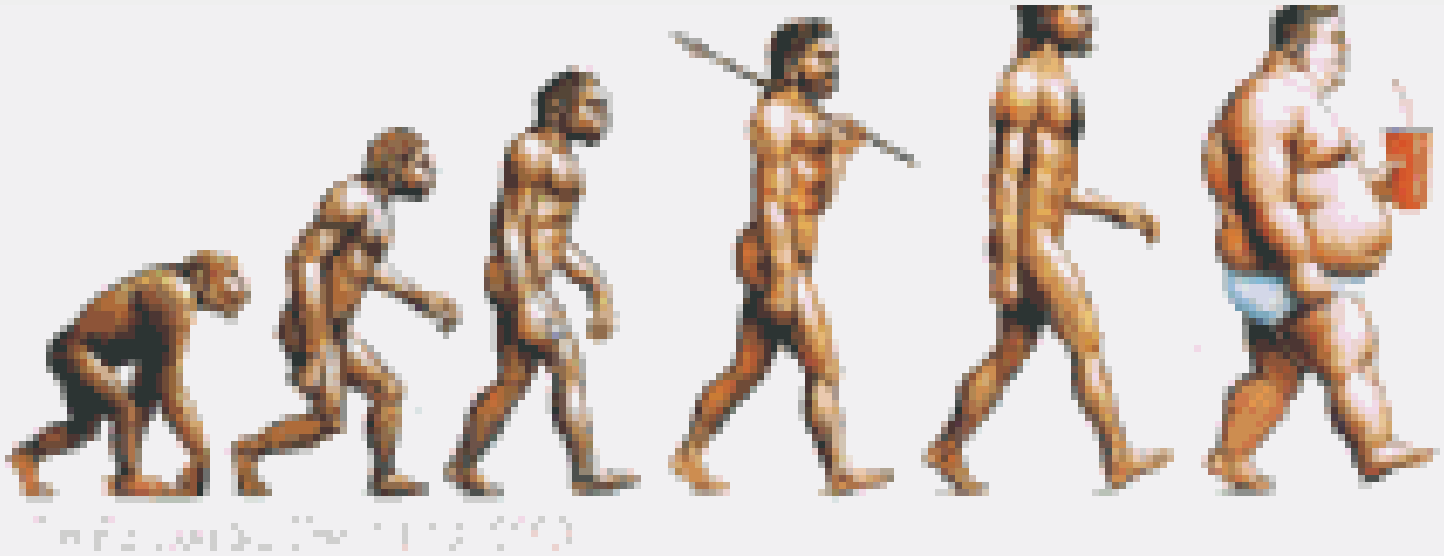
- Is the environment responsible for a significant proportion of ill-health?
- How did the environment and health situation evolved over the last decades?
- Is our knowledge improved over recent years?
- Which are the new environmental health challenges which the public health community has to face?
- Is there a vision and a strategy to move the public health agenda forward?

Tip
of the toxicity iceberg

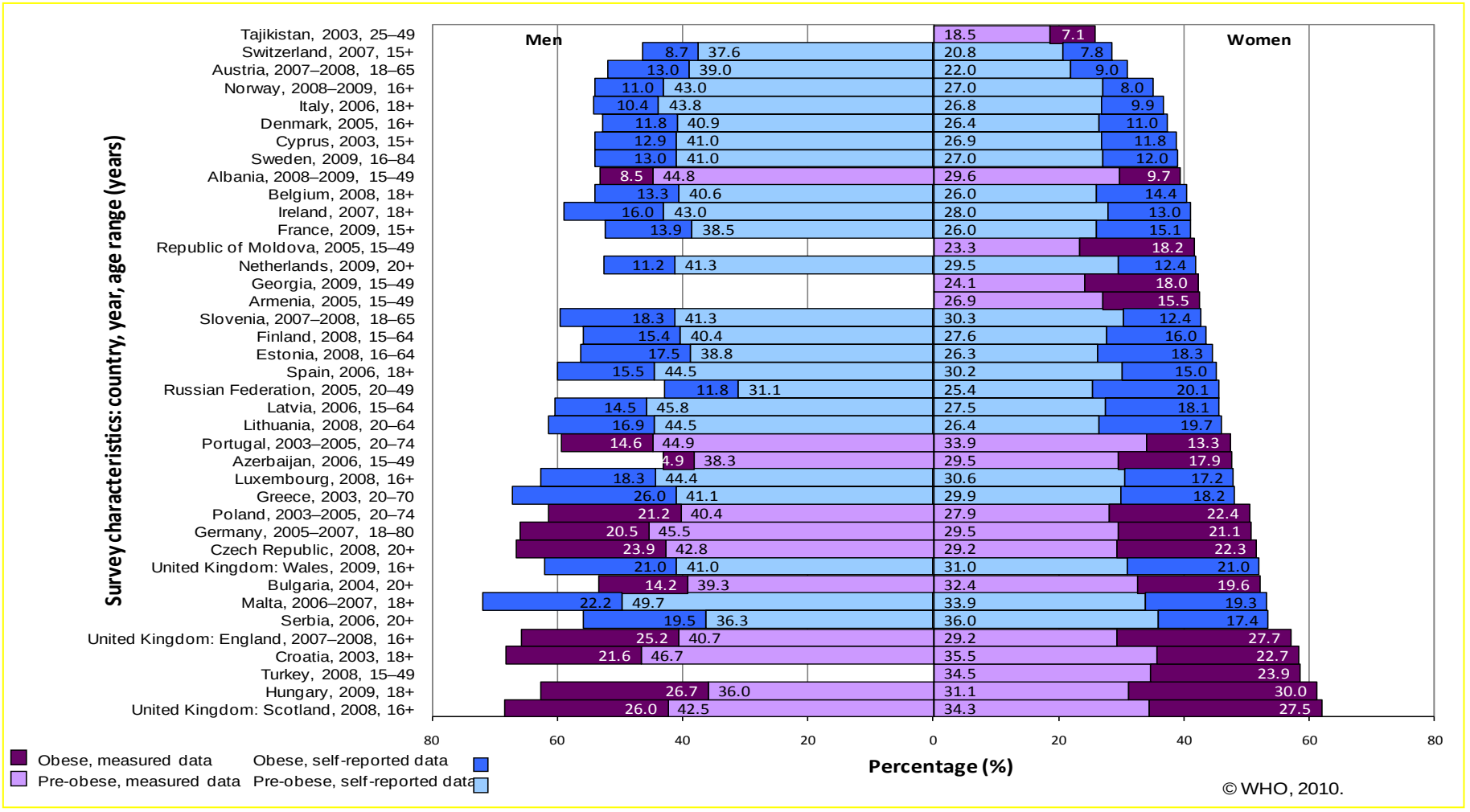


Evolution of human civilisation:

Obesity and diabetes are becoming more frequent, but the focus has been on diet and exercise



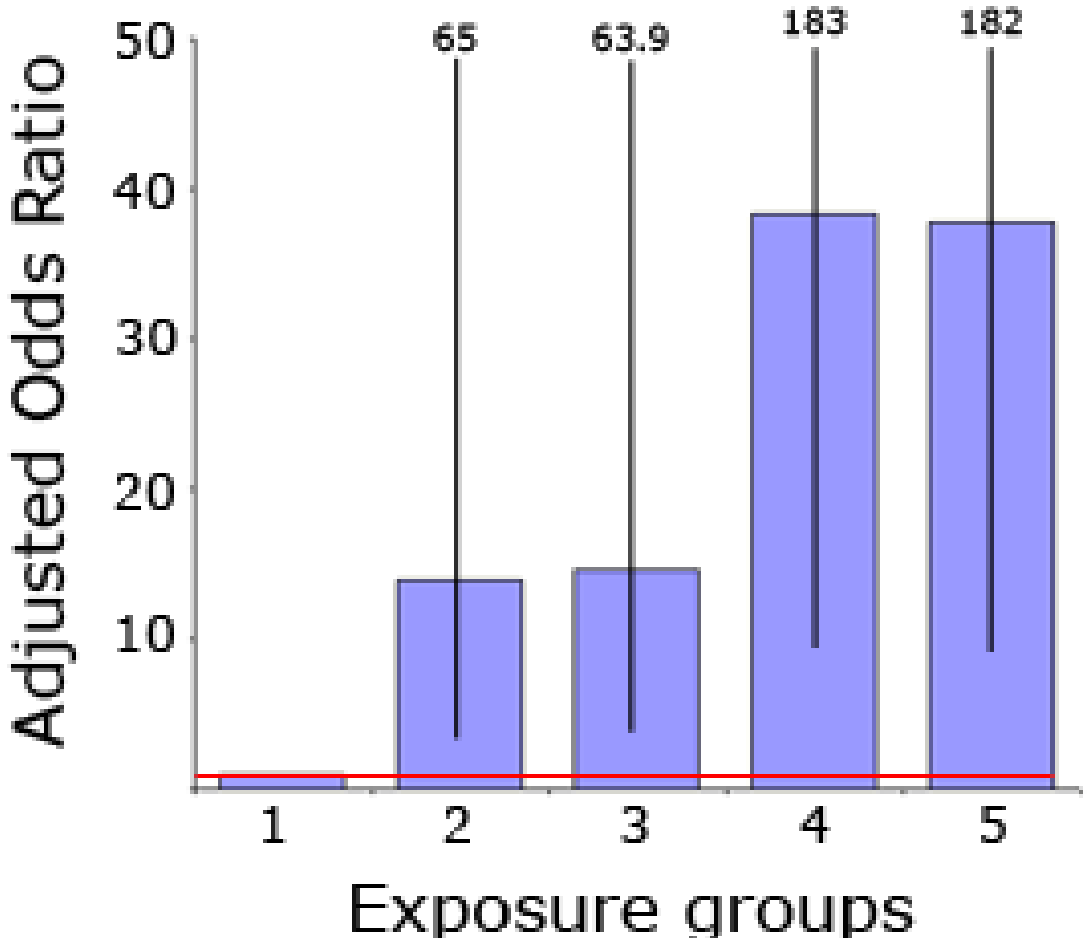
Overweight and Obesity in WHO/EURO



The mouse on the right was exposed in the womb to 1 ppb diethylstilbestrol (an experimental oestrogen).

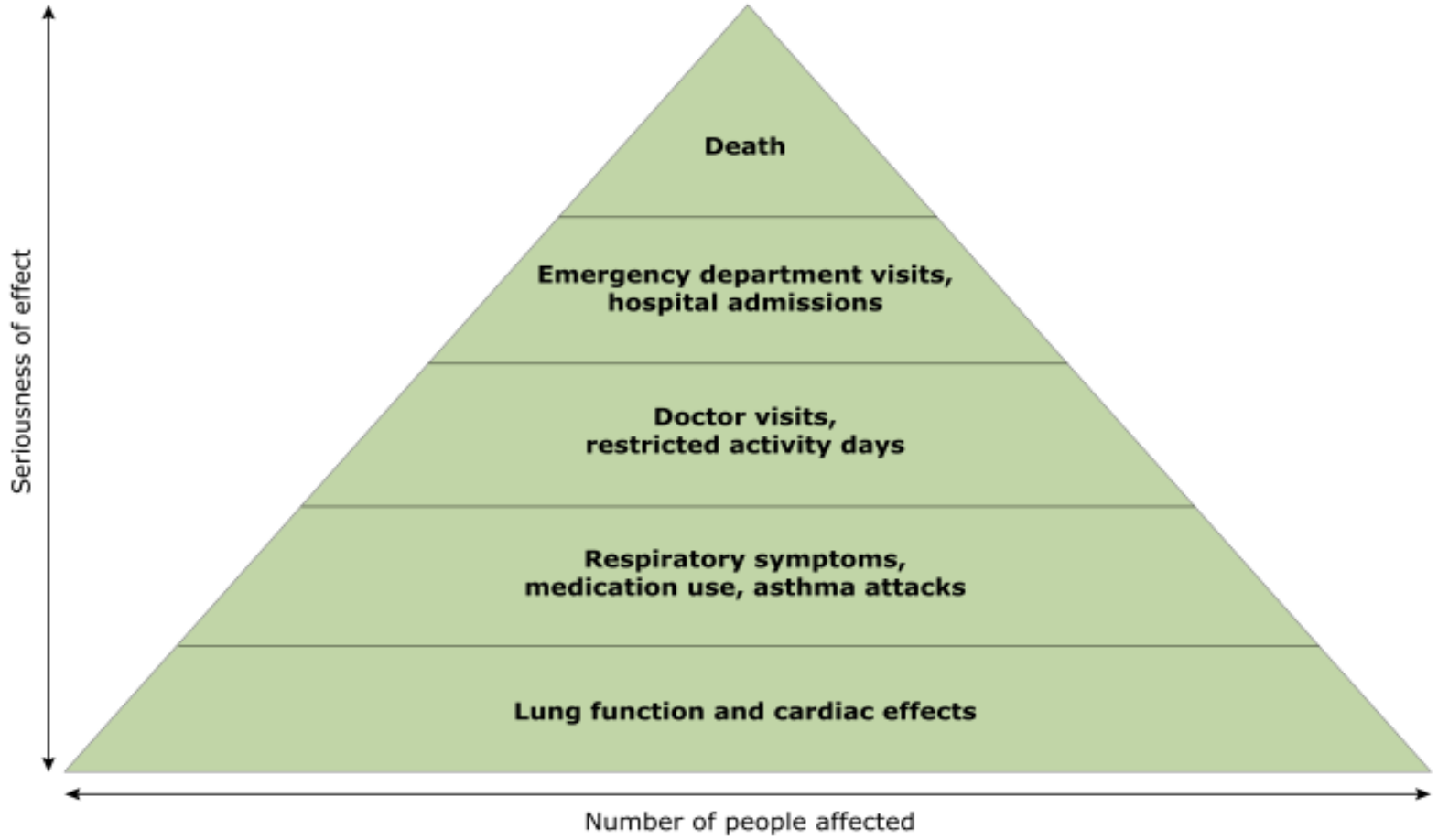
Diabetes – possible link to environmental chemicals

In a study of >2000 subjects of the US general population, of whom 217 had type 2 diabetes, people in the highest exposure group were almost 38 times more likely to have diabetes.



Lee et al., Diabetes Care 2006; 29:1638-1644

Air pollution causes a wide range of health effects and varying number of people are affected



Source: EEA, 2014 (Based on US EPA)

World Health Organization

Children exposed to air pollution had deficient development of lung function

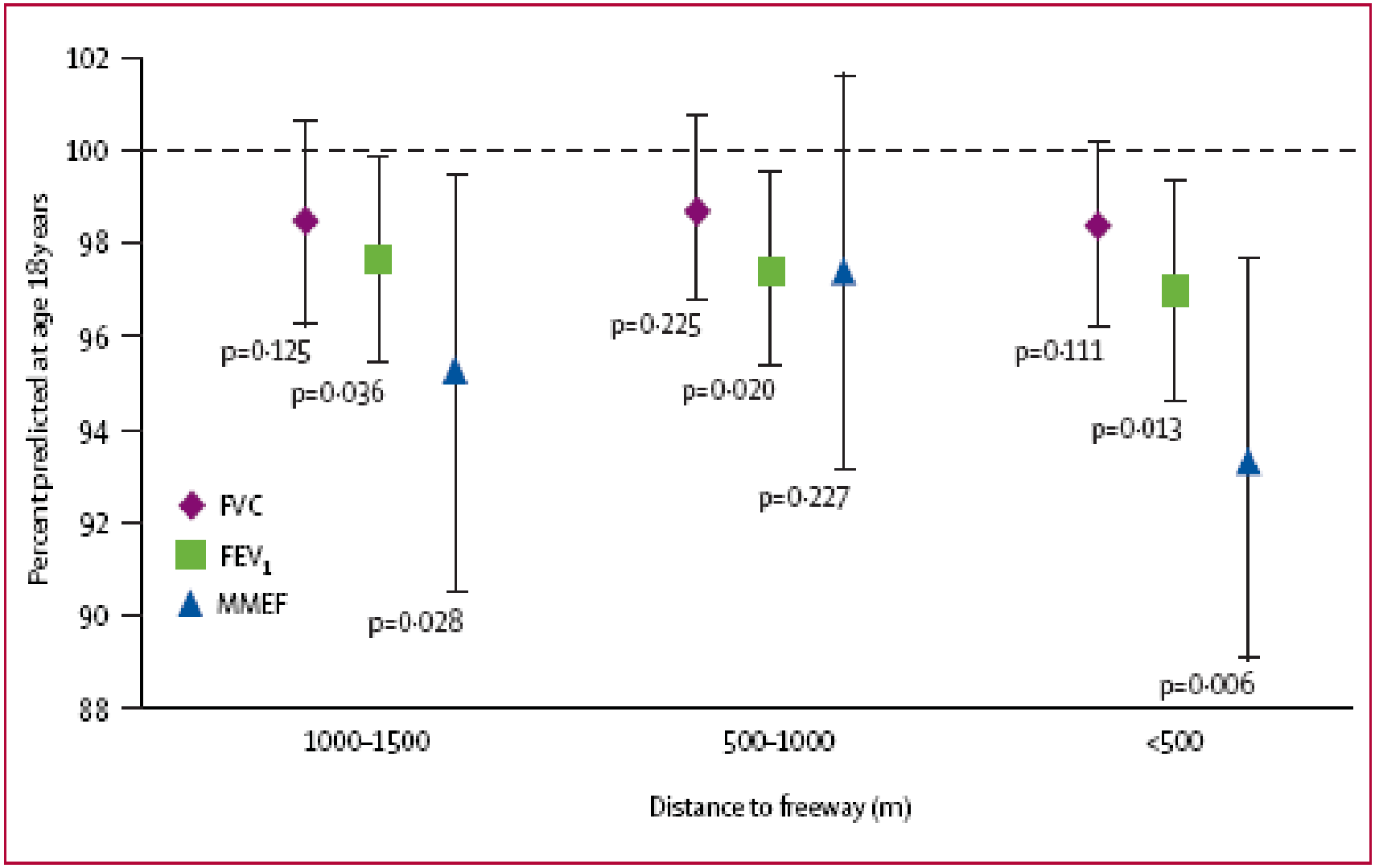


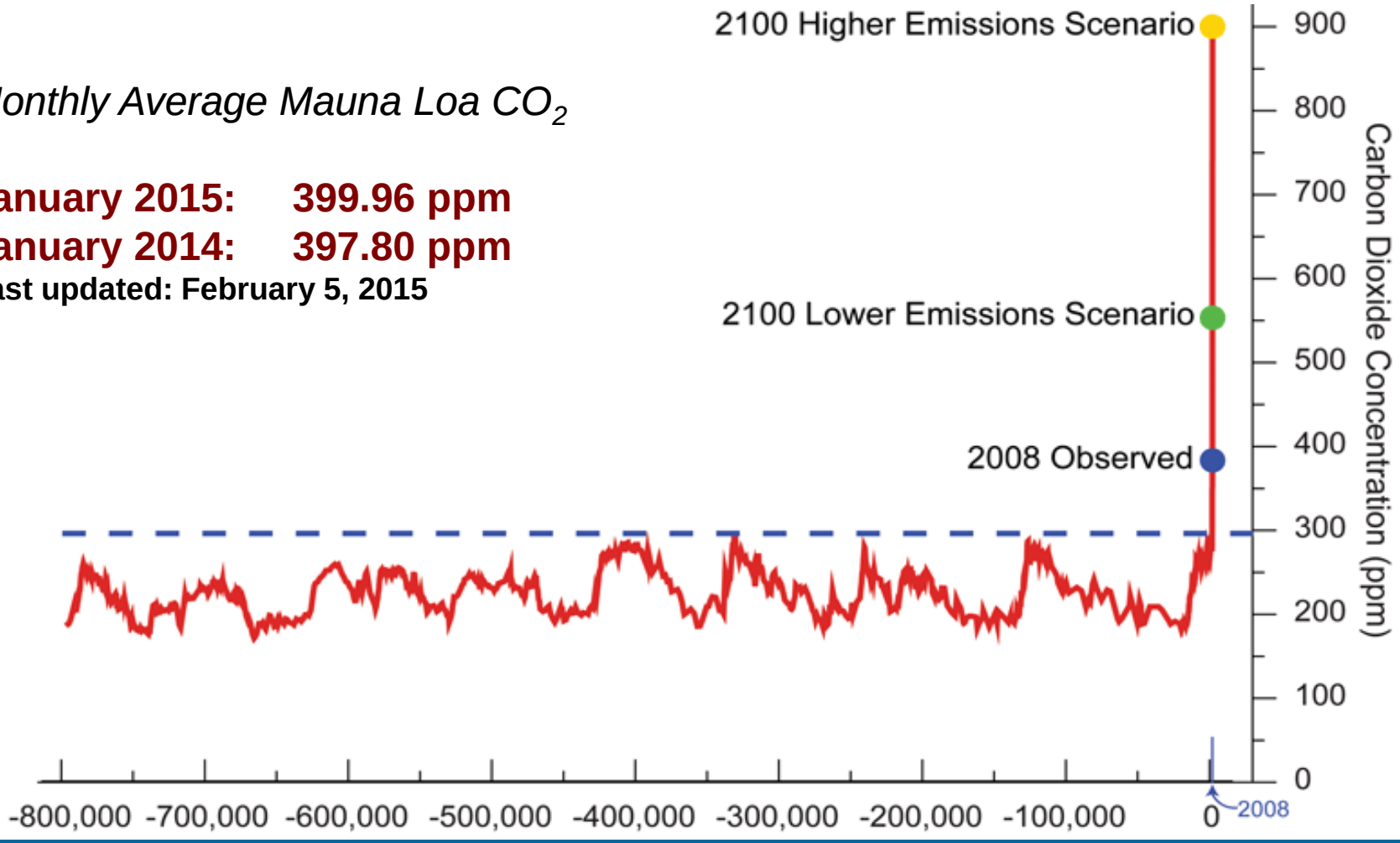
Figure: Percent-predicted lung function at age 18 years versus residential distance from a freeway
The horizontal line at 100% corresponds to the referent group, children living >1500 m from a freeway.

(Gauderman et al., 2007)

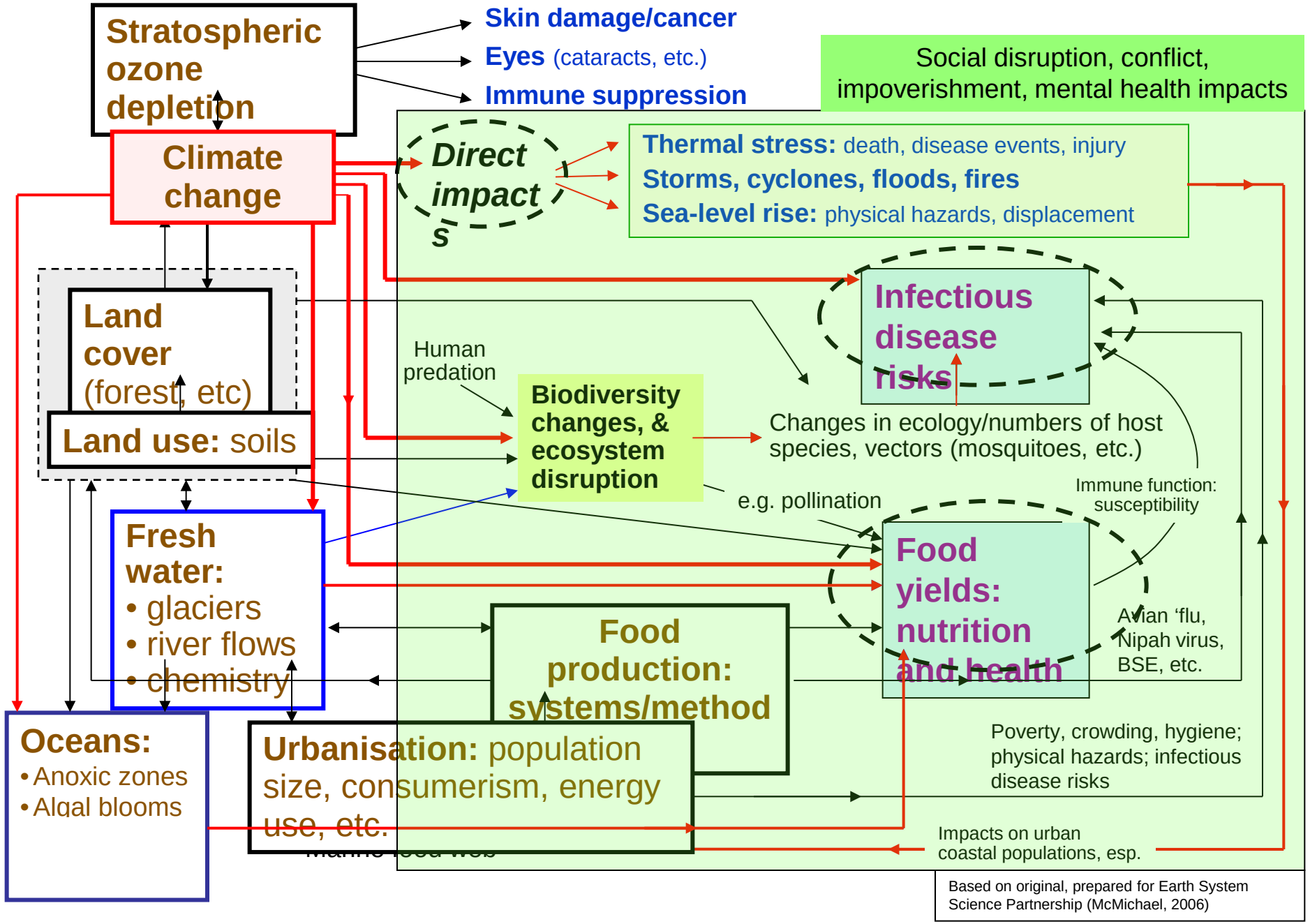
CO2 levels in the earth atmosphere in the last 800,000 years

Monthly Average Mauna Loa CO_2

January 2015: 399.96 ppm
January 2014: 397.80 ppm
Last updated: February 5, 2015

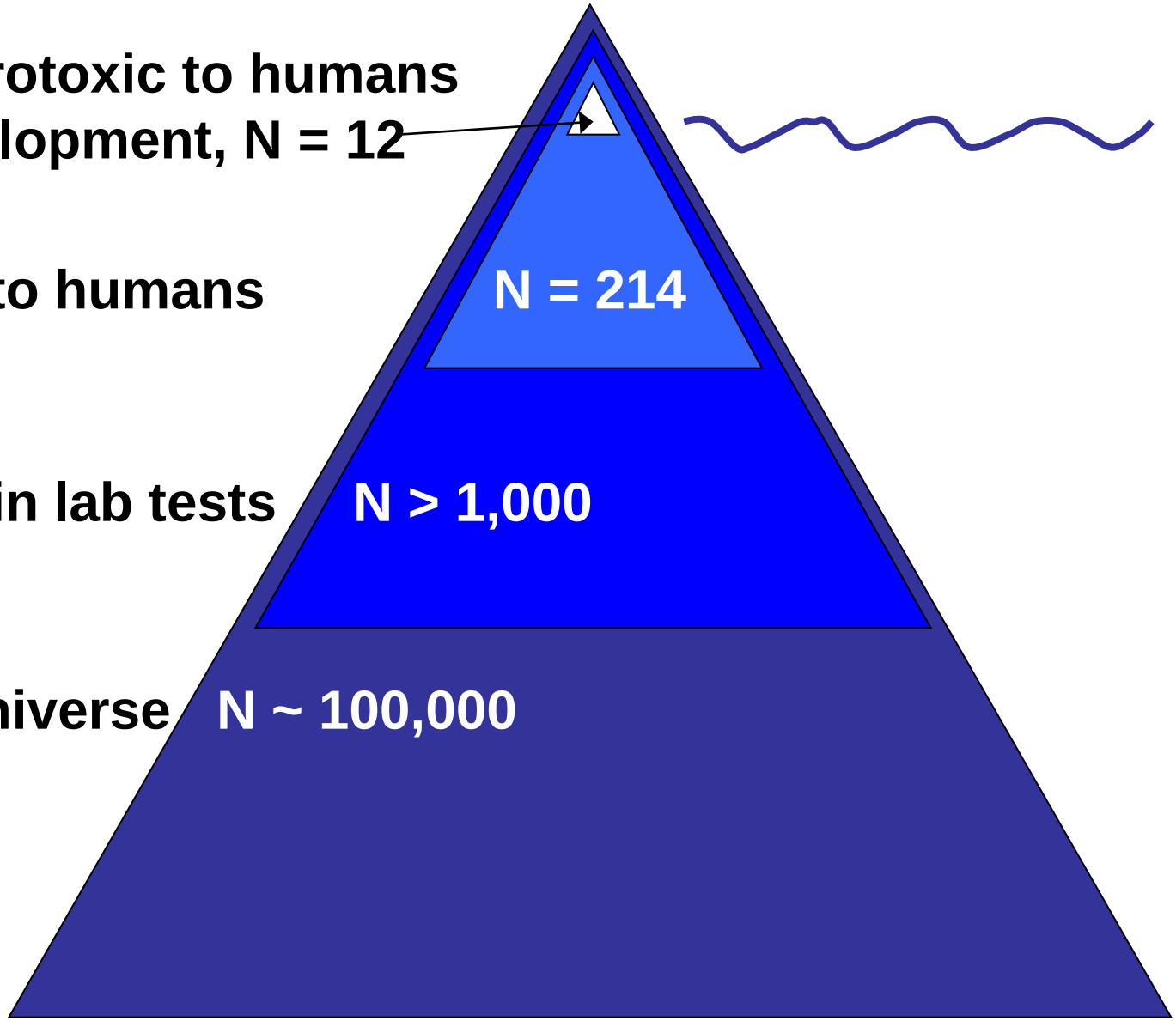


Global Environmental Changes: health risks



Based on original, prepared for Earth System Science Partnership (McMichael, 2006)

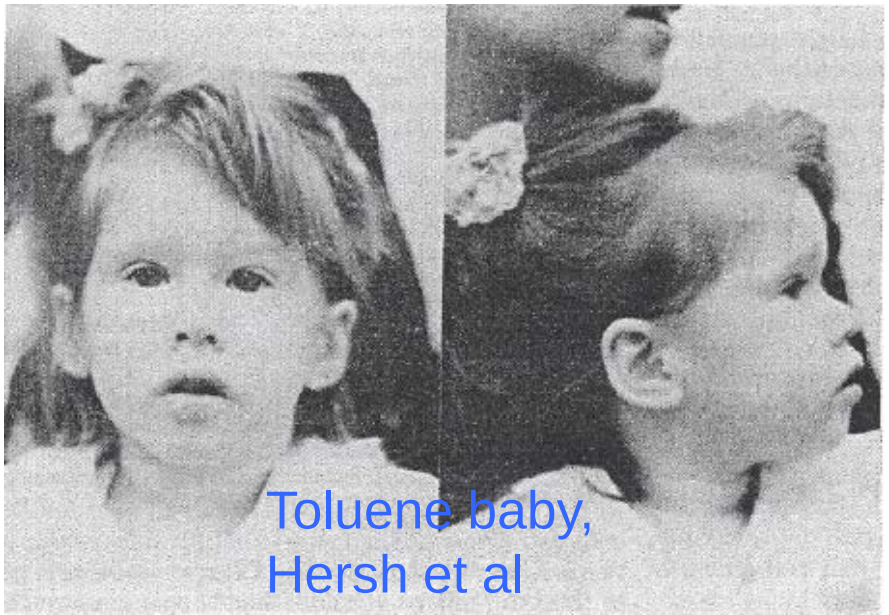
Number of environmental toxicants



Only twelve documented human developmental neurotoxicants (I)

- Lead
- Polychlorinated biphenyls
- Methylmercury
- Arsenic
- Toluene

Grandjean P, Landrigan P. 2014

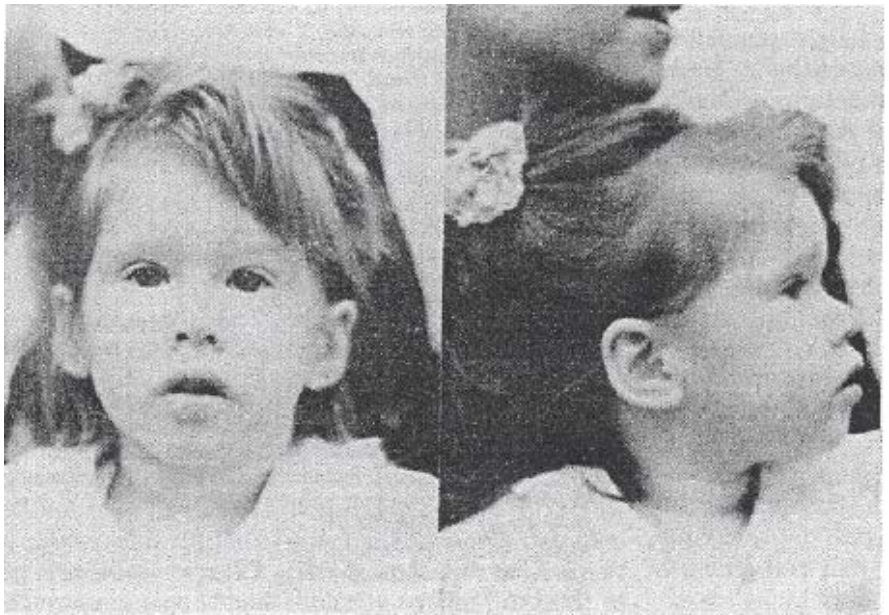


Toluene baby, Hersh et al

Only twelve documented human developmental neurotoxicants (II)

- Manganese
- DDT/DDE
- Chlorpyrifos
- Fluoride
- PBDE

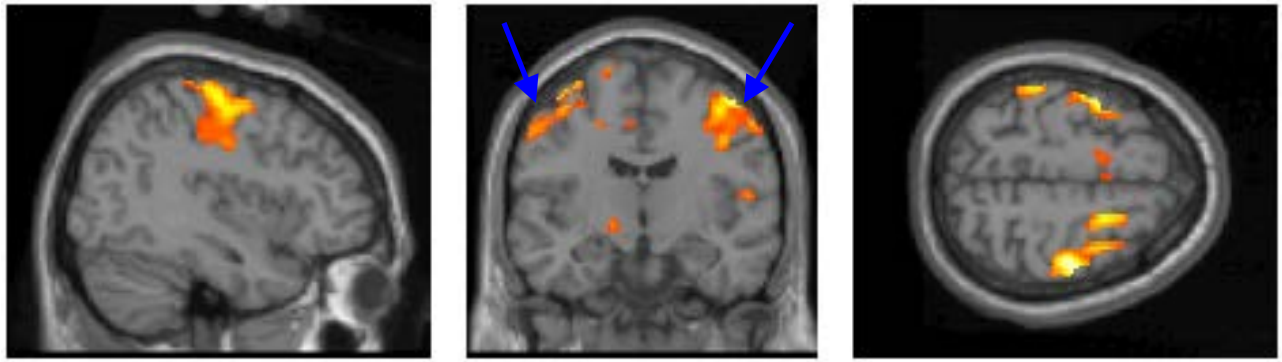
Toluene baby,
Hersh et al



Modern imagining methods show that children with high prenatal pollutant exposure must activate brain regions not needed by controls

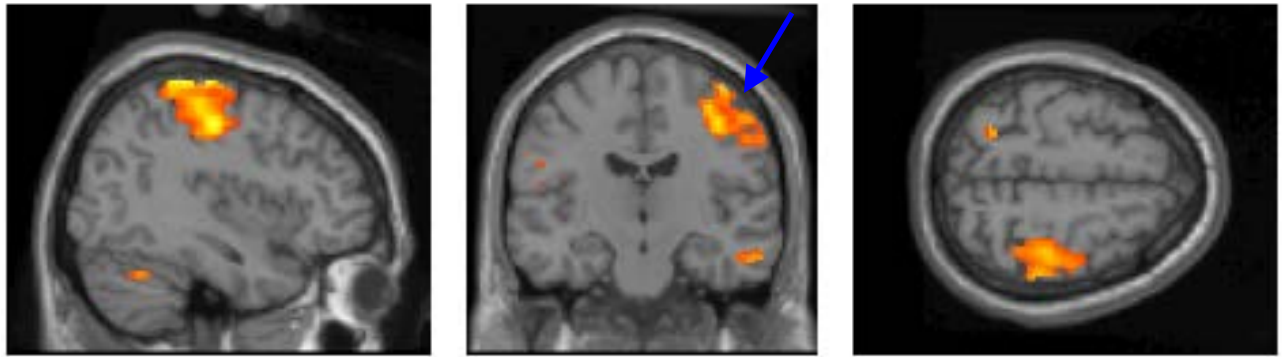
Finger tapping with the left hand activates motor cortex on right AN

Increased prenatal exposure to MeHg + PCB (N = 3)



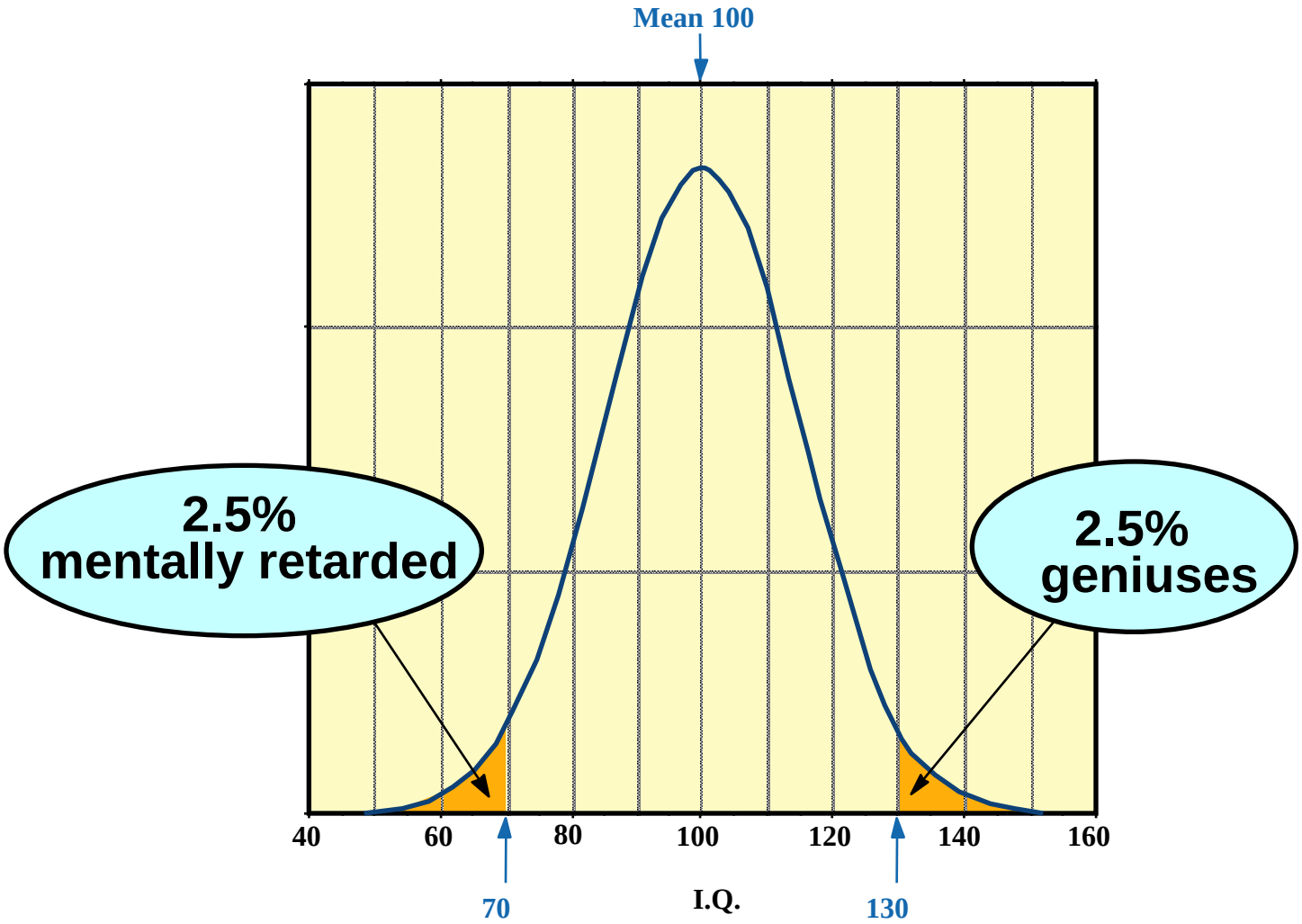
In non-exposed controls, only the right motor cortex is activated

Controls (N = 3)

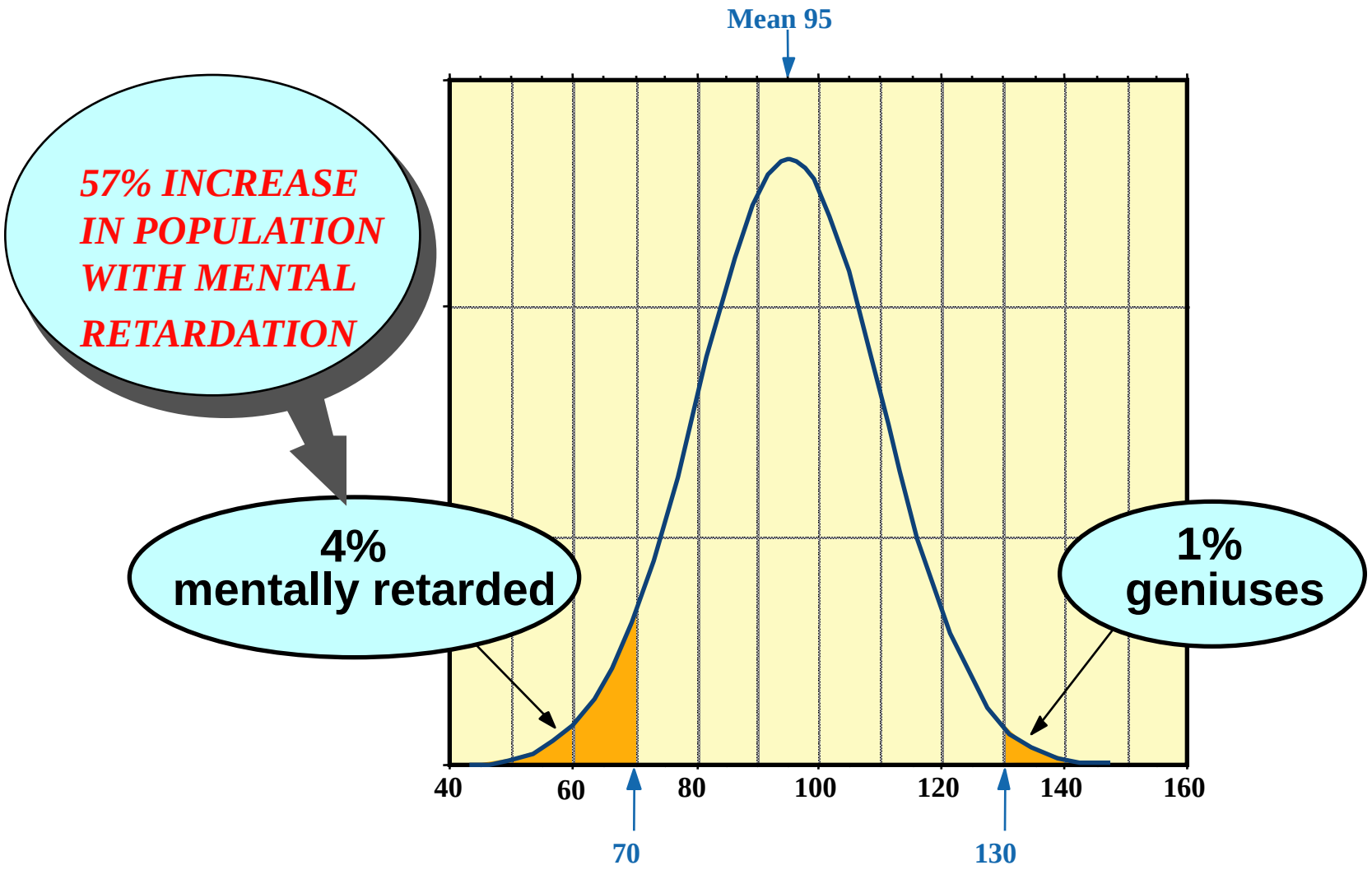


(D.A.Yurgelun-Todd, R.F.White et al., unpublished data)

IQ population distribution



5 point decrease in mean IQ



Annual costs due to IQ losses (in billion €)

	France*	**EU**
• Lead:	~11	>100?
• Mercury:	~1.2	~10
• Pesticides:	~5?	~50?
• Other toxicants:	?	?
• Total cost:	>15	>150?

***From Pichery et al., 2011, 2012**

Air pollution and health in Rome

Summary table. Health and monetary impacts of air pollution in Rome

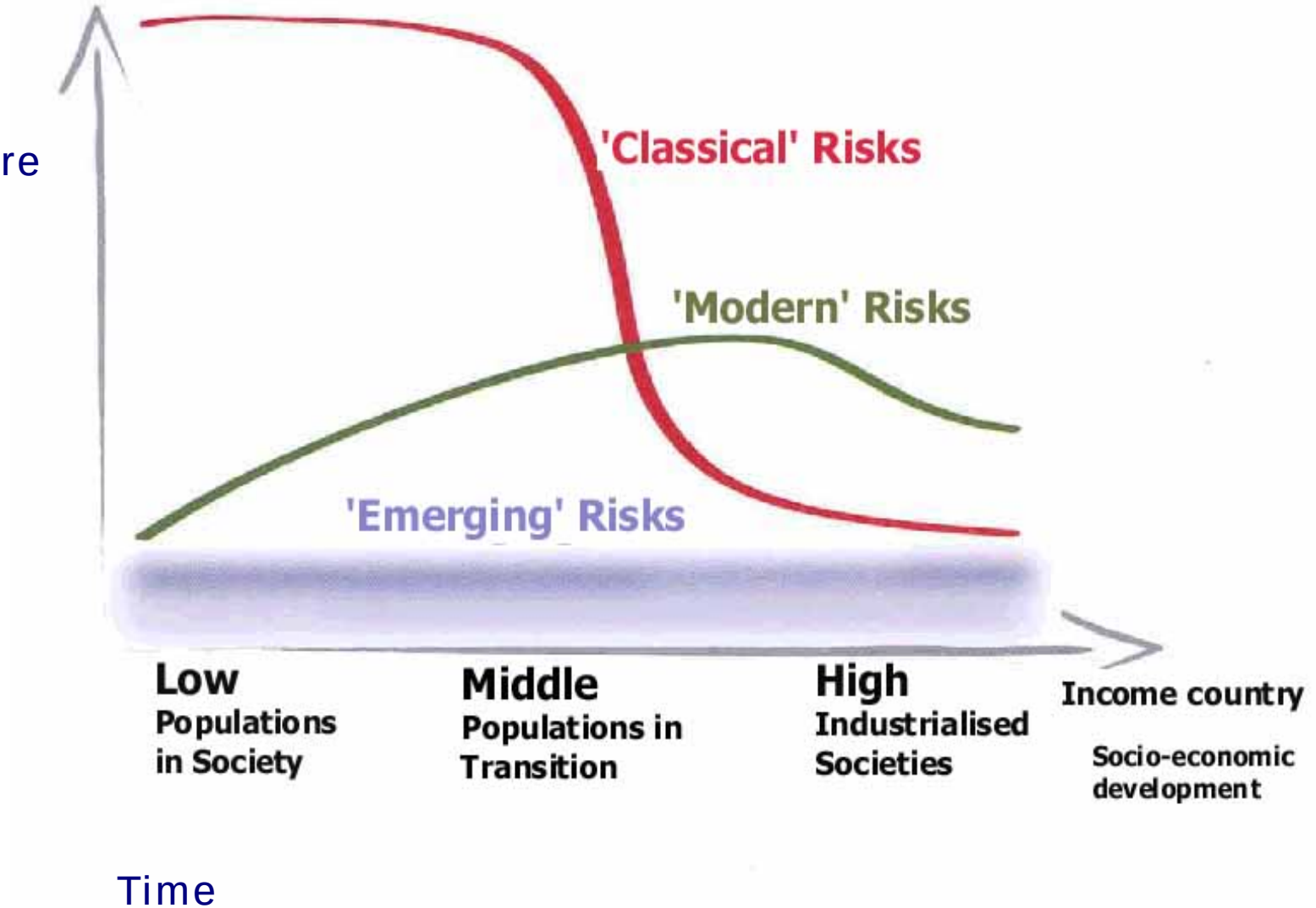
	Short term effects PM10		Long term effects PM2.5	
	decrease by 5µg/m^3	decrease to WHO guidelines	decrease by 5µg/m^3	decrease to WHO guidelines
Mortality				
Gain in life expectancy (years)			0.4	1.0
Total annual number of cardiovascular deaths avoided			471	997
Total annual number of natural deaths avoided	61	227	594	1278
Monetary gain (euro)	5,282,600	19,658,200	983,070,000	2,115,090,000
Respiratory hospitalizations				
Total annual number of cases avoided	158	579		
Monetary gain (euro)	635,792	2,329,896		
Cardiovascular hospitalizations				
Total annual number of cases avoided	118	434		
Monetary gain (euro)	457,026	1,680,925		

Cesaroni G et al., 2012

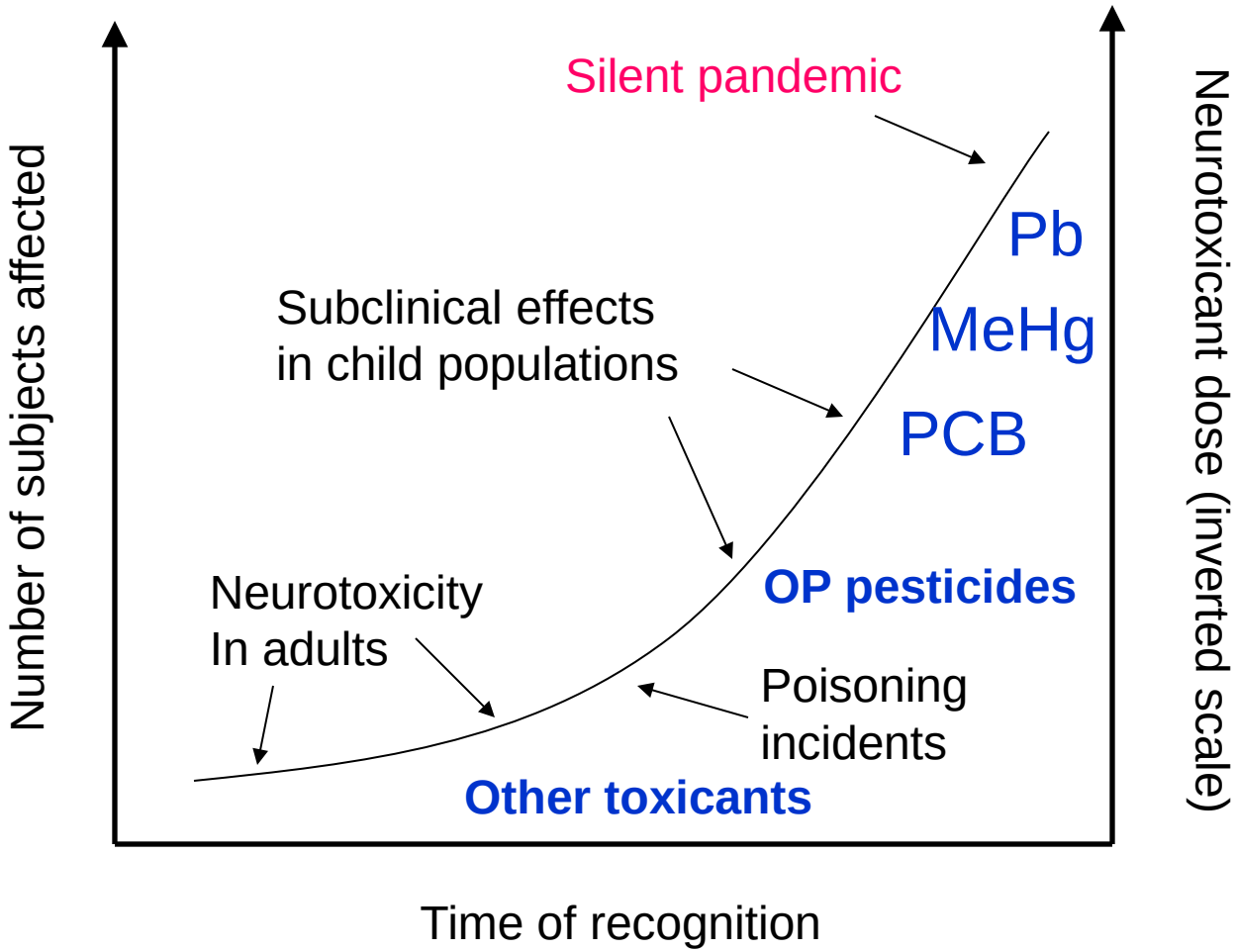
Outline

- Is the environment responsible for a significant proportion of ill-health?
- How did the environment and health situation evolved over the last decades?
- Is our knowledge improved over recent years?
- Which are the new environmental health challenges which the public health community has to face?
- Is there a vision and a strategy to move the public health agenda forward?

Environmental health transition



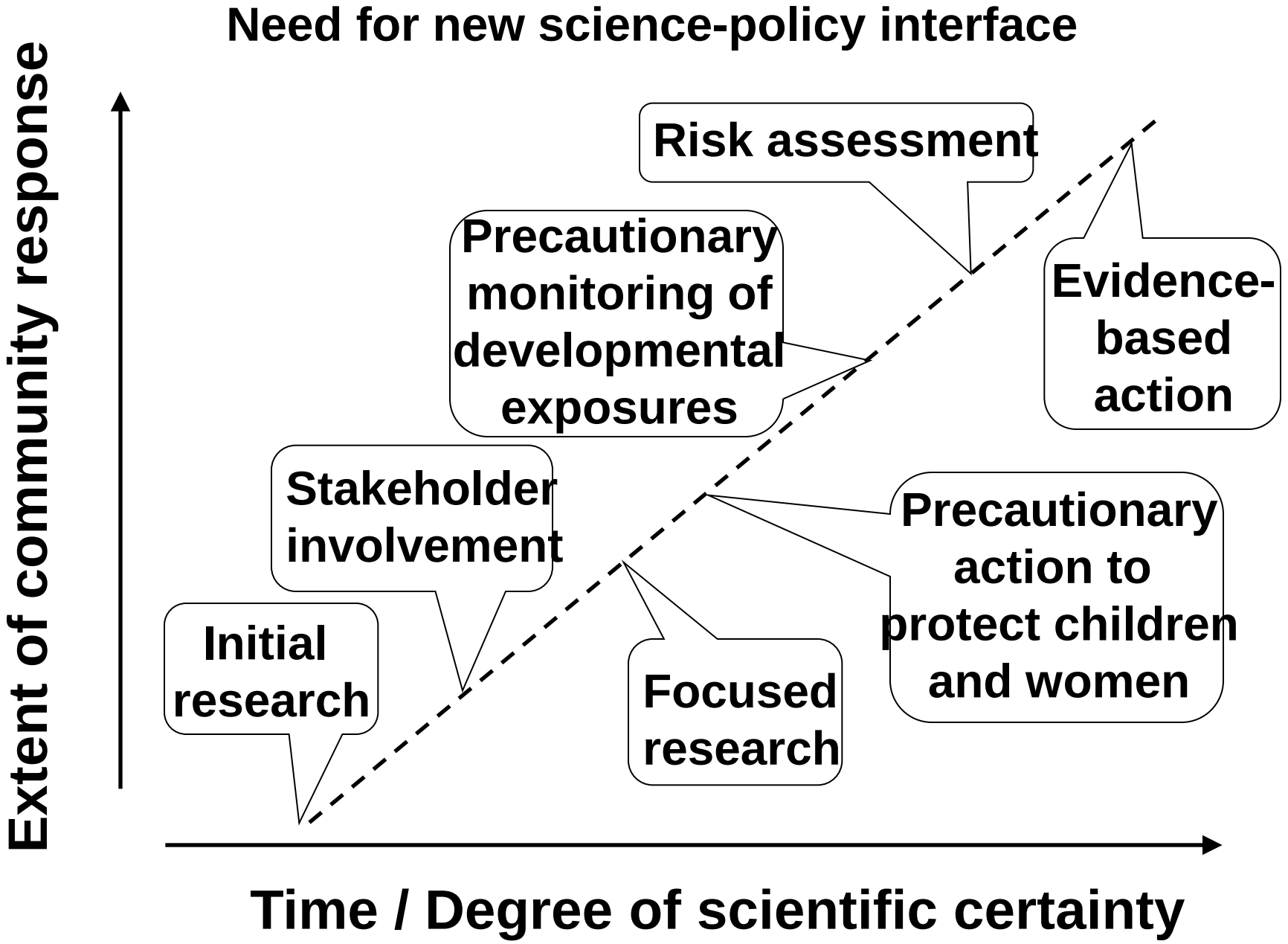
Emerging paradigm: Time course of recognition (developmental neurotoxicants as example)



Grandjean & Landrigan, The Lancet, 2006

Limitations of science as basis for decision-making

- Inherent inertia
- Skepticism towards new findings
- Some uncertainties will always remain
- Delay from planning to reporting


Need for new science-policy interface
Extent of community response
Risk assessment
Precautionary monitoring of developmental exposures
Evidence-based action
Stakeholder involvement
Precautionary action to protect children and women
Initial research
Focused research
Time / Degree of scientific certainty

Avoiding the Unmanageable

Mitigation and Adaptation

Managing the Unavoidable

Averting Climate Change: Immediate Collateral Benefits to Health

- Wise emissions reduction (mitigation) policies will provide health 'co-benefits' – another important research topic

- Our response to climate change could thus become a transformative vehicle for revitalising health promotion and for achieving true, sustainable, primary prevention of disease.

Win-win opportunities for health and the environment

"Health benefits from reduced air pollution as a result of actions to reduce greenhouse gas emissions… may offset a substantial fraction of mitigation costs" – IPCC, 2007

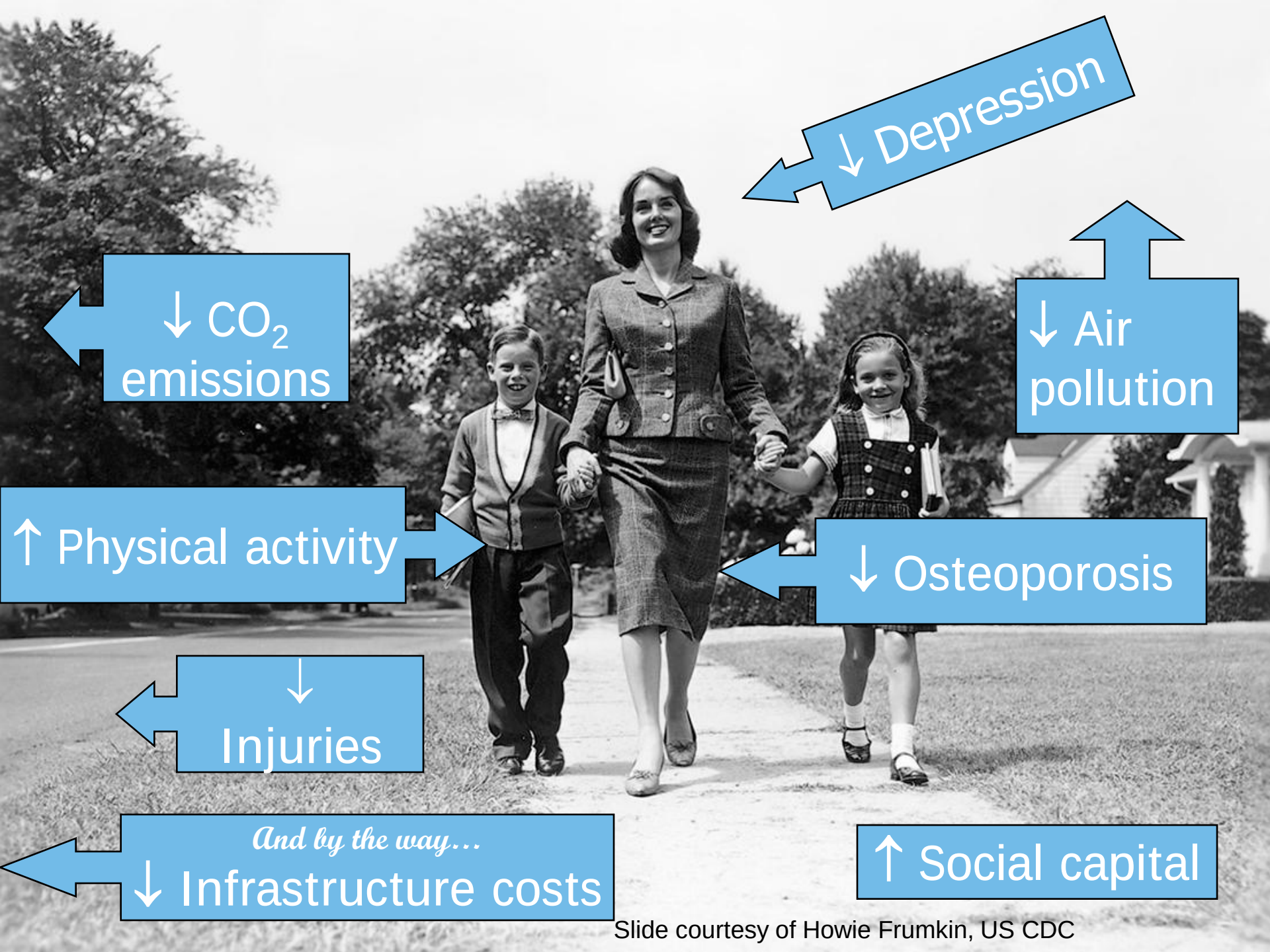
We have an opportunity to reduce:

The 800,000 annual deaths from urban air pollution, and the 1.6 million from indoor air pollution

The loss of 1.9 million lives, and 19 million years of healthy life, from physical inactivity

The 1.2 million deaths and over 50 million injuries from road traffic accidents

Climate-Friendly Solution to the Overweight/Obesity Epidemic



Slide courtesy of Howie Frumkin, US CDC

World Health Organization
Europe

EUROPEAN ENVIRONMENT AND HEALTH PROCESS

The European Environment and Health Process

The European Environment and Health Process

In 1989 WHO/Europe launched a process to eliminate the most significant environmental threats to human health.

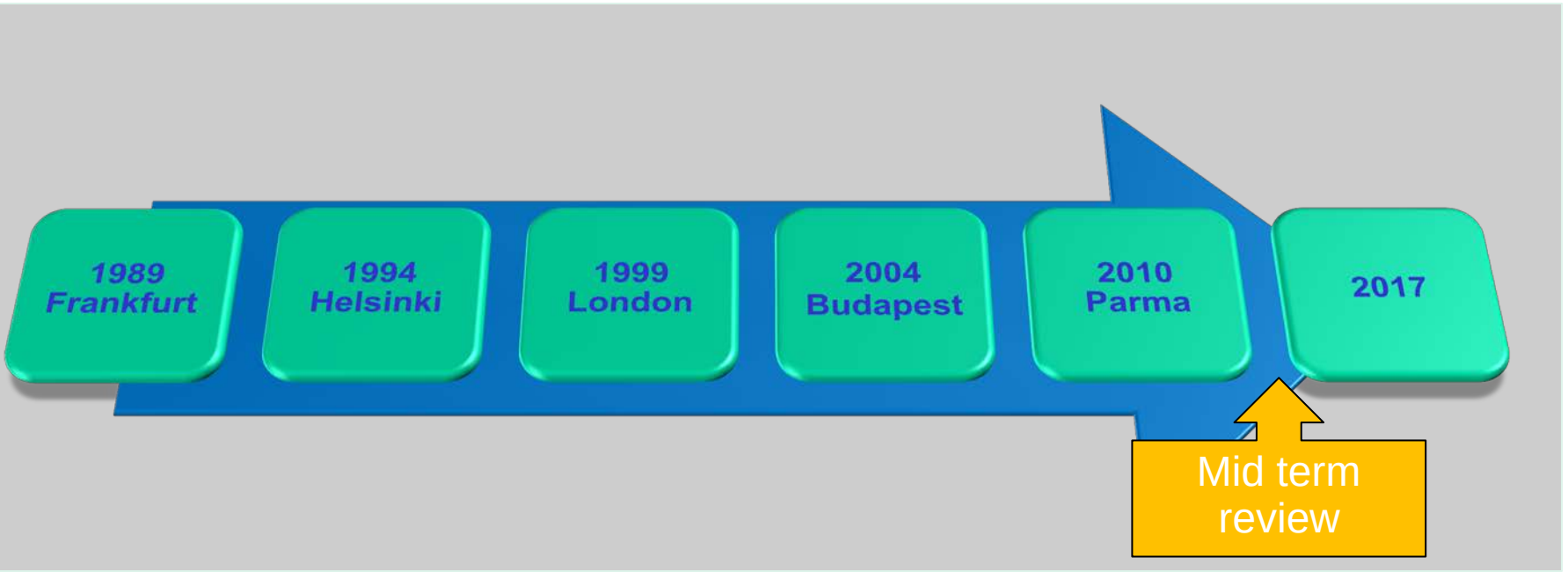
Progress towards this goal is marked by a series of Ministerial Conferences held every five years.

The Conferences are unique, bringing together Ministries of Health and Ministries of Environment on a equal footing and different sectors to shape European policies and actions on environment and health.

World Health Organization Europe

EUROPEAN ENVIRONMENT AND HEALTH PROCESS

Ministerial Conferences on Environment and Health: the pillars of the process



Challenges and limitations in intersectoral action for environment and health

1. Complexity/uncertainty
2. Different institutional agendas
3. Unclear assignment of responsibilities
4. Competition for political attention and resources
5. Difficulty in retaining relevance to health ***AND*** other sectors
6. Risk perceptions greatly influence the political agenda
7. Tensions among different societal priorities and values
8. Different understanding of “evidence” to inform decisions

Acknowledgments

For the slides, the thoughts and discussions
Philippe Gandjean

For his guidance, vision and leadership
A J McMichael

Photo : L. Donaldson, discours au personnel de l'OMS, 2008