Society of Actuaries in Ireland

Longevity and mortality improvements - will history repeat itself?

03.10.2013

Dr John Schoonbee
Chief Medical Officer, Swiss Re, Europe

Swiss Re

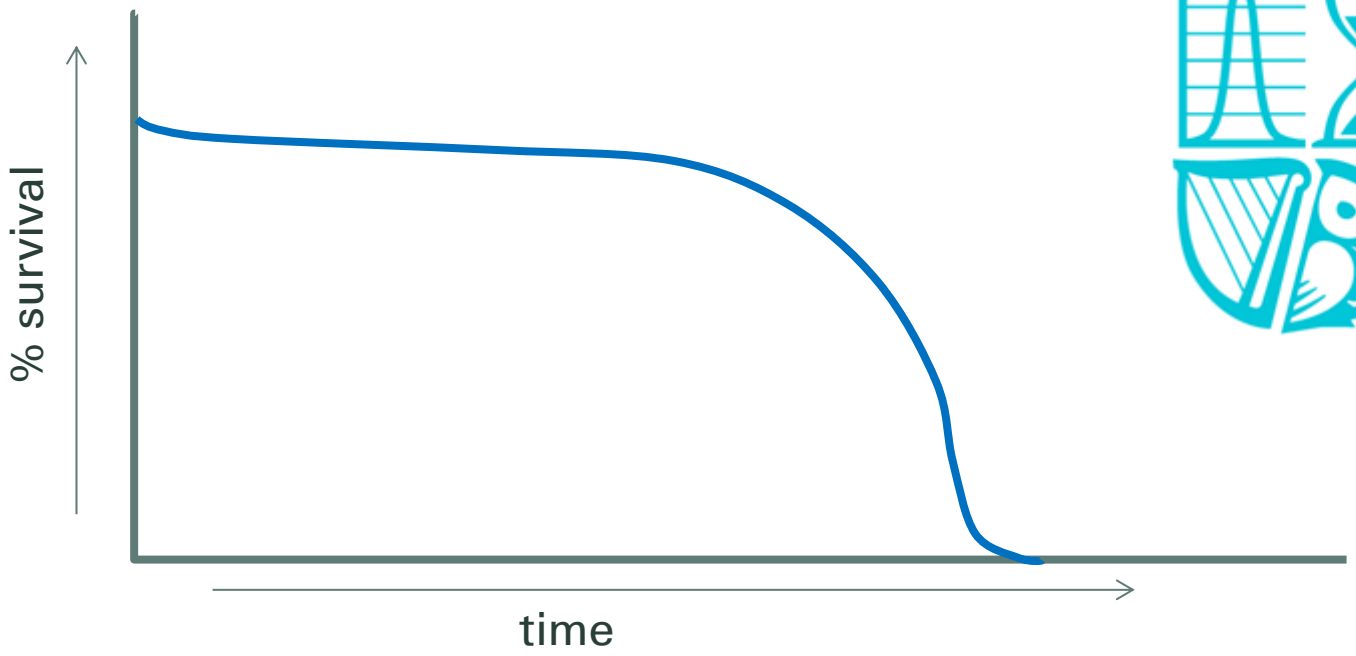
Swiss Re Medical Officers Global Network

- 36 medical officers globally
- spanning all 6 continents
- covering 15 languages
- Specialities include
  - oncology
  - cardiology
  - surgery
  - psychiatry
  - neurology
  - geriatrics
  - hepatology
  - diabetology
  - internal medicine
  - occupational medicine
  - intensive care/ER
  - epidemiology

SWISS RE 150 YEARS

Swiss Re

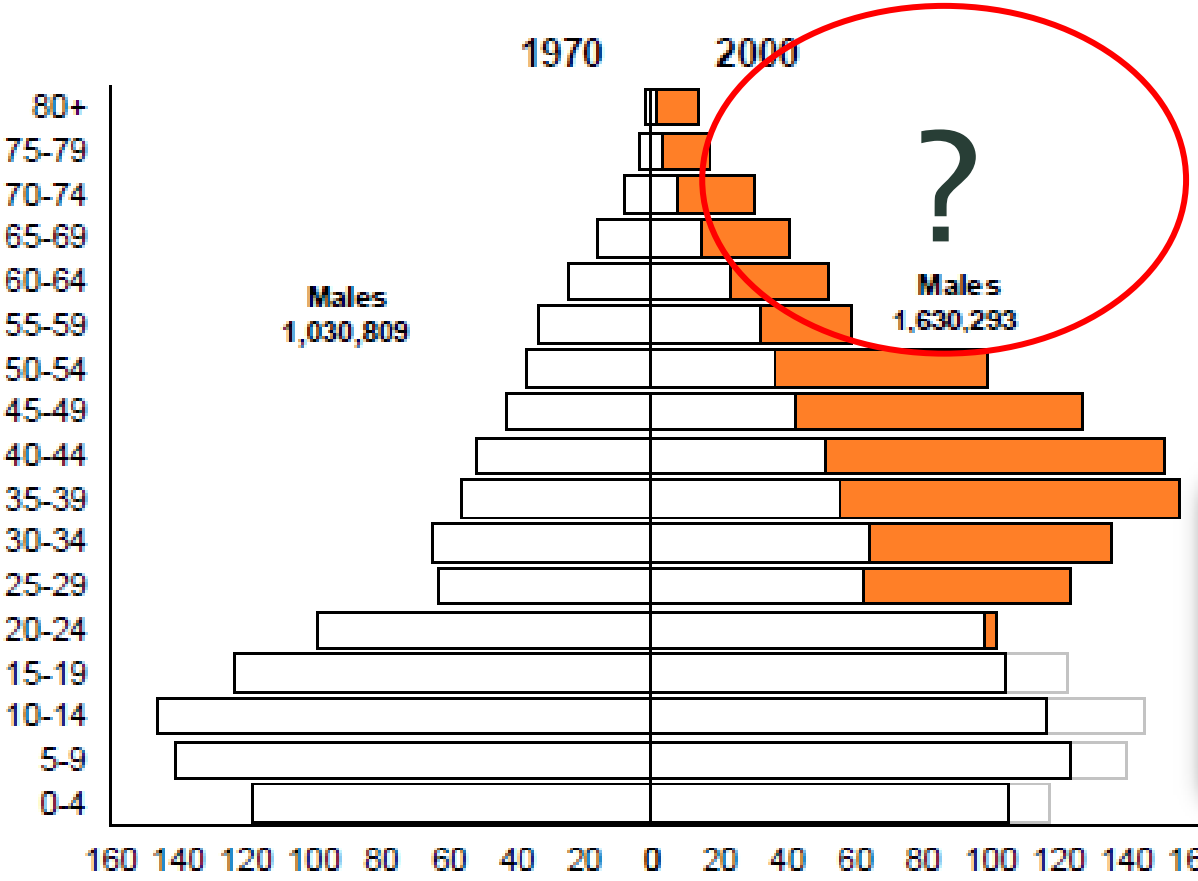
Today's theme – survival curve shifts



Why longevity matters

Swiss Re

Male population distribution by age band 1970 – 2000 in Singapore



adapted by John Schoonbee, from Singapore Cancer Registry, Report 7, 2010

Number of people aged over 100 rises five-fold in 30 years

Health Insurance & Protection DAILY

Cash Plans/Dental | Group Risk | Healthcare Trust | Income Protection | International PMI | Life/Critical Illnes

People Moves | Awards | Directory | Product Reviews | Guides | Insider View

Long Term Care

Number of people aged over 100 rises five-fold in 30 years

Monday 30 September 2013 LONG TERM CARE DIRECTORY

Send to Colleague | Printer Friendly Format | Email the Editor

Now more than 12,000 centenarians in England and Wales

The number of people aged 100 and over in England and Wales has risen five-fold in the past 30 years, official data has revealed.

Figures published today by the Office for National Statistics (ONS) shows there were 12,320 centenarians in 2012 – up from just 2,420 in 1981.

And between 2002 and 2012 alone, the number of centenarians has increased by 74%, from 7,090 to 12,320. While female centenarians continue to outnumber males, the gap between the two sexes is beginning to

12,320 centenarians in 2012 – up from just 2,420 in 1981

AAL AMBIENT ASSISTED LIVING

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Products & Increased Longevity Risk

- Life
  - mortality improvement assumption used by actuaries
- Critical Illness and cancer
  - older ages – data on incidence?
  - how steep is the curve if we get everyone to live longer?
- Long term care
  - payout duration is an increased risk, older only, or healthy older
  - experience on incidence rates for v old ages not too strong
- Annuities
  - guaranteed payouts
  - impaired annuities

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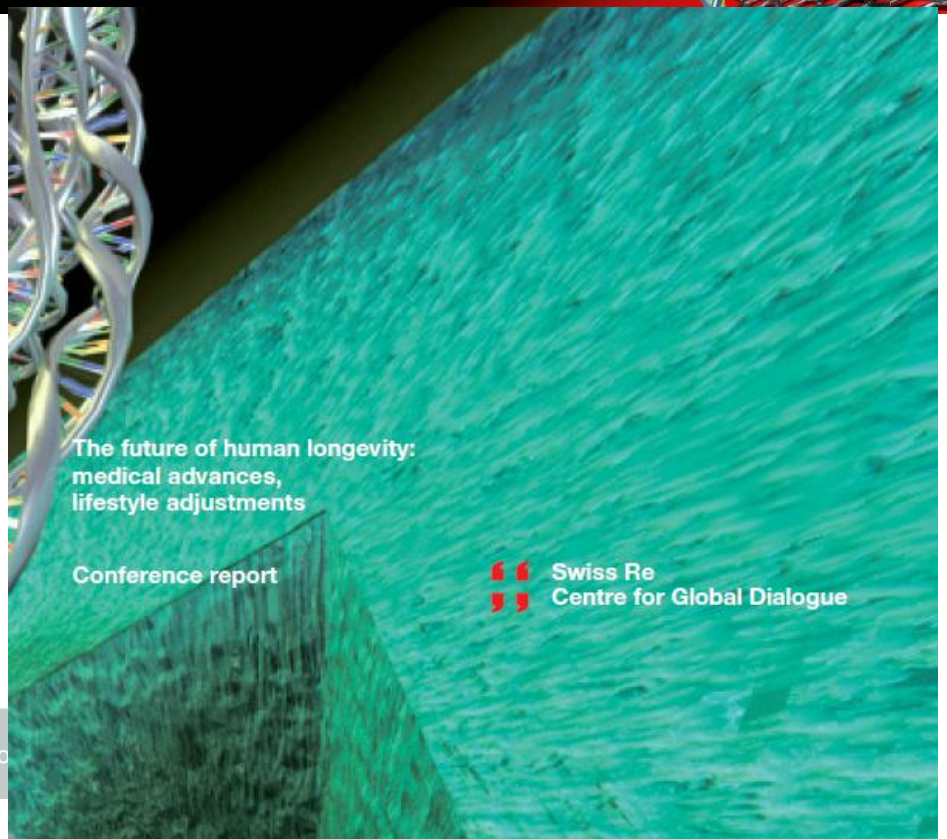
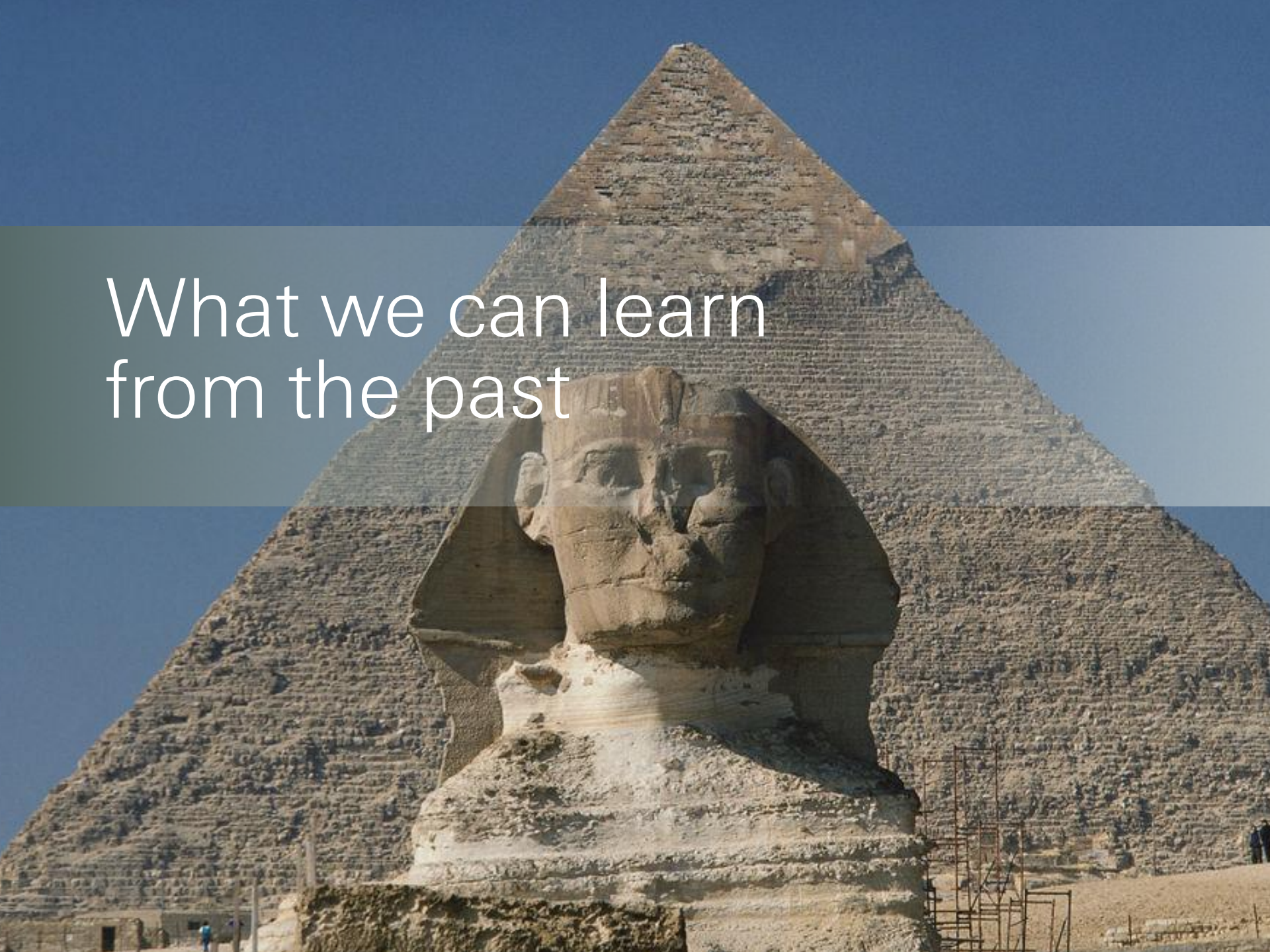


The future of human longevity:
focusing on you

Conference report

Swiss Re
Centre for Global Dialogue



What we can learn from the past

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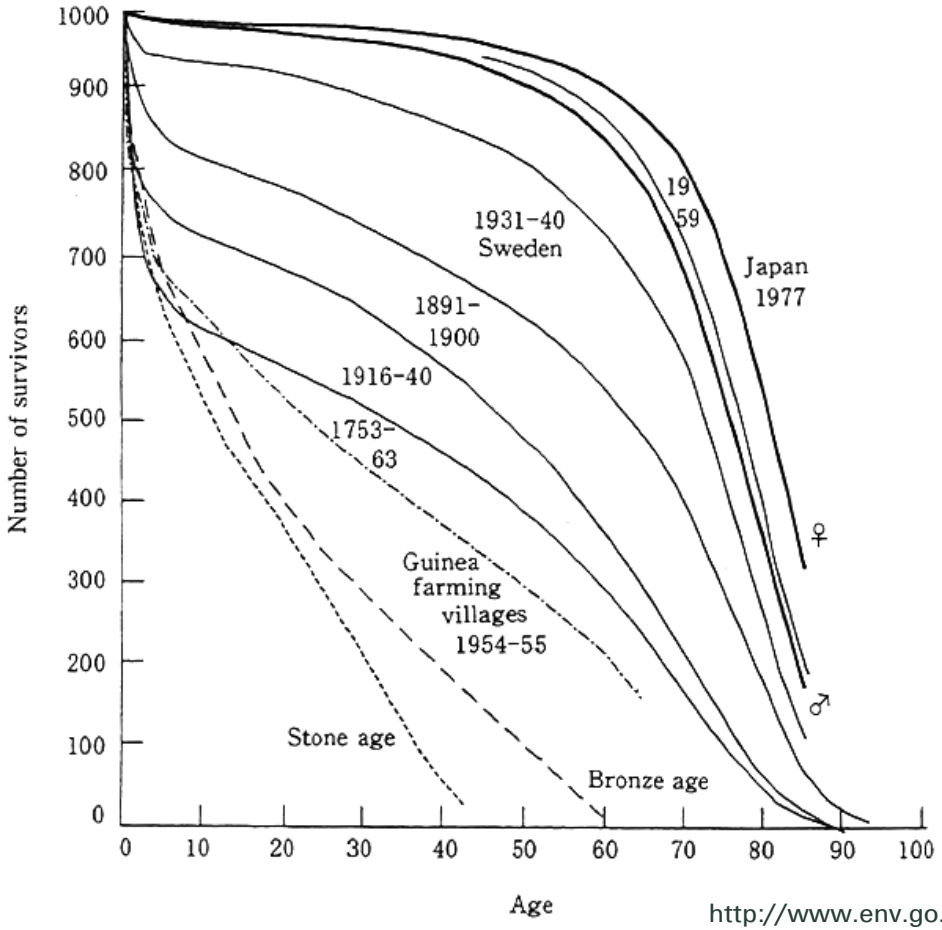
History of survival



what's next ?

http://www.env.go.jp/en/wpaper/1995/eae240000000000.html

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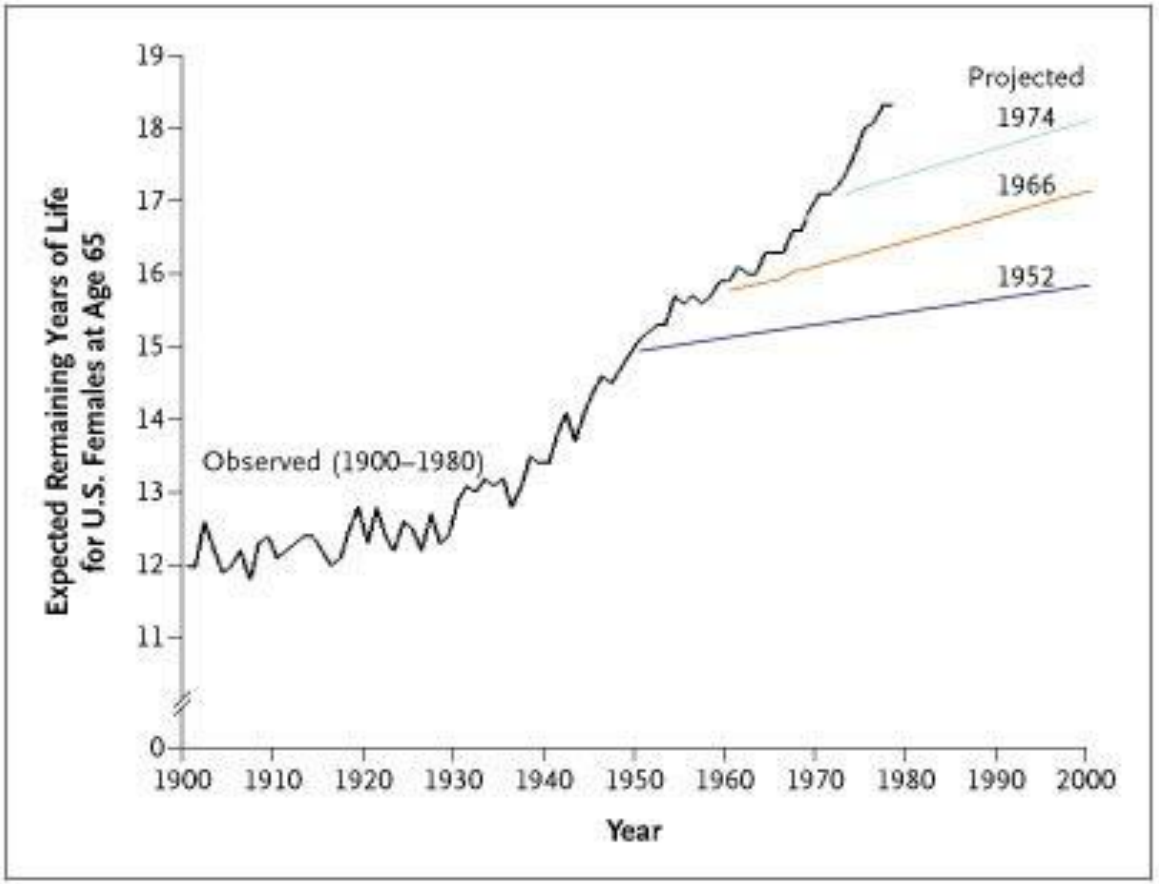
Life expectancy for U.S. females (to 1970)



Olshansky, SJ et al, NEJM, March 17,2005;352 (11):1138

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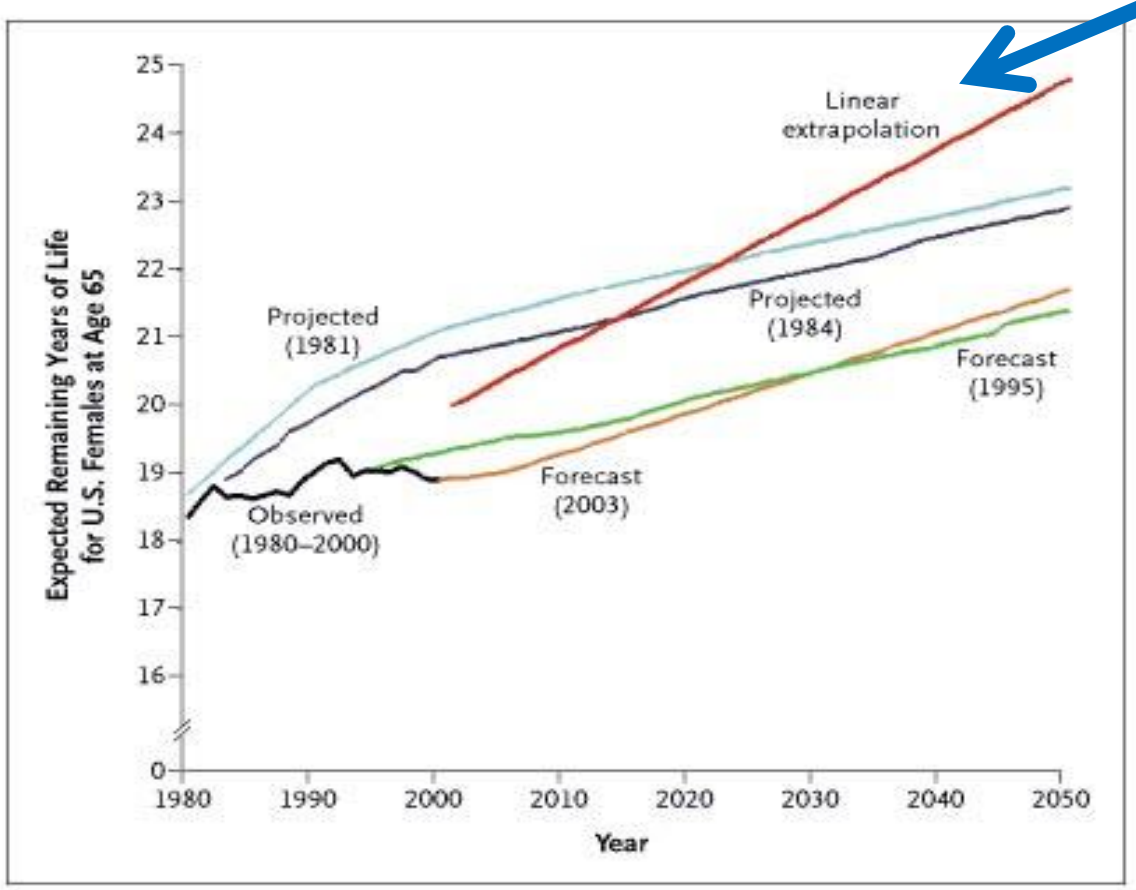
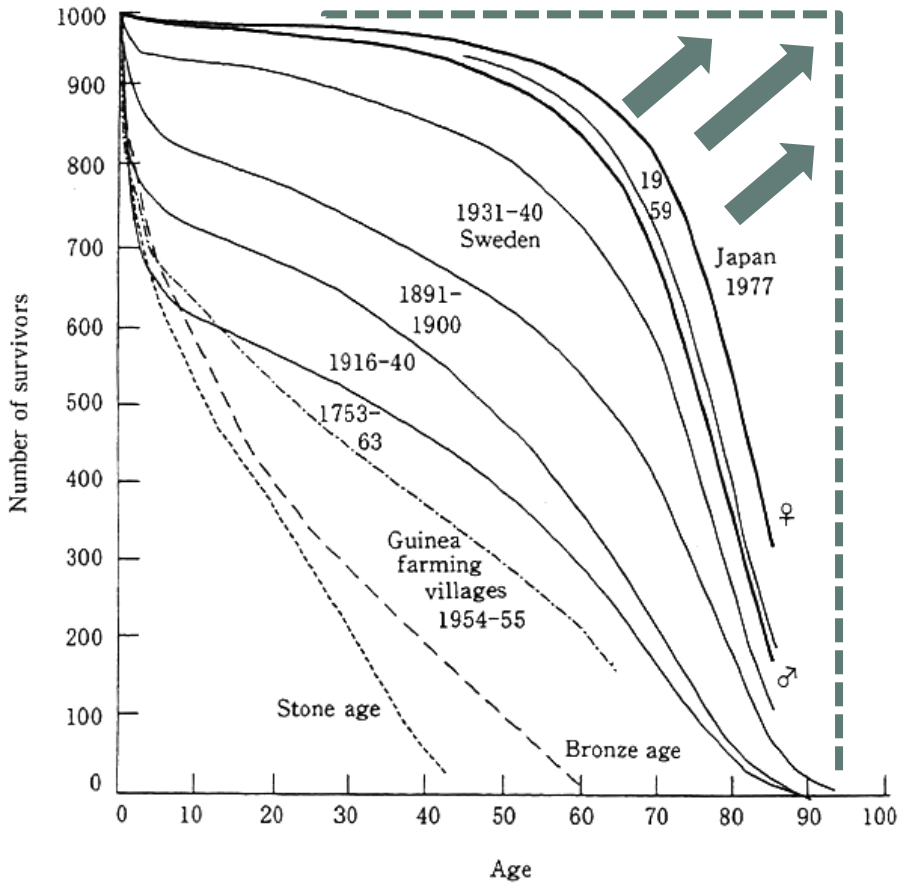
Life expectancy for U.S. females (to 2050)

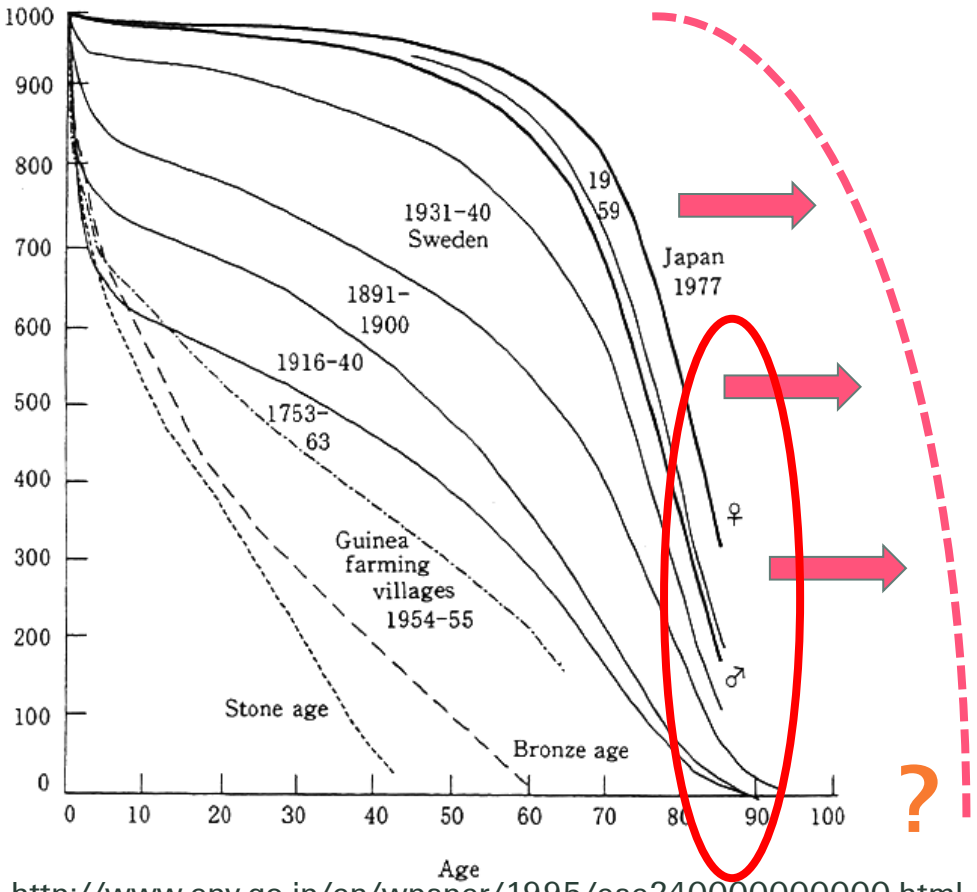


?

Olshansky, SJ et al, NEJM, March 17,2005;352 (11):1138

Future of longevity – "Rectangularisation" or Methuselah

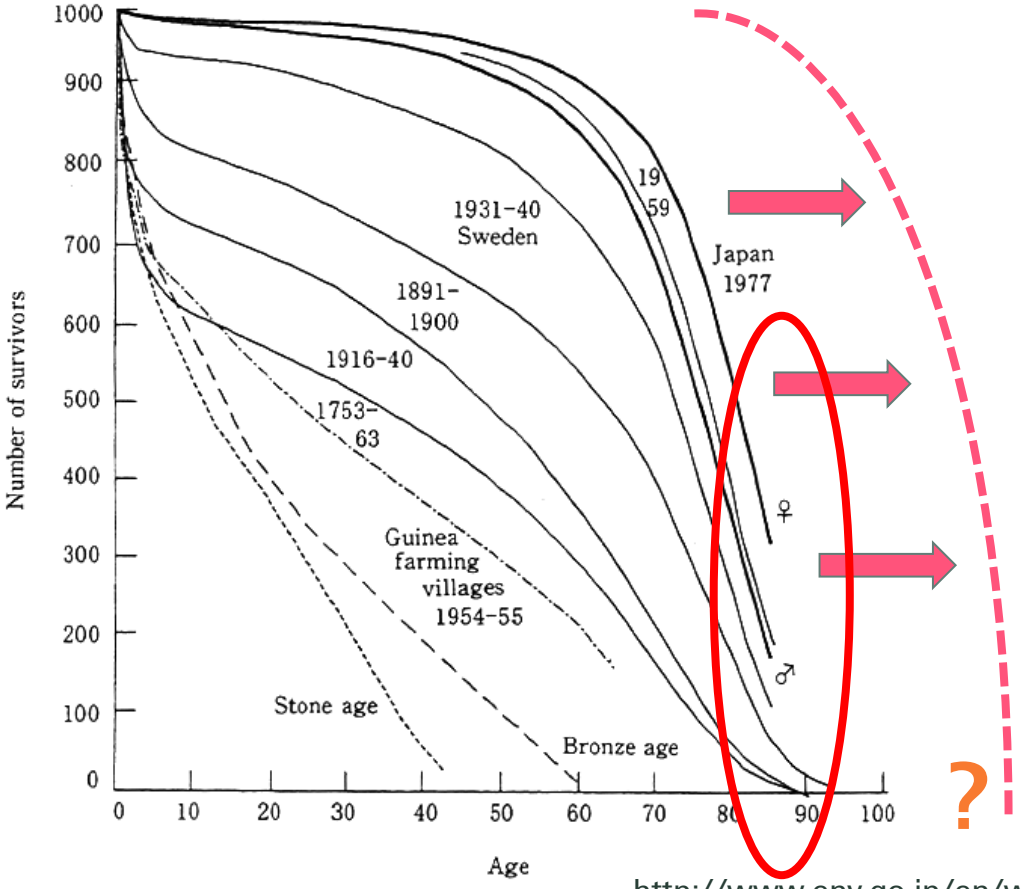


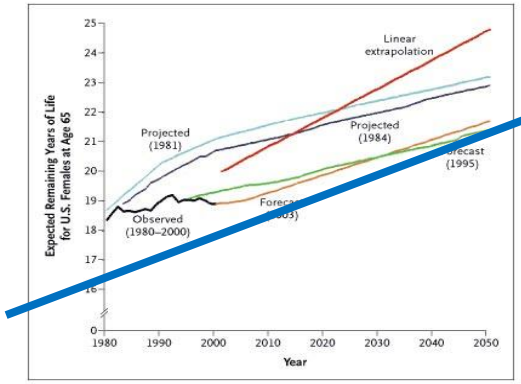


http://www.env.go.jp/en/wpaper/1995/eae240000000000.html

Ageing : Shifting the mortality curve to the right – can we delay ageing?

Future of longevity? – Shift to the Right





http://www.env.go.jp/en/wpaper/1995/eae240000000000.html

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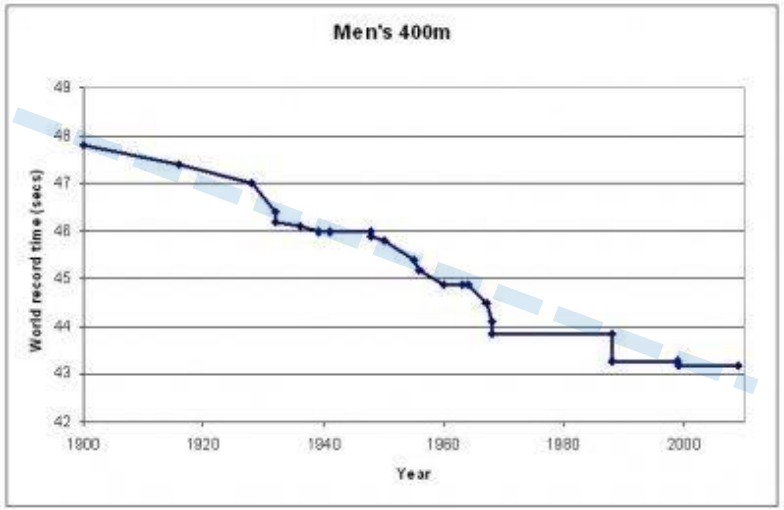
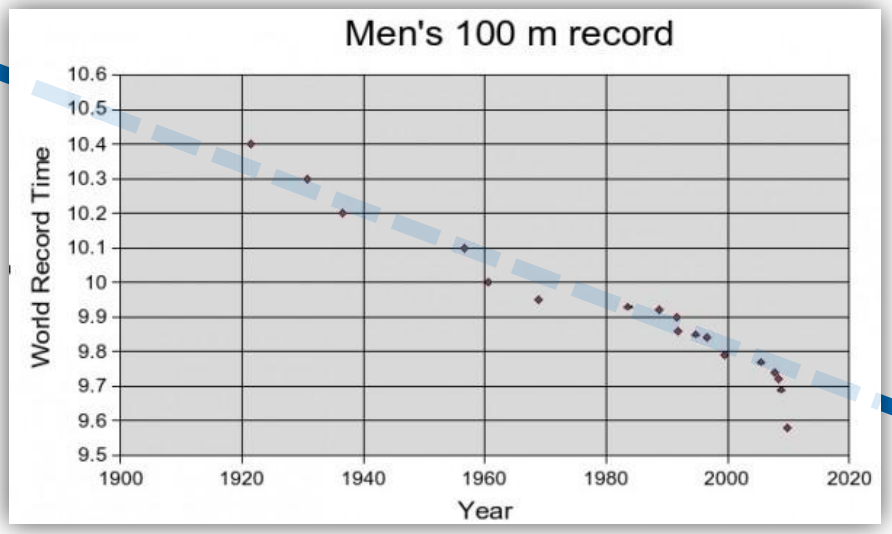
Can we use a ruler?





Age-specific contributions to the increase in record life expectancy : women from 1850 to 2007

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	1850–1900	1900–25	1925–50	1950–75	1975–90	1990–2007
0–14 years	62·13%	54·75%	30·99%	29·72%	11·20%	5·93%
15–49 years	29·09%	31·55%	37·64%	17·70%	6·47%	4·67%
50–64 years	5·34%	9·32%	18·67%	16·27%	24·29%	10·67%
65–79 years	3·17%	4·44%	12·72%	28·24%	40·57%	37·22%
>80 years	0·27%	−0·06%	−0·03%	8·07%	17·47%	41·51%

Declining early/mid-life mortality

Declining later life mortality

Lancet 374:1196(2009). Data derived from the Human Mortality Database and from Oeppen J, Vaupel JW. Broken limits to life expectancy. Science 2002; 296: 1029–31.

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Disposable soma theory

- 2 jobs : reproduction and maintenance
- maintenance cannot get 100%
- hence senescence is a byproduct (not a component) of our biology *(we are not designed to die, but we are not designed to live forever)*
- Senescence has many modalities
  - most if not all of which are stochastic
  - these are ubiquitous, continuous and affect everything - their effects accumulate, interact and create emergent effects
- Cost of longevity
  - reduced developmental viability, increased developmental lethality
  - age-dependent infertility (FOXO3), premature ovarian failure (FOXO3)

(1013 cells) x (3 x 109 base pairs) x (2 x 103 polypeptides) = 6 x 10^{25} targets

(80 yrs) x (356 days) x (24 hrs) x (60 min) x (60 s) x (108 ns) ≈ 4.1 x 10^{15} ns

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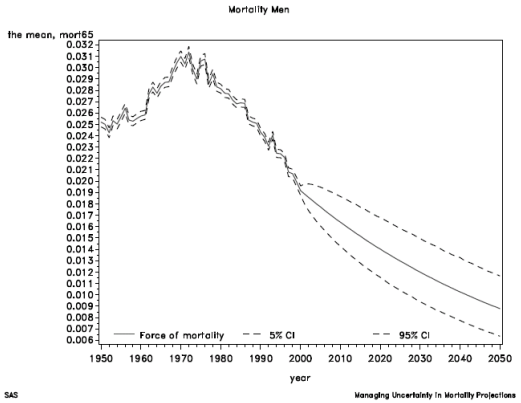
Ageing and Longevity

- Mathematical models ≠ biological permissibility



Swiss Association of Actuaries, 2002

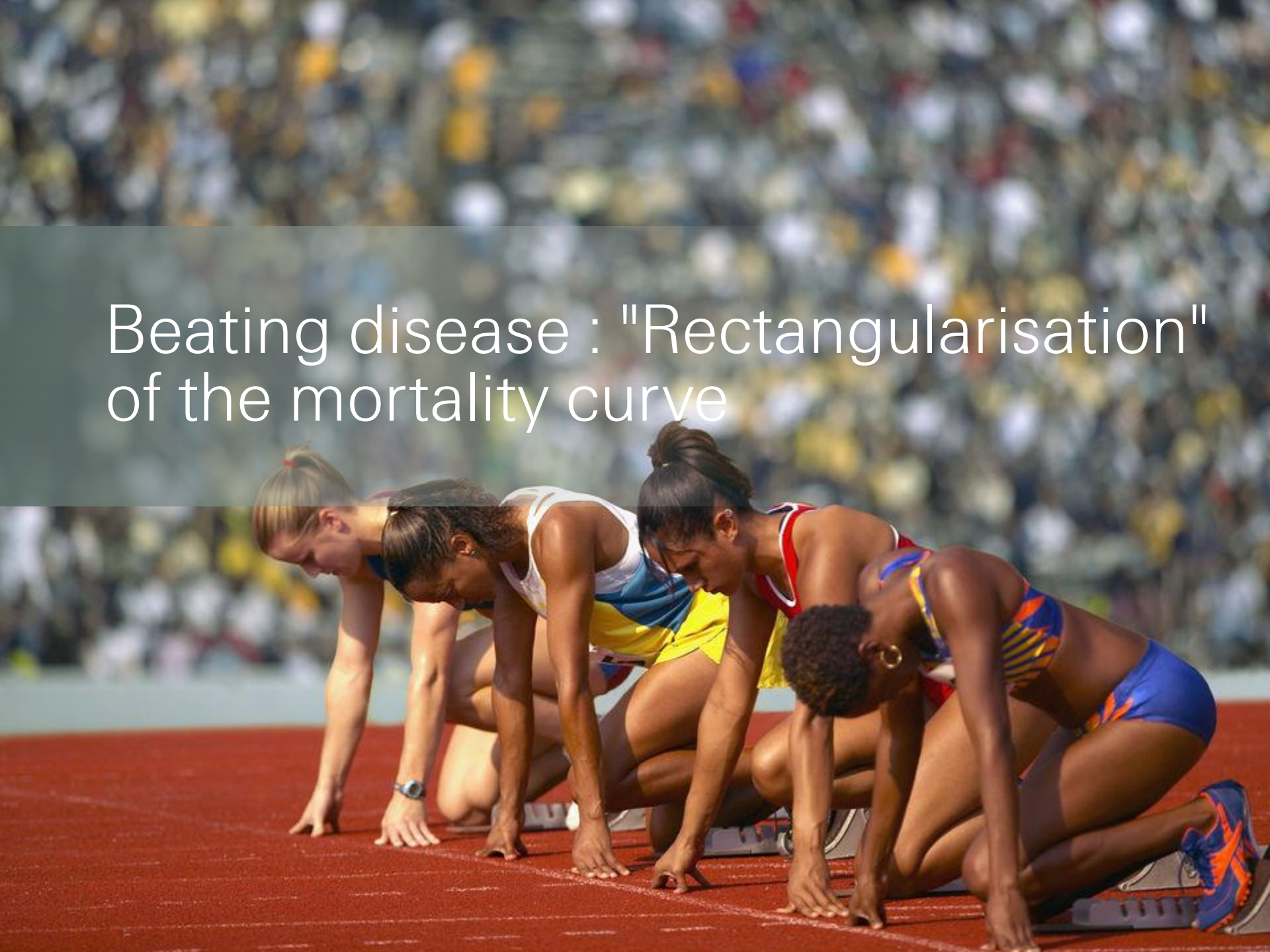
- What causes ageing?

... concept of an "ageing gene" – no such thing

- "... senility is ... an artifact of domestication; that is, something revealed and made manifest only by the most unnatural experiment of prolonging an animal's life by sheltering it from the hazards of its ordinary existence."

Peter Medawar, An Unsolved Problem in Biology, 1951
(Nobel Prize in Physiology or Medicine: 1960)

Beating disease : "Rectangularisation" of the mortality curve



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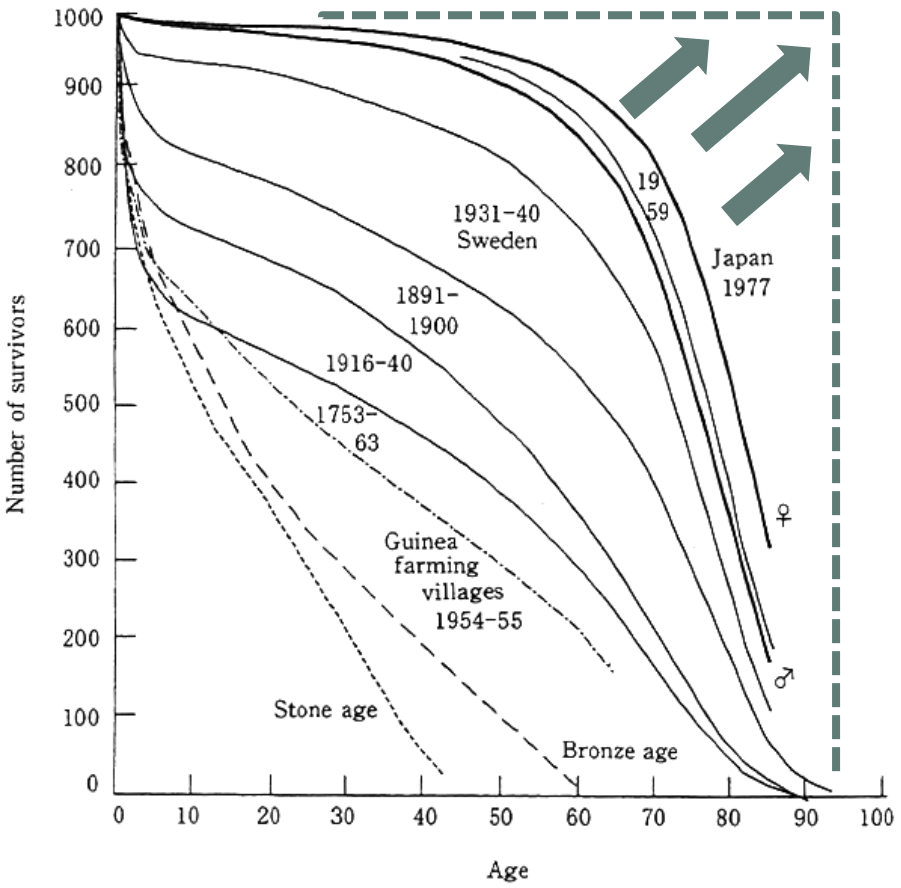
Medical "advances"

- Rectangularise the curve



http://www.env.go.jp/en/wpaper/1995/eae240000000000.html

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Ten great public health achievements - United States: 1900-1999

- Vaccination
- Motor-vehicle safety
- Safer workplaces
- Control of infectious diseases
- Decline in deaths from CHD and stroke
- Safer and healthier foods
- Healthier mothers and babies
- Family planning
- Fluoridation of drinking water
- Recognition of tobacco use as a health hazard

MMWR (Morbidity and Mortality Weekly Report) by the U.S. Centers for Disease Control and Prevention (CDC)

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Top 10 US medical advances 2000-2010

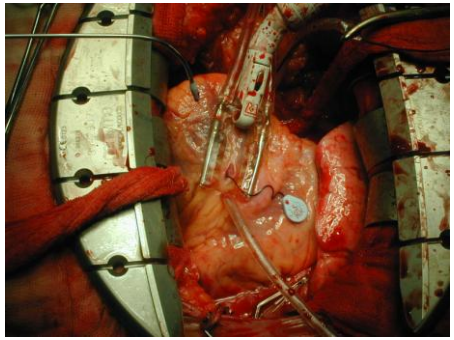
- Human Genome Discoveries Reach the Bedside
- Doctors and Patients Harness Information Technology
- Anti-Smoking Laws and Campaigns Reduce Public Smoking
- Heart Disease Deaths Drop by 40 Percent
- Stem Cell Research: Laboratory Breakthroughs and Some Clinical Advances
- Targeted Therapies for Cancer Expand With New Drugs
- Combination Drug Therapy Extends HIV Survival
- Minimally Invasive Techniques Revolutionize Surgery
- Study Finds Heart, Cancer Risk With Hormone Replacement Therapy
- Scientists Peer Into Mind With Functional MRI

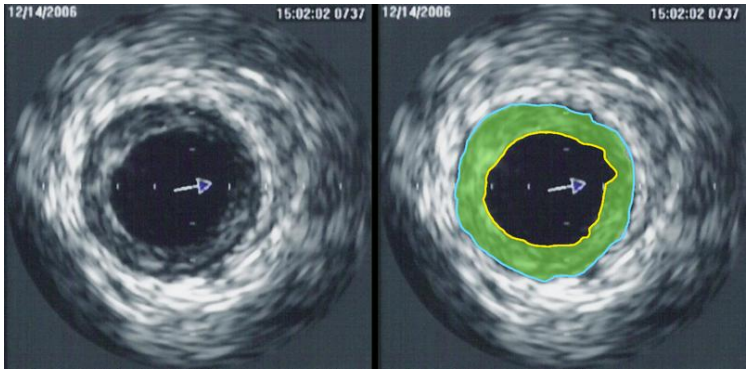
ABC news and Medpage Today

Are we running out of "rectangularisation" space?

Advances in CAD treatment

- Coronary IV ultrasound
- Minimally invasive techniques
- CAC, HsCRP
- Total Artificial Heart





SynCardia Freedom Driver

Skin cancer treatment

Skin cancer treatment

ECC 2013 Press Release: Longest Follow-Up of Largest Number of Melanoma Patients Treated with Ipilimumab Shows Some Survive up to Ten Years

- Patients with advanced melanoma, who have been treated with the monoclonal antibody, ipilimumab, can survive for up to ten years, according to the largest analysis of overall survival for these patients, presented at the 2013 European Cancer Congress
- The analysis of the 1861 patients showed that the median overall survival was 11.4 months.
- 22% were still alive after three years. 17% after 7 years
- The longest overall survival follow-up in the database is 9.9 years

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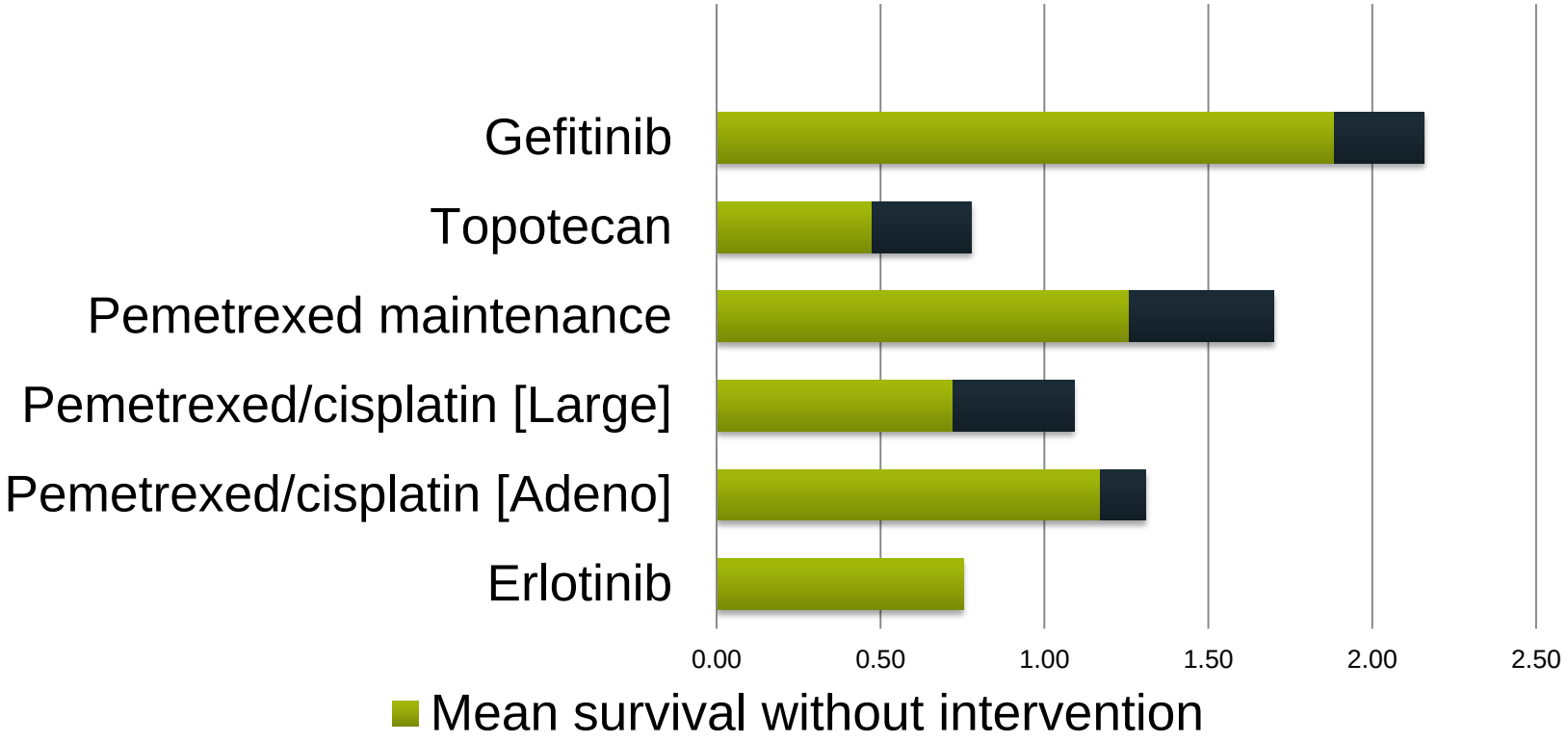
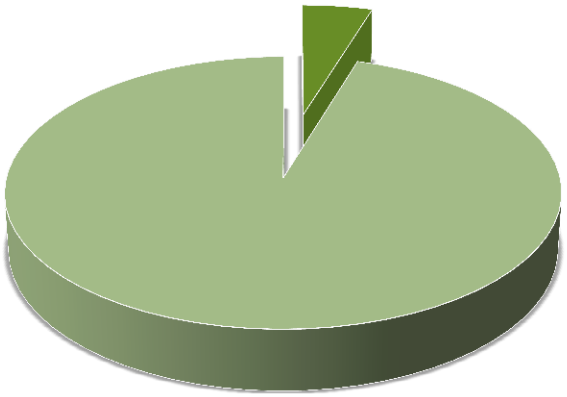
Lung cancer treatments

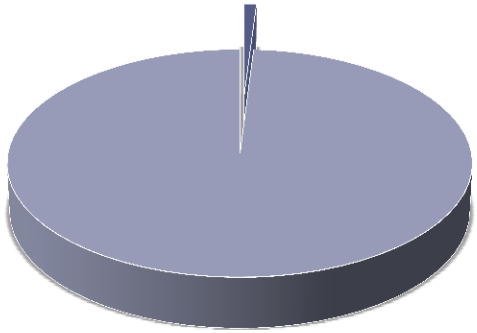
Modelled life expectancy with and without interventions



Indicated/recommended populations as a % of total incident lung cancer cases



Pemetrexed TA190



Topotecan

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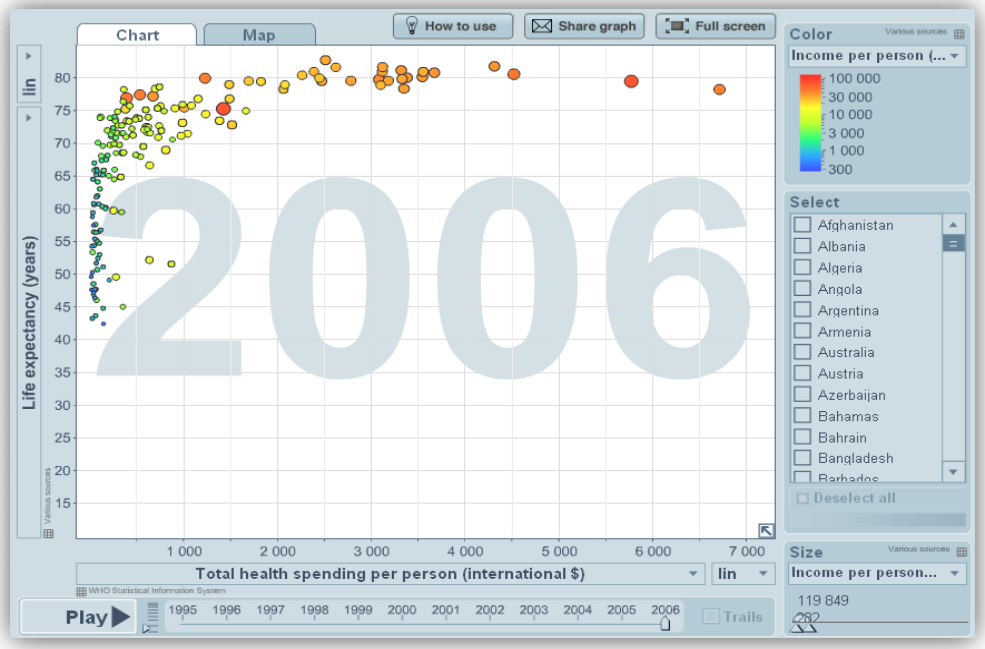
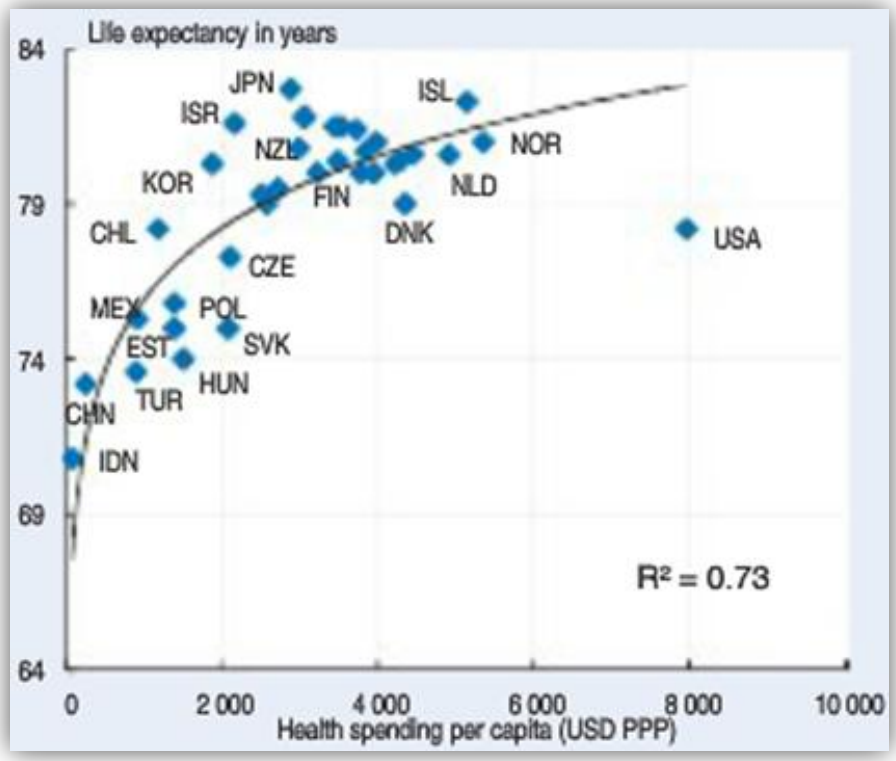
Healthcare expenditure vs. life expectancy



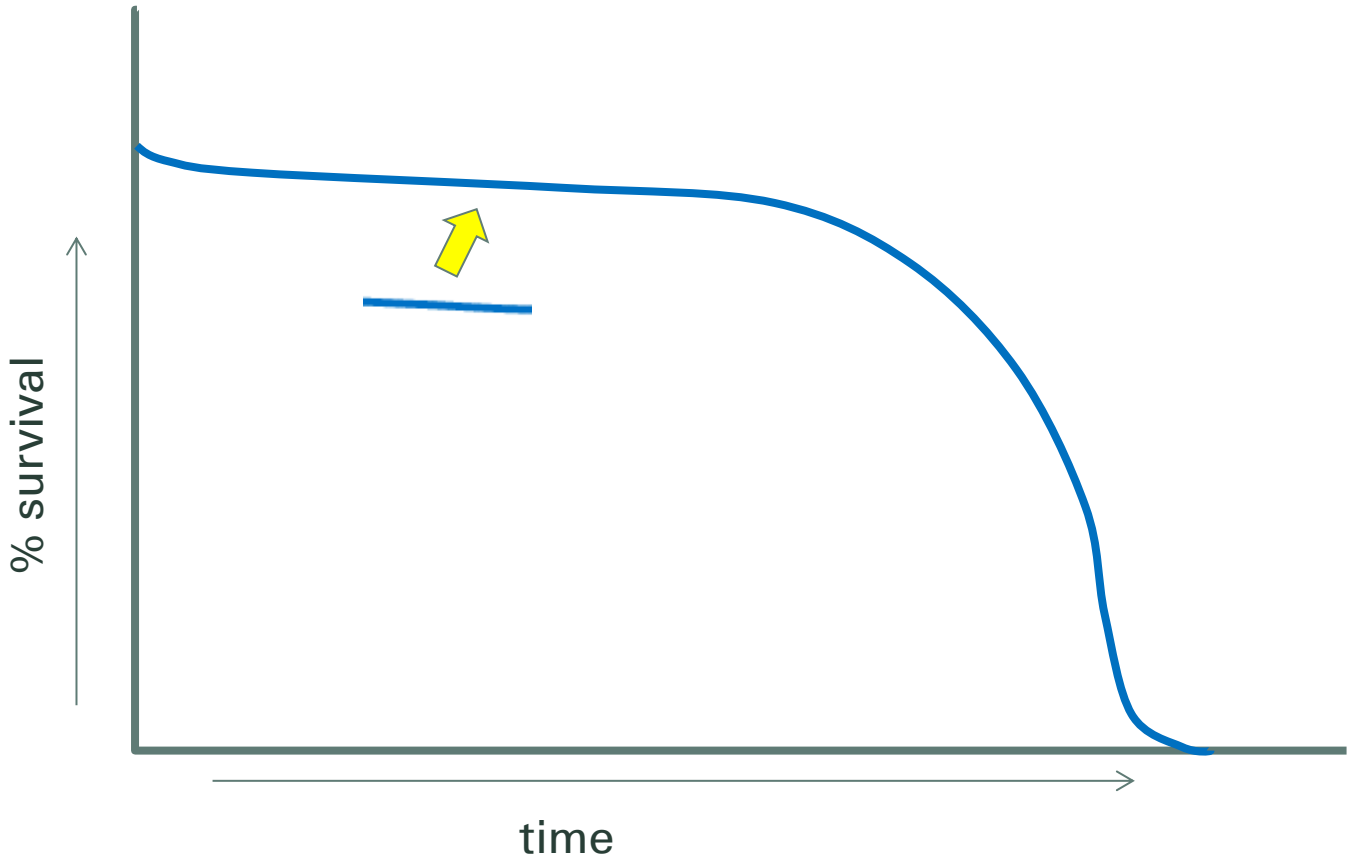
www.gapminder.com



OECD 2011

- More effort for less reward
- Expensive drugs – won't be made available to all
- ?Lifestyle is becoming more important than medical advances

Survival curve : "sub-sectional shift"



Landmark publication (Lancet 2003) Jaggy et al.

- Original cohort
  - Switzerland
  - original study 1997-2001
  - ±25 'insurable' deaths

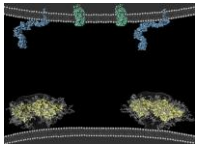
...“Patients with successfully treated cancer have much the same excess death rates but are not excluded from life insurance policies”. (Extracted from abstract)

	Hepatitis-C negative			Hepatitis-C positive		
	Patients (follow-up years)	Deaths	EDR (95% CI)	Patients (follow-up years)	Deaths	EDR (95% CI)
All	2318 (7598)	134	14·0 (11·3–17·2	1645 (5313)	211	38·1 (33·2–43·7)
Successfully treated patients						
CD4 >250 (cells/μL)	1567 (4498)	35	4·2 (2·0–7·2)	944 (2521)	59	21·7 (16·5–28·4)
CD4 >250 (cells/μL), and viral load <400 (copies/mL)	1281 (3594)	25	3·4 (1·1–6·7)	726 (1894)	42	20·5 (14·8–28·1)
CD4 >250 (cells/μL), and viral load >400 (copies/mL)	274 (861)	10	8·0 (3·7–17·6)	215 (618)	17	25·9 (15·6–42·0)
CD4 >250 (cells/μL), and viral load <400 (copies/mL), but CD4 nadir <250 cells/μL before HAART	545 (1564)	11	3·1 (0·0–8·6)	425 (1118)	28	23·3 (15·6–34·2)
Patients with unsuccessful treatment						
CD4 count never >250 cells/μL	257 (620)	76	117·4 (93·9–145·6)	309 (777)	89	112·7 (92·2–137·0)

Excess death rates (EDR) per 1000 patient-years in Swiss patients of the SHCS, 1997–2001

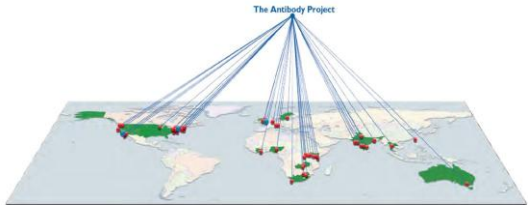
Insurability of HIV positive people treated with antiretroviral therapy in Europe

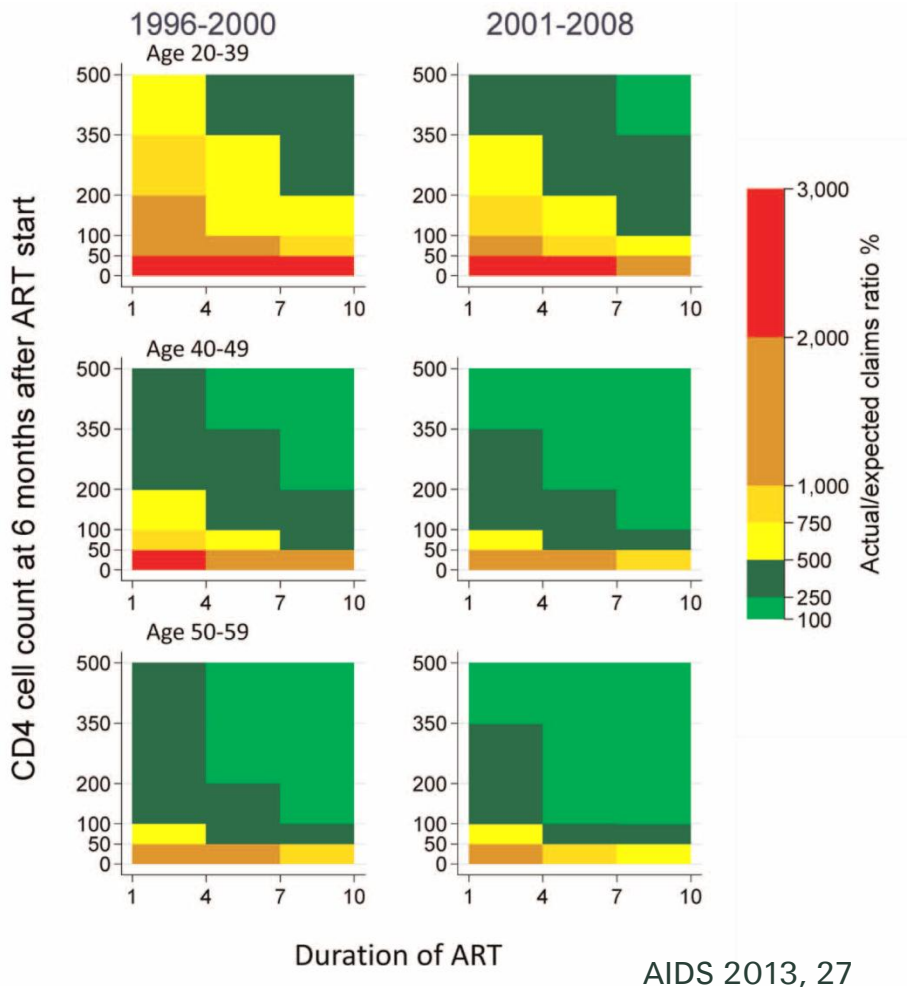
- 20-25 years now given to HIV+ve



Timothy Brown
Science. 2011 May 13;332(6031):784-5, 787-9.

Dr Wayne Koff, IAVI





AIDS 2013, 27

Over-diagnosis (and health care costs)

Table. Change in Incidence and Mortality of Cancers Over Time From 1975 to 2010 as Reported in Surveillance, Epidemiology and End Results[1]

	Incidence			Mortality		
	Per 100 000		%	Per 100 000		%
Change[a]	1975	2010[b]	Change	1975	2010[b]	Change
Example 1						
Breast[c]	105.07	126.02	20	31.45	21.92	−30
Prostate	94	145.12	54	30.97	21.81	−30
Lung and bronchus[d]	52.26	56.68	8	42.56	47.42	11
Example 2						
Colon	41.35	28.72	−31	28.09	15.51	−45
Cervical	14.79	6.71	−55	5.55	2.26	−59
Example 3						
Thyroid	4.85	13.83	185	0.55	0.51	−7
Melanoma	7.89	23.57	199	2.07	2.74	32

JAMA, July 29, 2013

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UN Study on Ageing

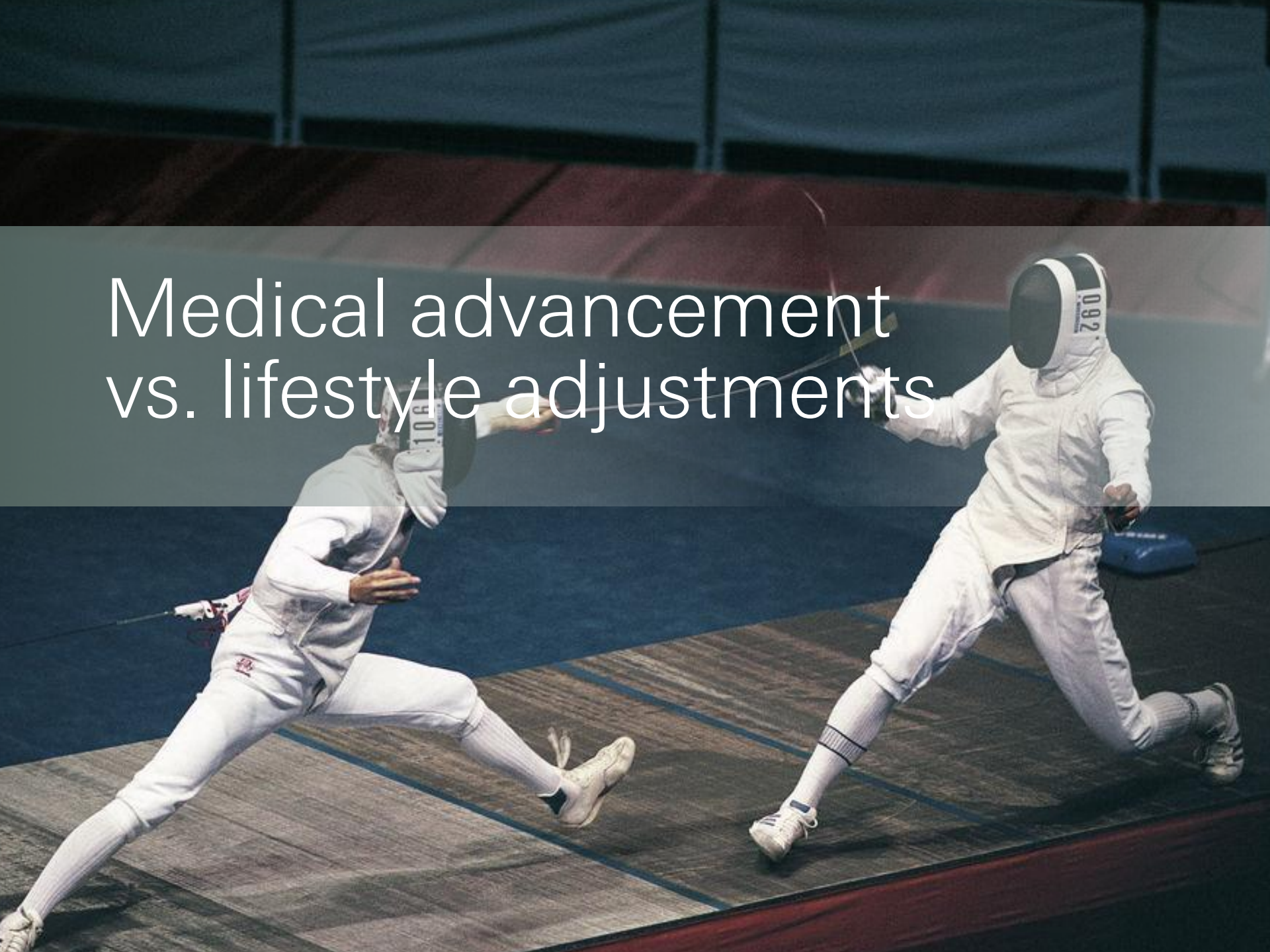
Table 1: Global ageing indicators

Life expectancy	2011/12	2050 projection
Life expectancy at birth by sex (men/women)	67.1 / 71.6	73.2 / 78.0
Life expectancy at 60 by sex (men/women)	18.5 / 21.6	20.9 / 24.2
Life expectancy at 80 by sex (men/women)	7.1 / 8.5	8.3 / 9.8
Population		
Number of people aged 60+	809,742,889	2,031,337,100
Number of people aged 80+	114,479,616	402,467,303
Number of people aged 100+	316,600	3,224,400
Percentage of people aged 60+	11.5	21.8
Percentage of people aged 80+	1.6	4.3
Sex ratio: Number of men aged 60+ per 100 women aged 60+	83.7	86.4

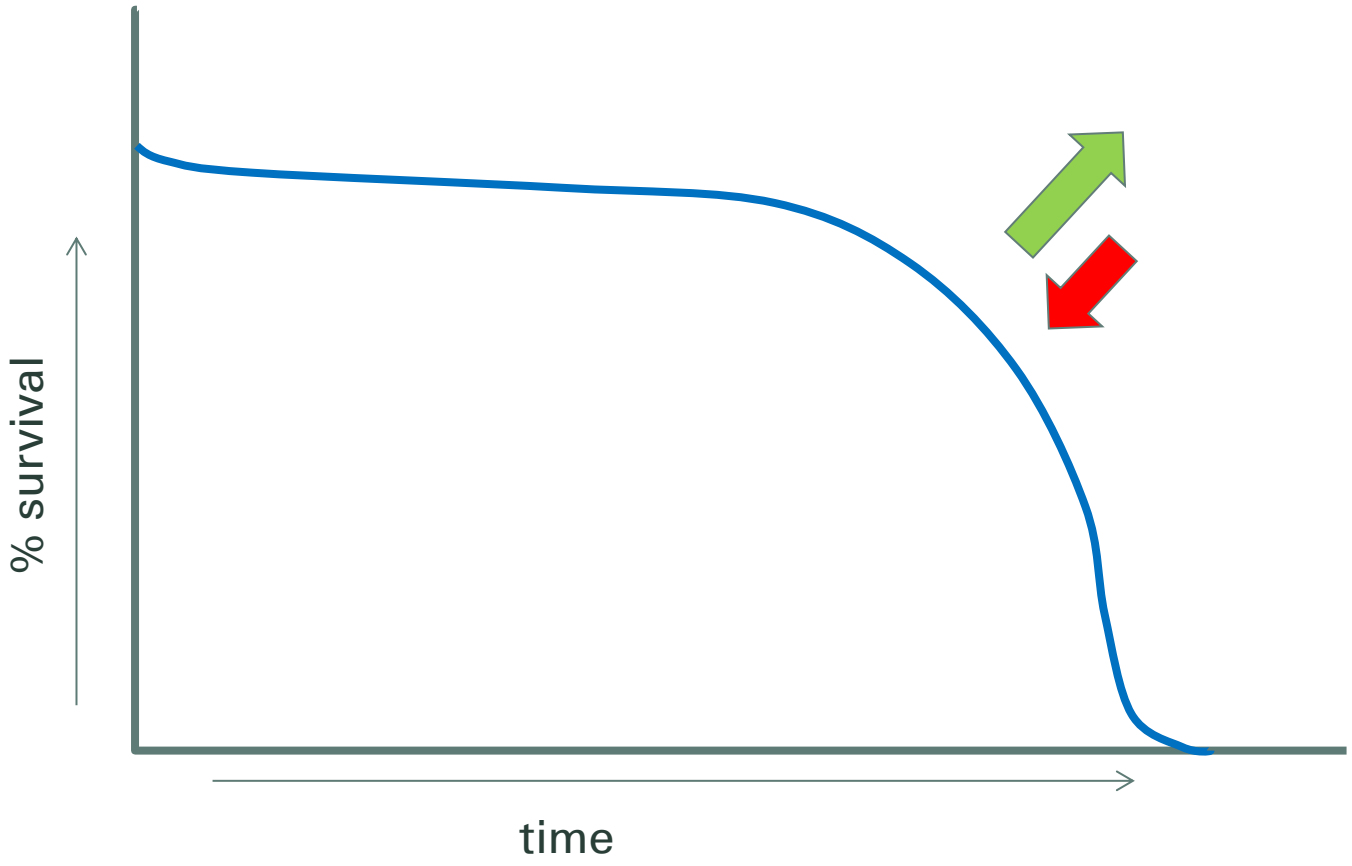
6.1
2.4
1.2

Source: UNDESA, Population Division (2012). Prepared by the Population and Development Section on the basis of data from UNDESA, *World Population Prospects: The 2010 Revision* (New York, 2011), and UNDESA, *World Population Ageing and Development 2012, Wall Chart* (2012; forthcoming) www.unpopulation.org, and UNDESA, Population Division, *World Population Ageing: Profiles of Ageing 2011* (New York, 2011), CD-ROM.

Ageing in the Twenty-First Century: A Celebration and A Challenge


Medical advancement
vs. lifestyle adjustments

Survival curve pushing out, but being counteracted?



The ten leading causes of death by broad income group, 2004

Low-income countries	% of deaths	Middle-income countries	% of deaths	High-income countries	% of deaths
Lower respiratory infections	11.2	Stroke and other cerebrovascular disease	14.2	Coronary heart disease	16.3
Coronary heart disease	9.4	Coronary heart disease	13.9	Stroke and other cerebrovascular disease	9.3
Diarrhoeal diseases	6.9	Chronic obstructive pulmonary disease	7.4	Trachea, bronchus, lung cancers	5.9
HIV/AIDS	5.7	Lower respiratory infection	3.8	Lower respiratory infections	3.8
Stroke and other cerebrovascular disease	5.6	Trachea, bronchus, lung cancers	2.9	Chronic obstructive pulmonary disease	3.5
Chronic obstructive pulmonary disease	3.6	Road traffic accidents	2.8	Alzheimer and other dementias	3.4
Tuberculosis	3.5	Hypertensive heart disease	2.6	Colon and rectum cancers	3.3
Neonatal infections	3.4	Stomach cancer	2.2	Diabetes mellitus	2.8
Malaria	3.3	Tuberculosis	2.2	Breast cancer	2.0
Prematurity and low birth weight	3.2	Diabetes mellitus	2.1	Stomach cancer	1.8

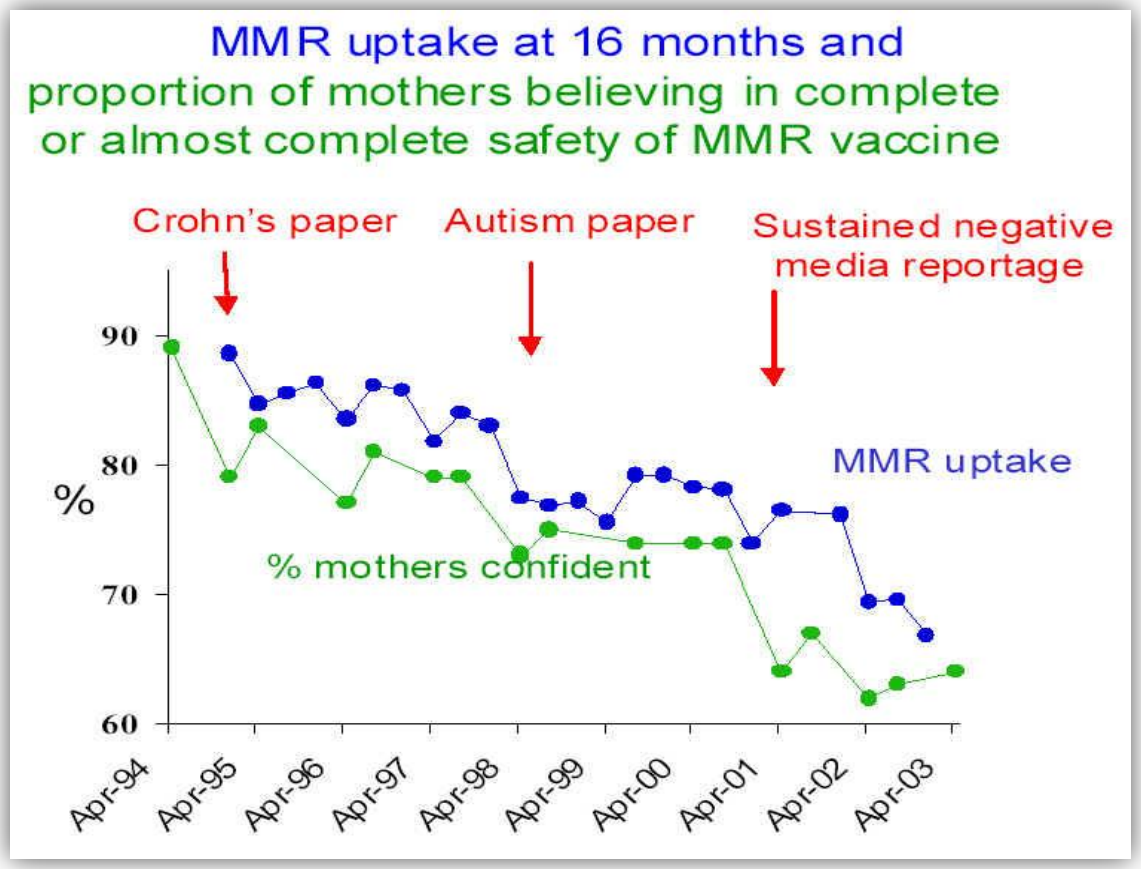
WHO (2008a), "The top ten cause of death", WHO Fact Sheet No.310

Behaviour does not only relate to risk factors

- Compliance
  - WHO study 2003, 50% compliance overall
  - Hypertension
    - Despite the availability of effective treatment, over half of the patients being treated for hypertension drop out of care entirely within a year of diagnosis
    - Of those who remain under medical supervision only about 50% take at least 80% of their prescribed medications
    - Approximately 75% of patients with a diagnosis of hypertension do not achieve optimum blood-pressure control
- 30% compliance in UK for hpt

WHO 2003, Adherence to long-term therapies: evidence for action.

Health awareness has a two-edged sword : Individuals as an obstacle to progress



Source: Sunday Times - Brian Deer

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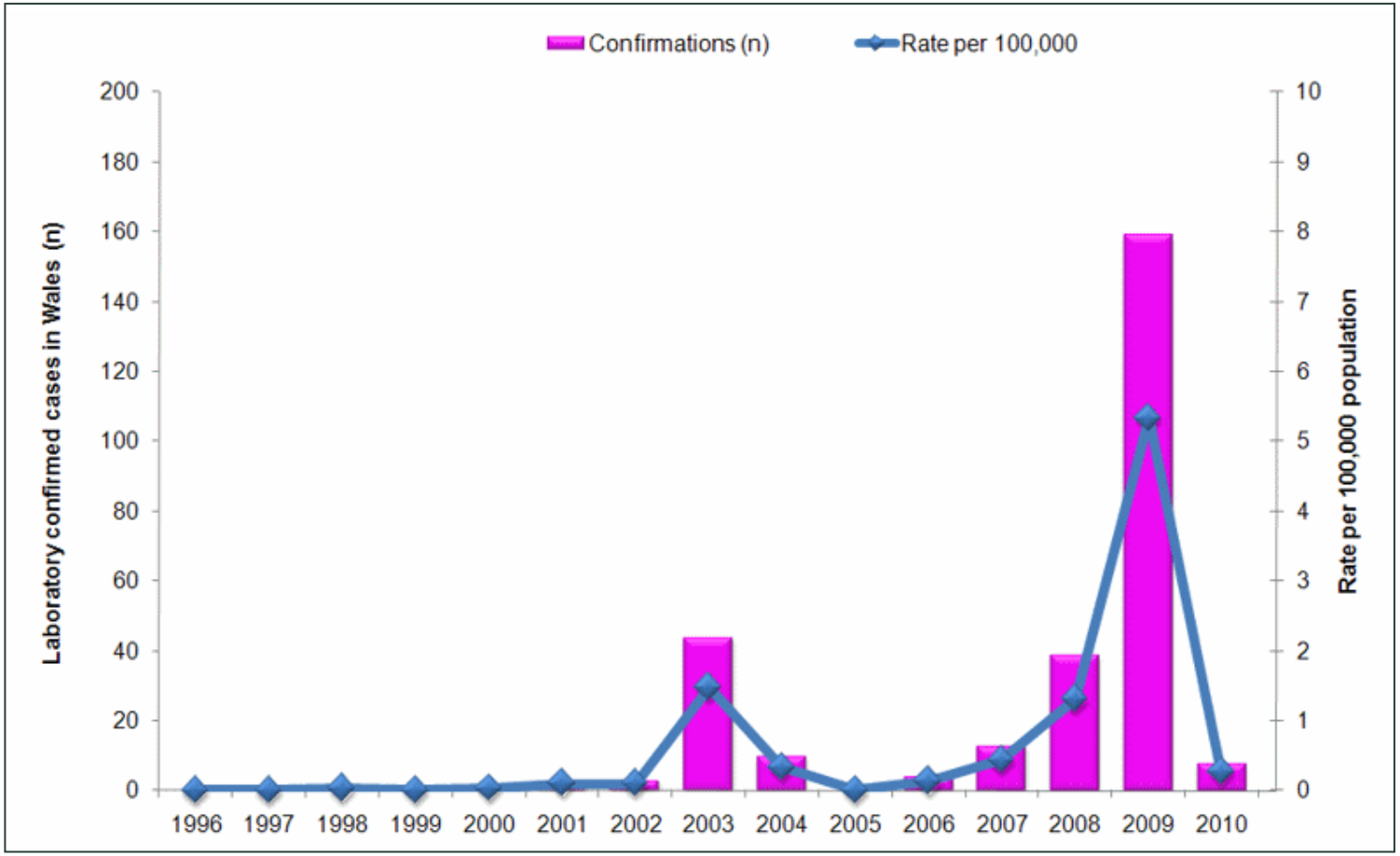
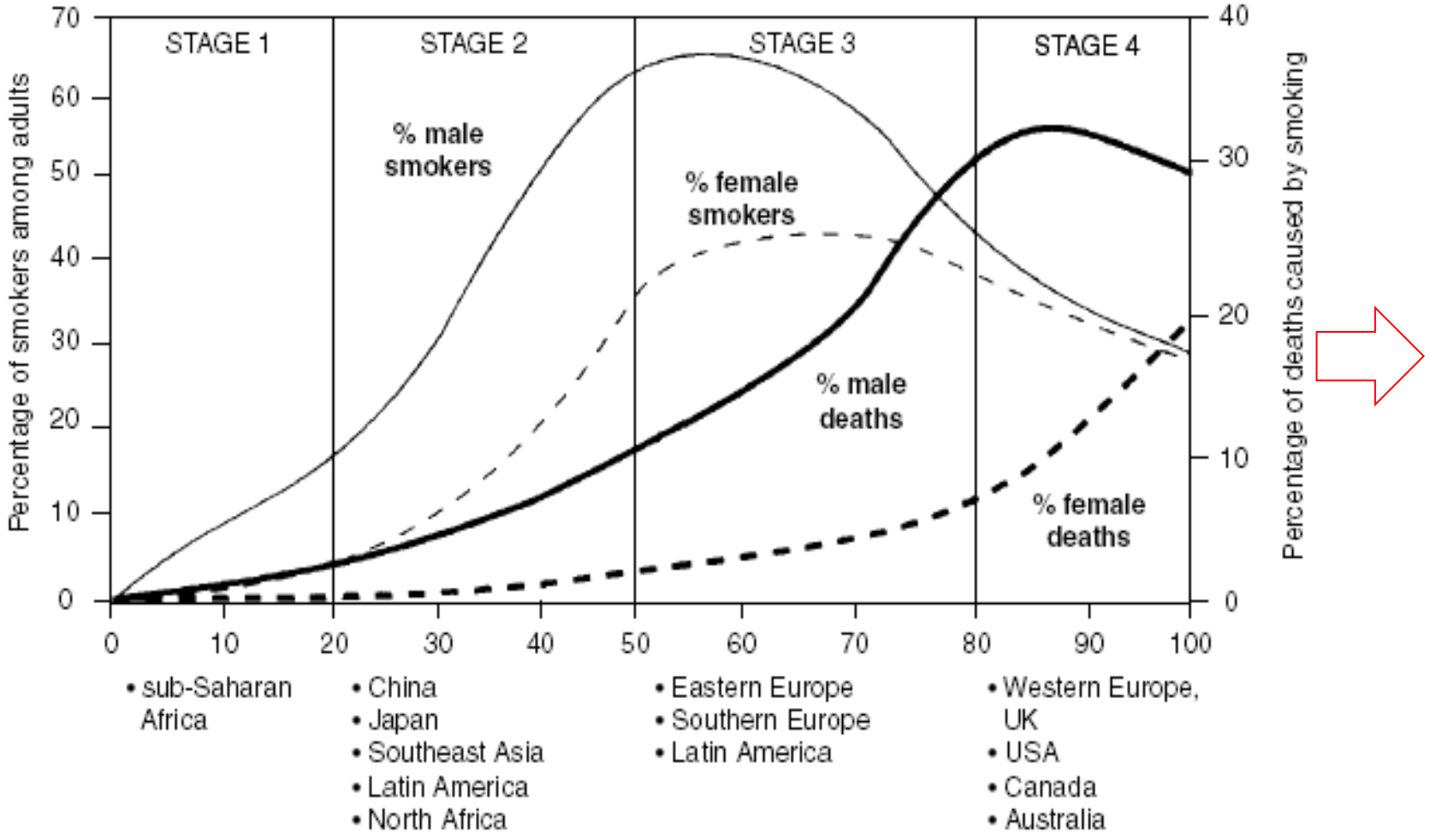
Measles in Wales: 1996-2011



Health Protection Agency, May 2011

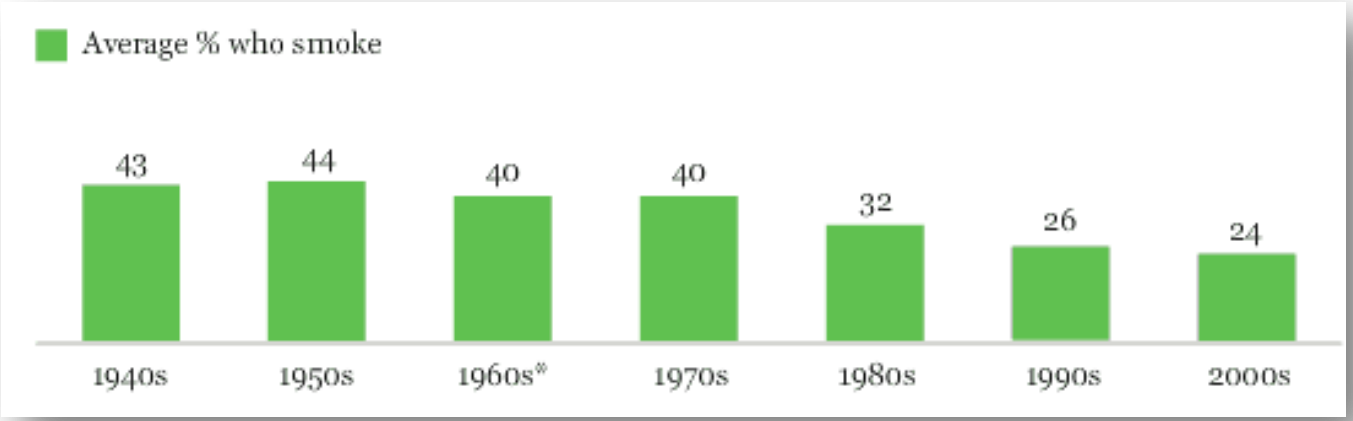
Swiss Re

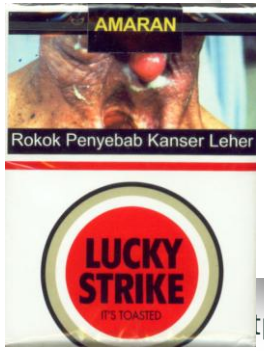
Cigarette Century (Allan M. Brandt)

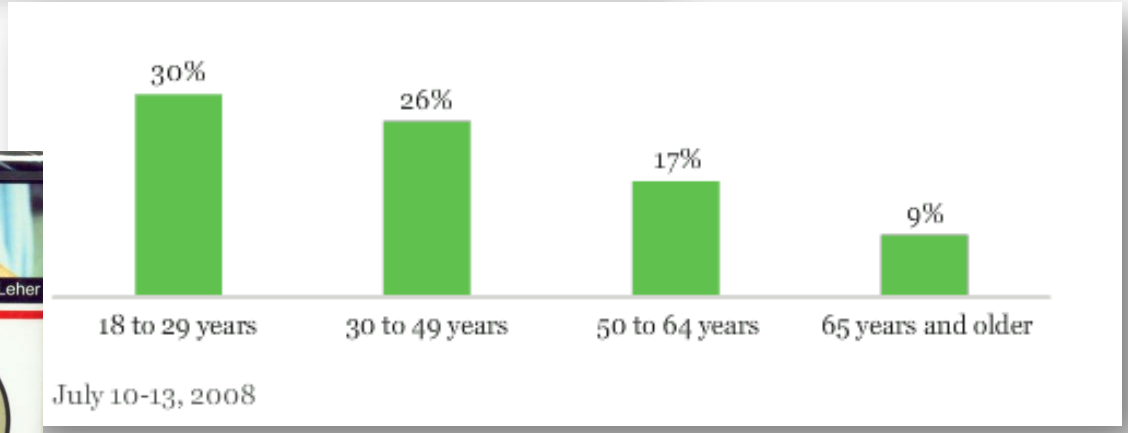


Swiss Re

US cigarette smoking

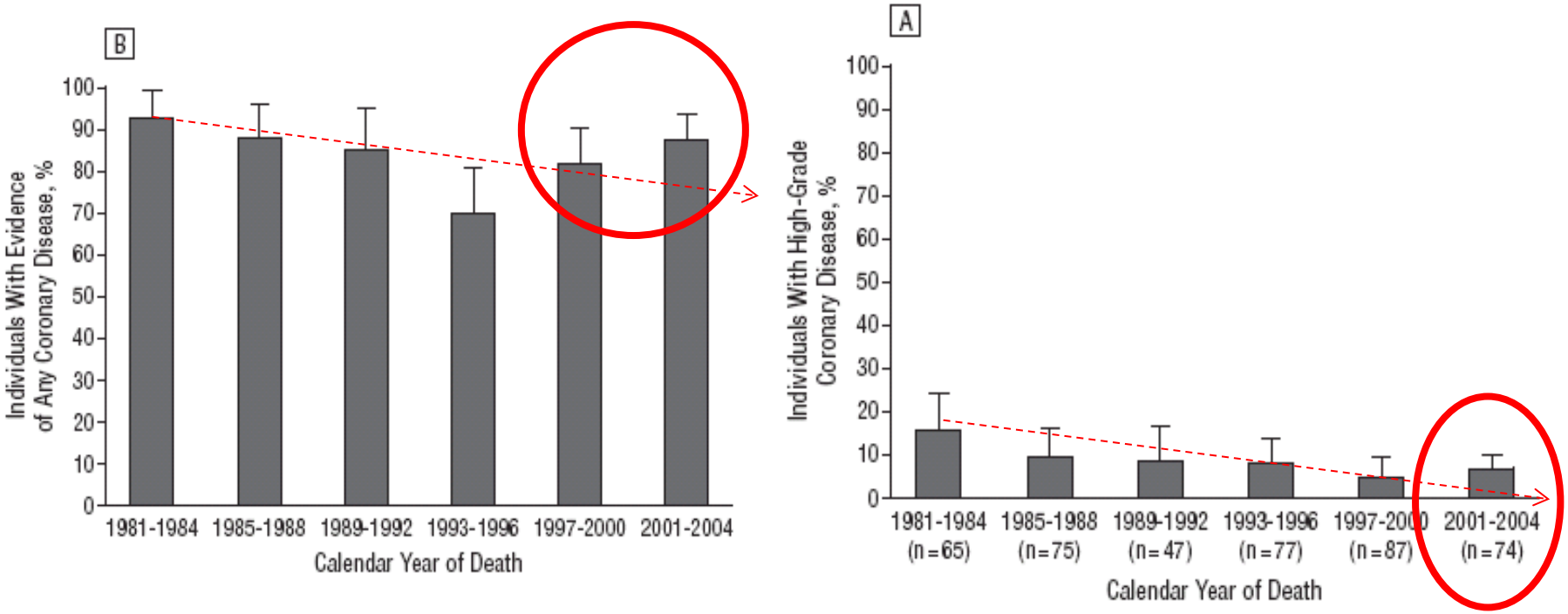






tp://www.gallup.com/poll/109048/us-smoking-rate-still-coming-down.aspx

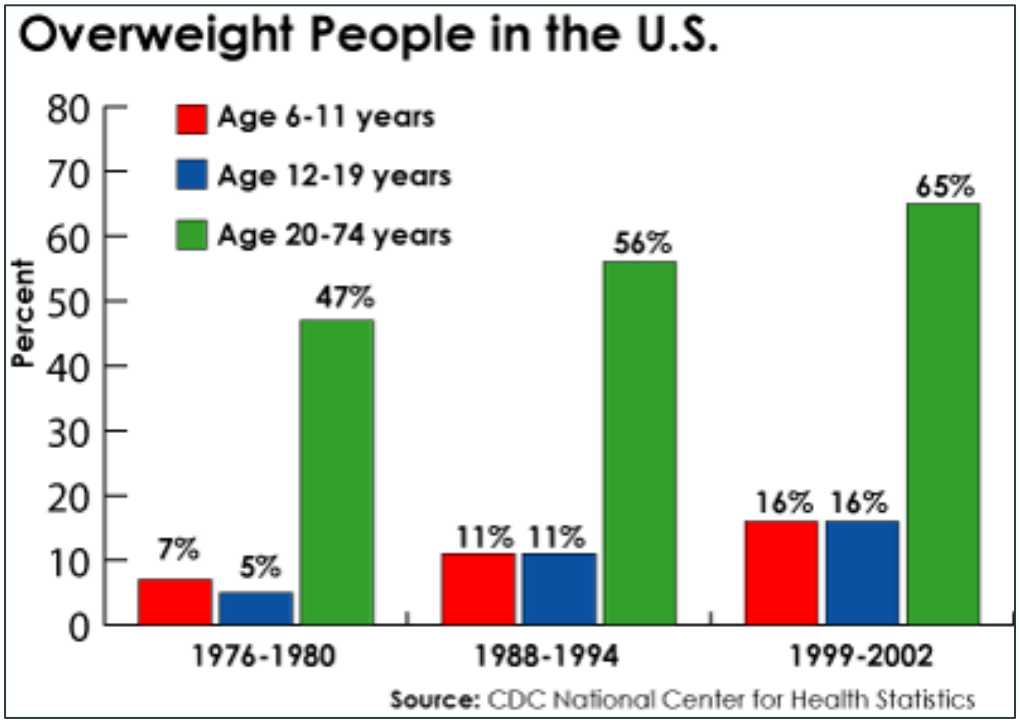
Warning signs: CAD trends in young adults- autopsy data



"Age- and sex-adjusted regression analyses revealed temporal declines over the full period (1981-2004) for high-grade disease, any disease, and grade of coronary disease. Declines in the grade of coronary disease ended after 1995 ($P<.01$ for every artery) and possibly reversed after 2000 ($P=.06$ for LCx)."

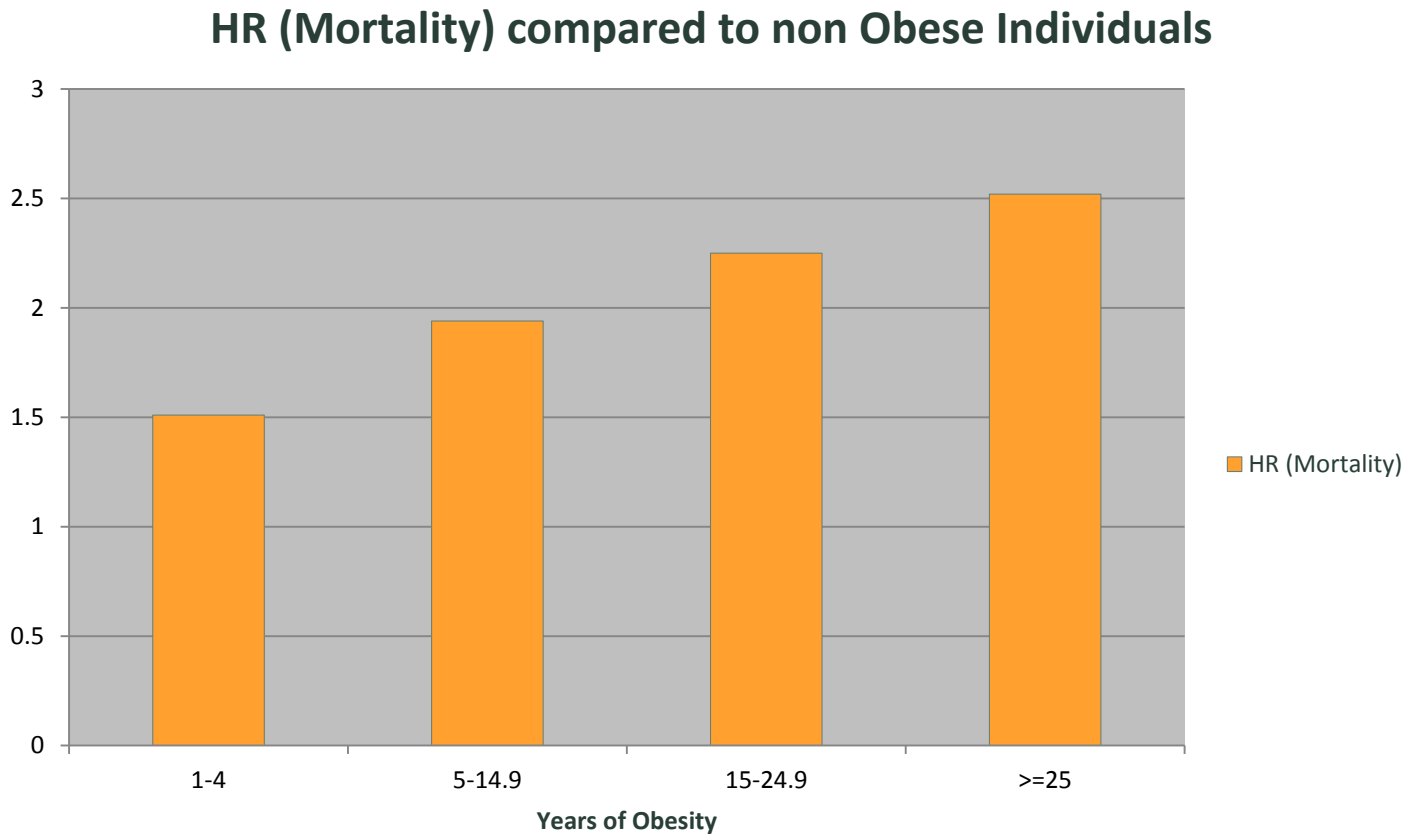
Nemetz P et al., Arch Int Med, 2008

Obesity



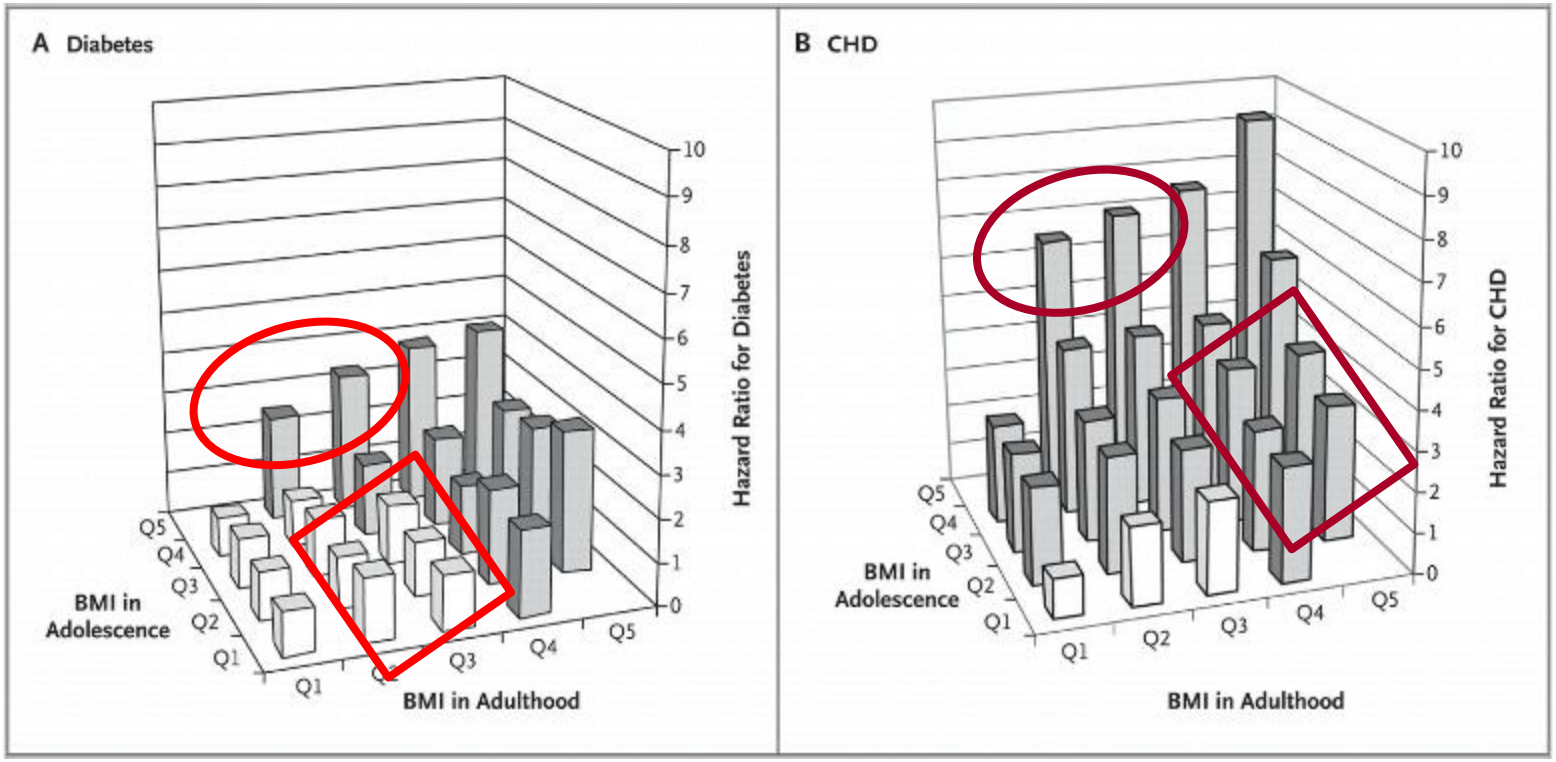
WHO and CDC

Years lived with obesity – an approaching storm?



Int. J. Epidemiol. (2011) 40 (4): 985-996.

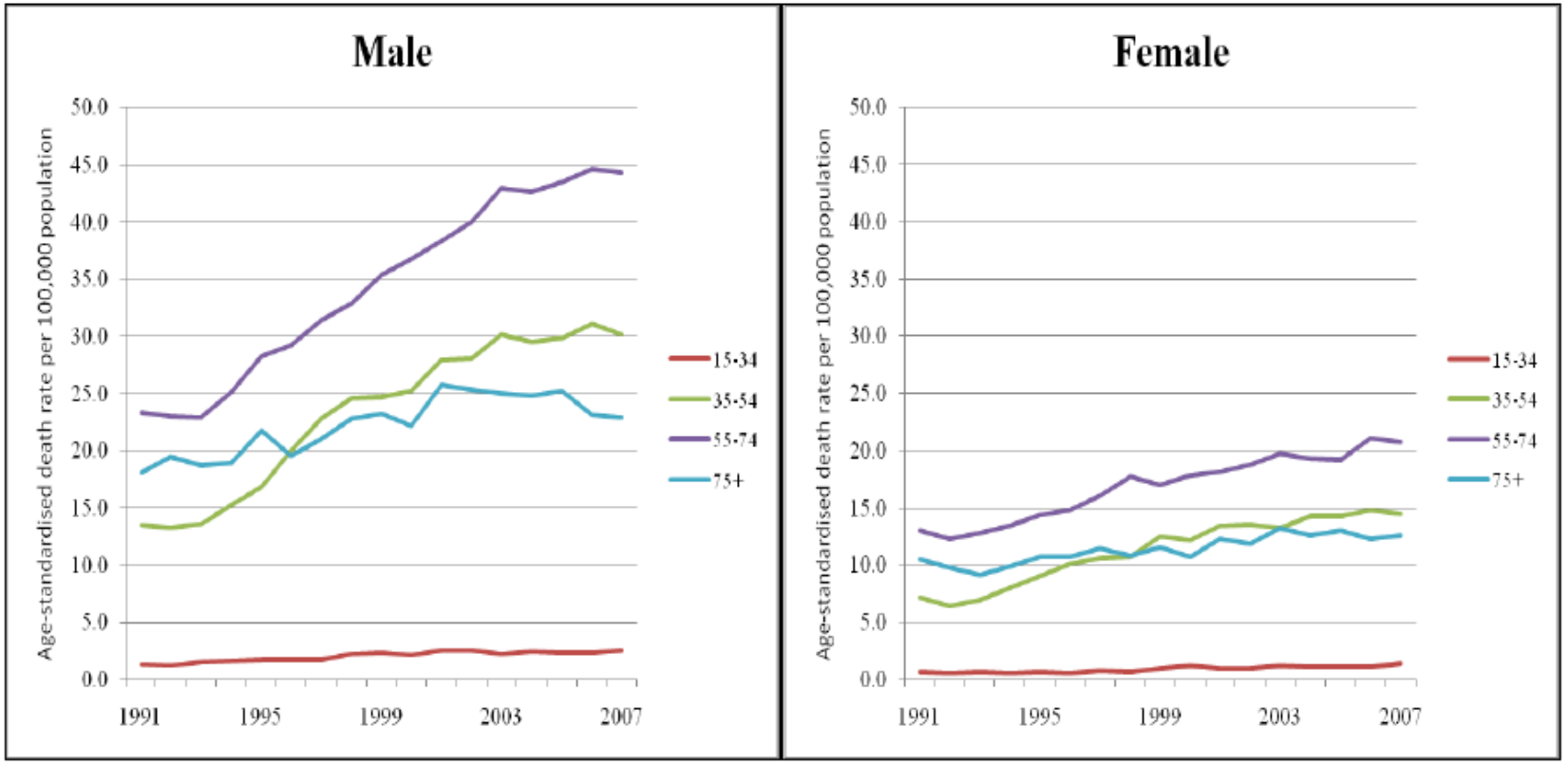
Age at time of obesity – another storm front?



N Engl J Med; 364 (14):1315-25

Swiss Re

UK trends in alcohol-related deaths



ONS (2009b), Health Statistics Quarterly 41

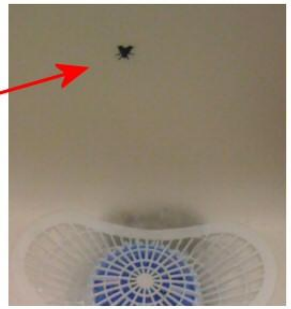
Swiss Re

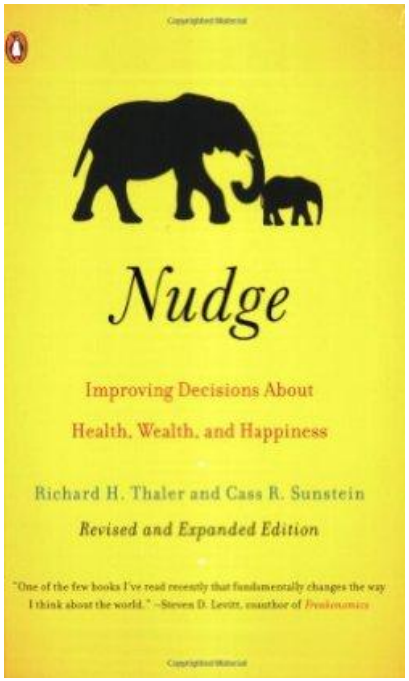
What tomorrow holds...

Medical Science vs. **Behavioural Science**

Swiss Re

"Choice architecture" (Nudging)





Thaler and Sunstein

But assumptions and rulers will still have to be used...

"Until I recover, let's just assume your prostate is fine."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Thank you
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YEARS

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