

The Actuarial Profession, making financial sense of the future
 Emerging Trends in Mortality and Longevity Symposium 2011
 The University of Warwick, Coventry 13-14 September 2011

International trends in mortality and longevity

Jean-Marie Robine
 INSERM, Paris & Montpellier, France

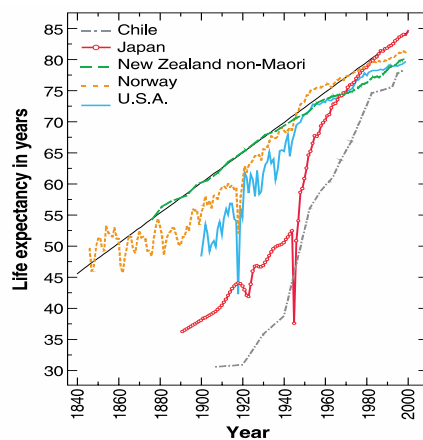
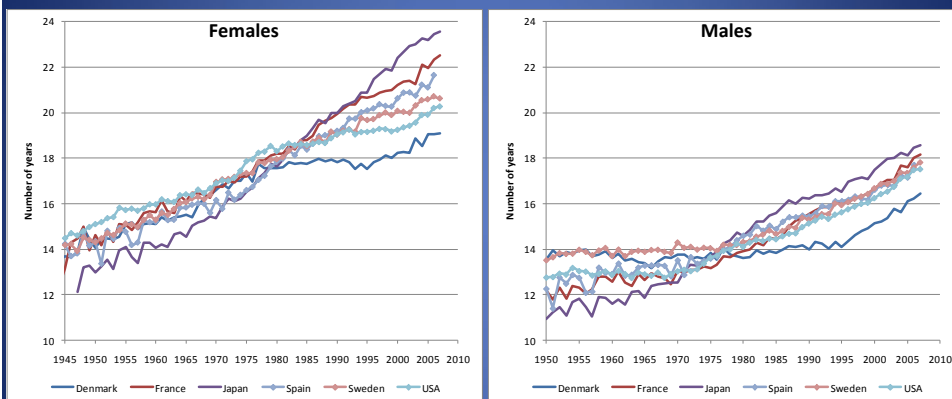


Fig. 2. Female life expectancy in Chile, Japan, New Zealand (non-Maori), Norway, and the United States compared with the trend in record life expectancy.

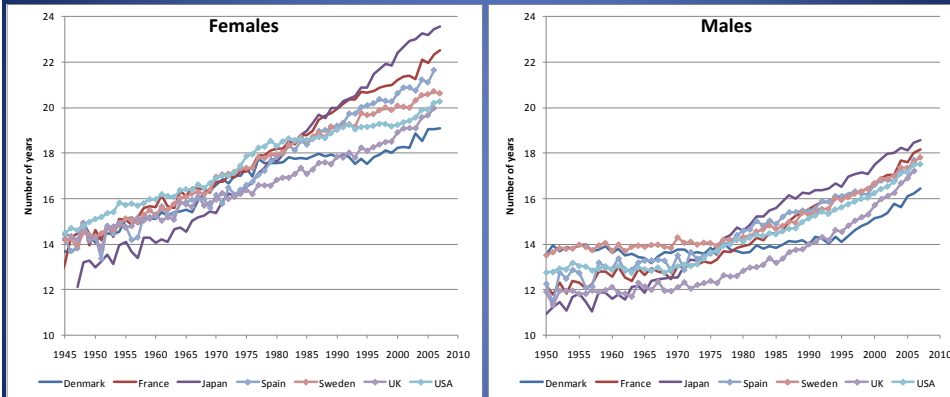
Oeppen &
 Vaupel, 2002

Convergence – Divergence

Divergence in life expectancy at age 65

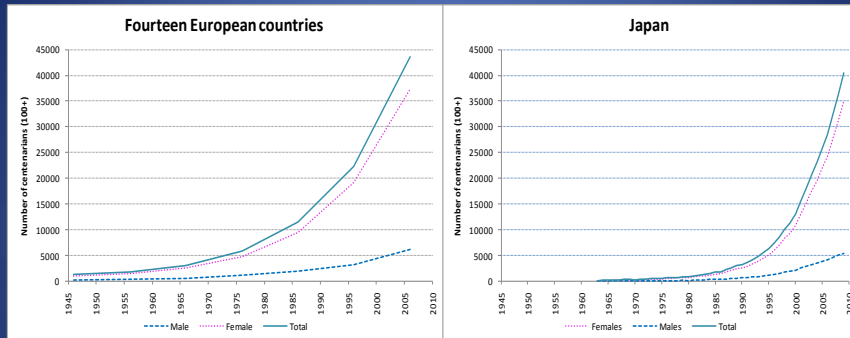


Divergence in life expectancy at age 65



Emergence of the oldest old

Change in the number of centenarians in Europe vs Japan



The New York Times

August 14, 2010

Asia Pacific

Japan, Checking on Its Oldest, Finds Many Gone



Kyodo News, via Associated Press

A Kobe city official, left, visited Mitsue Watase, 100, at her home last week as Japanese officials started a survey on the whereabouts of centenarians.

By MARTIN FACKLER

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10 September 2010 Last updated at 09:53 GMT

More than 230,000 Japanese centenarians 'missing'

More than 230,000 elderly people in Japan who are listed as being aged 100 or over are unaccounted for, officials said following a nationwide inquiry.

An audit of family registries was launched last month after the remains of the man thought to be Tokyo's oldest were found at his family home.

Relatives are accused of fraudulently receiving his pension for decades.

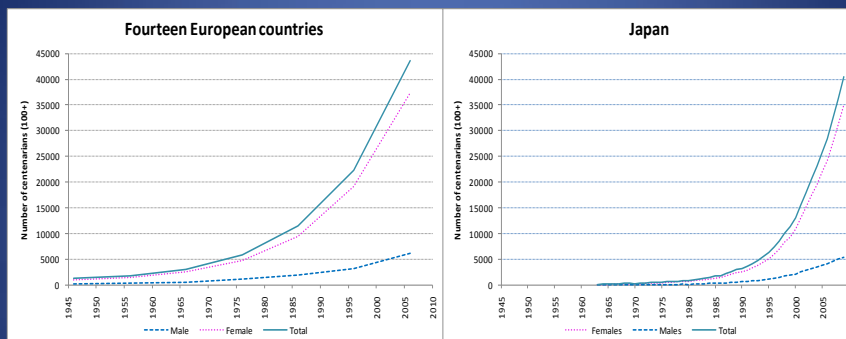
Officials have found that hundreds of the missing would be at least 150 years old if still alive.

The Justice Ministry said some of those unaccounted for may have died as long ago as World War II, possibly during the post-war turmoil.



Japanese citizens are famous for their longevity

Change in the number of centenarians in Europe vs. Japan



Europe vs. Japan

Table 4: Europe compared with Japan: Number of centenarians in 2006 and various centenarian indicators, by sex

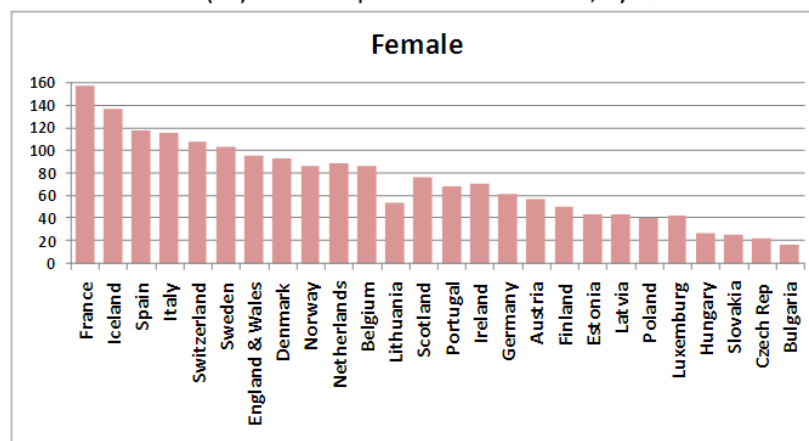
Country	Males	Females	Total	Sex-ratio	Males	Females	Total
Number of people aged 100 years and more				10-Year Increase			
Japan	3906	23236	27142	5,9	3,0	4,5	4,2
European countries	8228	49078	57306	6,0	2,0	2,0	2,0
Number of people aged 100 years				Centenarian Rate (CR)*			
Japan	1644	9181	10826	5,6	49,3	259,4	157,5
European countries	3823	20675	24499	5,4	18,5	86,5	55,0

Source of data: Human Mortality Database (HMD); *Slovenia excluded

Robine and Saito, in press

The centenarian rate in Europe

Centenarians Rate (CR) in 26 European countries in 2006, by sex



Robine and Saito, 2009

N° 1319 - OCTOBRE 2010

15 000 centenaires en 2010 en France, 200 000 en 2060 ?

Nathalie Blanpain, division Enquêtes et études démographiques, Insee

Au 1^{er} janvier 2010, 15 000 centenaires vivent en France métropolitaine : c'est treize fois plus qu'en 1970. Neuf centenaires sur dix sont des femmes et parmi les personnes de 110 ans et plus, qu'on appelle les « supercentenaires », il n'y a quasiment que des femmes. Un centenaire sur deux vit à domicile, qu'il soit seul, en couple, ou avec une autre personne que son conjoint. La part des centenaires qui vivent en solo ou en couple s'accroît. Les hommes sont plus fréquemment à leur domicile que les femmes. Dans cinquante ans, la France pourrait compter 200 000 centenaires, soit treize fois plus qu'aujourd'hui. Si les conditions d'espérance de vie sont meilleures que prévu, ils pourraient être 380 000 en 2060, contre 120 000 dans le cas contraire.

doyen a 114 ans et aucun homme n'a plus de 110 ans.

Treize fois plus de centenaires que dans les années 1970

En 2010, 15 000 centenaires vivent en France métropolitaine (encadré 1). Selon le point de vue adopté, on peut considérer que ce chiffre est élevé ou non. C'est beaucoup, car c'est treize fois plus que dans les années 1960-1970. Entre 1960 et 1975, leur nombre était stable, on en comptait 1 150 chaque année. Depuis 1975, leur effectif augmente continuellement au rythme de 8 % par an. Au total, ils ne représentent que 0,02 % de la population, ou encore un centenaire pour deux ou trois communes en moyenne, sur les 37 000 que compte la France.

Les « supercentenaires » : quasiment tous des femmes

Selon les travaux de recherches disponibles

INSEE
PREMIERE

10m alive in Britain today will live to be more than 100 years old

More than 10 million people alive today will live to be more than 100 years old, government figures suggest.



Experts said the rise in those aged over 100 years old has profound social, economic and financial implications. Photo: RODGER TAMBLYN

By Rosa Prince 10:03PM GMT 29 Dec 2010
151 Comments

In total, about half a million people a year will be celebrating their 100th birthday by 2066, compared with about 10,000 now. Nearly 8,000 of them will reach their 110th birthday.

In 1981, there were 2,600 centenarians but this is forecast to rise to more than 280,000 by 2050.

The Telegraph

Could half of us live to 100?

As another year draws to a close, Steve Jones looks at how many of 100 New Year's Eves.



Henry Allingham, the World War One veteran who was the oldest man in the world at the time of his death last year, aged 113. Photo: REUTERS

By Steve Jones 9:00AM GMT 28 Dec 2010
8 Comments

Number of Future Centenarians

December 2010

DWP Department for
Work and Pensions

Table 2: Number of centenarians in the United Kingdom

Year	100+	110+
1980	2,300	-
1985	3,400	-
1990	4,400	-
1995	5,700	-
2000	6,800	-
2005	8,900	-
2010	11,800	-
2015	15,000	-
2020	21,900	-
2025	37,600	-
2030	58,800	100
2035	97,300	100
2040	148,900	400
2045	202,100	1,000
2050	276,600	2,100
2055	306,200	5,600
2060	378,200	5,600
2065	487,400	7,200
2066	507,000	7,700
2070	563,500	10,700
2075	587,000	16,200
2080	626,900	21,000

Numbers rounded to nearest 100. Population estimates have been based on 2009, and 2008-based population projections from 2010

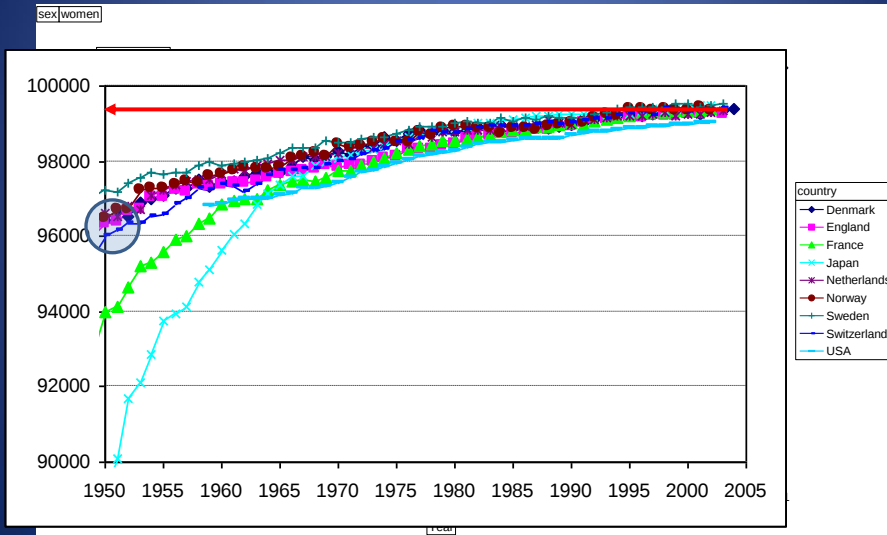
Source: Office for National Statistics, 2008-based Population Projections

Estimates of the very elderly:

www.statistics.gov.uk/statbase/Product.asp?vlnk=15003

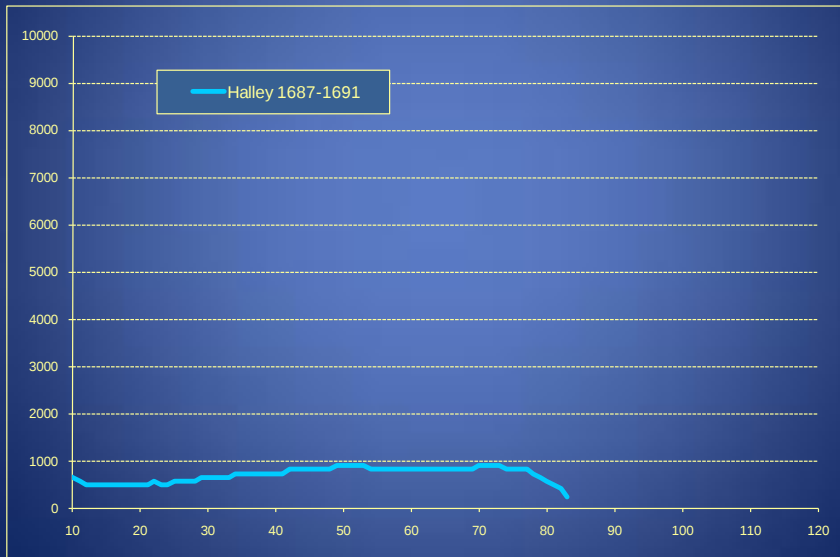
Variability - Uncertainty

How many newborn are becoming adults?

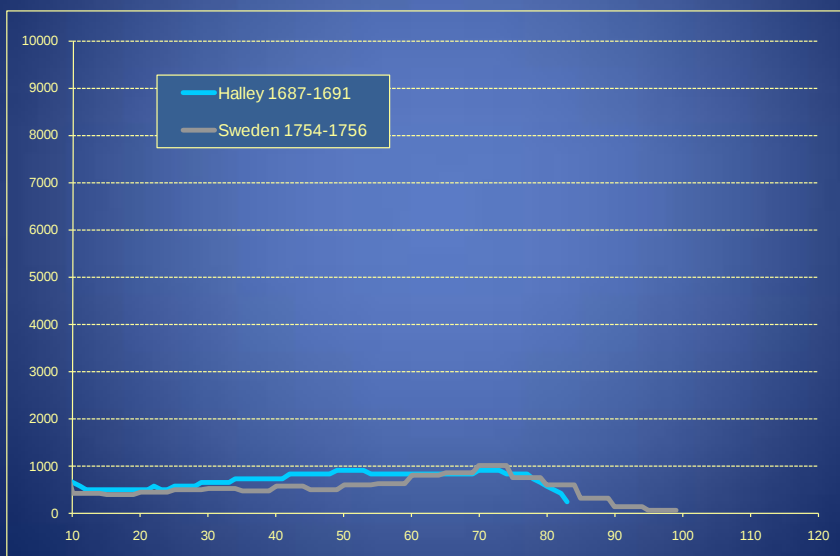


The adult longevity revolution

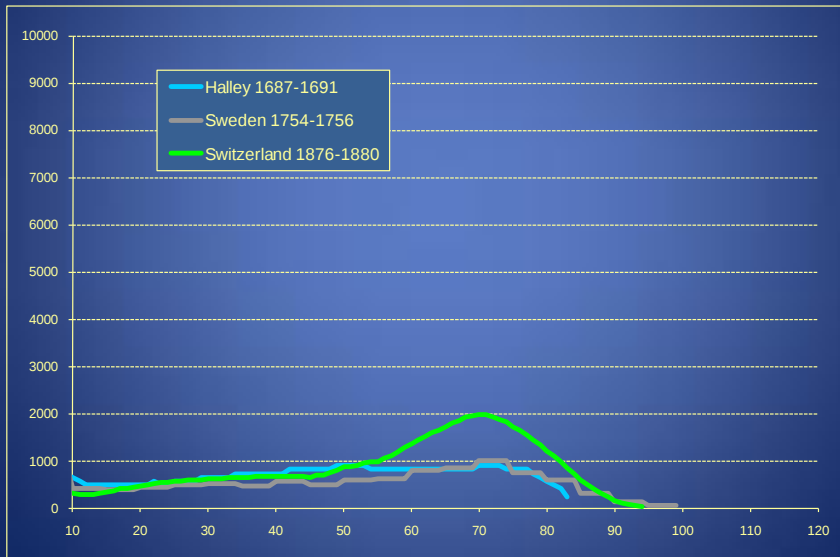
Halley, first life table, 1693



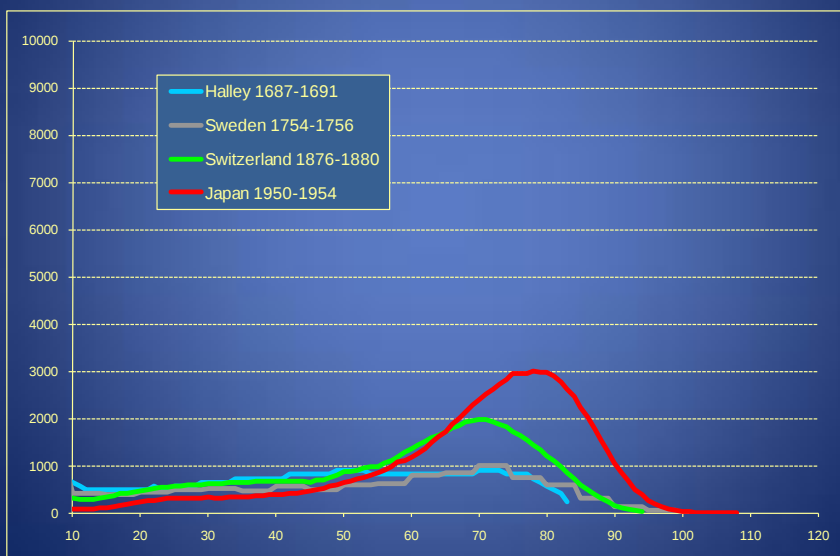
Sweden, 1754-1756, data sent by Wargentin to Deparcieux



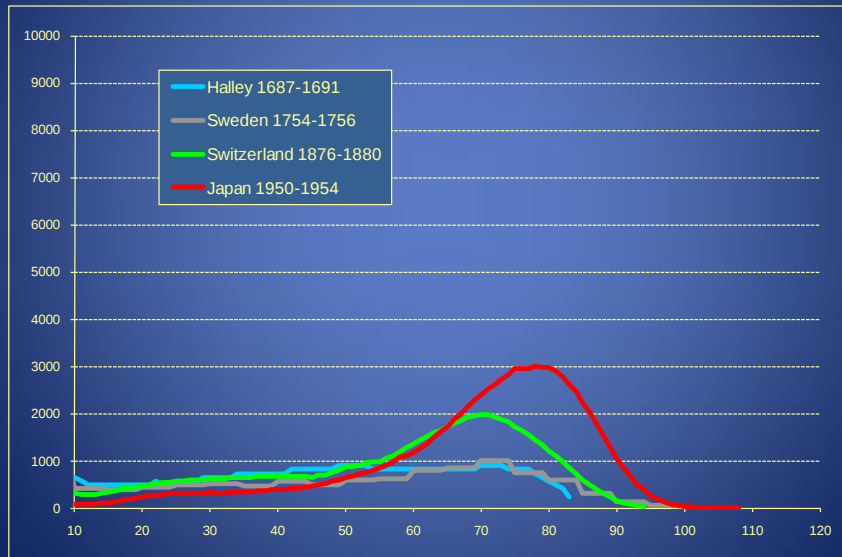
Switzerland, 1876-1880



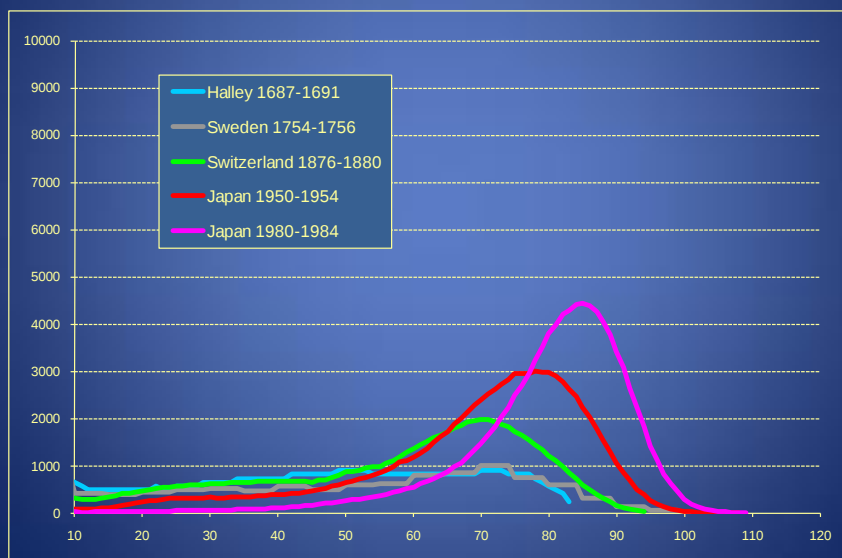
Japan, 1950-1954



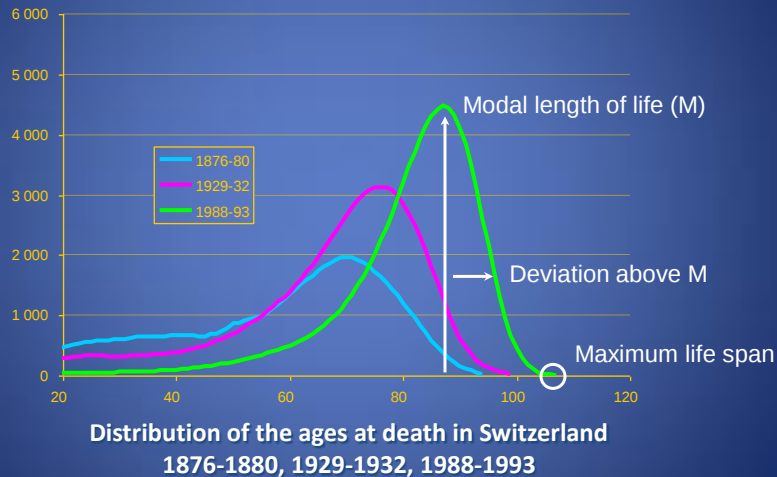
Japan, 1950-1954



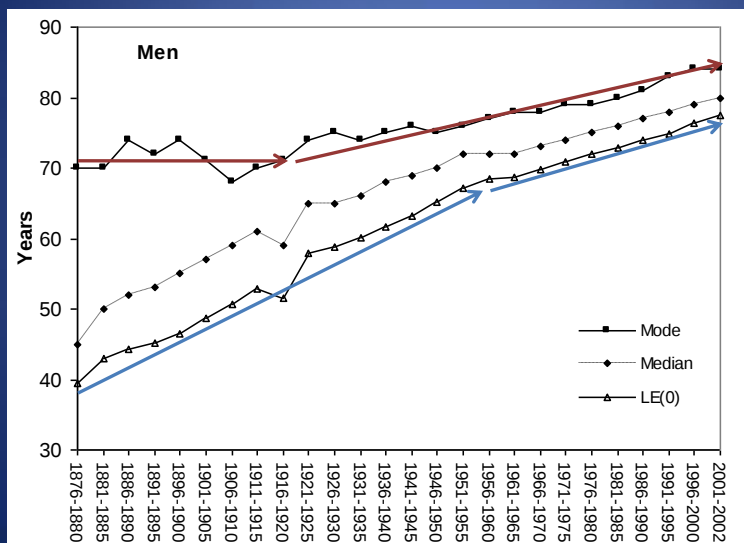
Japan 1980-1984



How long are adult life durations?

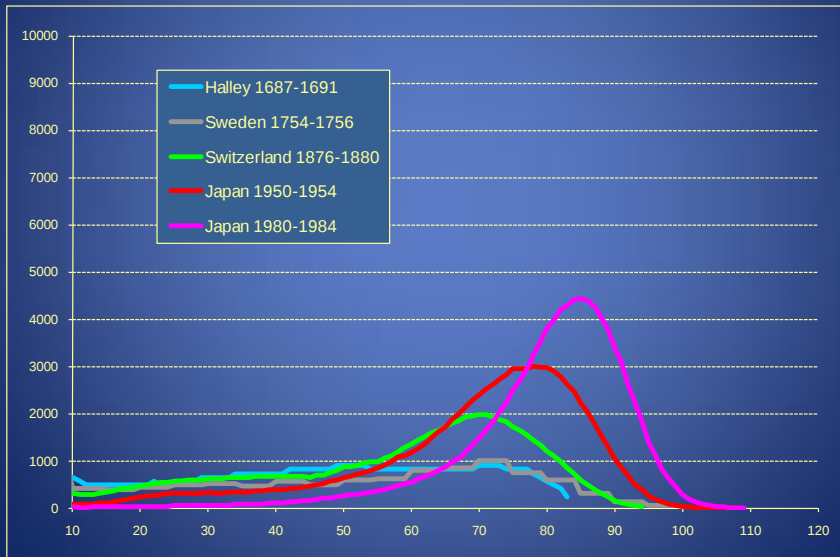


Life expectancy, median life and modal age at death, Switzerland from 1876

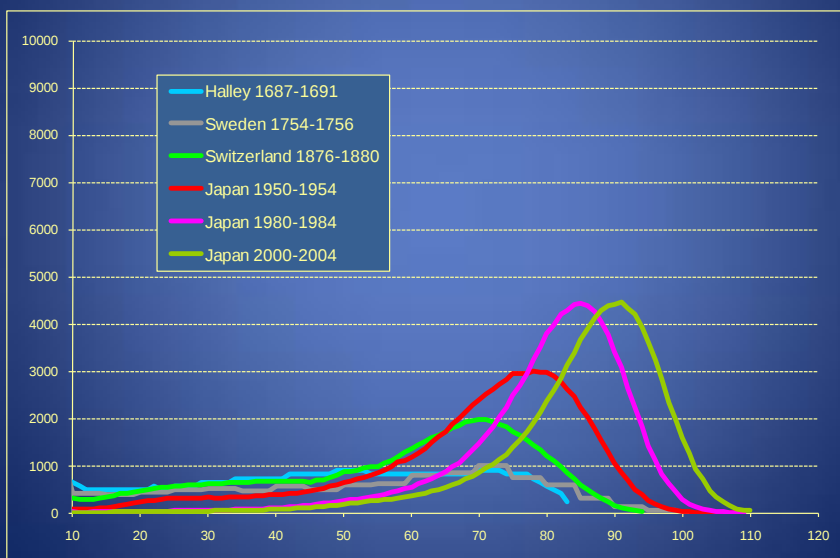


Cheung et al,
2006

Japan 1980-1984

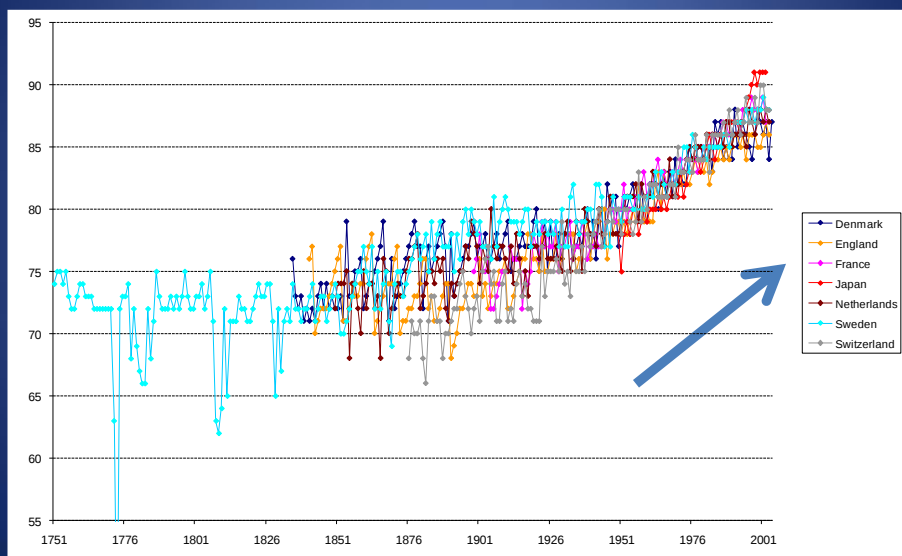


Japan 2000-2004

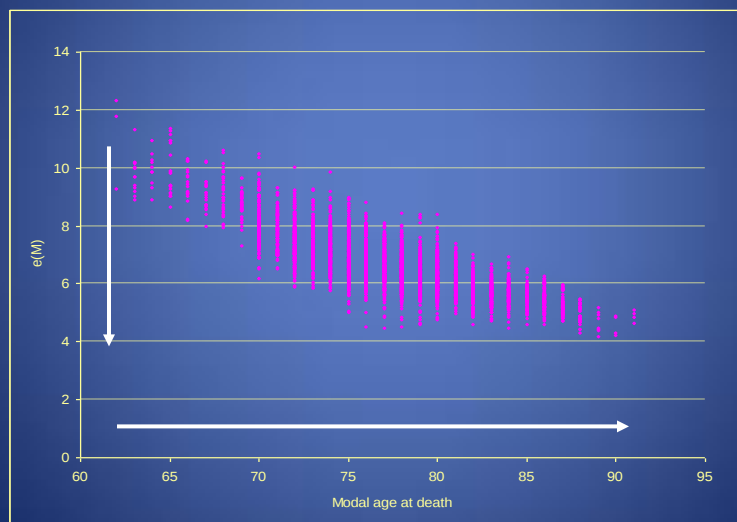


Compression of or shift in mortality ?

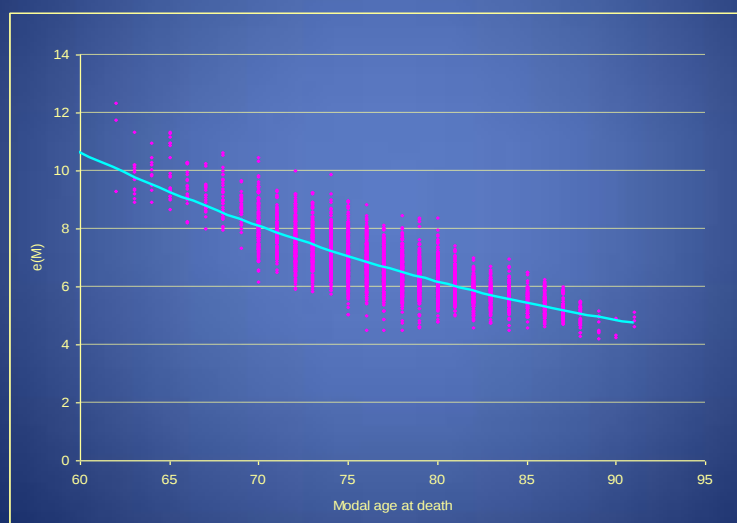
Increase in the modal length of life (M), since 1751:
a selection of 7 countries



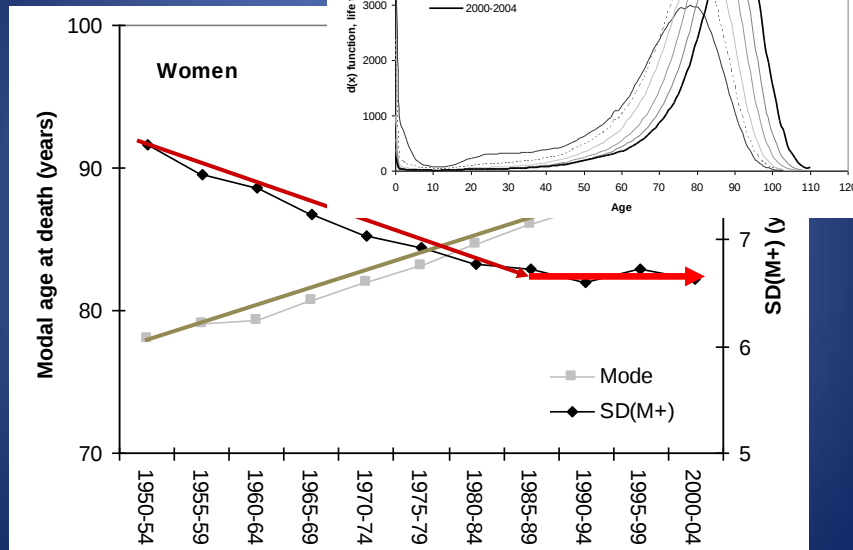
Correlation between the modal length of life (M) and the mean deviation above ($e(M)$) in 4188 life tables since 1751, males and females – (HMD)



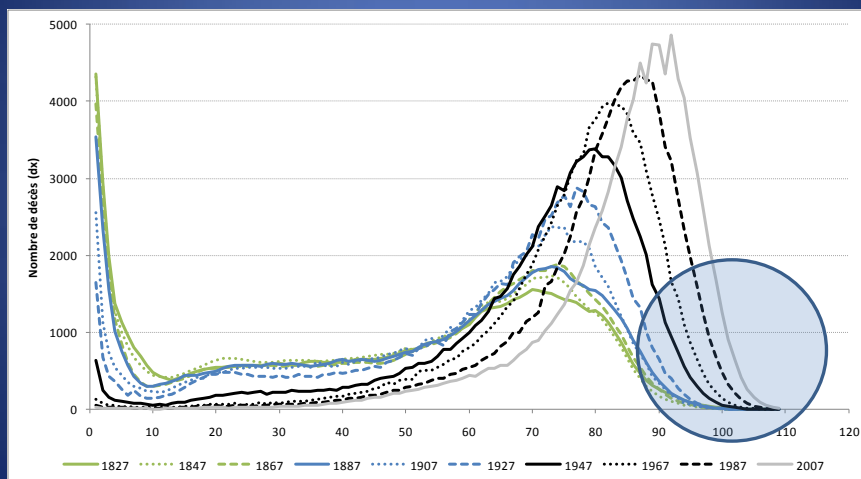
Correlation between the modal length of life (M) and the mean deviation above ($e(M)$) in 4188 life tables since 1751, males and females – (HMD)



Change in the modal age at death in Japan for women



Change over time in the distribution of the ages at death in France since 1827, female - for 100.000 newborn



Are centenarian people healthy people?

- The few representative studies of centenarians have demonstrated that they are in relatively poor health with a significant proportion being bedridden and/or demented
 - only 1% of Italian centenarians are fully independent
 - none of them continued social or productive activities that could be considered as examples of successful ageing
- On the other hand several studies suggested that these extremely old people were in relatively good health 5 or 10 years before (Christensen et al, 2008). Differential mortality must have eliminated the frailer dependant nonagenarians.

- Are older people more likely to be in better health because they are in better health easier to survive today?
- In Denmark, where the number of centenarians is increasing relatively slowly, the number of female centenarians (100) significantly increased in the last decade (Engberg et al, 2008)
- On the other hand in Japan, where the number of centenarians has increased more than 3-fold every decade since the 1970s, occasional centenarian surveys demonstrated significant declines in the functional health status of Japanese centenarians.

Population estimates: 100 years			
	Females	Males	Total
Denmark			
2005	233	47	280
2006	250	46	296
2007	265	36	301
2008	245	43	288
France			
2005	4189	652	4841
2006	4491	719	5210
2007	4949	773	5722
Japan			
2005	7674	1533	9207
2006	8991	1609	10600
2007	9769	1766	11535
2008	12483	2232	14715

Prevalence of centenarians confined to the room

Year	Population size	Sampling rate	% confined to the room		% bedridden	
			Males	Females	Males	Females
1973 (1)	405	28.9	19.1	37.5	14.3	21.9
1975 (2)	548	39.1	38.5	46.8	15.4	25.7
1981 (3)	1072	94.2	33.1	50.7	18.2	27.9
1992 (4)	4152	13.2	36.5	59.8	21.2	36.6
1993 (5)	4802	59.9	39.3	61.1	17.9	34.4
2000 (6)	13036	14.6	57.0	78.0	22.2	41.1

the last decade.

Research reports

- (1) Tokyo metropolitan institute of aging (1973)
- (2) Center for development of elderly welfare (1976)
- (3) Japan Health promotion and Fitness Foundation (1992)
- (4) Japan College of Social Work (1992)
- (5) Japan Health promotion and Fitness Foundation (1993)
- (6) Japan Health promotion and Fitness Foundation (2002)

where the number of centenarians has increased more than 3-fold every decade since the 1970s, occasional centenarian surveys demonstrated significant declines in the functional health status of Japanese centenarians.

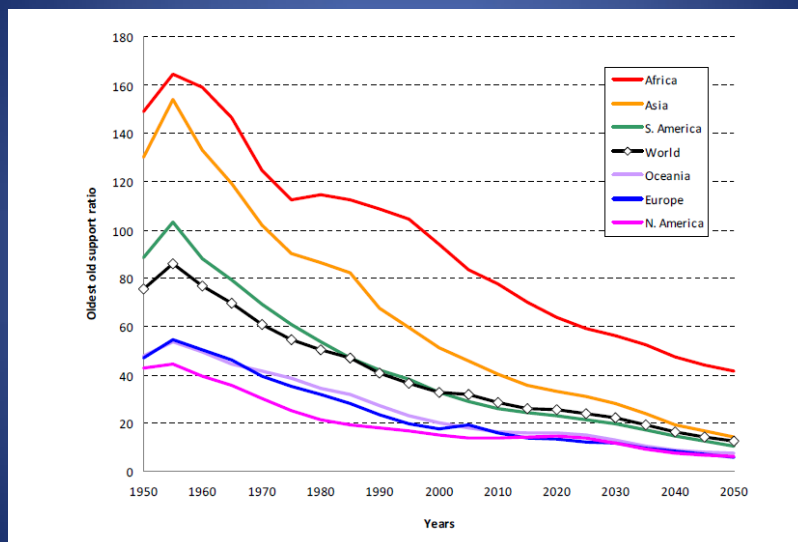
The Five Country Oldest Old Project (5-COOP): Relationships between the level of mortality selection and the health status of the oldest old

Denmark, France, Japan, Sweden & Switzerland

Robine et al, Centenarians today: New insights on selection from the 5-COOP study. *CGGR* 2011

The oldest old support ratio

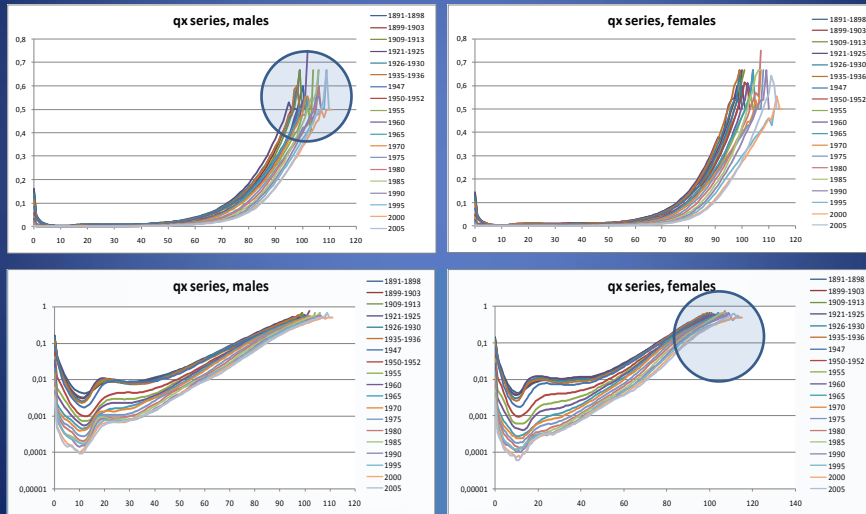
World wide decline in the oldest old support ratio



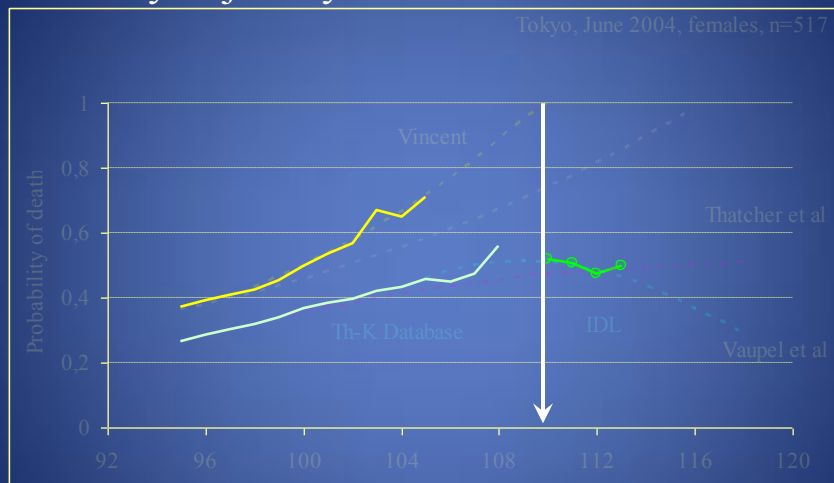
As the number of people aged 50-74 for each person aged ≥ 85

Mortality trajectory

Mortality trajectory with age

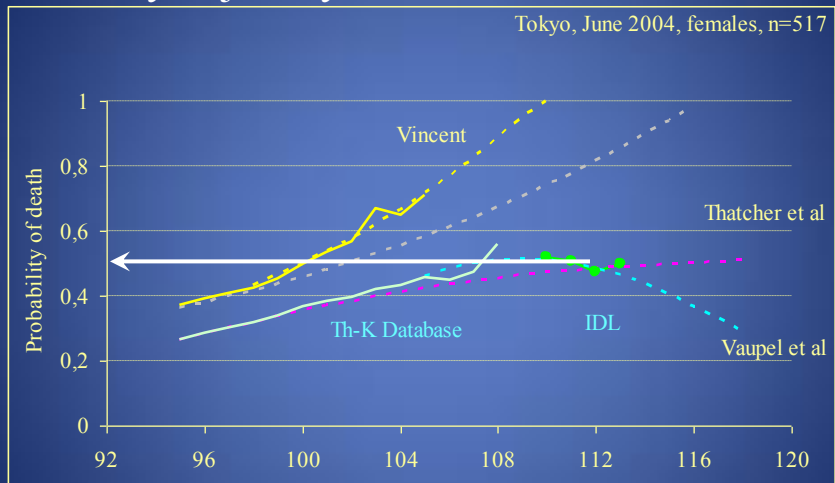


Mortality trajectory...



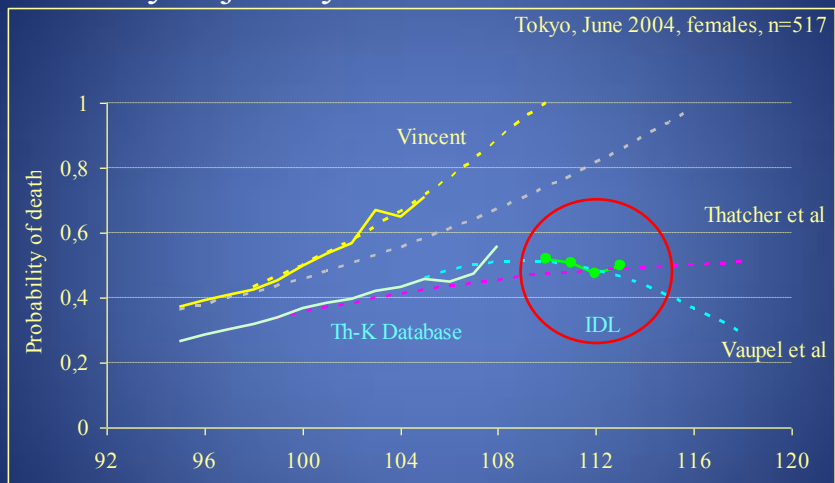
Robine & Vaupel, 2005

Mortality trajectory...



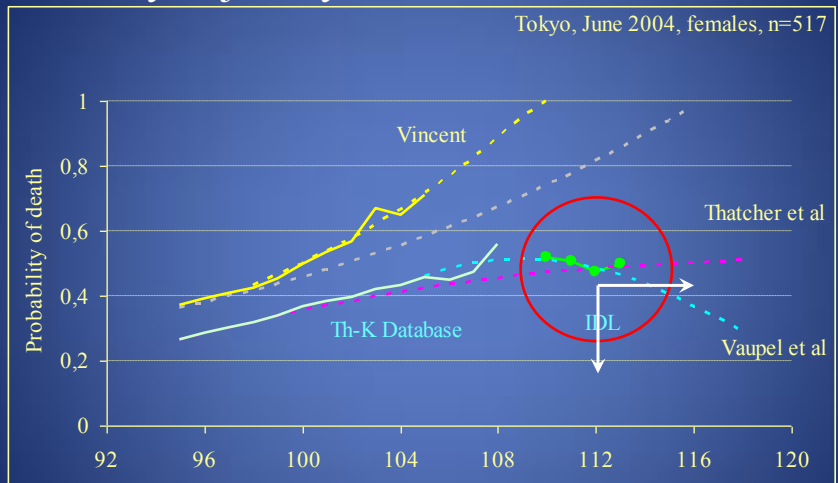
Robine & Vaupel, 2005

Mortality trajectory...

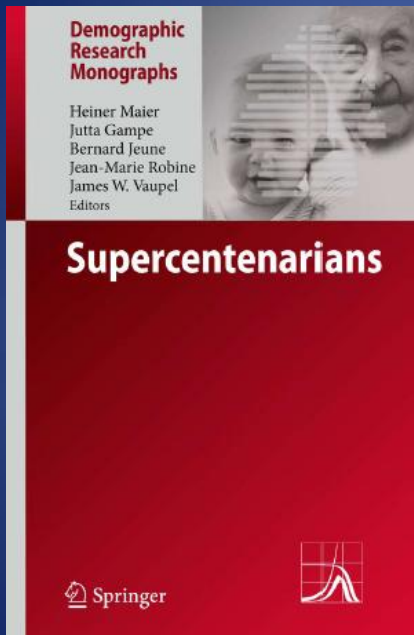


Robine & Vaupel, 2005

Mortality trajectory...

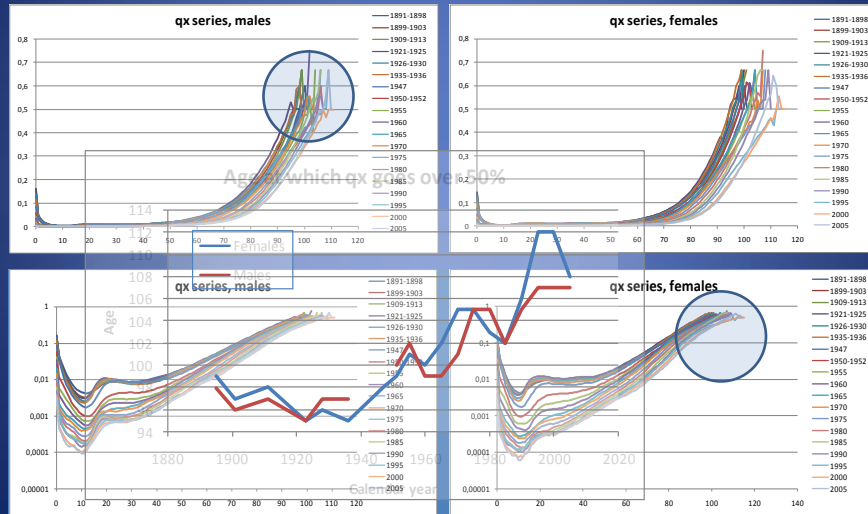


Robine & Vaupel, 2005



Mortality trajectory with age

Robine & Saito, Rostock 2008



Thank you for your attention!

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