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Global Health and The Future of Epidemiology

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"Prevention avoids the labour of being sick"

Thomas Adams (1618)

Global Health Overview

- Each year there are approximately 20 million deaths in each of the age groups 0-34, 35-69 and 70 and older.
- Death cannot be prevented. Life is a sexually transmitted disease which is invariably fatal.
- Define premature death as death before old age (i.e. at ages up to 69) and deaths at 0-5 years and middle age (35-69) years should be considered separately.
- Two thirds of all deaths globally occur before the age of 69.

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Global Health Overview

One death in every five occurs in a child younger than 5 years of age.

Of approximately 60 million annual deaths, about 10 million are in children: 99% of which live in a low-income or medium-income country.

Two-thirds of these deaths were due to acute respiratory infections, measles, diarrhea, malaria and to HIV/AIDS.

The majority of all these deaths were avoidable.

Global Burden of Disease: 2004 update (WHO, 2008)

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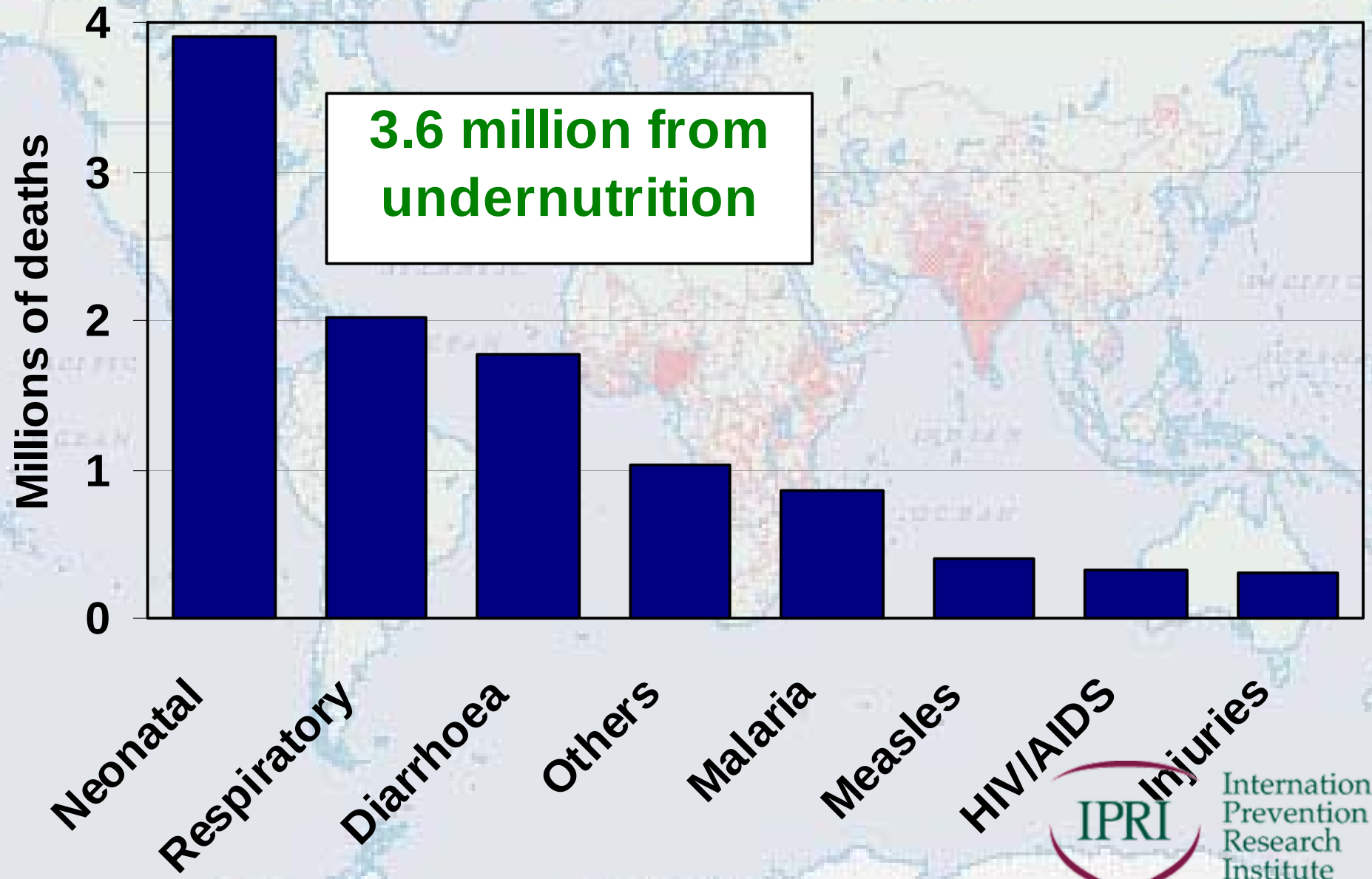
10 million children under 5 die each year

mostly of cheaply preventable conditions



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Global Health Overview

- Mills and Reinke (19th century) noted that the reduction in child mortality brought about by improvements in water and sanitation exceeded the number of deaths that could be attributed to diarrhoea alone.

- Currently, 9.1% of the global burden of disease could be prevented by improving water, sanitation and hygiene.

- In the 32 worst-effected countries, this figure is 15%.

- Currently 1.1 billion people do not have access to clean water and 2.6 billion do not have access to sanitation.

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The Gathering Storm

- The world population will grow from 6.5 billion in 2000 to reach 9 billion around 2050. As well as growing in magnitude, it will also grow older. The increases in growth and ageing will be greatest in low-income and lower middle-income countries.

- A programme of action should be drawn up and implemented to ensure that the growing and ageing world population will have access to at least basic health care and basic pharmaceuticals, drinking water and sanitation, adequate food supply and have hopes to improve their quality of life and living standards.

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Global Health Overview

The higher-income countries are launching and sustaining aggressive campaigns against infectious diseases, including tuberculosis, malaria and HIV/AIDS, among the poor countries of the world.

Chronic Diseases such as diabetes, cancer and heart and respiratory disease are becoming more frequent faster than expected in lower-income countries.

Economic growth and development is hastening the arrival of rich-world diseases before poor countries' health systems can prepare.

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Global Health Overview

Revolutionary changes in transportation, advertising and food production have led to the abrupt alteration of lifestyles in many lower resource countries.

Cheap cigarettes, western ‘junk food’, and the flood of new cars has led to may people in lower income countries to eat a poorer diet and exercise less than they did 10 or 20 years ago.

These trends have been exacerbated by population movements from rural areas to large cities.

Public Health awareness in most lower-resource settings has not kept pace.

Birt, M. Chronic neglect. Foreign Policy 2005: 95-96

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Global Health Overview

Diabetes is a particularly serious emerging hazard in lower resource settings. In such settings, it is anything but the manageable condition it can frequently be in high-income countries.

A diabetic in Mozambique who requires insulin injections, will probably live no more than one year. In Mali, the average life span after onset is 30 months.

The prevalence of diabetes has increased from 30 million to 250 million over the past 20 years. 50 million Chinese are now diabetic and there are 40 million in India. In the Middle East, the prevalence approaches 20 per cent.

Birt, M. Chronic neglect. Foreign Policy 2005: 95-96

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Global Health Overview

Cardiovascular Disease is the world's number 1 cause of death.

Eighty per cent of all cardiovascular deaths now occur in low-income and middle-income countries.

The trends in Cardiovascular disease in developed and developing countries are moving in opposite directions.

In developed countries, aggressive public health measures and medical intervention have cut cardiovascular mortality dramatically.

Death rates for heart disease have fallen by as much as 70% in Australia, United Kingdom, Canada and the United States during the last 30 years.

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Global Health Overview

In China, 300 million men smoke cigarettes and 160 million adults are hypertensive.

Many Chinese will contract chronic disease at young ages and the economic consequences will be profound.

At 2005 prices, China lost an estimated $18 Billion in national income in 2005 to heart disease, stroke and diabetes.

The cumulative loss between 2005 and 2015 will likely be over $550 billion: a staggering sum for a modernising economy.

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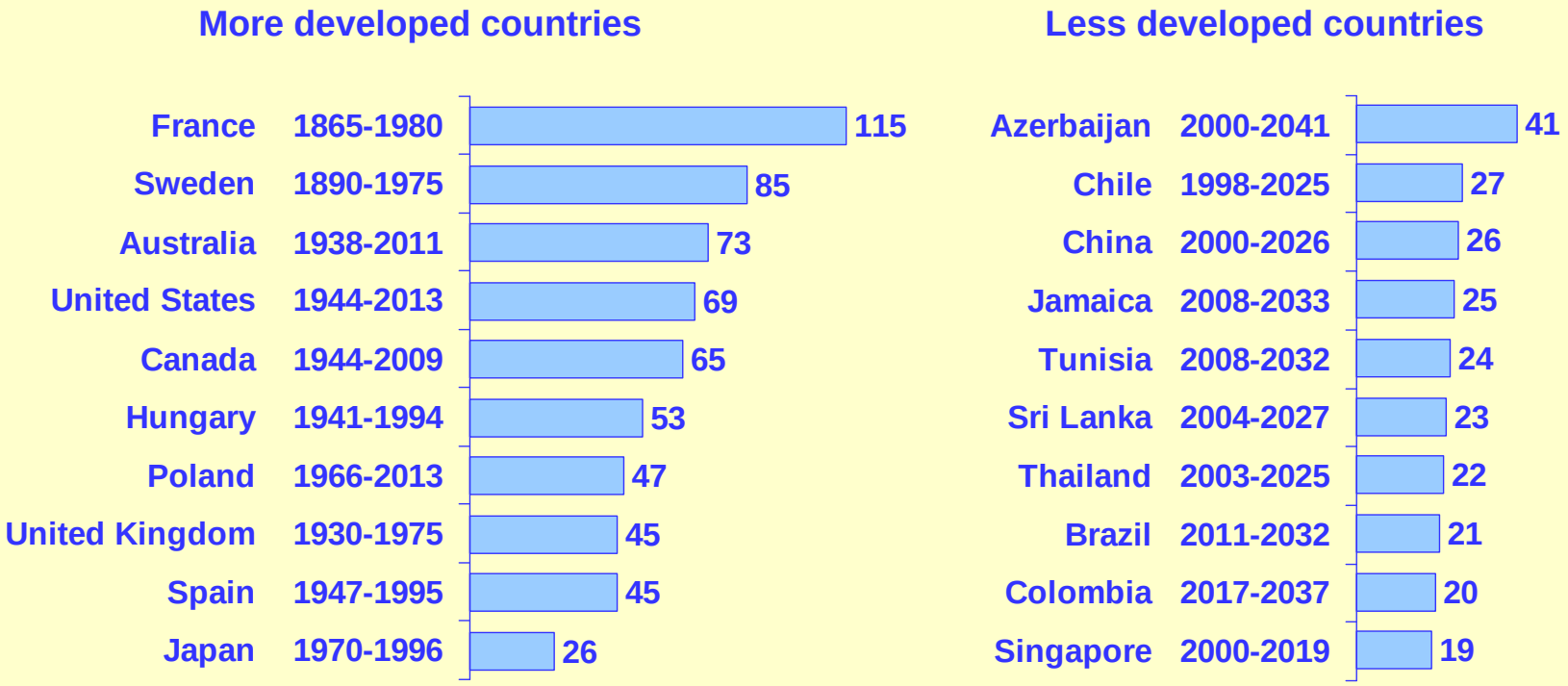
Speed of Population Ageing in Selected Countries

Number of Years for Percent of Population Age 65 or Older to Rise from 7% to 14%



•Dates show the span of years when percent of population age 65 or older rose (or is projected to rise) from 7 percent to 14 percent.

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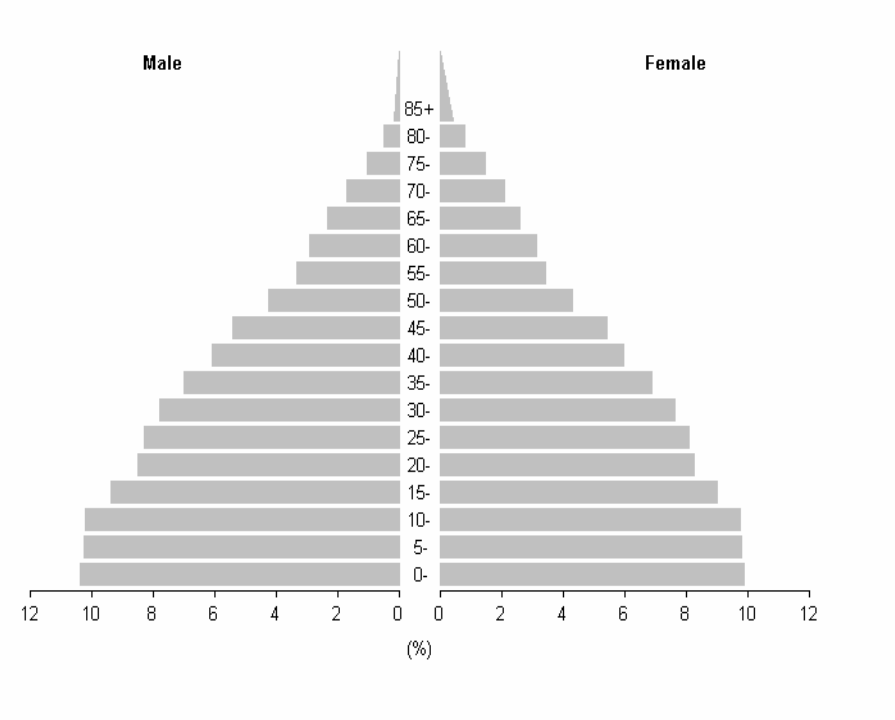
Global Population 2000 and 2030

Population (2000)

6,109,000,000

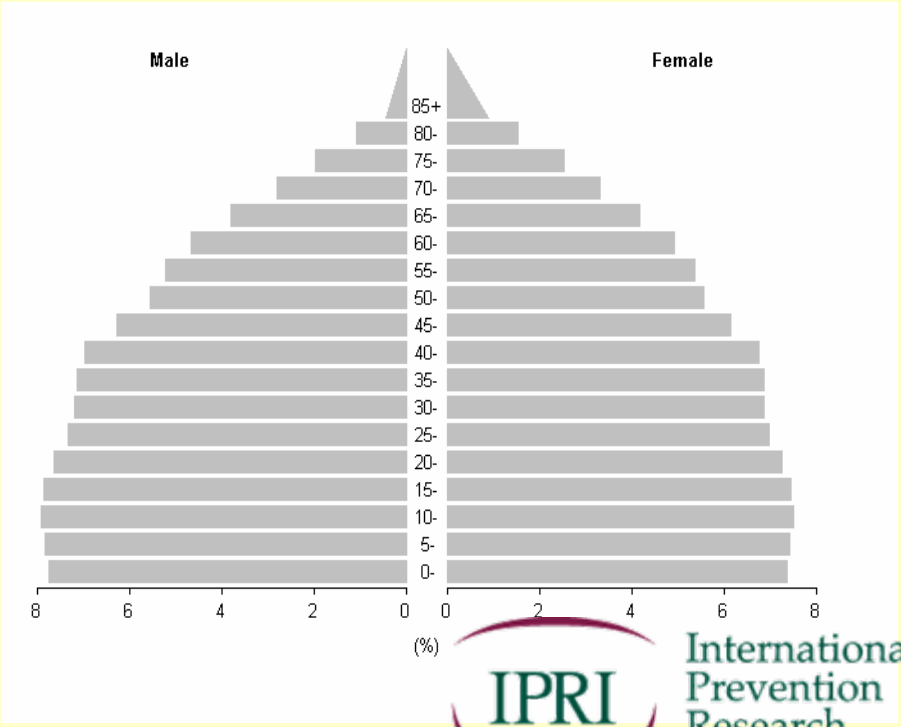
3,080,000,000 3,029,000,000



Population (2030)

8,293,000,000

4,165,000,000 4,128,000,000



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William Stewart

US Surgeon General 1969

"It is time to close the book on infectious diseases..."

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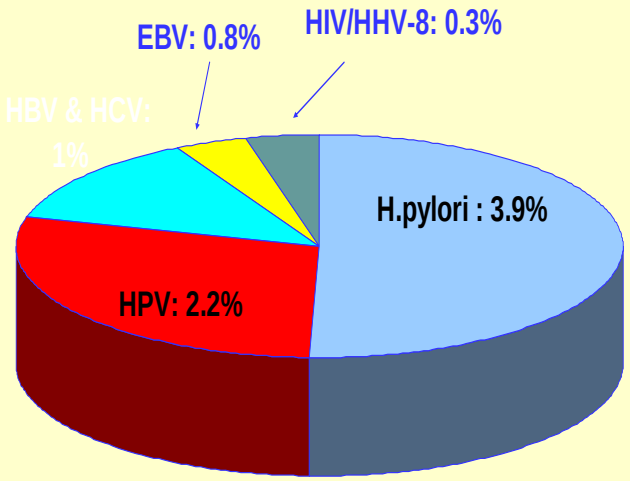
Infection-attributable cancers

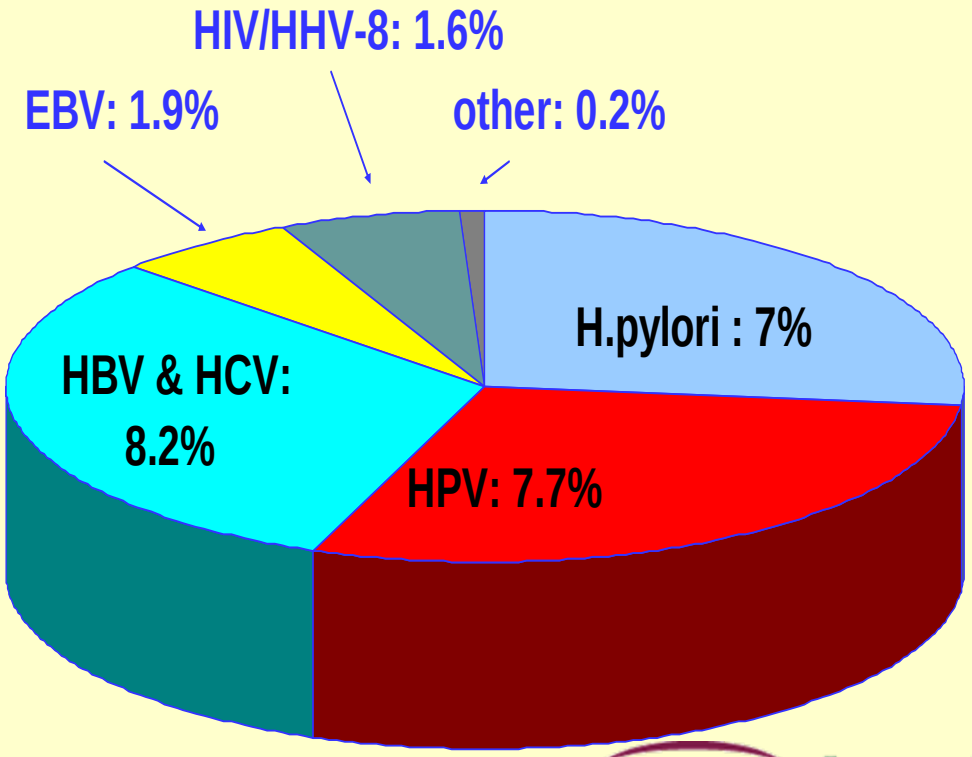
Developed countries

~ 8% of all cancers



Developing countries

~ 28% of all cancers



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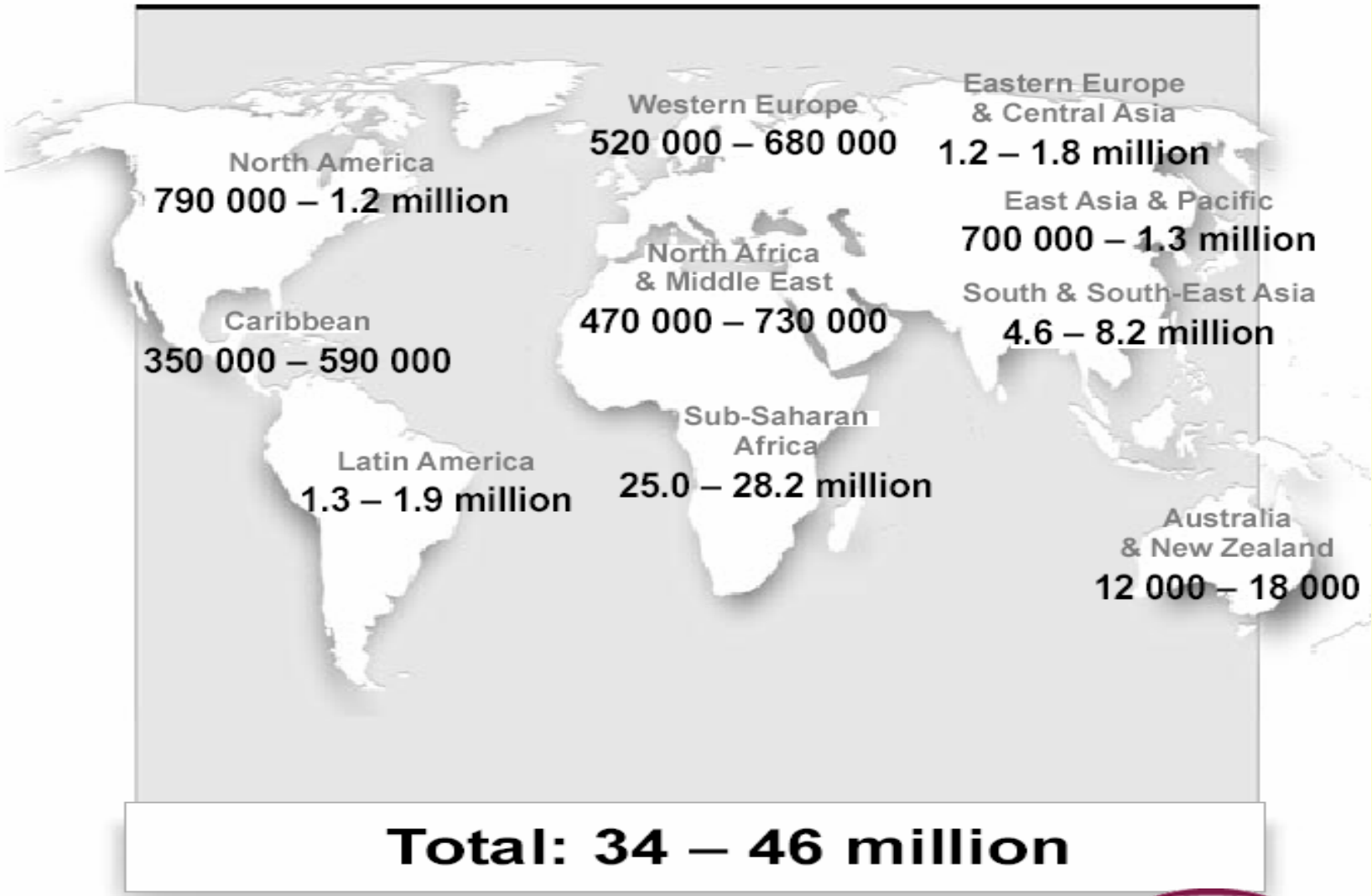
ADULTS AND CHILDREN ESTIMATED TO BE LIVING WITH HIV/AIDS, END 2003



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Global Health Overview

It is estimated that there are 75 million orphans due to HIV/AIDS in Africa.

Given the known difficulties of delivering health care in these low-income countries, the absolute necessity for a coordinated response to guarantee the health and welfare of this huge sub-group of the population is essential.

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Cancer Patients in Eldoret, Kenya 2009

Kaposi's sarcoma	2,596
Non-Hodgkin's lymphoma	257
Ca Breast	183
Hodgkin lymphoma	162
Chronic Myeloid Leukemia	106
Ca colon	103
Ca Cervix	103
ALL	101

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Kaposi's Sarcoma on the thigh

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Typical Kaposi's sarcoma in Eldoret, Kenya

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Cancer in Africa

- The probability that a woman who lives to age 65 in Kampala (Uganda) would develop a cancer is only 20% lower than that of a European.

- Because the population is generally young, cancer tends to affect the young, middle class, economically active segment of the population with devastating social, economic and psychological consequences.

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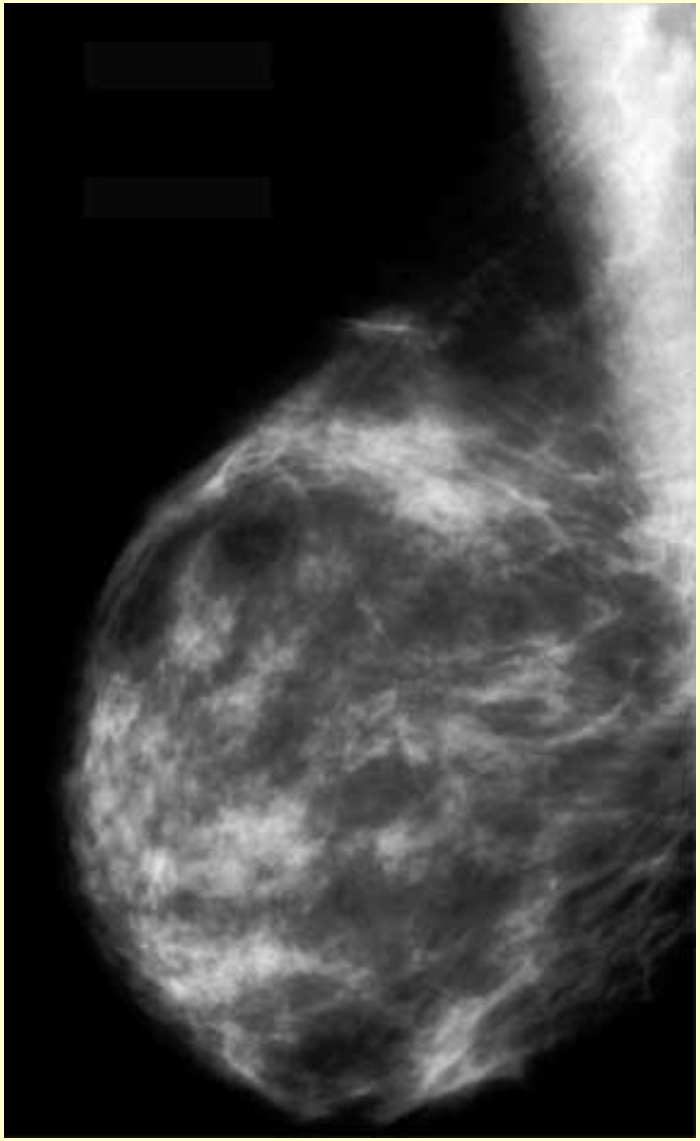
Locally advanced disease

Breast Cancer in High Resource Countries



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Health Inequalities in Glasgow in 1861

District	Servant:Resident	IMR/1,000 births
West End	1: 2.8	17.8
Central	1: 67.8	260.0

[John Strang, City Chamberlain. Glasgow, 1862]

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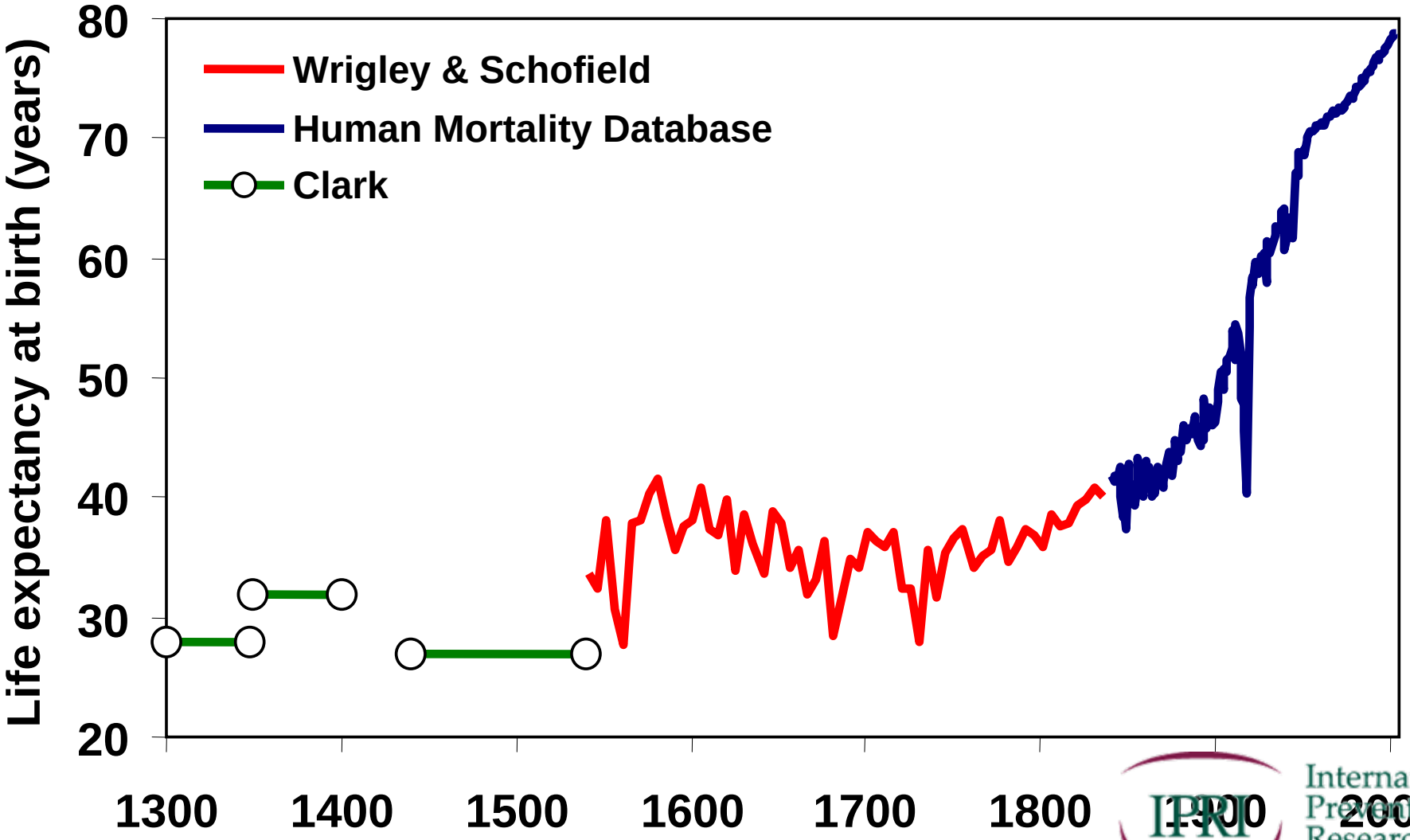
Industrial (r)evolution, health (r)evolution

Life expectancy in England 1300-2000



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Countries with Highest and Lowest life expectancy in Men, 2005-2010 (Abstracted from Pocket World in Figures (2008 Edition). The Economist, London)

Highest Life Expectancy	
Andorra	80.6
Iceland	80.2
Hong King	79.4
Japan	79.0
Switzerland	79.0
Australia	78.9
Sweden	78.7
Israel	78.6
Macau	78.5
Canada	78.3
New Zealand	78.2
Singapore	78.0
Norway	77.8
Spain	77.7
Cayman Islands	77.5
Italy	77.5
Netherlands	77.5
Malta	77.3

Lowest Life Expectancy	
Swaziland	39.8
Sierra Leone	41.0
Angola	41.2
Mozambique	41.7
Zambia	42.1
Lesotho	42.0
Central African Rep	43.3
Afghanistan	43.9
Zimbabwe	44.1
Rwanda	44.6
Liberia	44.8
Guinee-Bissau	44.9
Congo-Kinshasa	45.2
Nigeria	46.4
Somalia	46.9
Cote d'Ivoire	47.5
Burundi	48.1
Malawi	48.1

Countries with Highest and Lowest life expectancy in Women, 2005-2010 (Abstracted from Pocket World in Figures (2008 Edition). The Economist, London)

Highest Life Expectancy		Lowest Life Expectancy	
Andorra	86.6	Swaziland	39.8
Japan	86.1	Lesotho	42.3
Hong Kong	85.1	Mozambique	42.4
Spain	84.2	Zambia	42.5
Switzerland	84.2	Zimbabwe	42.7
France	84.1	Afghanistan	43.8
Australia	83.6	Sierra Leone	44.2
Italy	83.5	Angola	44.3
Iceland	83.3	Central African Rep	46.1
Virgin Islands (US)	83.3	Liberia	46.6
Sweden	83.0	Nigeria	47.3
Canada	82.9	Congo-Kinshasa	47.7
Faroe Islands	82.8	Rwanda	47.8
Israel	82.8	Guinee-Bissau	47.9
Macau	82.8	Malawi	48.4
Cayman Islands	82.7	Cote d'Ivoire	49.3
Puerto Rico	82.7	Somalia	46.9
Austria	82.6	South Africa	49.7

Death Rates per Million in England and Wales

Cause of Death	1848-54	1971
Tuberculosis	2,901	13
Bronchitis, Influenza	2,239	603
Scarlet fever, Diphtheria	1,016	0
Whooping Cough	423	1
Measles	342	0
Smallpox	263	0
URT Infections	75	2

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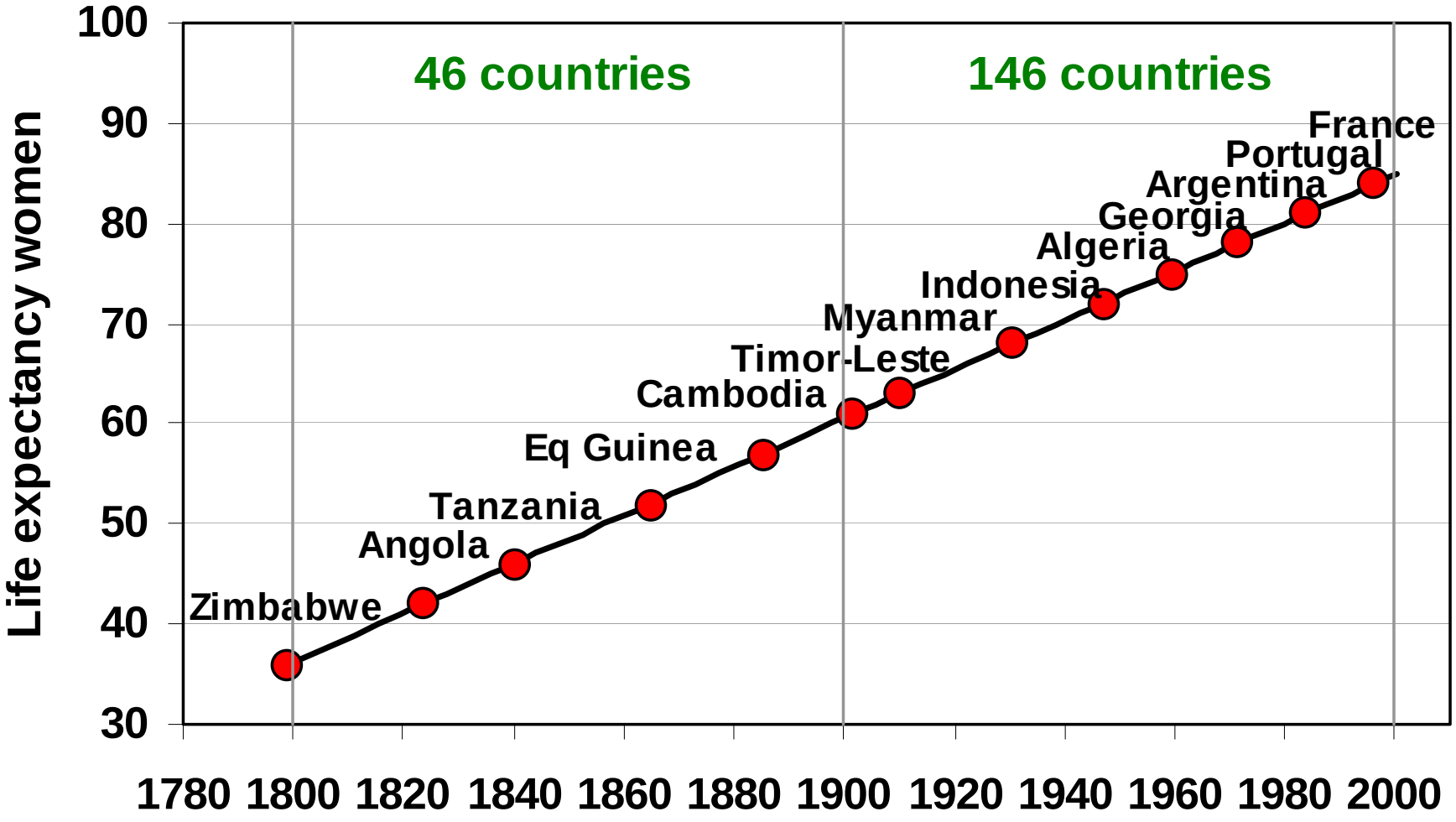
Death Rates per Million in England and Wales

Cause of Death	1848-54	1971
Cholera, Dysentry	1,819	33
Typhoid (typhus)	990	0
Non-Respiratory TB	753	2
Infections in Infants	1,322	0
Puerperal fever	62	1
Syphilis	50	0
Other Infections	635	52

Today's least favoured countries have longevity patterns of 19th century



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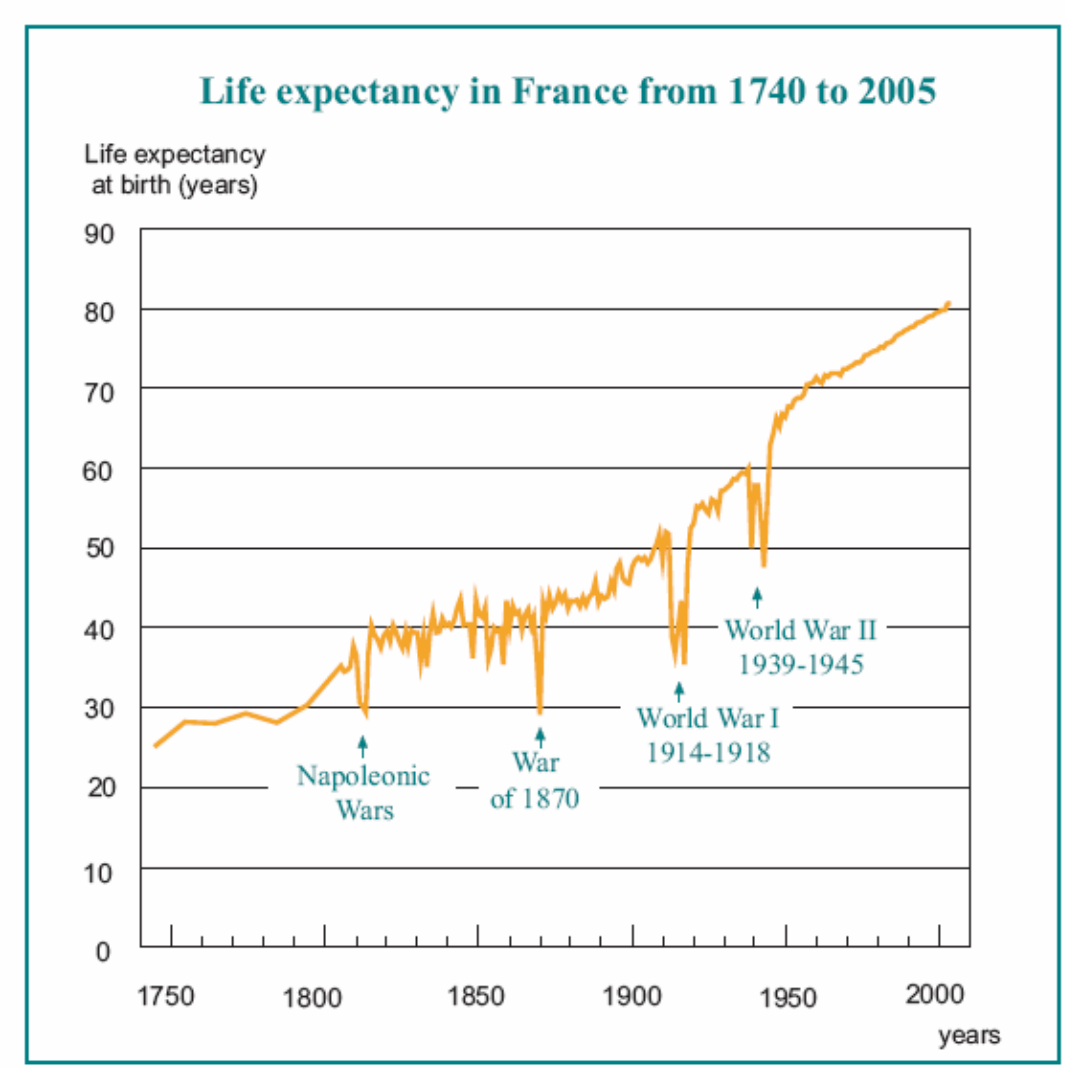
Life Expectancy in France, 1740-2005



Pison, 2005

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Big steps forward in Public Health ..... and Big Steps backwards.

For a man born in France in 1890, all the gains in life expectancy brought about by the great engineering and medical progress of the first half of the 20th Century were lost due to the two great European Wars.

For United Kingdom doctors born in the early part of the 20th century, all the gains in life expectancy brought about by the fantastic medical progress in the second half of the century were lost among those doctors who continued to smoke after 1950.

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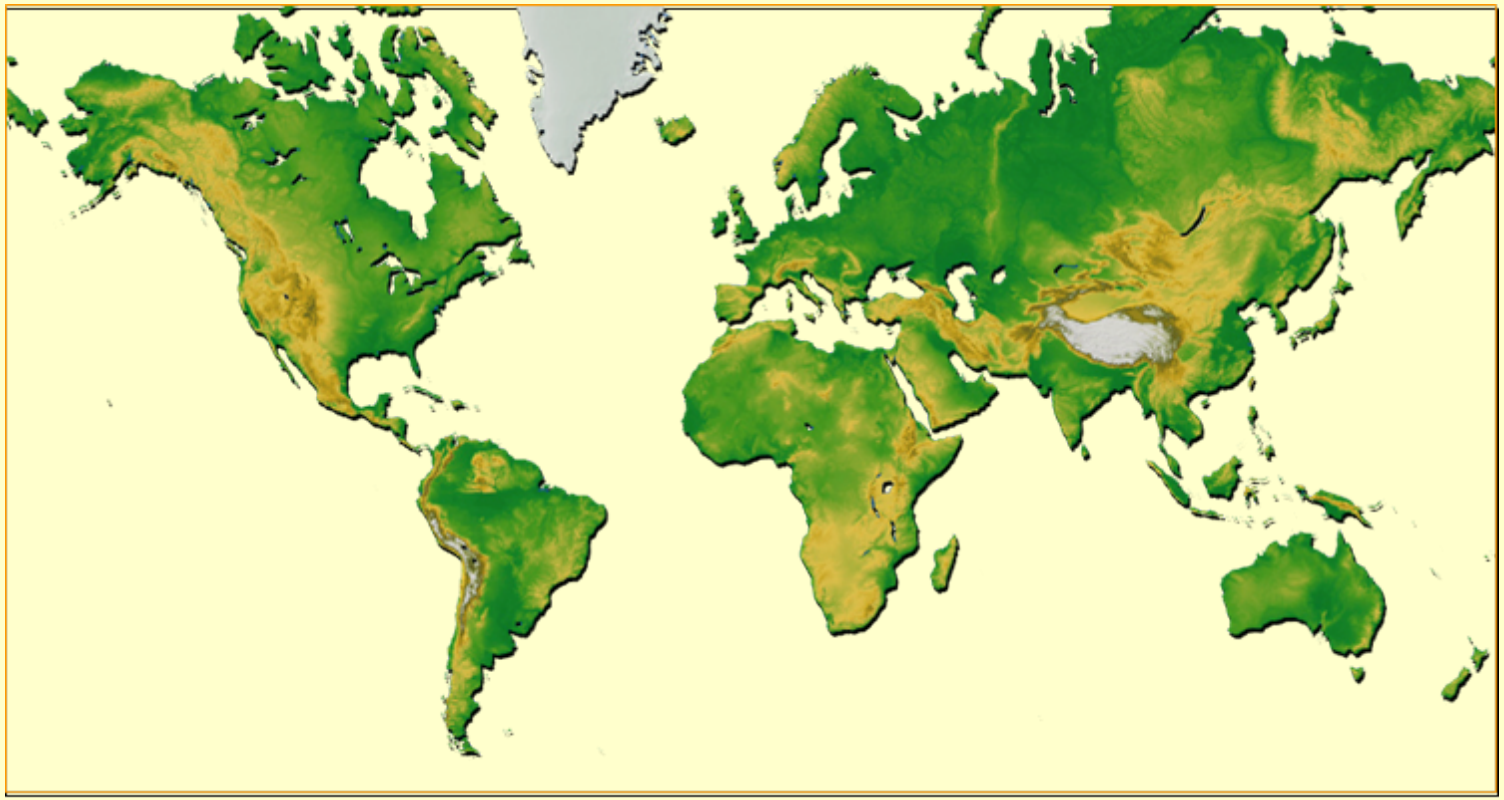
CANCER – WORLDWIDE BURDEN (2008)



12.5 million new cases

7.6 million deaths

28 million living with cancer

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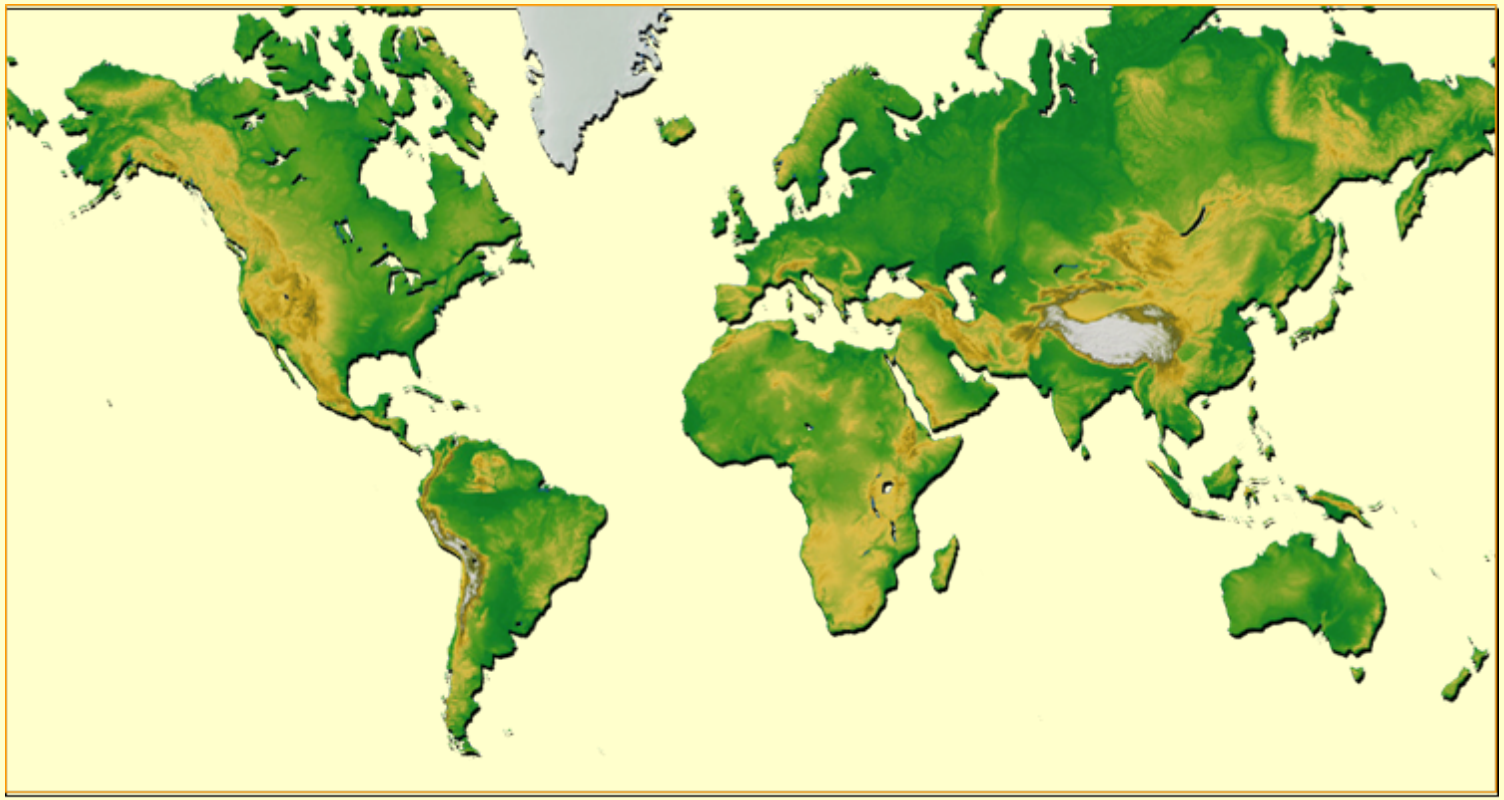
CANCER – WORLDWIDE BURDEN (2030)



26.4 million new cases

17.1 million deaths

80 million living with Cancer

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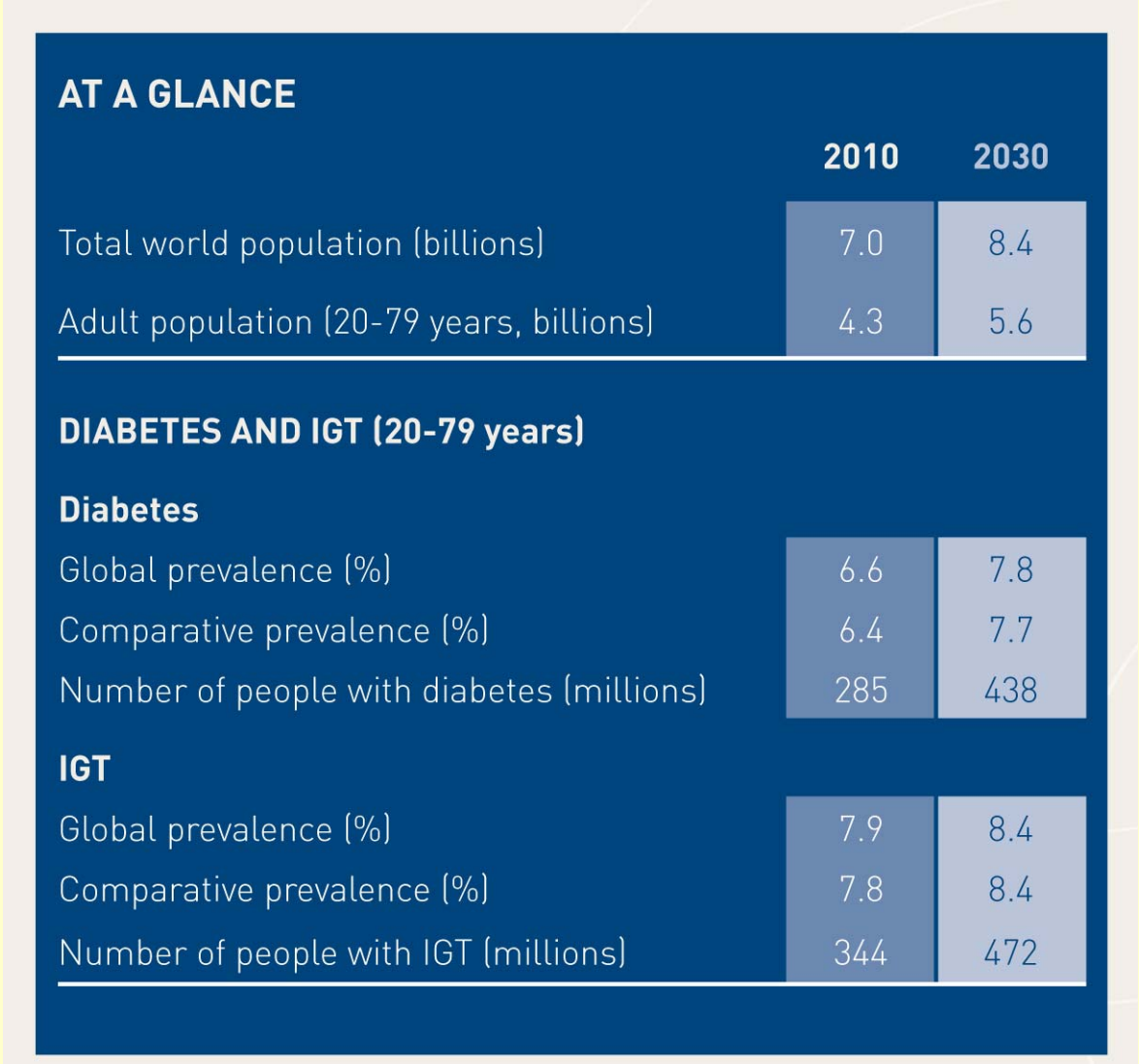
Global Prevalence of Diabetes and Impaired Glucose Tolerance (IGT) in 2010 and 2030.



AT A GLANCE

	2010	2030
Total world population (billions)	7.0	8.4
Adult population (20-79 years, billions)	4.3	5.6

DIABETES AND IGT (20-79 years)

Diabetes

Global prevalence (%)	6.6	7.8
Comparative prevalence (%)	6.4	7.7
Number of people with diabetes (millions)	285	438

IGT

Global prevalence (%)	7.9	8.4
Comparative prevalence (%)	7.8	8.4
Number of people with IGT (millions)	344	472

International Diabetes Federation

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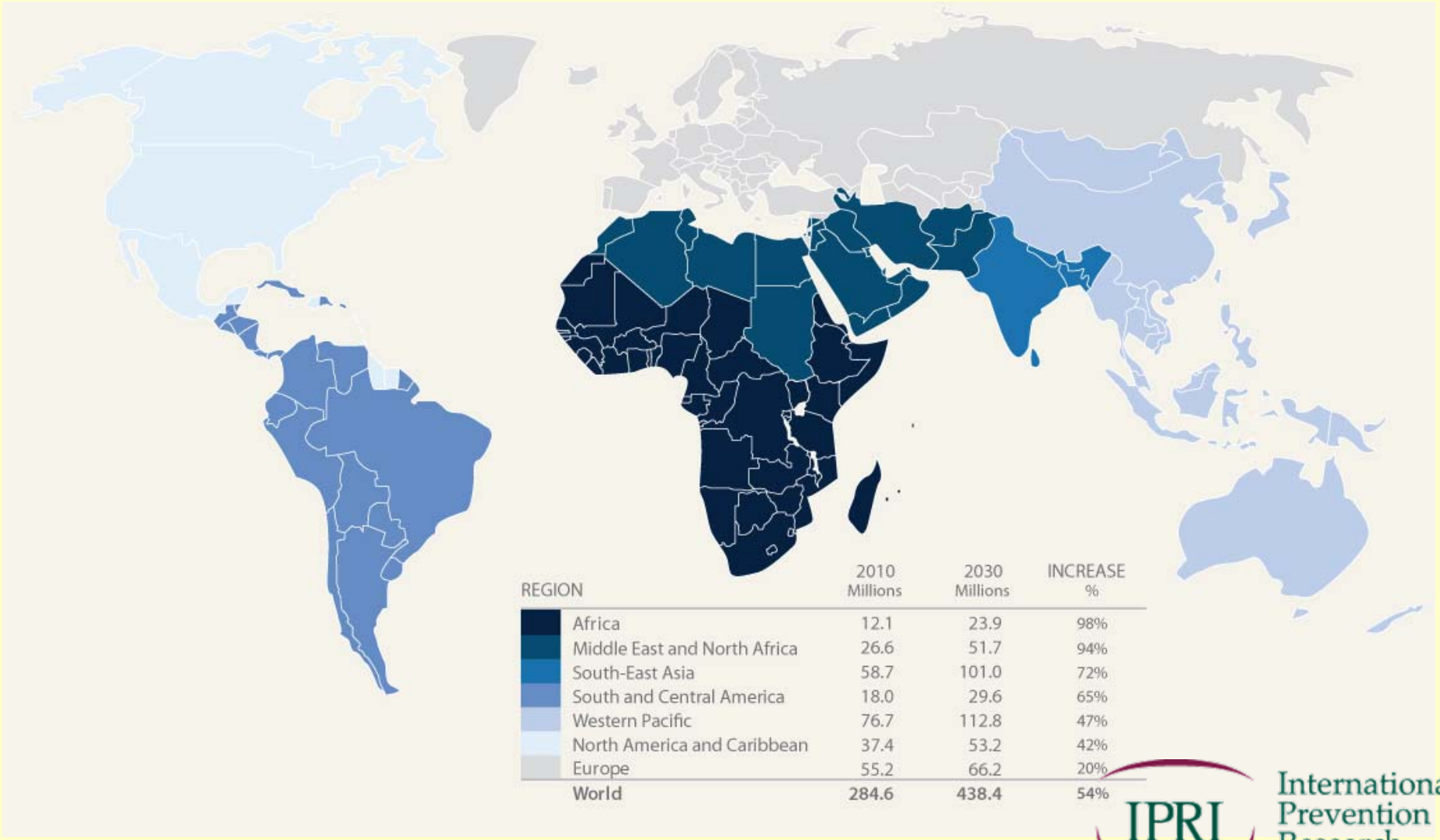
Global projections for the number of people with diabetes (20-79 years), 2010-2030



REGION	2010 Millions	2030 Millions	INCREASE %
Africa	12.1	23.9	98%
Middle East and North Africa	26.6	51.7	94%
South-East Asia	58.7	101.0	72%
South and Central America	18.0	29.6	65%
Western Pacific	76.7	112.8	47%
North America and Caribbean	37.4	53.2	42%
Europe	55.2	66.2	20%
World	**284.6**	**438.4**	**54%**

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Epidemiology

We are at what is known as a ‘tipping point’ in the evolution of the science of Epidemiology.

The best definition of Epidemiology is that it is ‘the scientific study of the distribution and determinants of disease in man’ [MacMahon, 1972].

While there is still a need for classical epidemiological studies such as descriptive epidemiology, case-control and cohort studies, the need is much less than previously. These should focus on identifying and quantifying threats to human health.

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Epidemiology must evolve

The priority for the future of epidemiology, the basic population science, must be a focus on several key areas;

- Finding effective ways to implement what is currently known in order to reduce the incidence and mortality of disease;
- Researching efficient methods of reducing disease disparities in all global settings;
- Establishing a clear focus on prevention in order to improve healthy life expectancy.

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Global Health Challenge
Could Premature Deaths be Halved?

- As an example of the new approach to Epidemiology, the challenge of halving premature deaths could be undertaken.
- Premature death could be considered as death before old age i.e. death at ages up to 69.
- The potential of this challenge must be addressed separately in the age groups 0-4, 5-34 and 35-69.

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Global under-5 mortality

- Each year there are approximately 10 million deaths in children and 130 million births;
- It would be approximately one million deaths if year 2000 Western European death rates were to apply globally.
- It would be approximately 30 million deaths if year 1900 Western European death rates were to apply globally.

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Halving mortality at ages 5-34 will be difficult

- HIV epidemic is increasing fast.
- Reducing transmission via concurrent partners, sex workers & needles might halve where HIV **would be** in the 2020s)
- External causes of death (accidents, violence and suicide) are important and difficult, but not impossible, to control.

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Can current vascular and cancer death rates in middle age (35-69) be halved?

There are approximately 130 million births each year worldwide.

At year 2000 death rates, 20 million will die before middle age; 40 million will die in middle age (35-69) of which 15 million deaths will be from Vascular Disease and 10 million from Cancer.

If premature deaths are to be halved, then this reduction will only come about if deaths from vascular disease and cancer can be halved.

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Halving Cancer and Vascular mortality rates in middle age (35-69)

Halving Cancer and Vascular Mortality will come from primary and secondary prevention;

Control of Hypertension and hyperlipidaemia are key to prevention cardiovascular mortality;

Key lifestyle risk factors notably Tobacco Smoking, physical inactivity, obesity, type of dietary fat consumed and extreme alcoholism are all relevant to primary and secondary prevention.

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How important is blood pressure to vascular death?

A 20 mmHg reduction in systolic Blood Pressure halves vascular mortality at age 35-69

Prospective Studies Collaboration (60 studies, 1M adults, 0.1M deaths) Lancet 2002; 360: 1903

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Premature Death is Largely Avoidable

Death is inevitable: premature death (0-69) is largely avoidable.

99% of deaths in children can be avoided by cheap and effective medication (e.g. vaccination against measles) and public health measures (e.g. clean water and sanitation).

More than half of the world's deaths in middle age can be prevented by steps to prevent cancer (vaccination and lifestyle changes such as elimination of cigarette smoking) and cardiovascular disease (control hypertension, blood lipids and lifestyle changes).

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Halving premature death: get the BIG issues correct

- The knowledge exists to halve premature mortality worldwide.
- Avoid catastrophic war, famine, pestilence and social collapse.
- Make effective treatments progressively more widely accessible worldwide.
- Better a moderate reduction in a big cause than a big reduction in a small one – must avoid confusing the few big with the many smaller causes.

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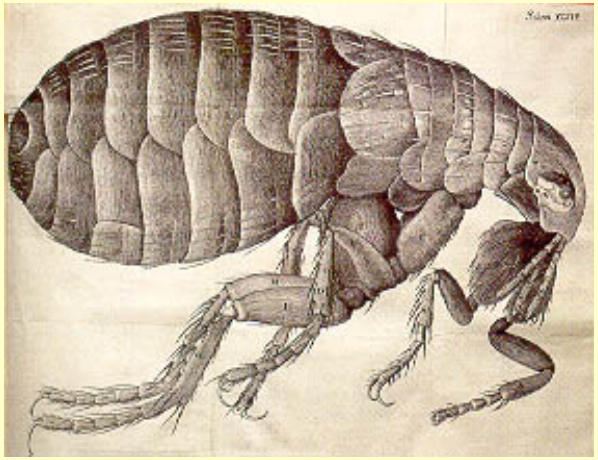
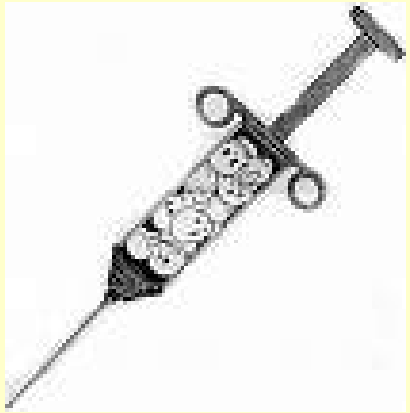
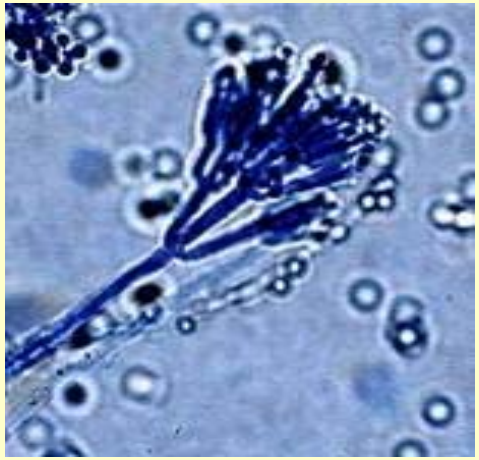
Characterisation of Centuries

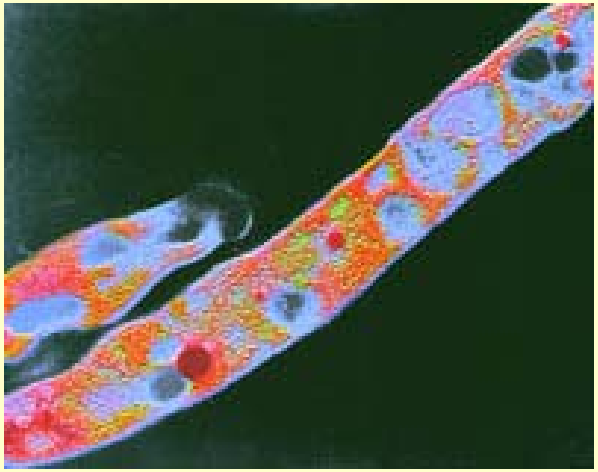
Diagnostics Vaccines Drugs

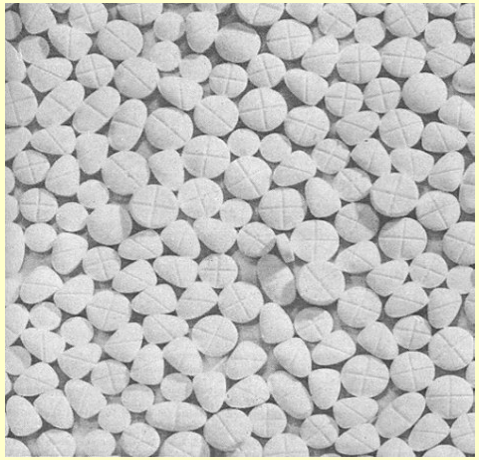
C17th **C19th** **C20th**











“ Prevention is so much better than healing because it saves the labour of being sick”

Thomas Adams (1618)

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