IAA Mortality Working Group – An overview

Martin Stevenson
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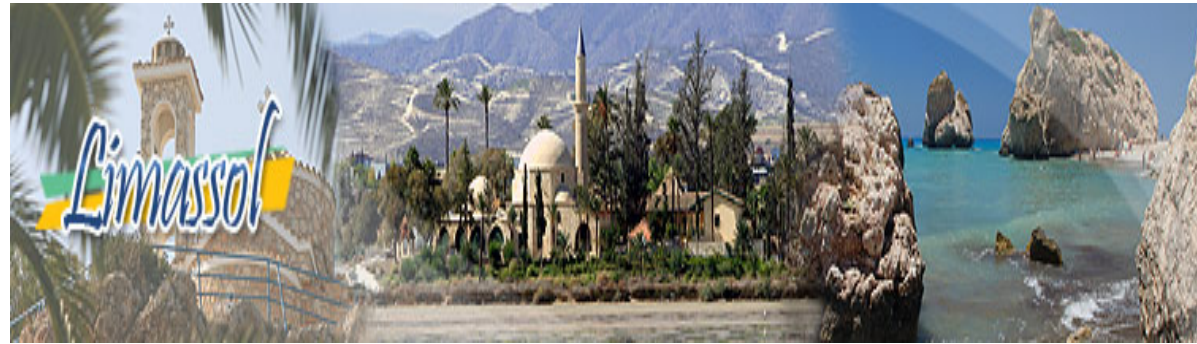
The Need

- Social Security
- Health care – public and private
- Pension funds – defined benefit and defined contribution
- Life insurers
- Financial products
- Work place practices
- Industries and infrastructures

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The Vision

Whenever insights are required in respect of mortality and trends in mortality, the body of knowledge produced by the IAA Mortality Working Group is sought for its valued and authoritative coverage.

Terms of Reference

- To monitor data collection efforts internationally and to facilitate continuous improvement in the quality and extent of data collection.

- To coordinate the work done by different Sections and Committees of the IAA in the area of mortality, especially when this involves cooperation with other international bodies.

- To extend the body of knowledge of the international actuarial community in respect of mortality through

  - research;
  - encouraging actuarial research;
  - collection of research from both actuarial and non-actuarial sources;
  - making research accessible to actuaries globally;
  - presentations and papers at professional seminars, colloquia, conferences etc.; and
  - encouraging and co-ordinating other actuaries to produce presentations and papers at professional seminars, colloquia, conferences etc.

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Areas of Investigation

- Collection of global mortality tables
- Data availability
- Mortality trends
- Uncertainty
- Pandemics

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Areas of Investigation (cont'd)

- Social and demographic stratification
- Analysis by cause of death
- Graduation techniques
- Mortality related financial products
- Society of Actuaries International Experience Study

Collection of global data bases

- SOA Table Manager
- Human Mortality Data Base (HMD)
- Continuous Mortality Investigation (CMI) Library
- World Health Organisation

SoA Table Manager

Description
- Some documentation
- Ultimate or select
- Subdivision by country and type

Strengths
- Free
- Accessible
- Uniform format

Weakness
- Infrequent updating
- Does not utilise latest technologies

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Human Mortality Data Base

Description
- Population mortality for 37 countries
- Information provided: Number of births, number of deaths, population size, qx, life tables, life expectancy at birth
- Considerable background information also provided

Strengths
- Very detailed data control
- Comprehensive information provided
- High quality

Weakness
- Relatively limited range of countries
- Any weaknesses of official statistics are duplicated

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Human Mortality Data Base Countries

Country and data series	Period Life Tables	Country and data series	Period Life Tables
Australia	1921-2007	Latvia	1959-2007
Austria	1947-2005	Lithuania	1959-2007
Belarus	1959-2007	Luxembourg	1960-2006
Belgium	1841-2006	Netherlands	1850-2006
Bulgaria	1947-2007	New Zealand	1948-2003
Canada	1921-2006	Norway	1846-2007
Chile	1992-2005	Poland	1958-2006
Czech Republic	1950-2008	Portugal	1940-2007
Denmark	1835-2007	Russia	1959-2008
Estonia	1959-2007	Slovakia	1950-2006
Finland	1878-2007	Slovenia	1983-2006
France	1816-2007	Spain	1908-2006
Germany	1956-2008	Sweden	1751-2007
Hungary	1950-2006	Switzerland	1876-2007
Iceland	1838-2007	Taiwan	1970-2008
Ireland	1950-2006	U.K.	1922-2006
Israel	1983-2007	U.S.A.	1933-2006
Italy	1872-2006	Ukraine	1959-2006
Japan	1947-2007		

Human Lifetable Database

- www.lifetable.de

- National population life tables published officially

- Includes some countries that could not be included in HMDB

- Include non-official tables produced by researchers

Human Lifetable Database

Additional countries on HLDB		
Afghanistan	India	Romania
Albania	Iran	Saudi Arabia
Algeria	Iraq	Singapore
Bahrain	Jordan	South Africa
Bangladesh	Kuwait	Sri Lanka
Brazil	Lebanon	Syria
China	Malta	United Arab Emirates
Costa Rica	Mexico	Uruguay
Egypt	Oman	Venezuela
Gaza Strip	Panama	West Bank
Greece	Peru	Yemen
Greenland	Qatar	
Hong Kong	Republic of Korea	

Continuous Mortality Investigation (CMI) Library

Description
- Assured lives, annuitants, pensioners, income protection
- Life offices and self-administered pension schemes
- Mortality and monetary functions
- Flexibility according to users' requirements
- Base rates and projections

Strengths
- Very comprehensive set of tables and projection
- Continuous process of improvement and innovation
- Readily tailored to users' needs

Weakness
- UK centric

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World Health Organisation

Description
- Mortality statistics derived from annual reported deaths in civil registration systems
- Sub-divided by cause of death

Strengths
- Wide range of countries covered
- Information provided on cause of death

Weakness
- High variability in quality of data
- Many countries with no data available

Lack of data is a global issue

Countries with no data				
Afghanistan	Comoros	Holy See (Vatican City State)	Namibia	Sudan
Algeria	Congo	Indonesia	Naura	Svalbard and Jan Mayen
American Samoa	Congo, DRC	Kenya	Nepal	Swaziland
Andorra	Cook Islands	Korea, Democratic People's Republic of	New Caledonia	Tanzania
Angola	Cote D'ivoire	Lao People's Democratic Republic	Niger	Tibet
Antarctica	Djibouti	Lesotho	Nigeria	Timor-Leste
Ascension Island	East Timor	Liberia	Niue	Togo
Benin	Equatorial Guinea	Libya	Norfolk Island	Tokelau
Bhutan	Eritrea	Liechtenstein	Northern Mariana Islands	Tonga
Bolivia	Ethiopia	Macau	Pakistan	Tunisia
Botswana	Faroe Islands	Madagascar	Palau	Turkey
Bouvet Island	French Polynesia	Malawi	Palestinian Territory, Occupied	Tuvalu
Burkina Faso	French Southern Territories	Mali	Pitcairn	Uganda
Burundi	Gabon	Marshall Islands	Rwanda	United Arab Emirates
Cambodia	Gambia	Mauritania	Saint Helena	United States Minor Outlying Islands
Cameroon	Ghana	Mayotte	Samoa	Vanuata
Cape Verde	Gibraltar	Micronesia, Federated States of	Senegal	Vietnam
Central African Republic	Guam	Montenegro	Sierra Leone	Virgin Islands, British
Chad	Guinea	Morocco	Solomon Islands	Wallis and Futuna
Christmas Island	Guinea-bissau	Mozambique	Somalia	Western Sahara
Cocos (keeling) Islands	Heard Island and McDonald Islands	Myanmar	South Georgia / South Sandwich Islands	Zambia

Two approaches to mortality projections and uncertainty

- Spread Adjusted International Trend (SAINT) – Use of multiple geographies to eliminate "noise" in past short term mortality levels and trends of a single country

- Distinguish between short term trend and long term trend and combine both in the model. Long term effects can include expert opinion about future life expectancy.
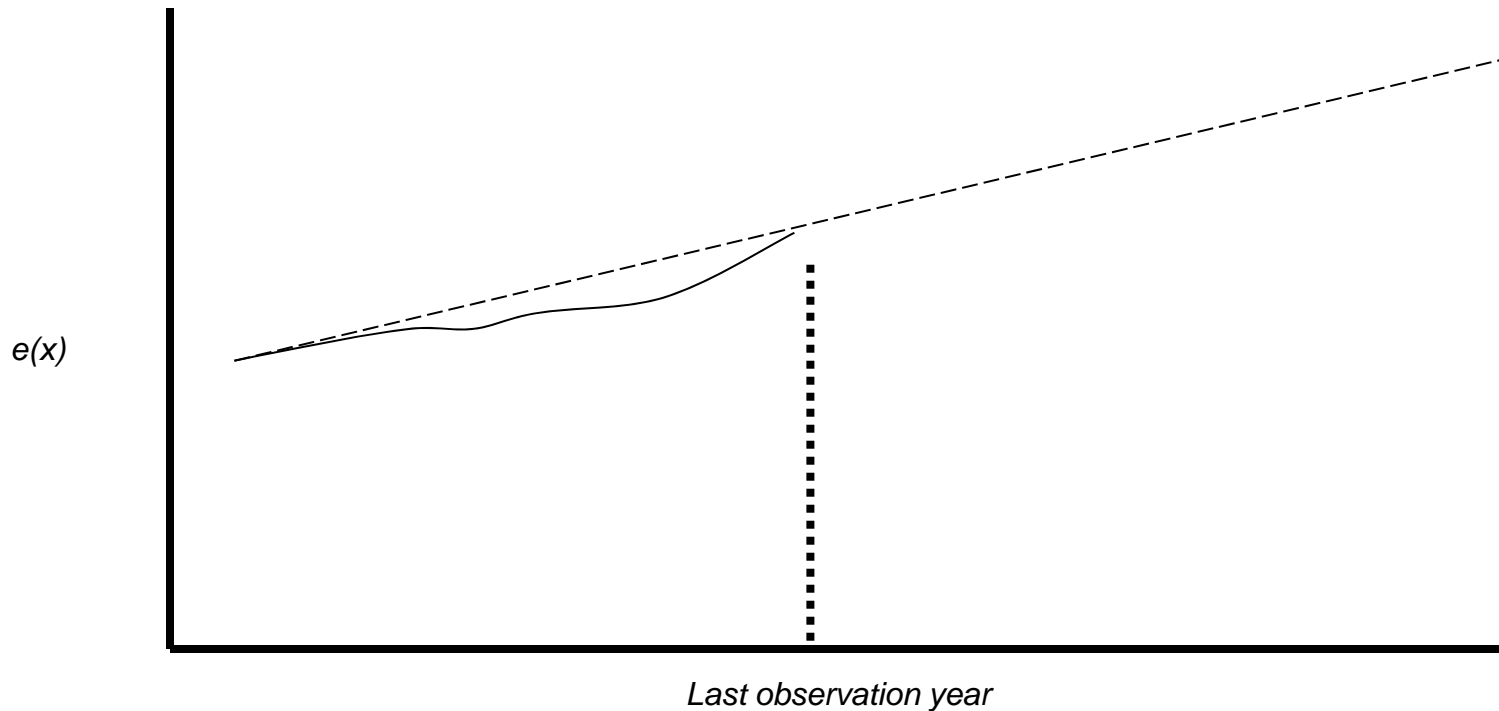
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Divergent Lee-Carter projections from separate analyses
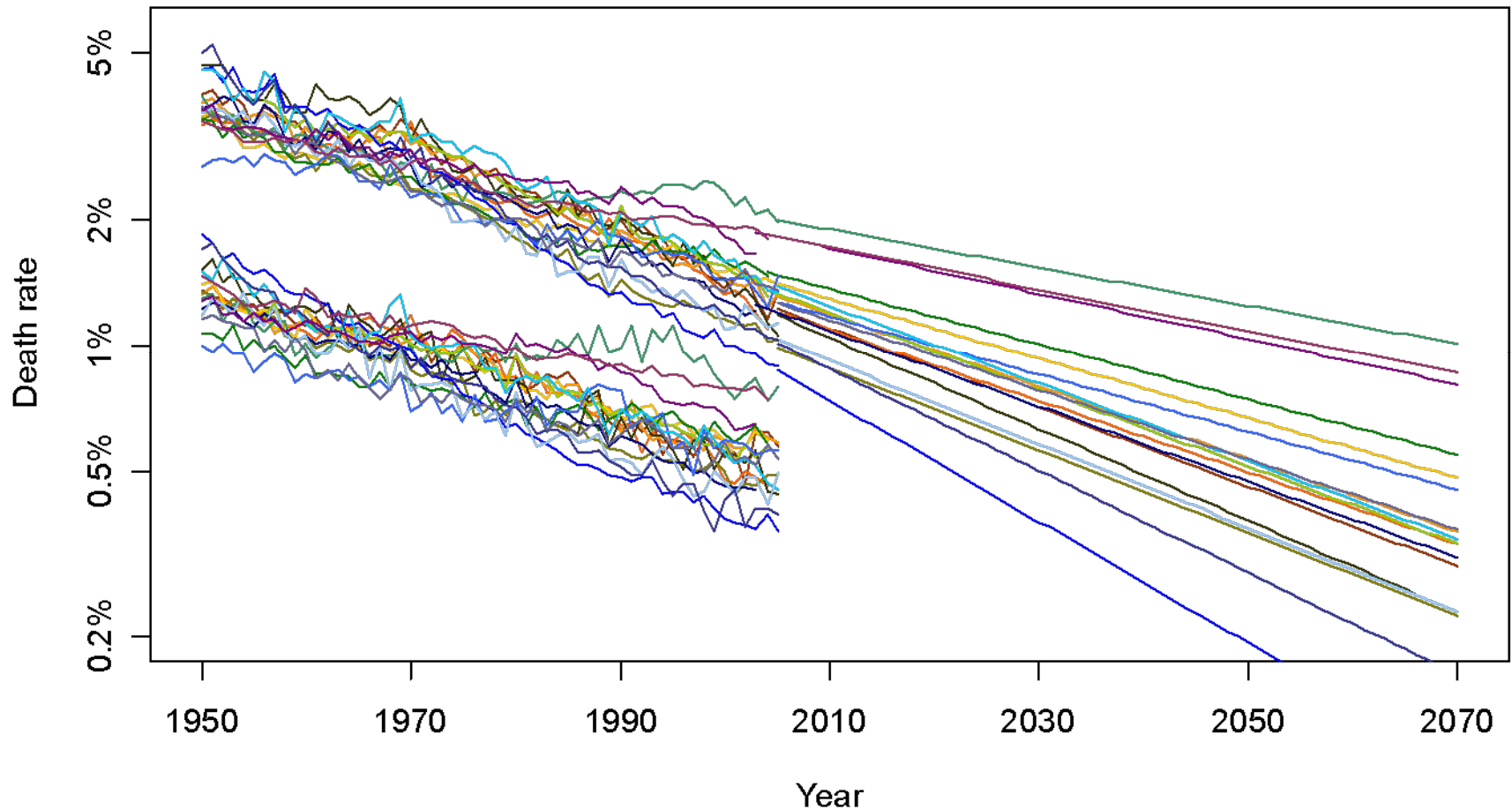
Short-term deviations from long-term trend

- All countries appear to follow the same long-term trend
  - But improvements occur at different times in the individual countries
  - Variation in annual improvement rates differ between countries

- Separate analyses
  - Diverging projections with non-overlapping confidence intervals
  - Unreasonable variation in forecasting uncertainty
    - inability of RW to distingush between short- and long-term uncertainty

- Coherent mortality projections
  - Model common long-term trend
  - Allow country-specific short-term deviations from trend

Long term trend versus short term trend

$e(x)$

Last observation year
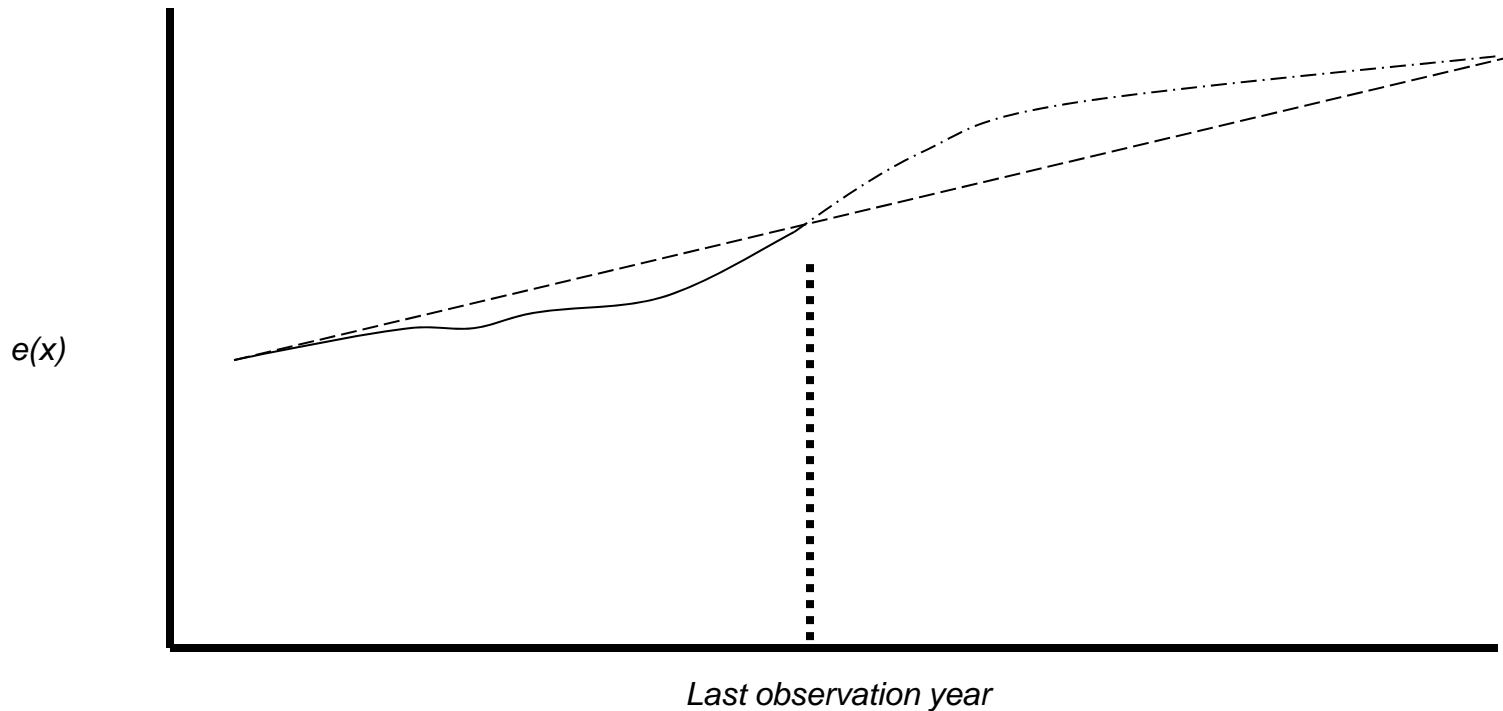
Comparison of ALT 2000-2002 with ALT 2005-2007

Mortality Improvement Rates ALT 2000-02 to ALT 2005-07
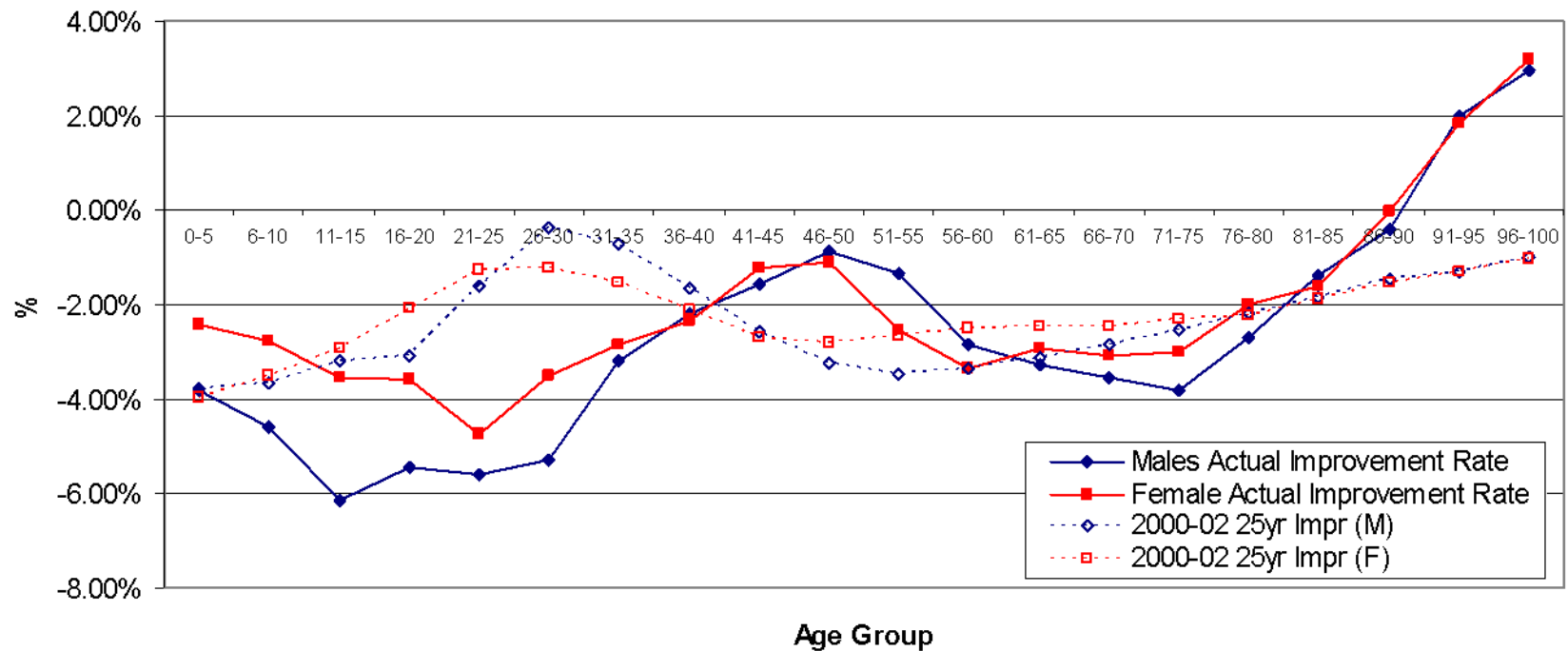
Cohort population models
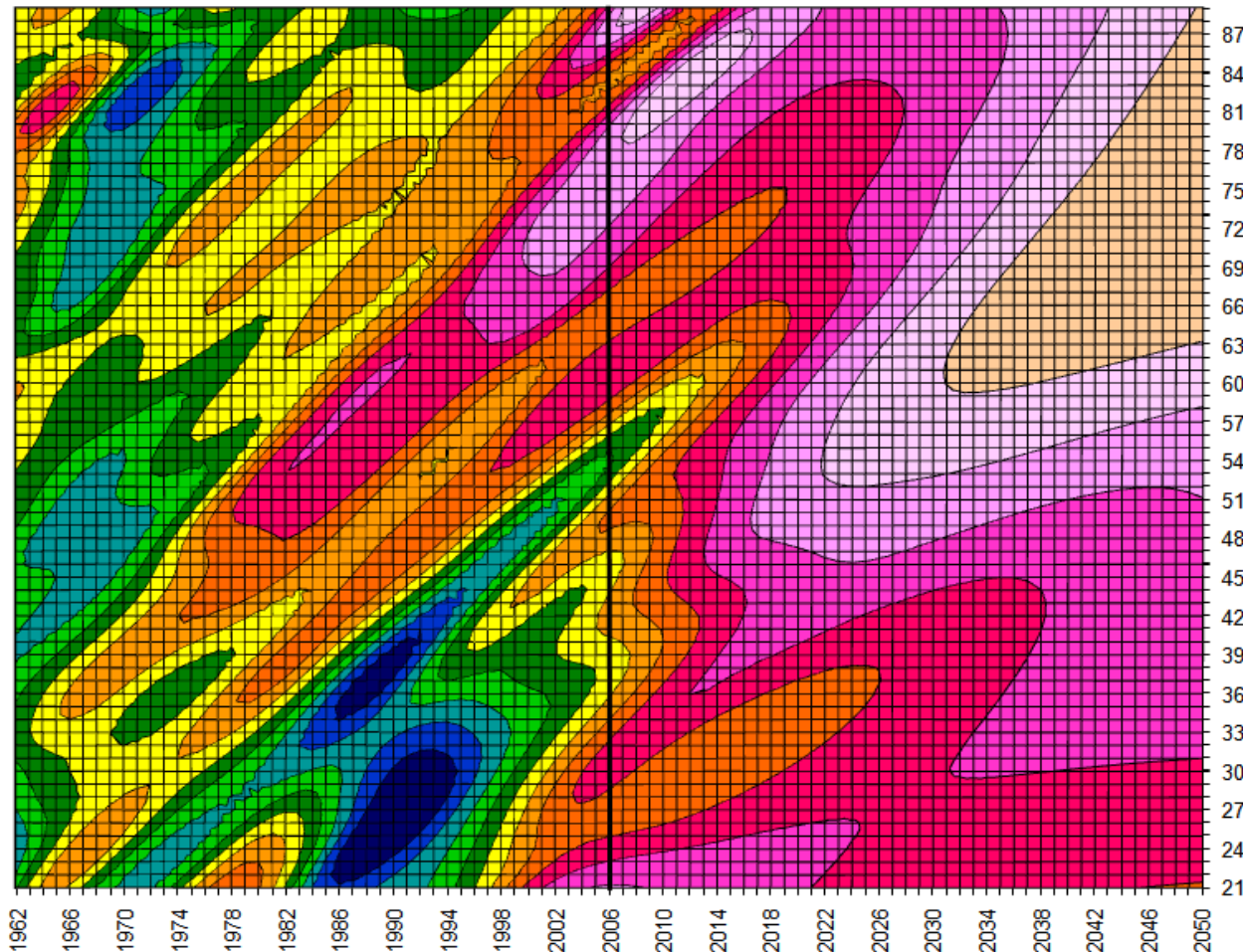
• Source Tony Leandro Barnett Waddington LLP

Caveat: Some data limitations – the following is about the techniques more than the results

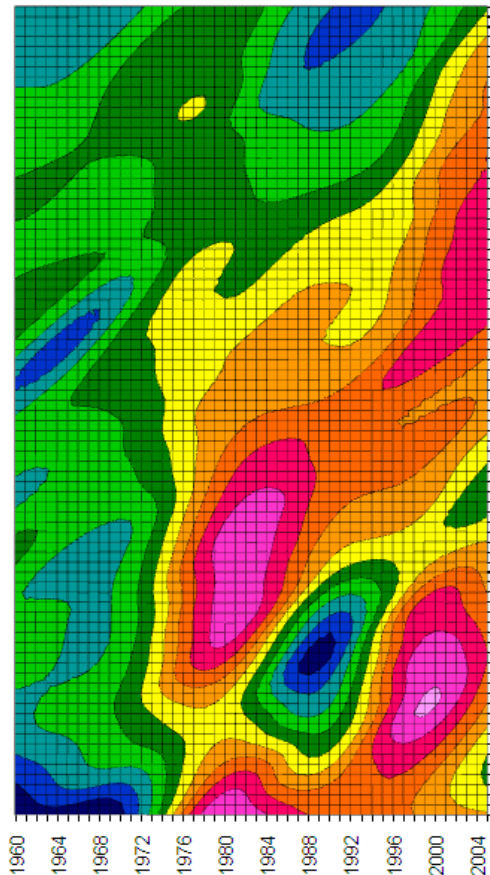Heat maps used to illustrate the cohort effect

- 5.4%-6.0%
- 4.8%-5.4%
- 4.2%-4.8%
- 3.6%-4.2%
- 3.0%-3.6%
- 2.4%-3.0%
- 1.8%-2.4%
- 1.2%-1.8%
- 0.6%-1.2%
- 0.0%-0.6%
- -0.6%-0.0%
- -1.2%--0.6%
- -1.8%--1.2%

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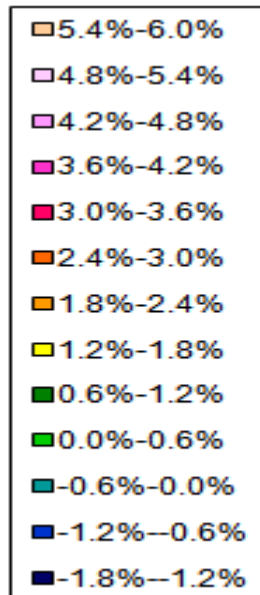
P-spline – UK population (ONS) – Projection from 2006

Canada, p-spline fitting
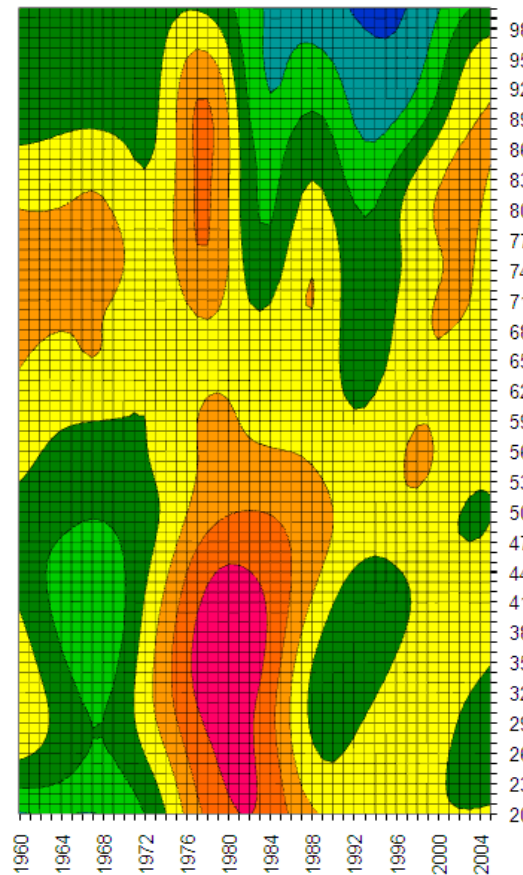
Males

Females

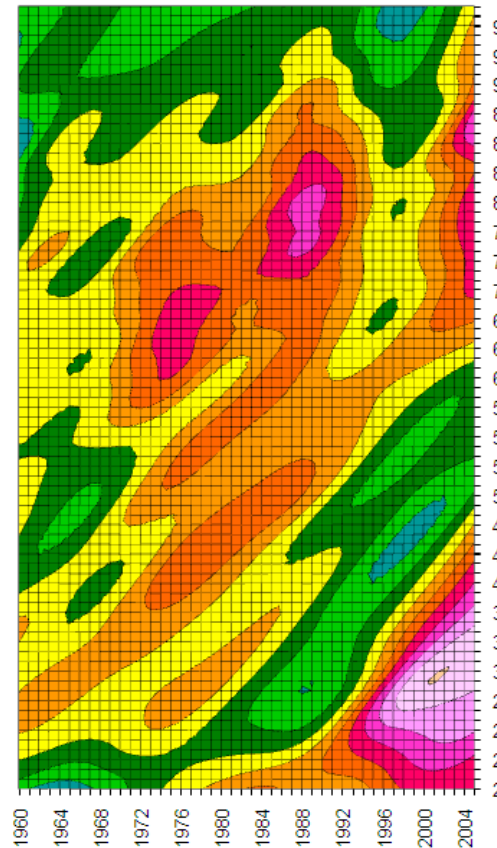# France, p-spline fitting
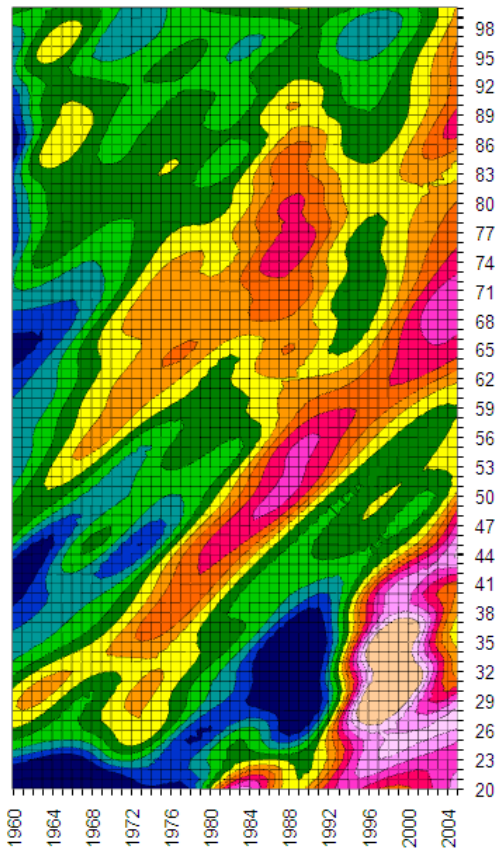
Males   Females
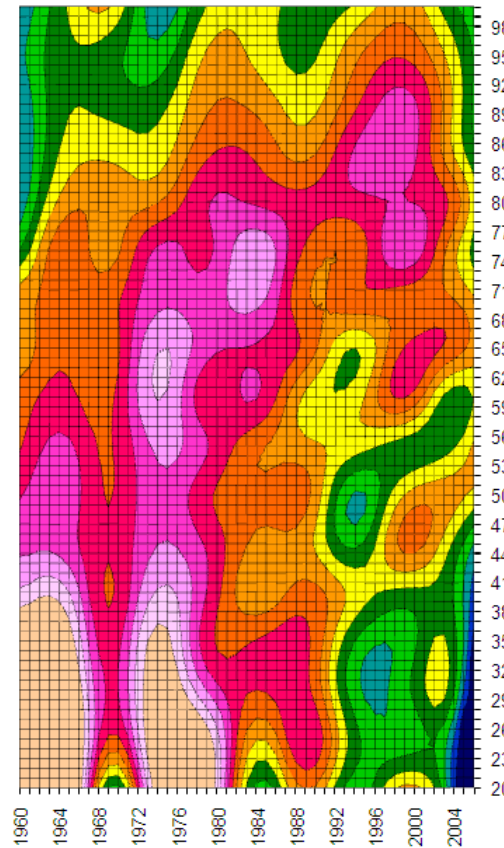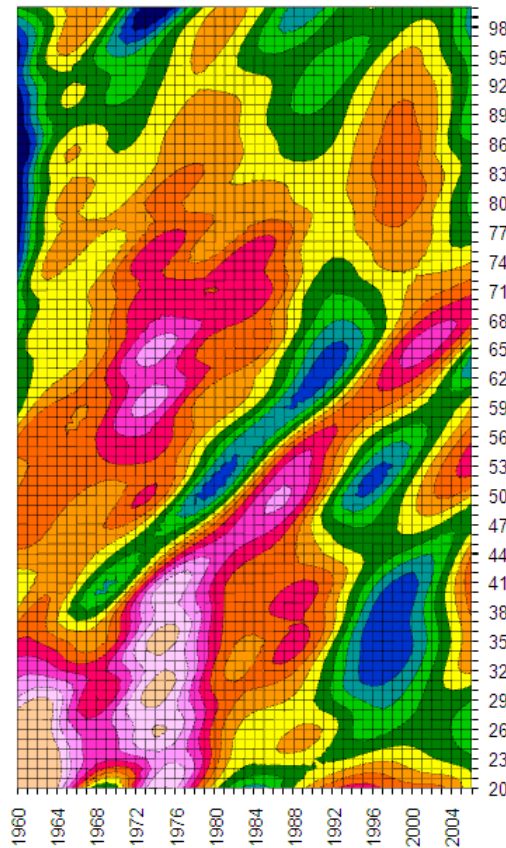
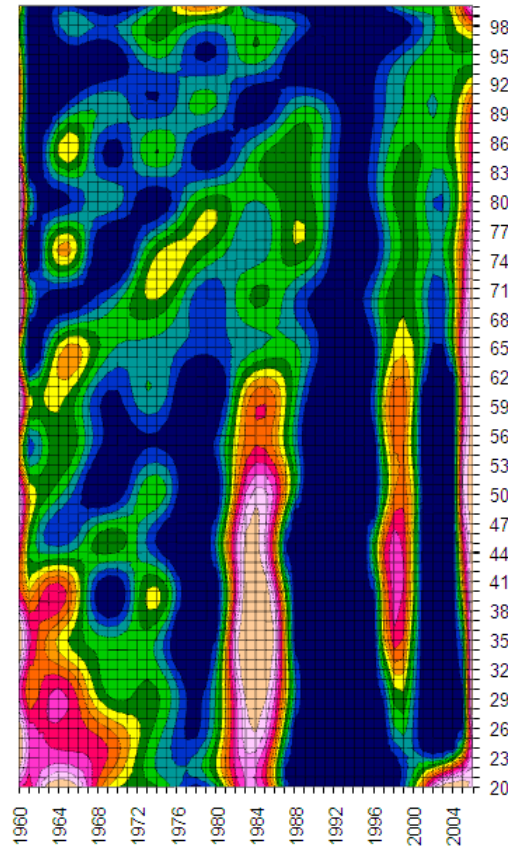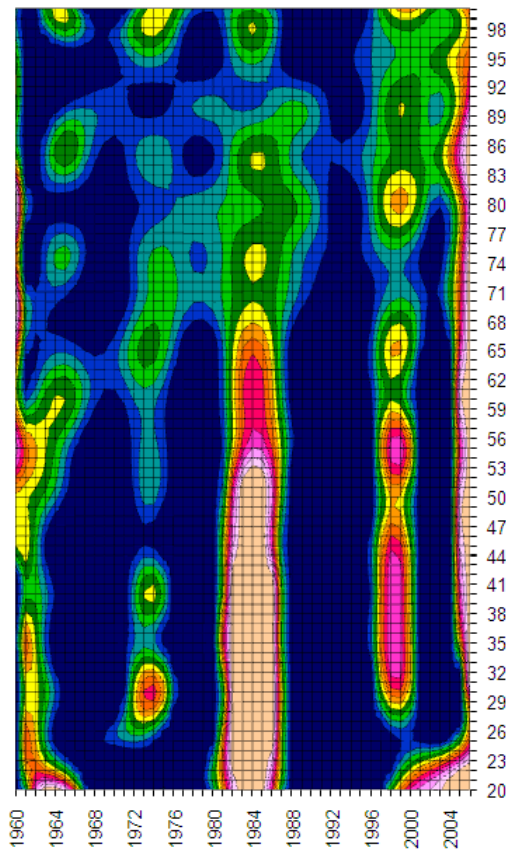# Japan, p-spline fitting

Males   Females

Russia, p-spline fitting
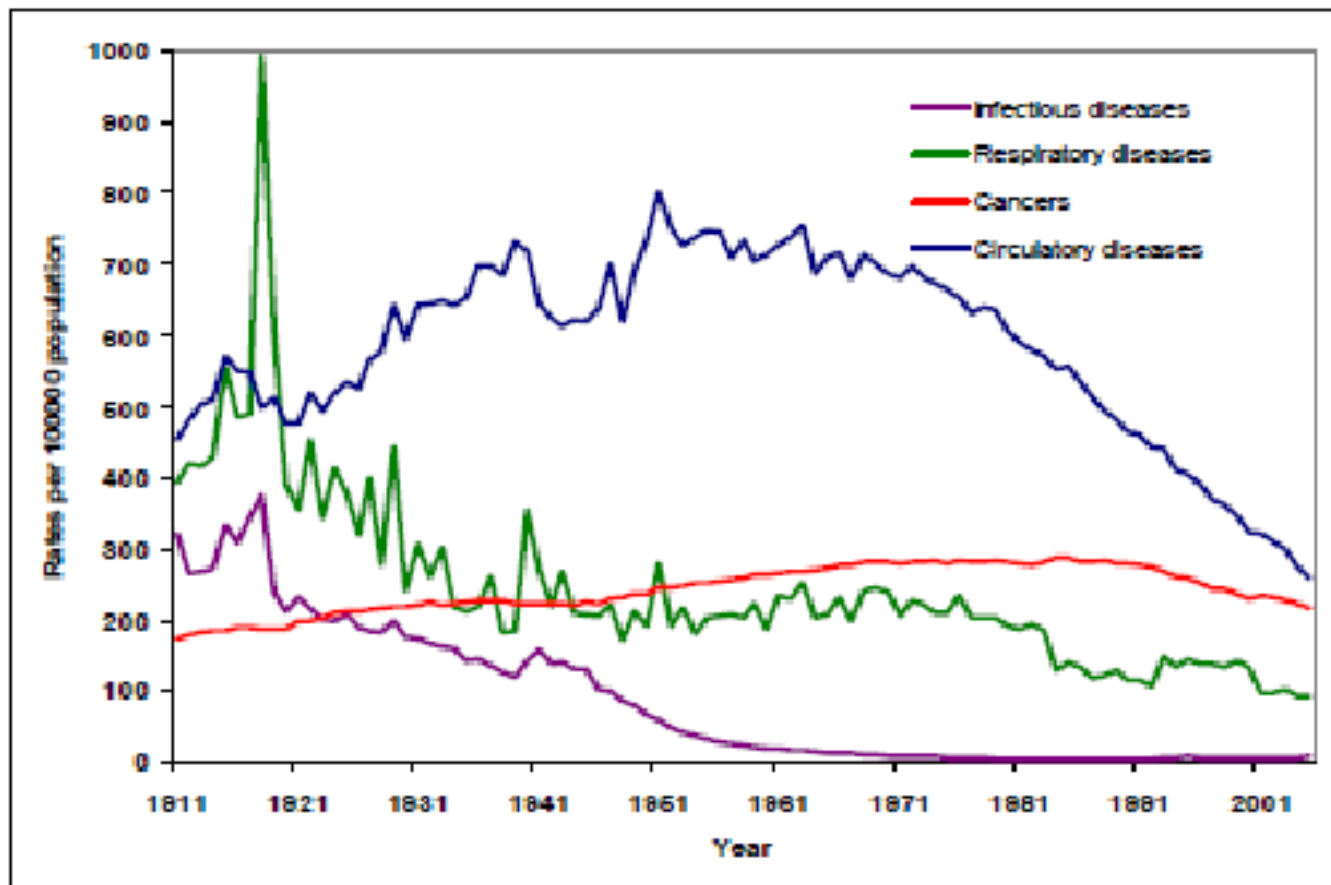
Males

Females
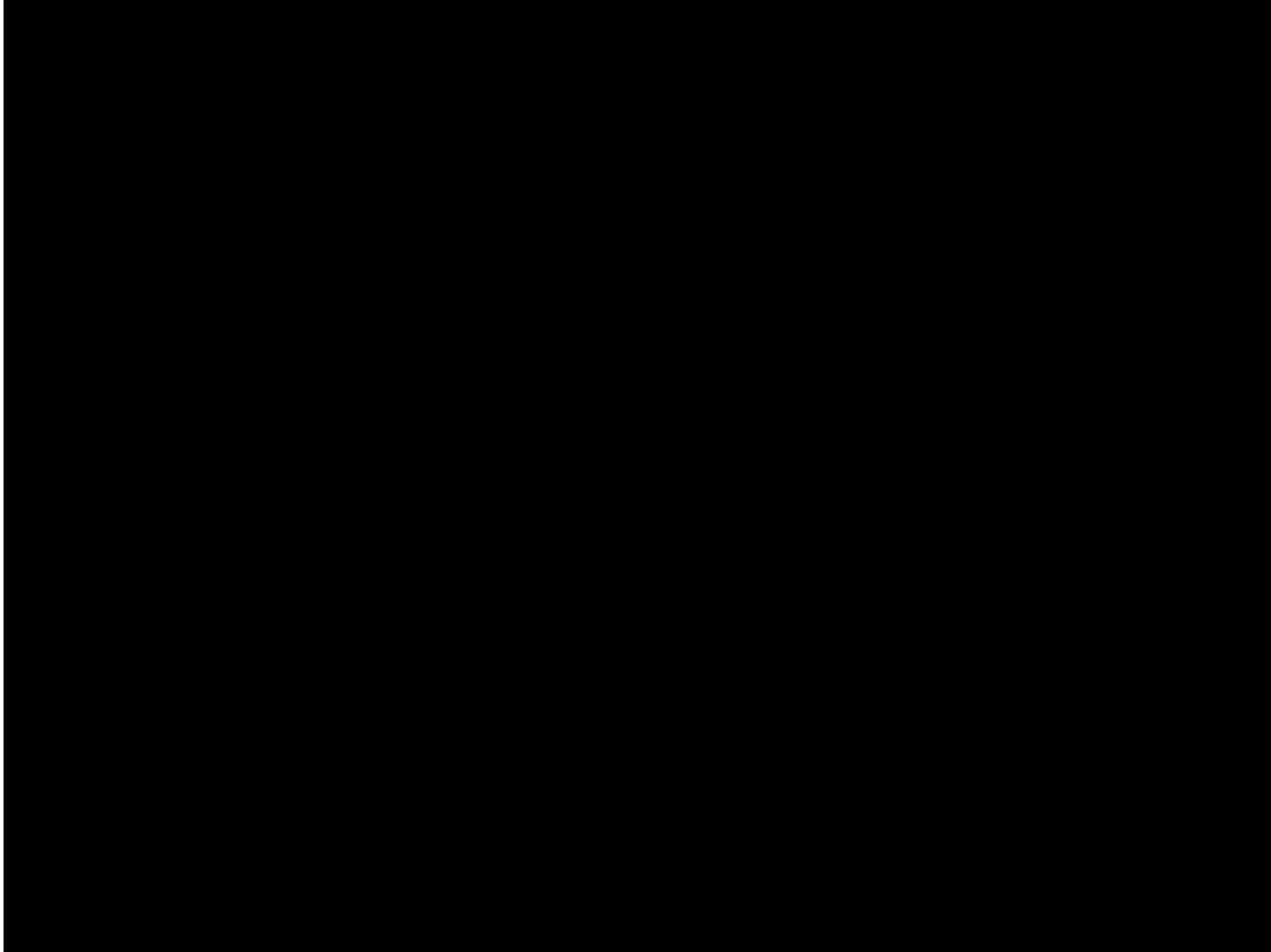
Social and demographic stratification

Trends in male period life expectancy at age, 1972-2005, England and Wales
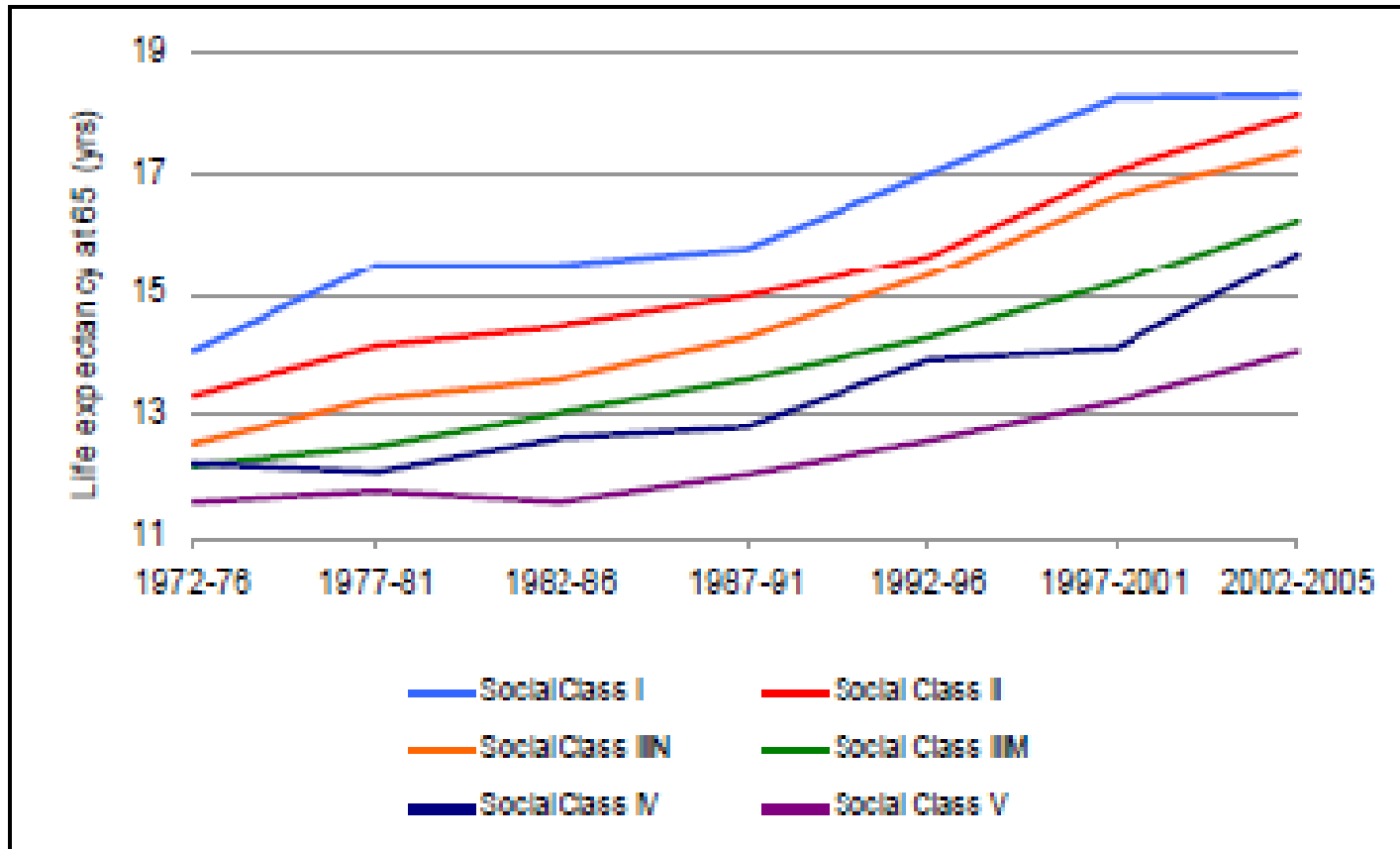
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Mortality by cause of death

Overall mortality by major cause for males – England and Wales, 1911-2005 age-standardised

Source: BAS based on ONS figures

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SoA International Experience Study

- Assists developing countries to produce credible actuarial experience

- The SoA and the country actuaries jointly share responsibilities to successfully complete a mortality and persistency study of life insurance experience

- Also applicable to Social Security mortality studies

- No charge provided permission for combined results to be published.

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SoA International Experience

| Countries studies	Countries Interested
Argentina	Bangladesh
Caribbean	Botswana
Estonia	Columbia
Poland	El Salvador
Philippines	Ghana
Vietnam	India
	Middle East countries
	Nigeria
	Tanzania

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Pandemics

- What is a pandemic?

- Pandemics of the past

- Present day pandemics and the role of WHO

- Implications of pandemics for insurance business

- Influenza A (HINI)

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Gender differences

Figure 8: Gender differentials in life expectancy at selected ages
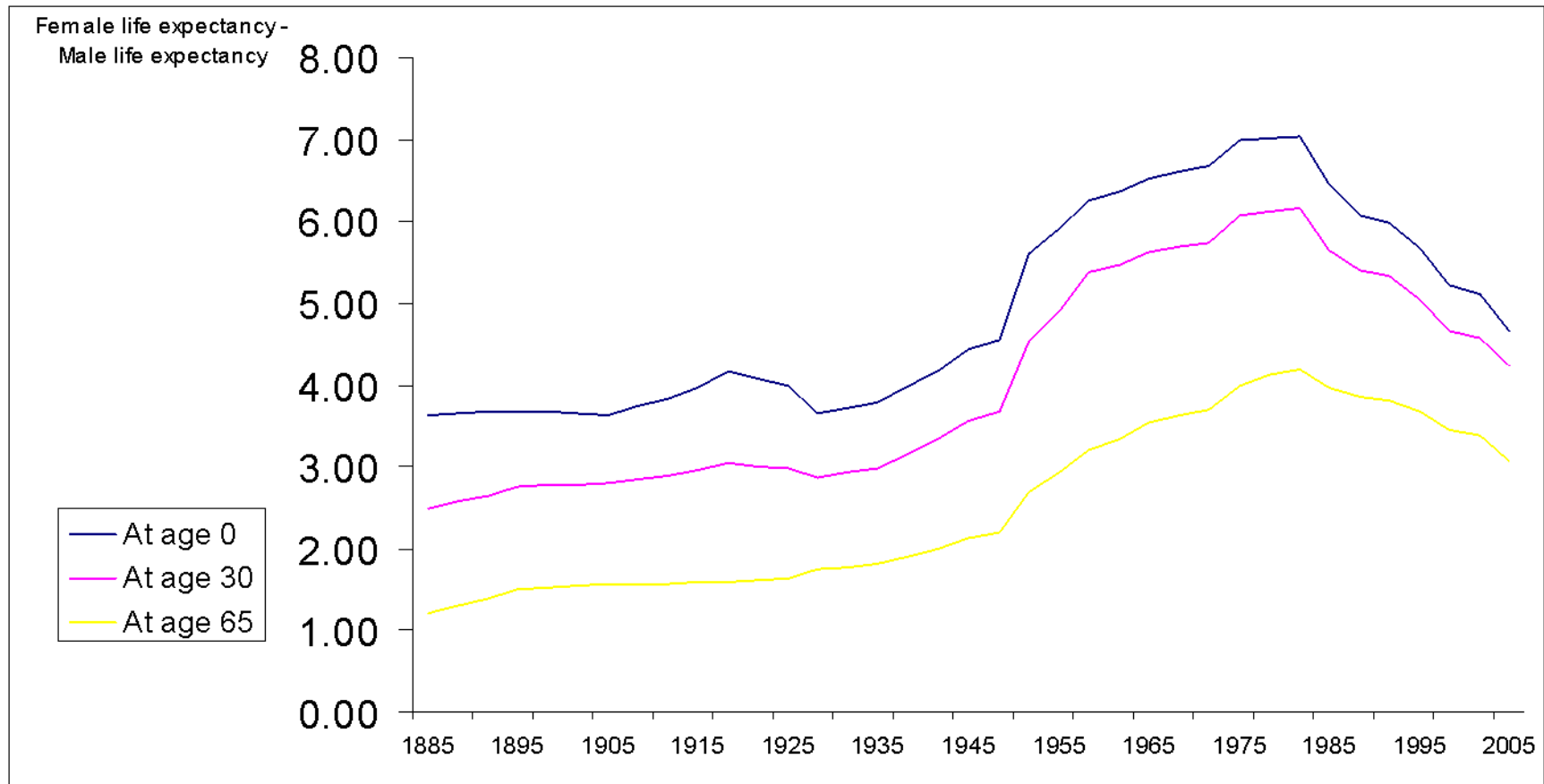
Source: Australian Life Tables 2005-2007
Australian Government Actuary

Gender difference in animal mortality
(Presentation by Erik Alm, General Manager
Hannover Life Re Sweden)

Animal category	Females mortality/male mortality
Apes	66%
Small primates	109%
Carnivores	95%
Hoofstock	62%
Kangaroos	67%
Crocodiles	61%
Ratites (Emu, Rhea)	125%
Raptors (Eagle etc)	95%

Reasons for gender differences

- Men's behaviour is more risky
- Immune system weakened by level of testosterone
- Men are larger – uses up the metabolic system more quickly
- Men have only one X-chromosome
  - Y is much smaller than X
    - Females have reserve capacity in the extra X chromosome
  - Male birds have two chromosomes of the same type (Z-chromosomes)
    - Female birds have two different chromosomes (WZ)
    - Compares the Ratites

The membership

Chairperson	Martin Alexander Stevenson
Co-Vice-Chairpersons	William R Horbatt H.W.M. Van Broekhoven
Members	Erik T Alm (Svenska Aktuarieföreningen) John Stephen Armstrong (Society of Actuaries in Ireland) Chresten Dengsoe (Den Danske Aktuarforening) Michael John Eves (Association Suisse des Actuaires) Kurt Lambrechts (Institut des Actuaires de Belgigue) Paul Lewis (Actuarial Society of South Africa) Mika Mäkinen (Suomen Aktuaariyhdistys) Taisuke Nishimura (Institute of Actuaries of Japan) Ksenia Orekhova (Russian Guild of Actuaries) Ermanno Pitacco Italiano degli Attuari Thierry Poincelin (Institut des Actuaires) Brian Philip Ridsdale (Faculty of Actuaries) Yoshihiro Takahashi (Institute of Actuaries of Japan) Marc Tardif (Canadian Institute of Actuaries) Thomas S Terry (Conference of Consulting Actuaries) Peter Ying (Actuarial Institute of Chinese Taipei) Paul Sweeting (Institute of Actuaries/Faculty of Actuaries) Helge-Ivar Magnussen

Other matters

- Web developments
- Mortality professionals welcome to join

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