

Paolo Vineis

Global non-communicable
diseases

BSc Global health

12 November 2012

Outline

The content of this topic will cover:

- How non-infectious disease occurrence varies by space and time, and how hypotheses about the causes of such variation are formulated
- Key examples of geographic variation for the most common non-infectious diseases (cancer, diabetes, cardiovascular diseases, asthma)
- Key examples of time trends for some common non-infectious diseases
- Role of migration

Learning Outcomes

By the end of the learning activities in this session you will:

- Be able to describe how geography affects the distribution of chronic diseases and what the hypotheses on geographic variation could be
- be able to interpret incidence and mortality rates
- Be able to describe time trends and understand their determinants

Epidemiologic transition

- Continuous process of transformation with some diseases disappearing and others appearing or reappearing
- Infectious diseases are still an important public health problem
- Non-communicable diseases are coming to the forefront as causes of illness and death, especially in countries where it used to be possible to control many communicable diseases

Biological, environmental, social, cultural and behavioural factors have been responsible for structuring these patterns in the community

Several stages of transition may overlap in the same country. Epidemiological surveillance has a major role to play in identifying the changes and in planning how to address them

The neglected epidemic of chronic disease

Chronic disease represent a huge proportion of human illness. They include cardiovascular disease (30% of projected worldwide deaths in 2005), cancer (13%), chronic respiratory diseases (7%) and diabetes (2%)

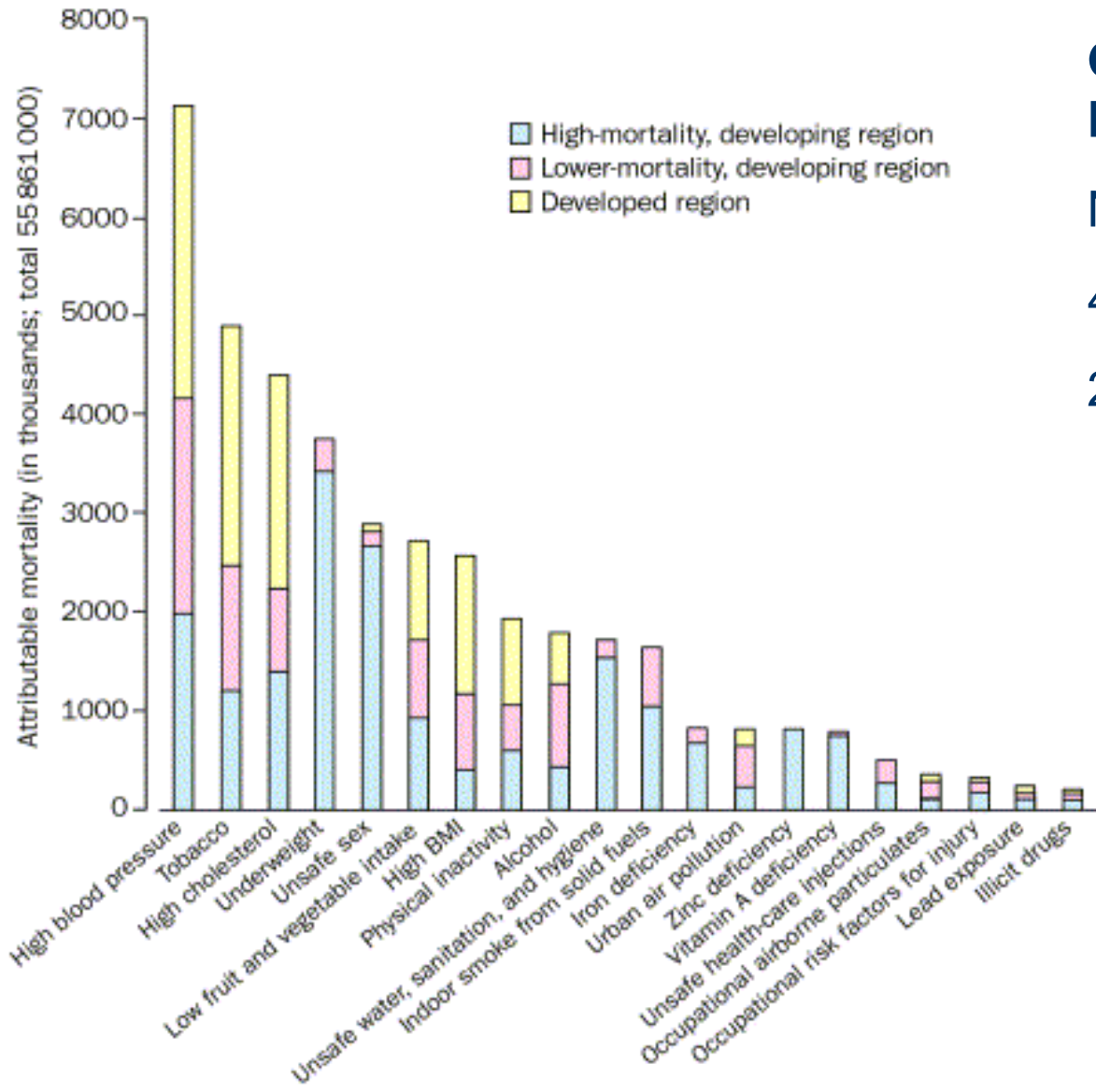
Editorial, the Lancet, October 2005

Global Burden of Disease 2000

No. of Deaths (Region)

4.17 M (Developing)

2.96 M (Developed)



Lancet 2002; 360: 1347-60

Ten leading causes of death: high income countries

High-income countries	Deaths in millions	% of deaths
Coronary heart disease	1.34	17.1
Stroke and other cerebrovascular diseases	0.77	9.8
Trachea, bronchus, lung cancers	0.46	5.8
Lower respiratory infections	0.34	4.3
Chronic obstructive pulmonary disease	0.30	3.9
Colon and rectal cancers	0.26	3.3
Alzheimer and other dementias	0.22	2.7
Diabetes mellitus	0.22	2.7
Breast cancer	0.15	1.9
Stomach cancer	0.14	1.8

Ten leading causes of death: middle income countries

Middle-income countries	Deaths in millions	% of deaths
Stroke and other cerebrovascular diseases	3.02	14.6
Coronary heart disease	2.77	13.4
Chronic obstructive pulmonary disease	1.57	7.6
Lower respiratory infection	0.69	3.3
HIV/AIDS	0.62	3.0
Perinatal conditions	0.60	2.9
Stomach cancer	0.58	2.8
Trachea, bronchus, lung cancers	0.57	2.7
Road traffic accidents	0.55	2.6
Hypertensive heart disease	0.54	2.6

Ten leading causes of death: low income countries

Low-income countries	Deaths in millions	% of deaths
Coronary heart disease	3.10	10.8
Lower respiratory infections	2.86	10.0
HIV/AIDS	2.14	7.5
Perinatal conditions	1.83	6.4
Stroke and other cerebrovascular diseases	1.72	6.0
Diarrhoeal diseases	1.54	5.4
Malaria	1.24	4.4
Tuberculosis	1.10	3.8
Chronic obstructive pulmonary disease	0.88	3.1
Road traffic accidents	0.53	1.9

Leading causes of death in 2003: US

Cause of death	Number	Percent
1 Heart disease	685,089	28.0
2 Malignant neoplasms	556,902	22.7
3 Cerebrovascular disease	157,689	6.4
4 Chronic lower resp. tract dis.	126,382	5.2
5 Accidents	109,227	4.5
6 Diabetes mellitus	74,219	3.0
7 Influenza and pneumonia	65,163	2.7
8 Alzheimer's disease	63,457	2.6
9 Nephritis, nephrotic syndrome	42,453	1.7
10 Septicemia	34,069	1.4
Total	2,448,288	100

Incidence rate: newly diagnosed cases each year,
per 10^5 subjects

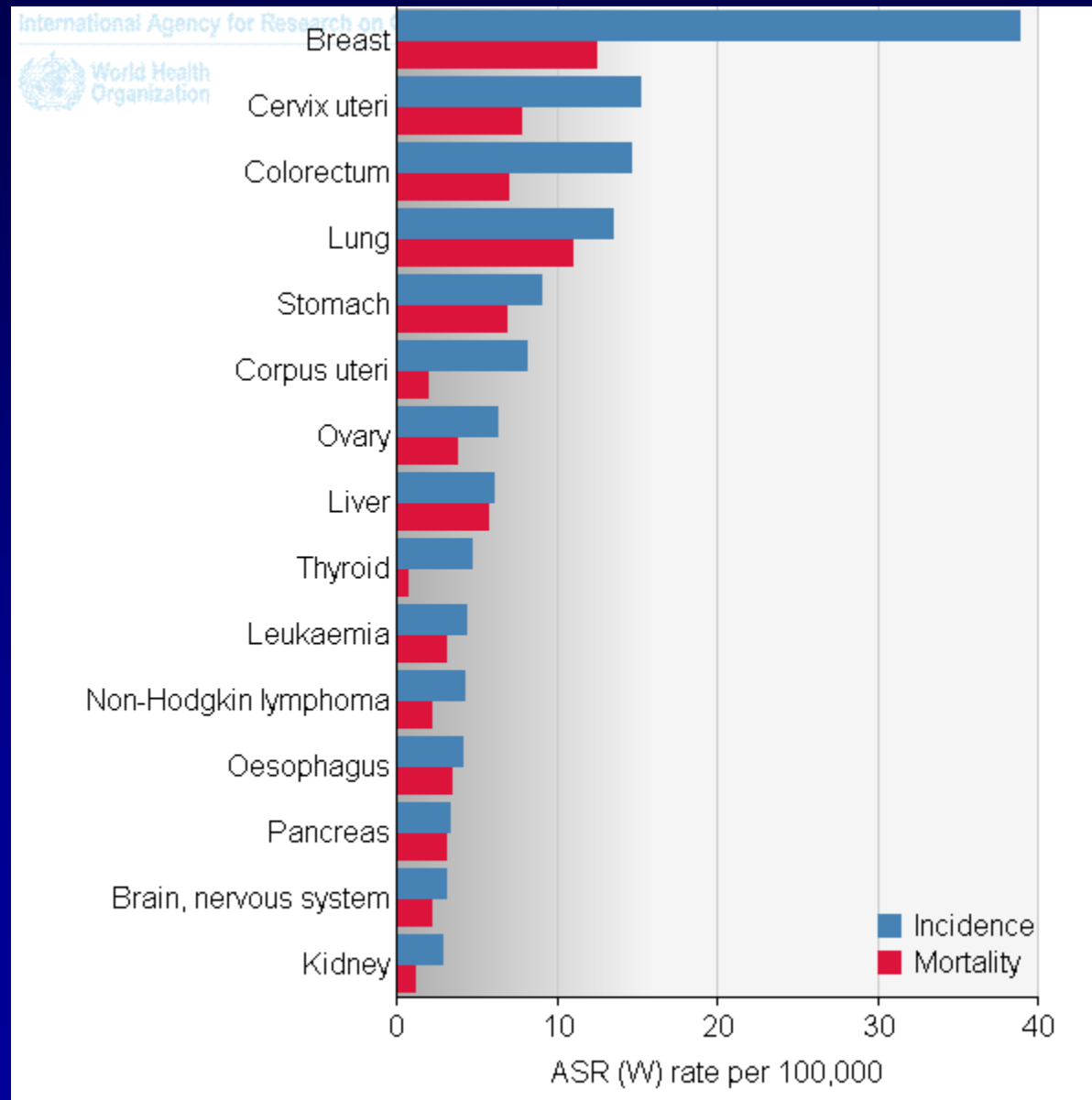
Mortality rate: deaths each year, per 10^5 subjects

Discrepancies between incidence and mortality
may indicate:

- changes in diagnostic sensitivity (earlier diagnosis, including screening)
 - possible overdiagnosis
 - low lethality
- better treatment/survival or a combination

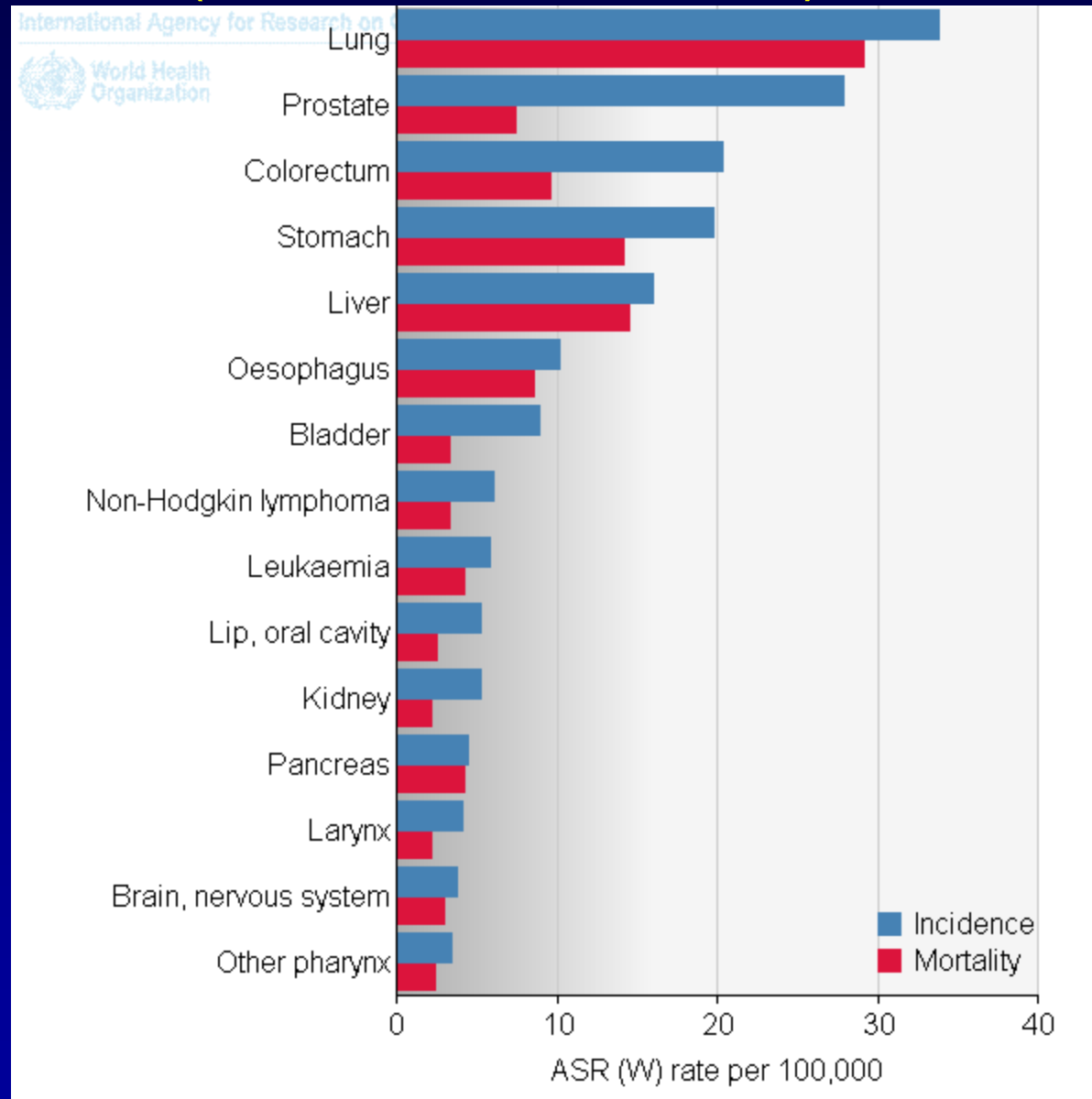
Age-Standardized Cancer Incidence Rates for Women, 2008 (Worldwide estimate)

WHO-IARC-globocan 2008



Age-Standardized Cancer Incidence Rates for Men, 2008 (Worldwide estimate)

WHO-IARC-globocan 2008



Incidence vs mortality ($\times 10^5$ per year)

	Breast (F)	Prostate (M)
High-income countries		
Incidence rates	66.4	63
Mortality rates	15.5	10.6
Ratio	4.2	6
Low-income countries		
Incidence rates	27.3	12
Mortality rates	10.8	5.6
Ratio	2.5	2.1

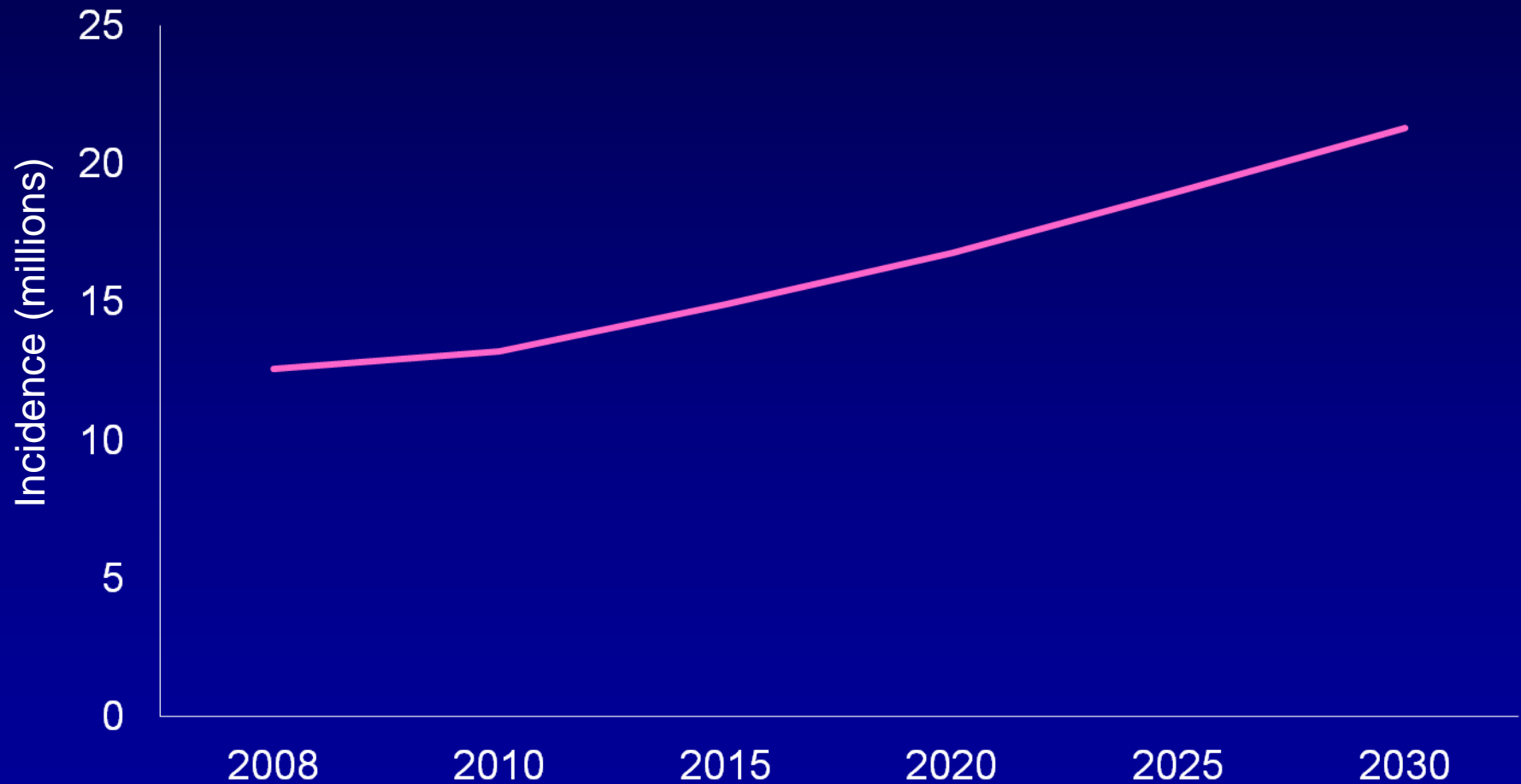
Survival from cancer is strongly uneven by continent and by socio-economic status

5-year survival for breast cancer

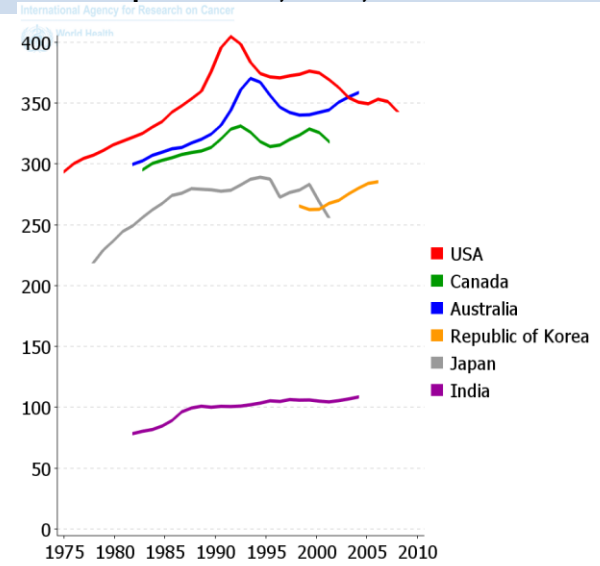
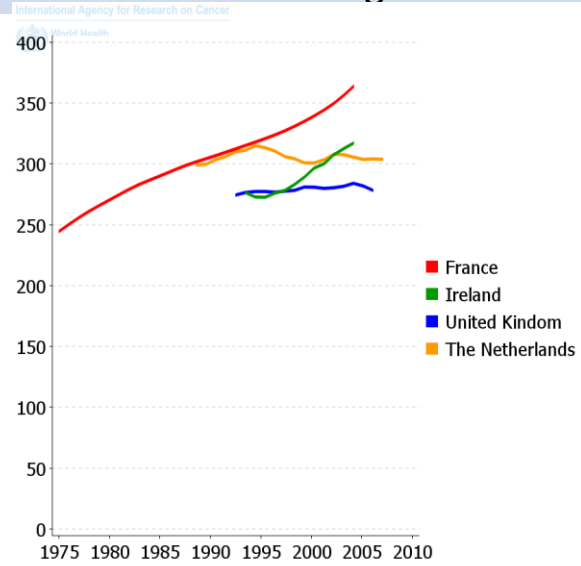
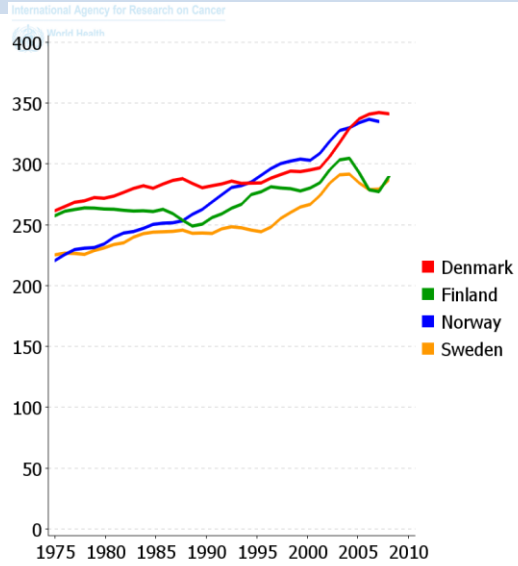
The Gambia	12%
China	80%
Singapore	80%

(Sankaranarayanan et al, 2010)

Projected Worldwide Cancer Incidence (Numbers) 2008-2030 (Globocan, IARC)

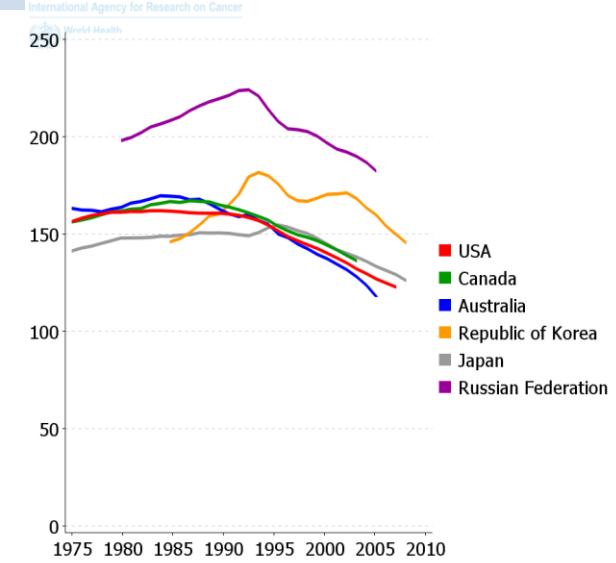
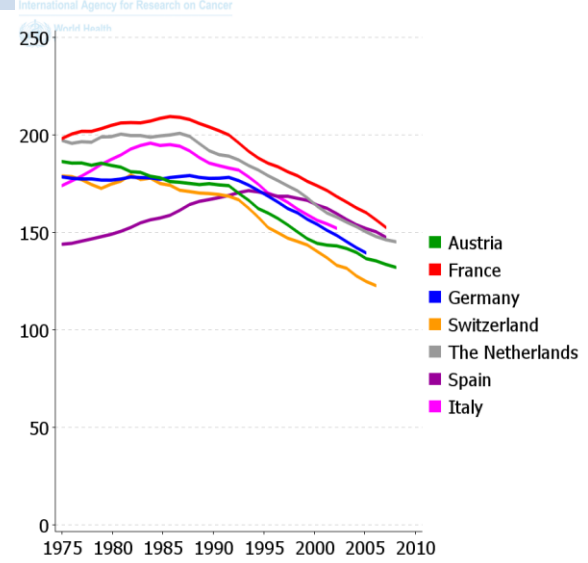
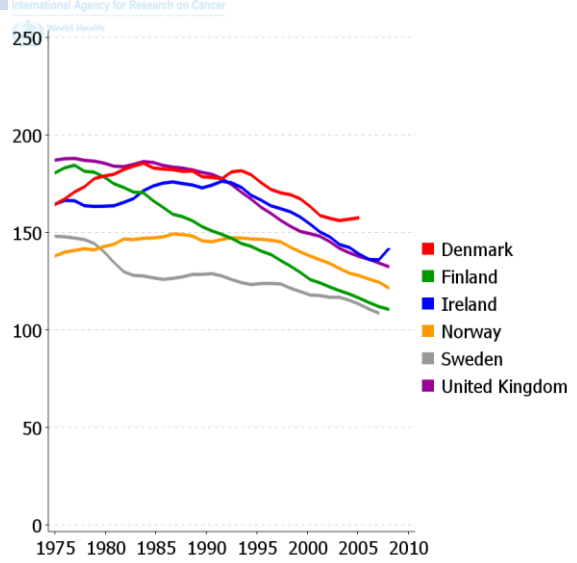


Trends in incidence of cancer in selected countries: age-standardised rate per 100,000, men



Cancer in 5 Continents,
IARC

Trends in mortality from cancer in selected countries: age-standardised rate per 100,000, men



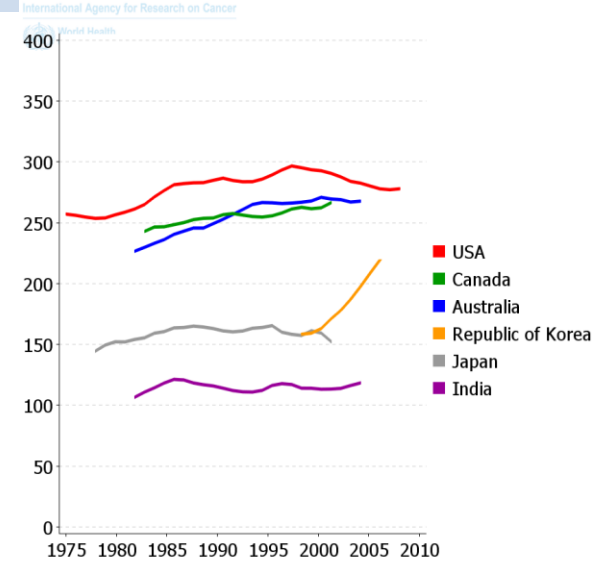
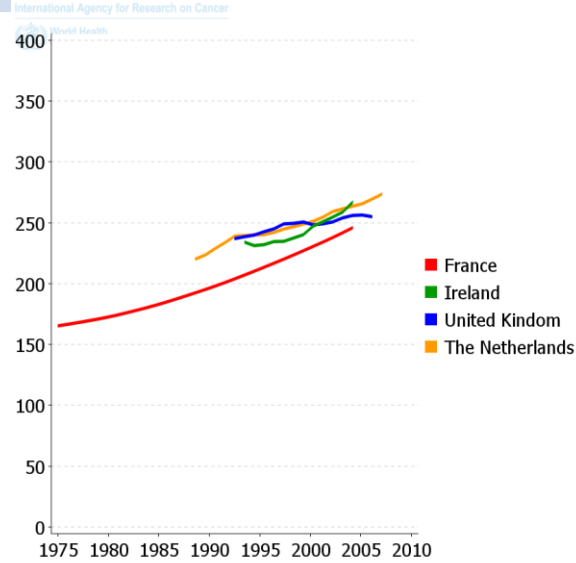
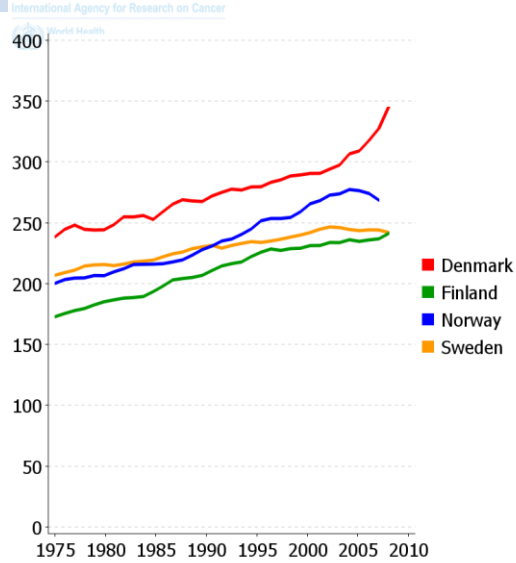
WHO (www.who.int/whosis)

WHO (www.who.int/whosis)

WHO (www.who.int/whosis)

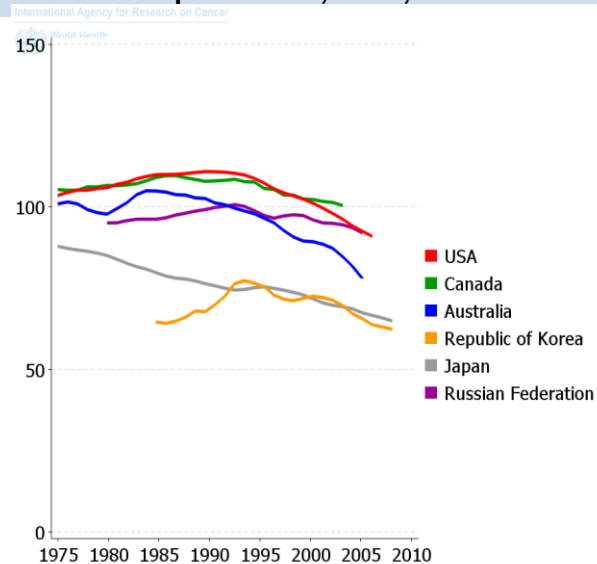
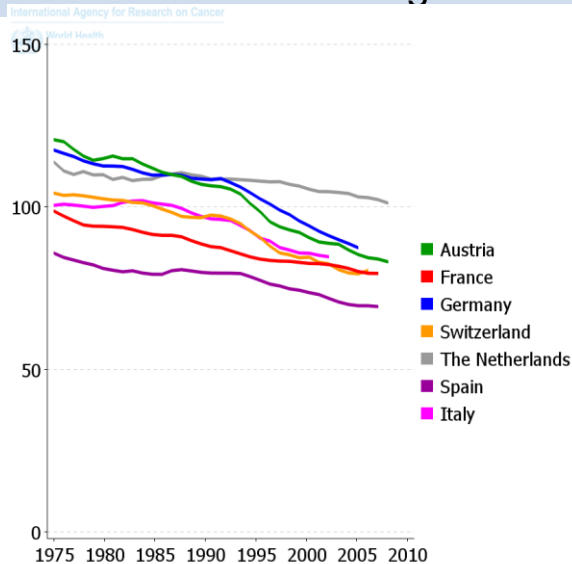
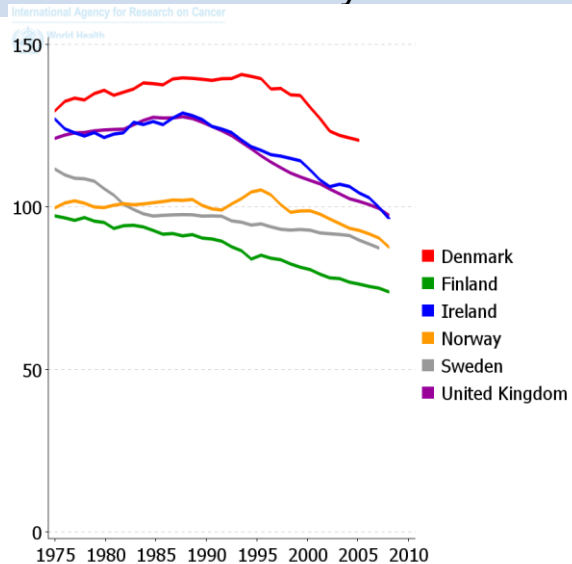
Cancer in 5 Continents,
IARC

Trends in incidence of cancer in selected countries: age-standardised rate per 100,000, women



Cancer in 5 Continents, IARC

Trends in mortality from cancer in selected countries: age-standardised rate per 100,000, women



Cancer in 5 Continents,
IARC

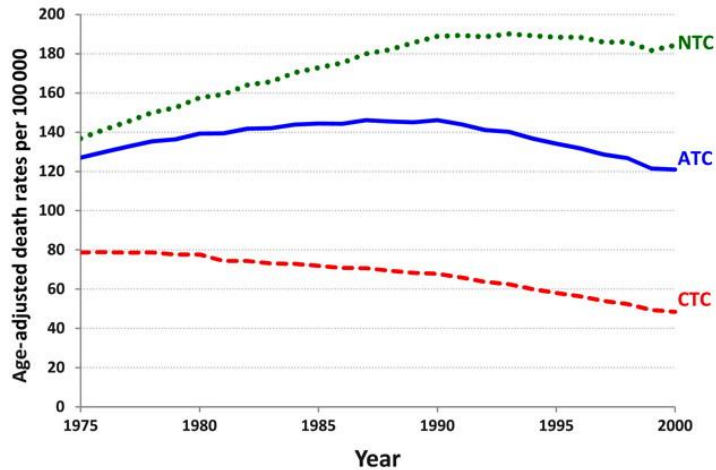
American Cancer Society Annual Report: More Than a Million Cancer Deaths Avoided in 2 Decades

A total of 1,638,910 new cancer cases and 577,190 deaths from cancer are projected to occur in the U.S. in 2012. **Between 1990/1991 and 2008, the most recent year for which data is available, overall death rates decreased by about 23% in men and 15% in women.**

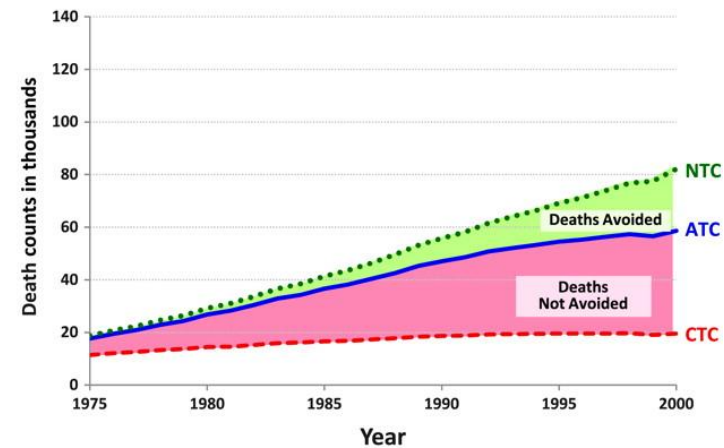
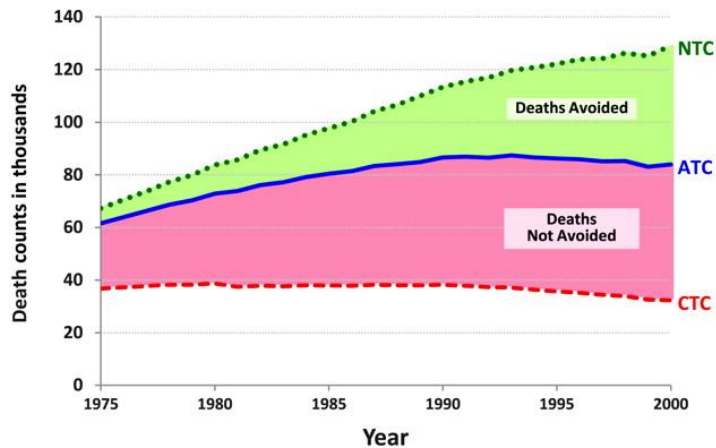
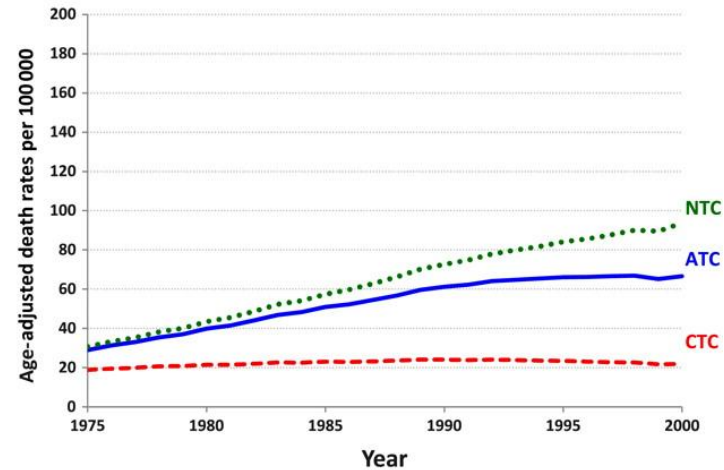
This translates to more than 1 million deaths from cancer that were avoided.

Lung cancer death rates and counts for men and women aged 30-84 for modeled scenarios.
ATC = Actual Tobacco Control; CTC = Complete Tobacco Control; NTC = No Tobacco Control.

Age-adjusted lung cancer death rates and counts among US men



Age-adjusted lung cancer death rates and counts among US women

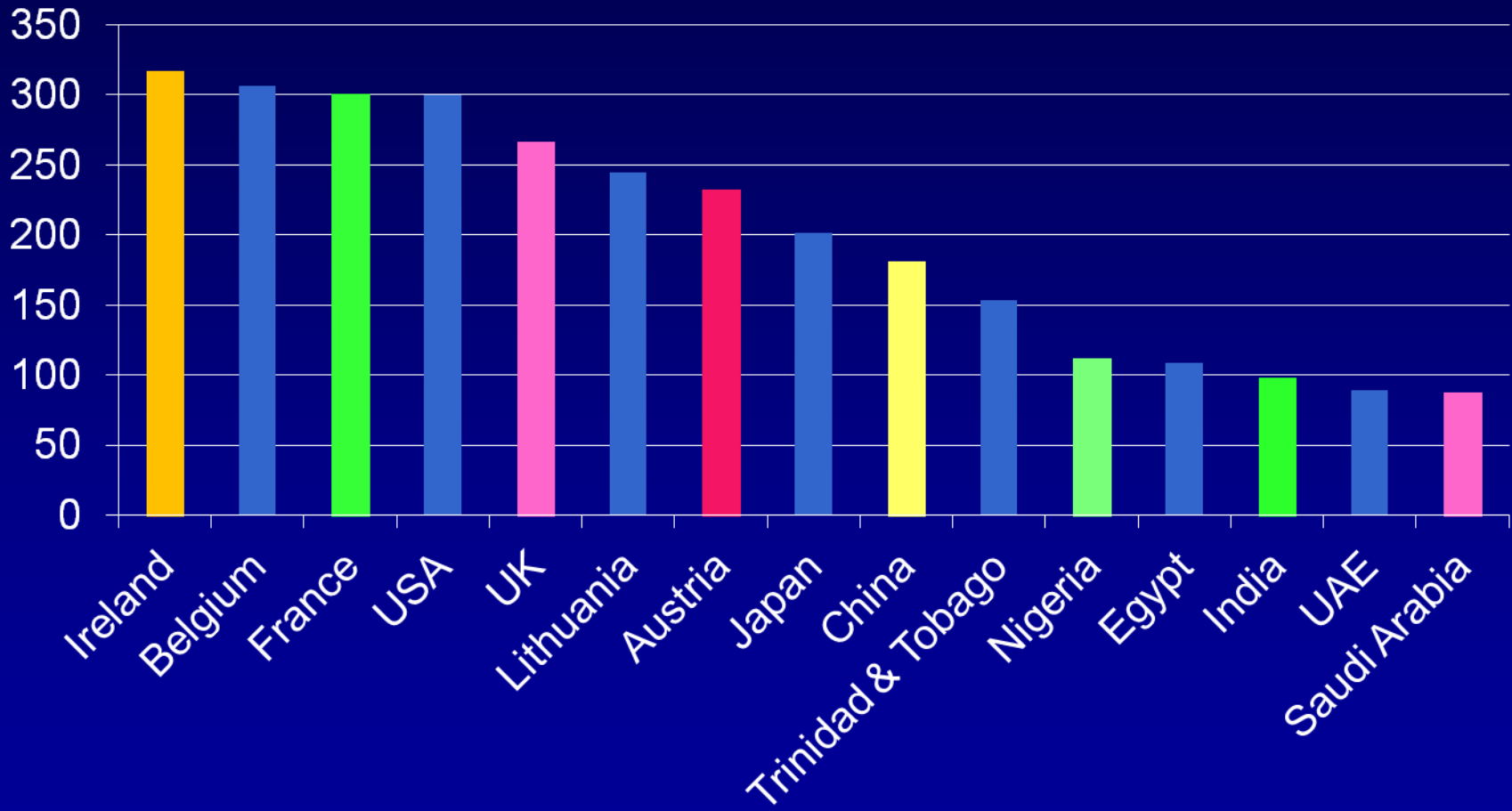


Moolgavkar S H et al. JNCI J Natl Cancer Inst 2012;jnci.djs136

Who is at risk?

Geographic variation

Cancer Incidence Rates in Selected Countries



*Incidence Rates per 100,000 per Year

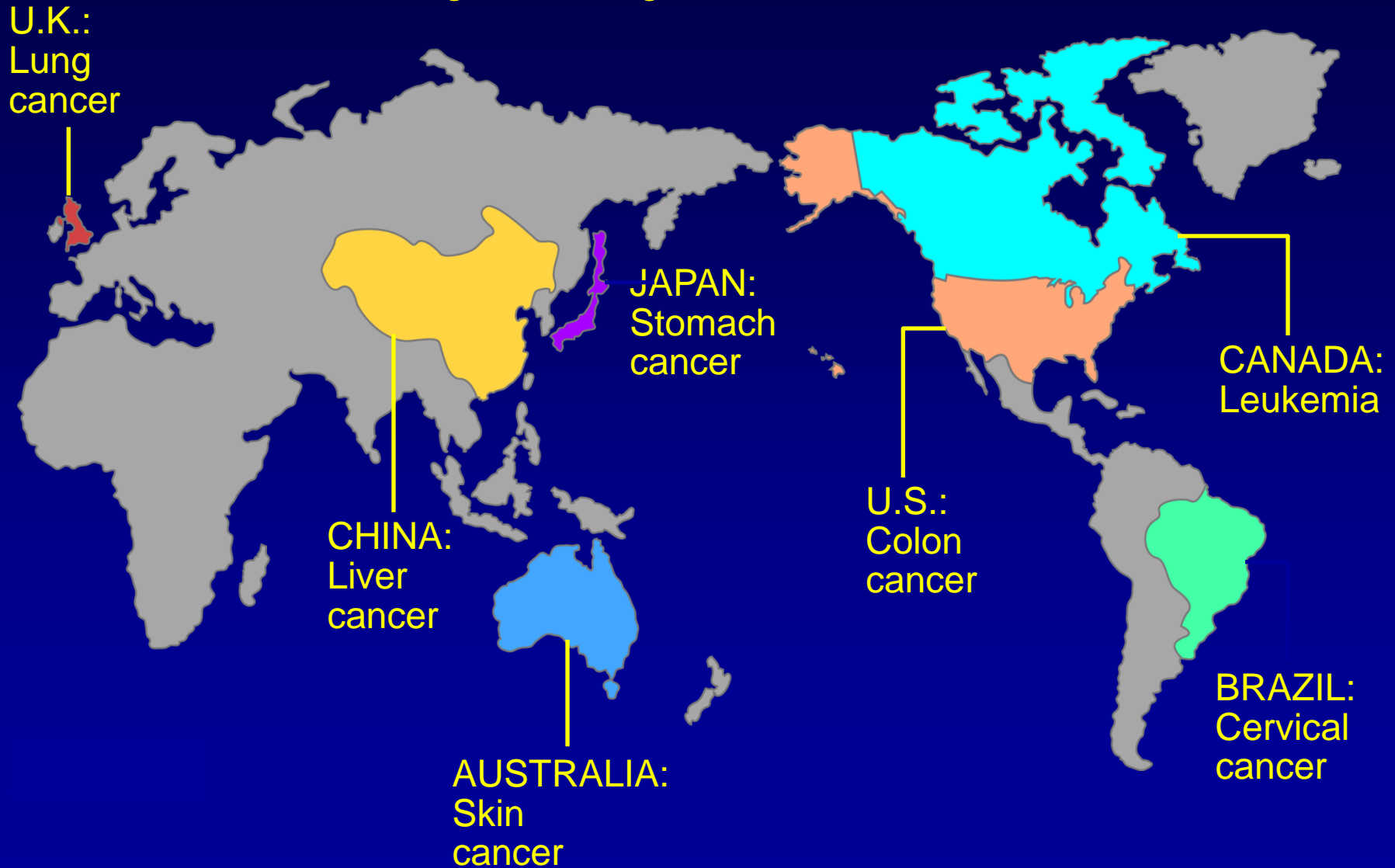
International geographic variation in cancer incidence (rates per 100,000), 2002

Cancer	High-incidence area	Low-incidence area	Ratio
Melanoma	Australia/NZ (M 38)	China (M 0.2)	189
Prostate	N. America (120)	China (1.6)	75
Lung	E. Europe (M 66)	W. Africa (M 2.4)	27
Colorectal	Japan (M 49)	Middle Africa (M 2.3)	21
Esophageal	China (M 27)	W.Africa (M 1.3)	21
Liver	China (M 38)	South Central Asia (2.6)	15
Bladder	S. Europe (M 27)	Melanesia (M 1.8)	15
Breast	N. America (99)	Middle Africa (16.5)	6
Non-Hodgkin	N. America (M 17)	China (M 3.0)	6

M= Males

Population-Based Studies

Regions of Highest Incidence



This suggests either genetic or environmental determinants

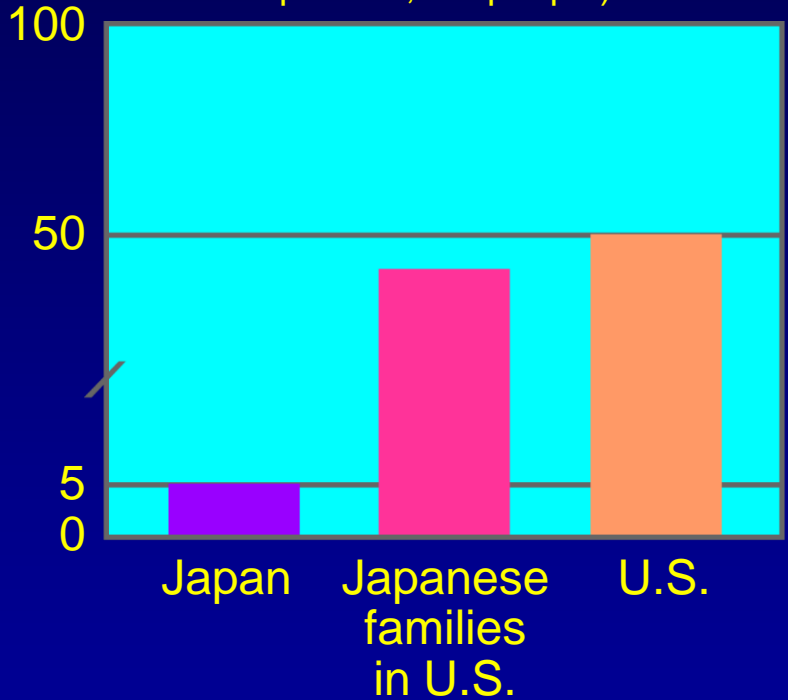
How can we disentangle nature and nurture?

Migrants

Migrants

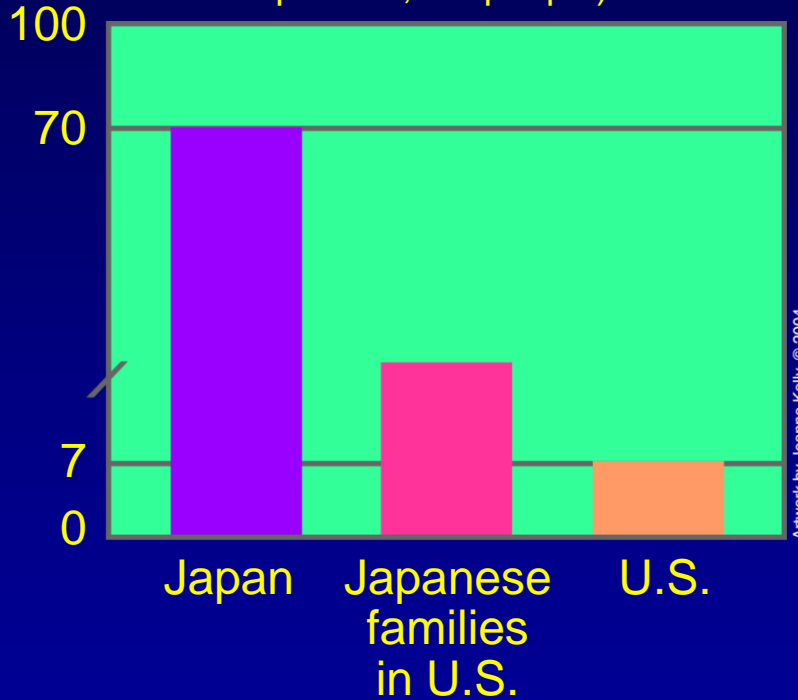
Colon Cancer

(Number of new cases per 100,000 people)



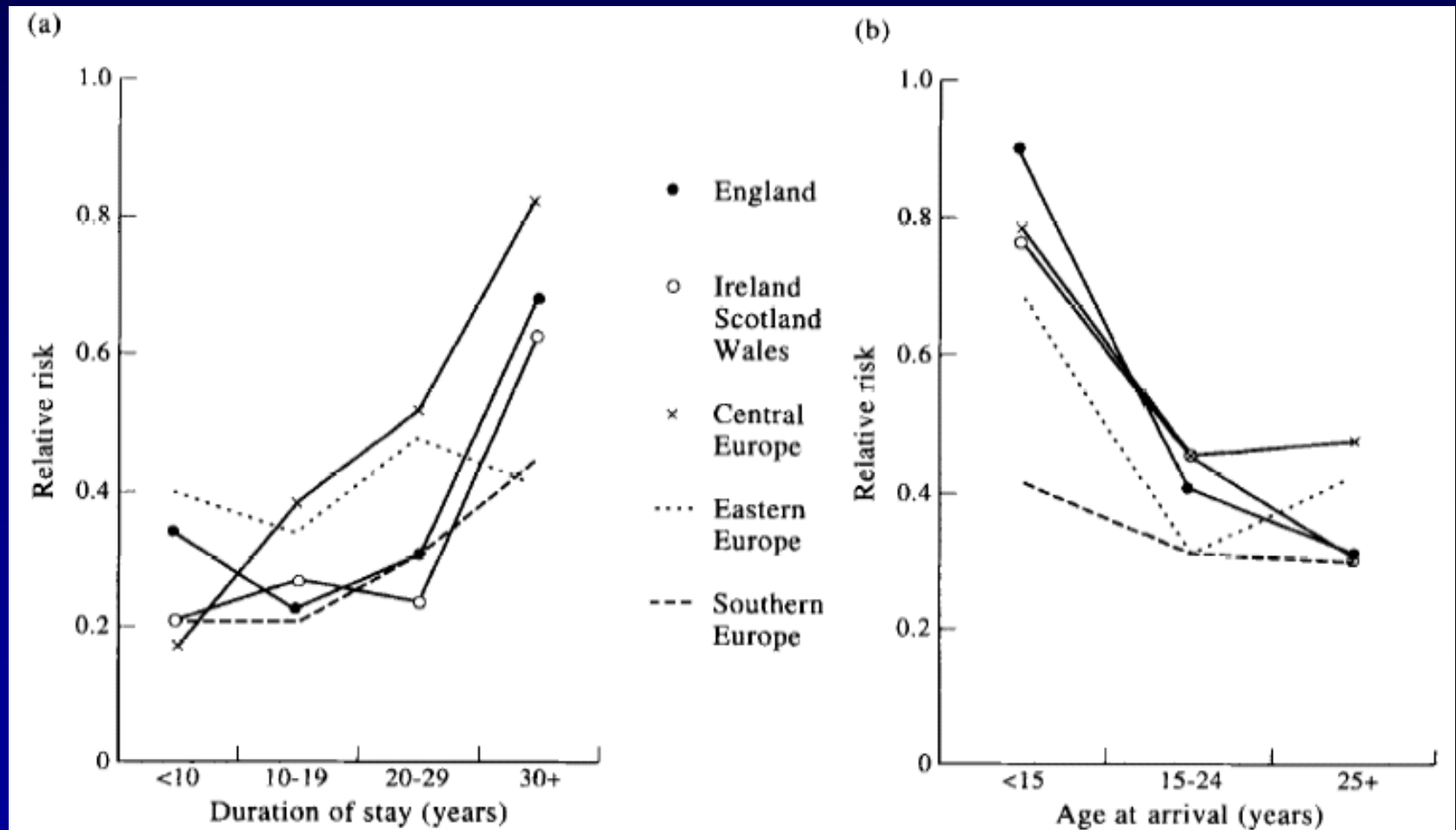
Stomach Cancer

(Number of new cases per 100,000 people)



Artwork by Jeanne Kelly, © 2004.

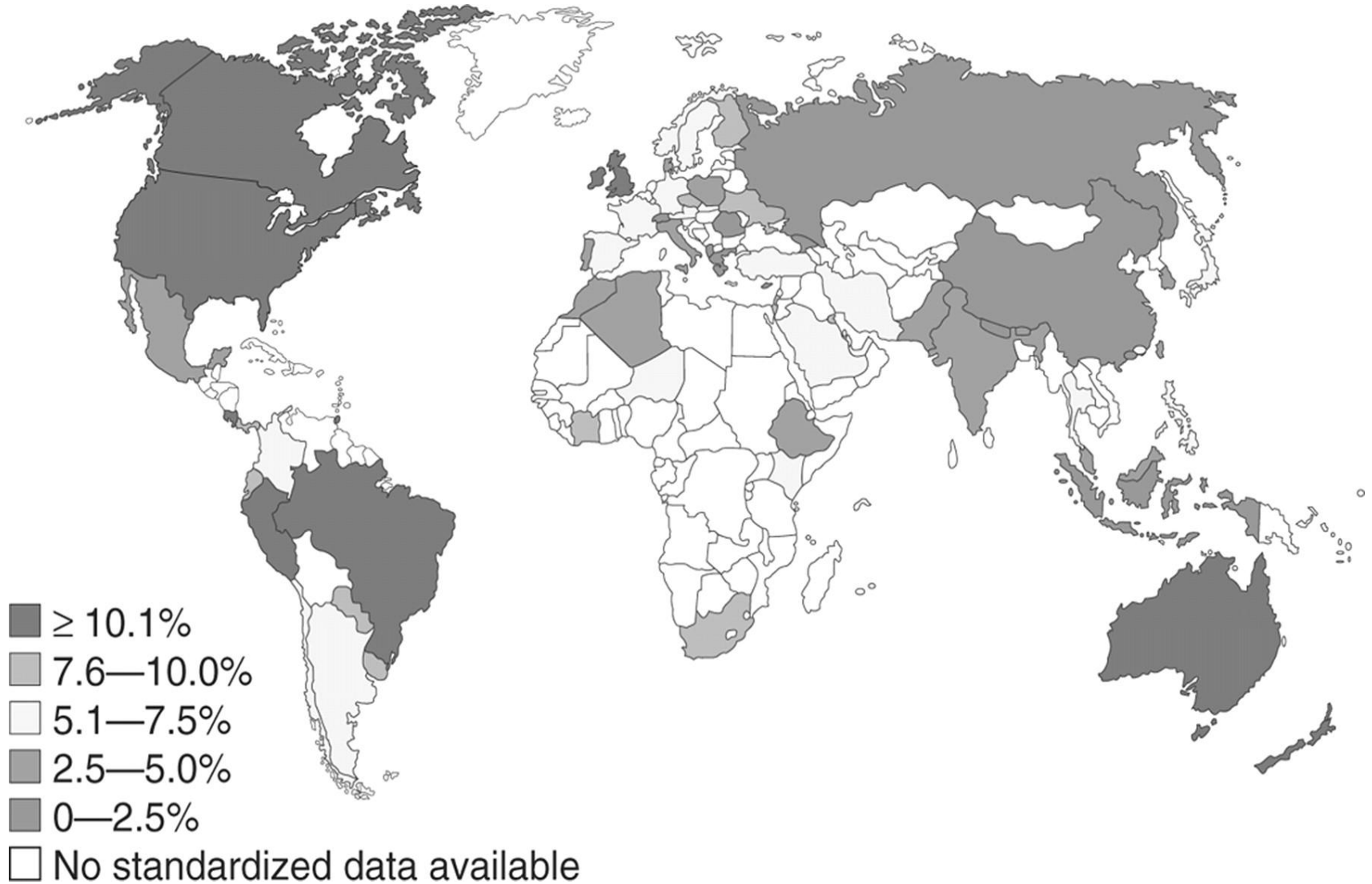
Melanoma in male migrants to Australia



Risk of death for six migrant populations compared to Australia-born

Asthma

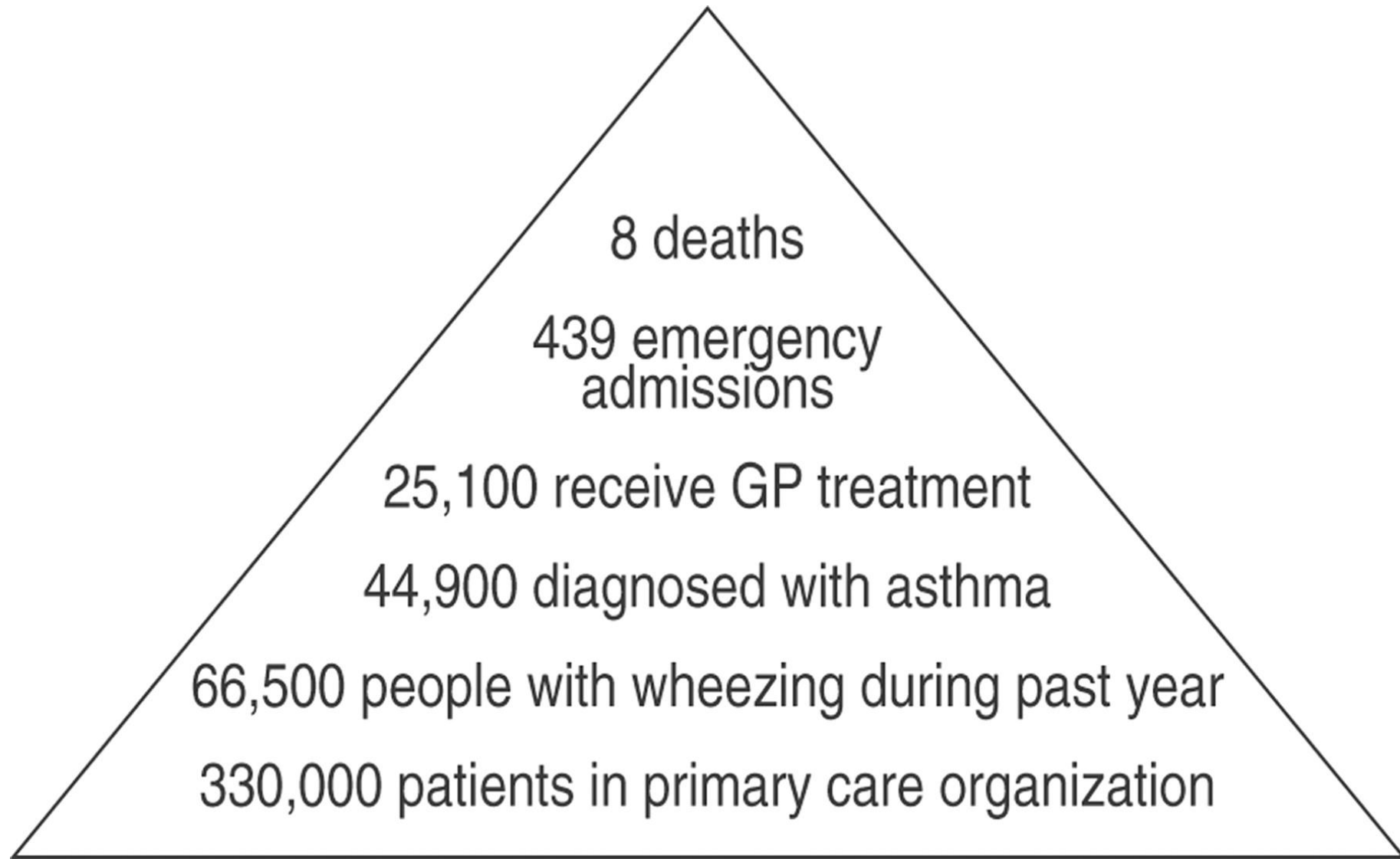
Worldwide prevalence of clinical asthma.



Asthma case fatality rates worldwide (deaths/100,000 cases).



**Estimate of asthma morbidity and mortality in a primary care organization
(n = 330,000) in the United Kingdom.**



Diabetes and CHD

Global projections for the diabetes epidemic: 1995-2010

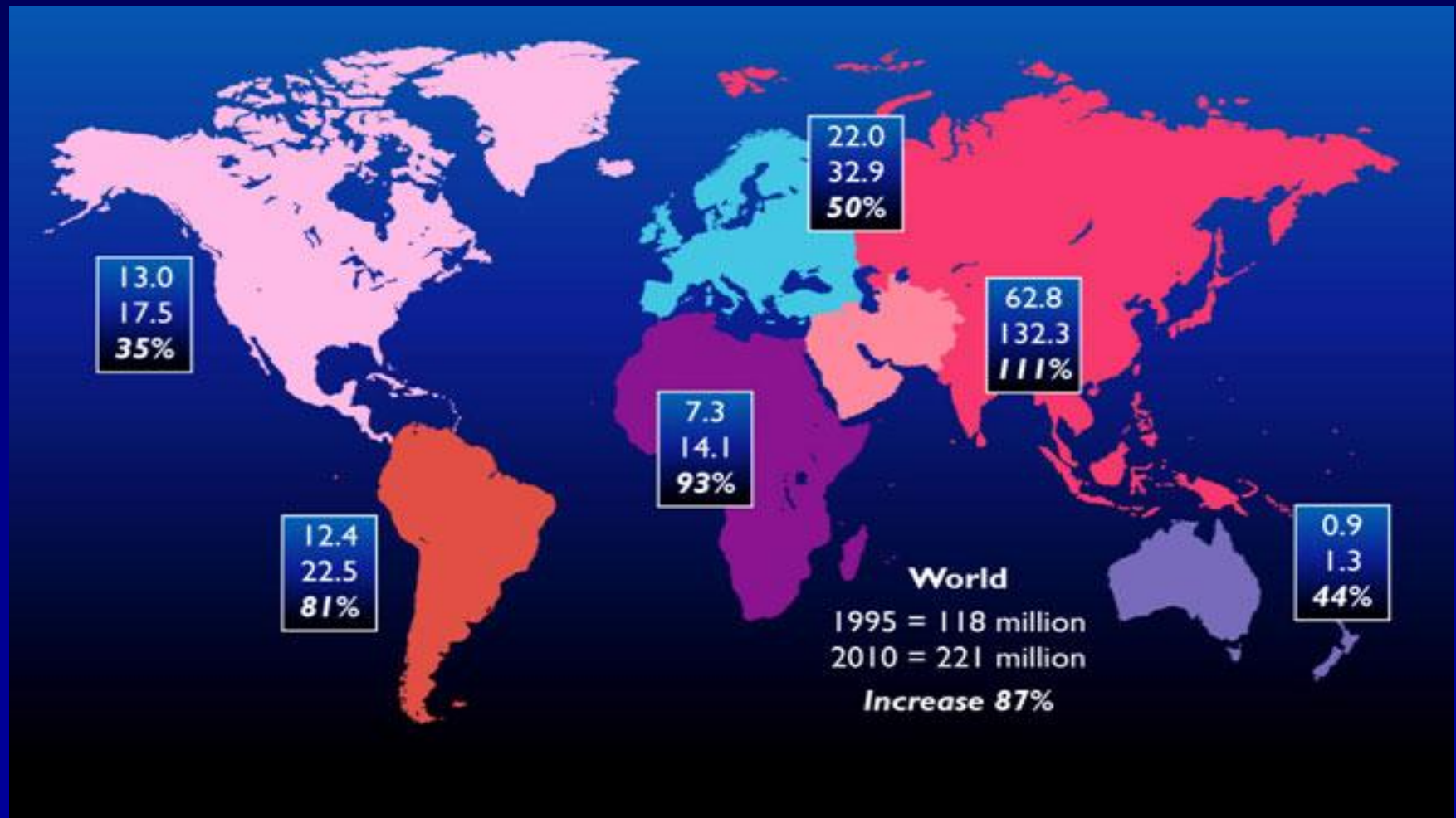
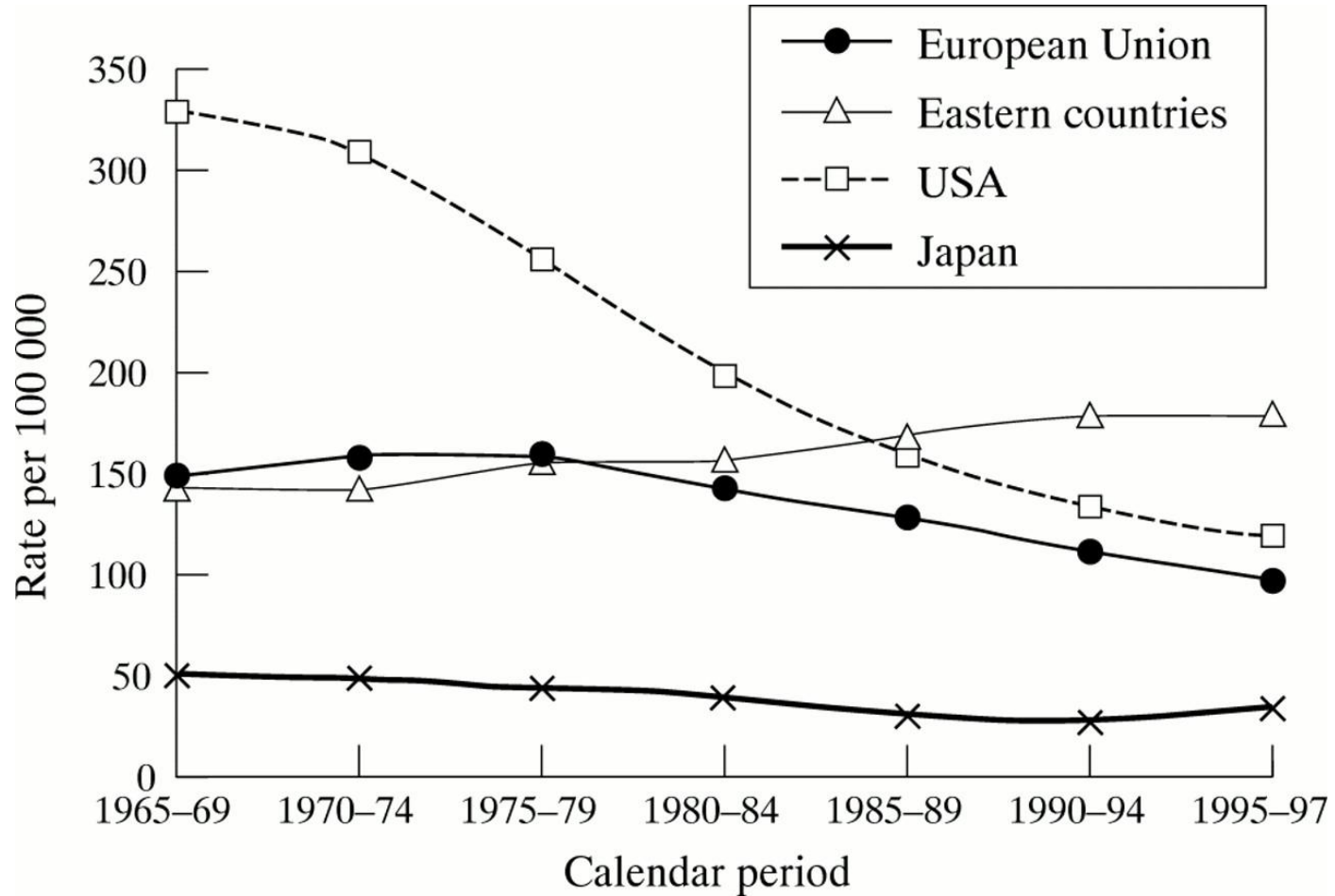


Figure 1 Trends in age standardised (world population) death certification rates from coronary heart diseases in men in all age groups from the European Union, eastern European countries (Bulgaria, Czech Republic, Hungary, Poland, Romania, and Slovakia), the USA, and Japan, 1965 to 1997.



Levi, F et al. *Heart* 2002;88:119-124

The end

Preview Mother 60 with password

<http://vimeo.com/30249064>

PW: P_60

Q & A

Exposure

Proximity

(residual) Confounders?

Misclassification

Cases and measures

Incidence – changes of exposure

Prevalent – influenced by incidence plus duration

Deaths

Observed cases in small area

Expected cases = null hypothesis

O/E (95% CI)