



Institute of Actuaries of Australia

5th Financial Services Forum

Renovating the Financial System

2010

13 and 14 May 2010 – SYDNEY

LIWMPC Longevity Research Group update 2010

Prepared by the LIWMPC Longevity Research Group

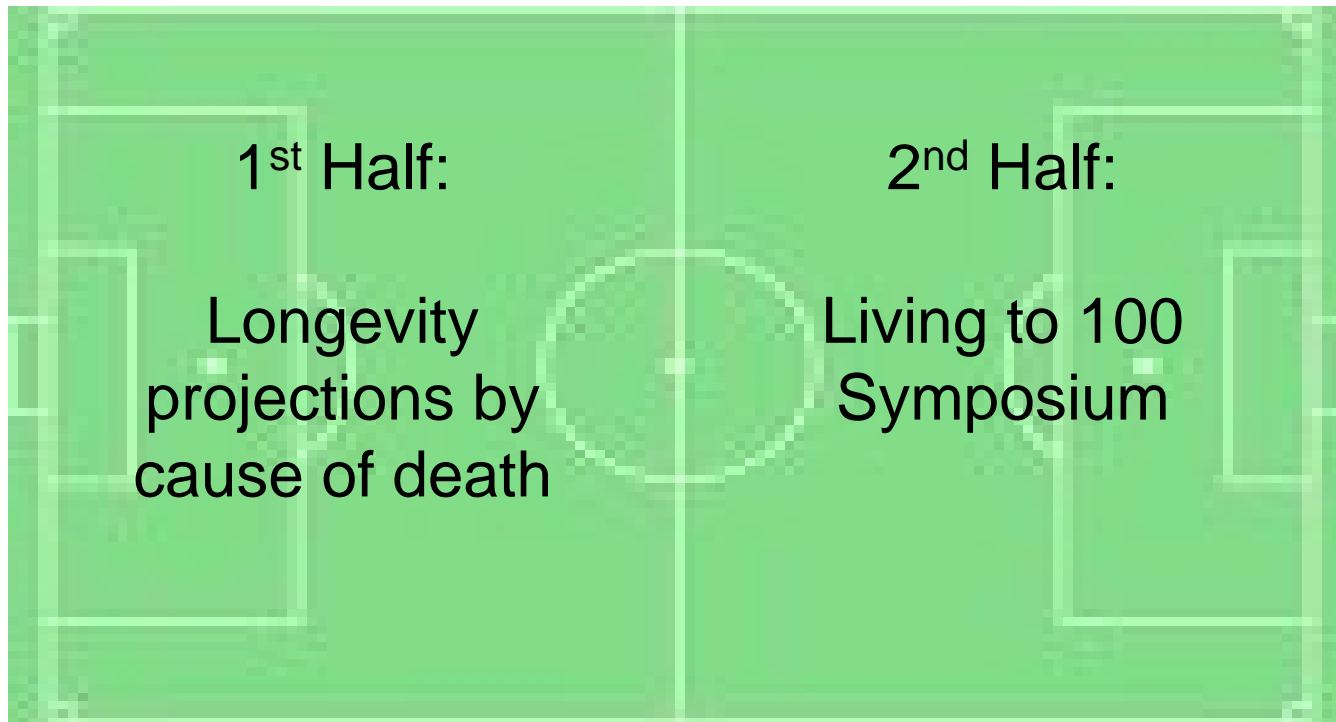
Francis Burgess

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Agenda

“It’s a game of two halves!”



Extra time: Comments & Questions

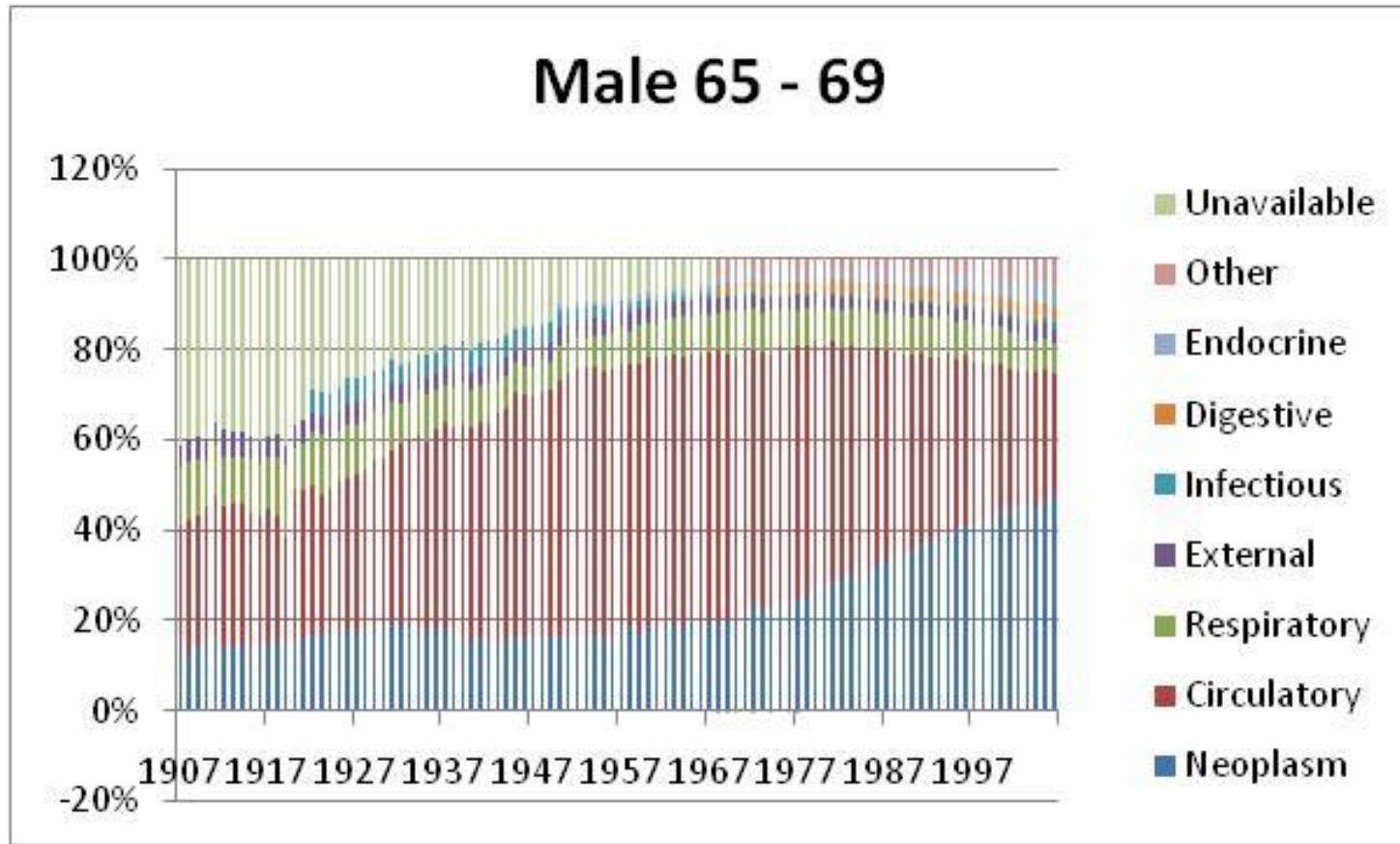


Longevity projections by cause of death

1. Cause of death – especially older ages.
2. Determine mortality improvements by cause of death and overall
3. Project into the future using regression.



Proportion of deaths by cause

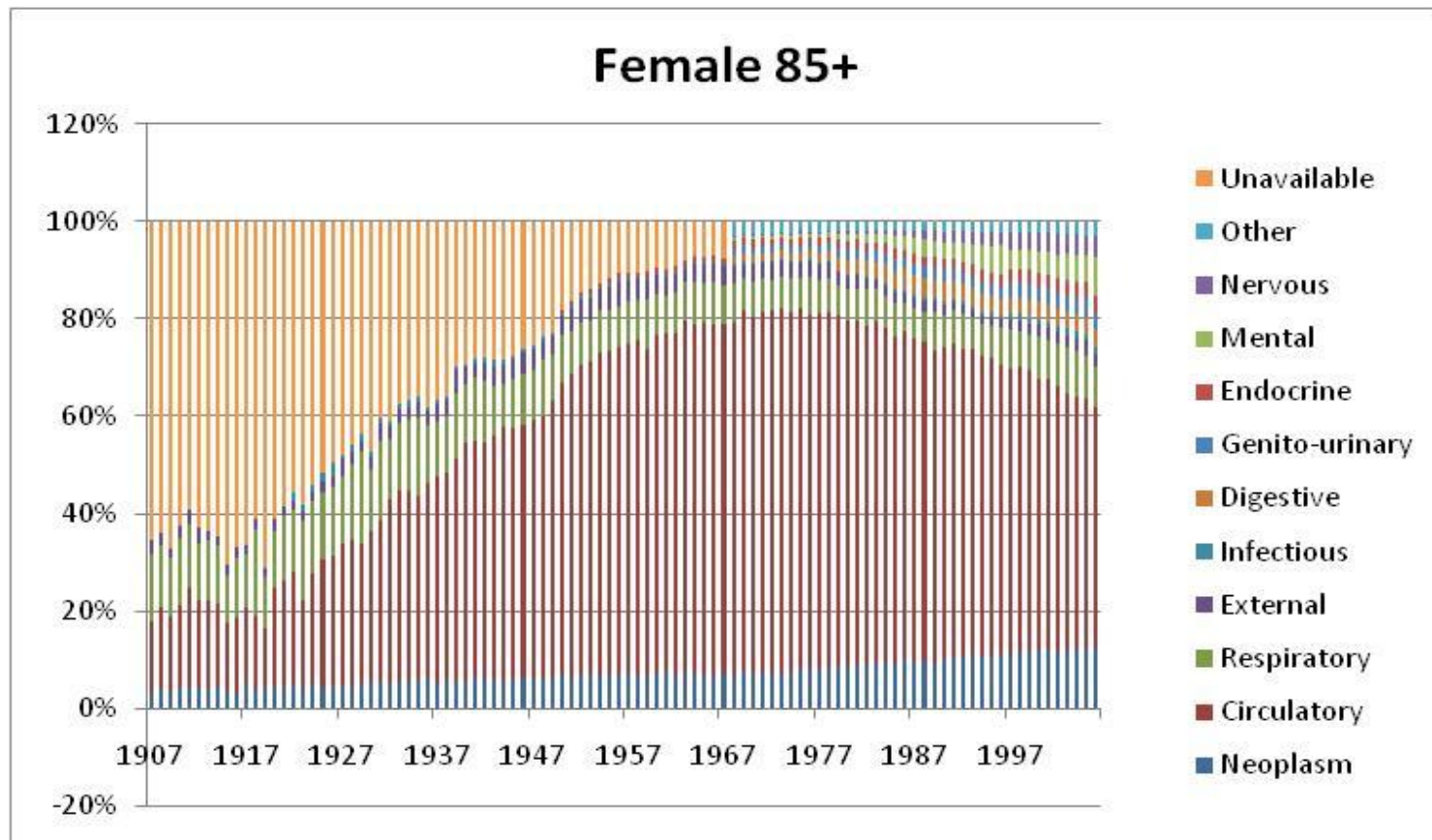




Proportion of deaths by cause

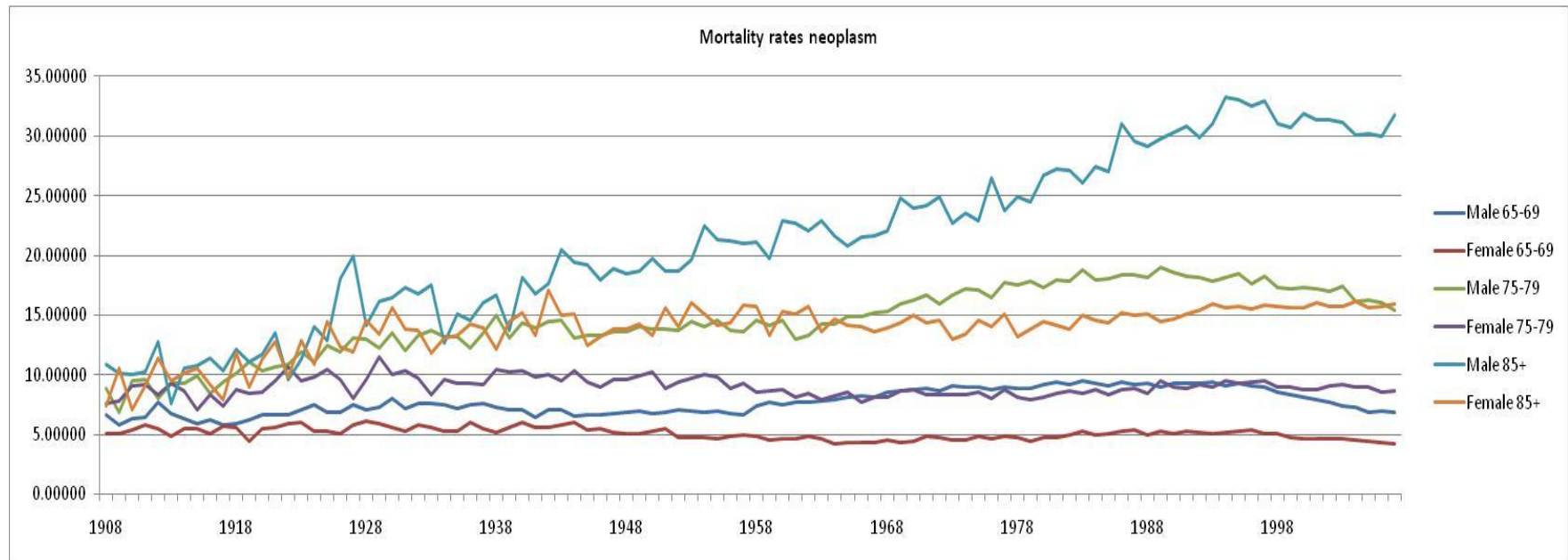
- As age increases the increase in neoplasm is not as noticeable.
- Male and female are not distinctly different in shape and trend at these high ages.

Proportion of deaths by cause



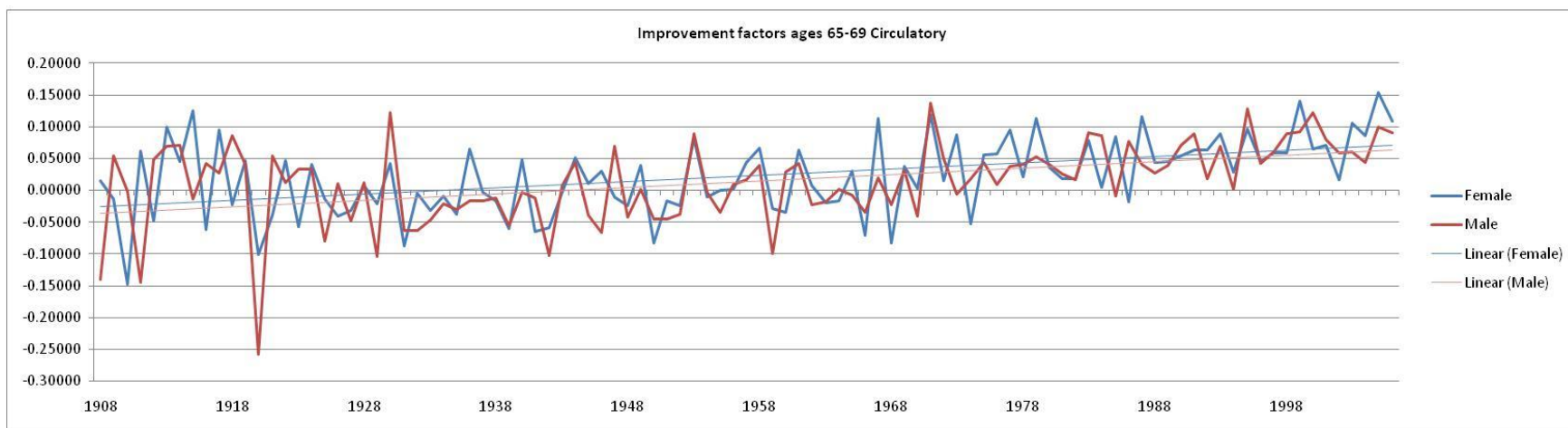
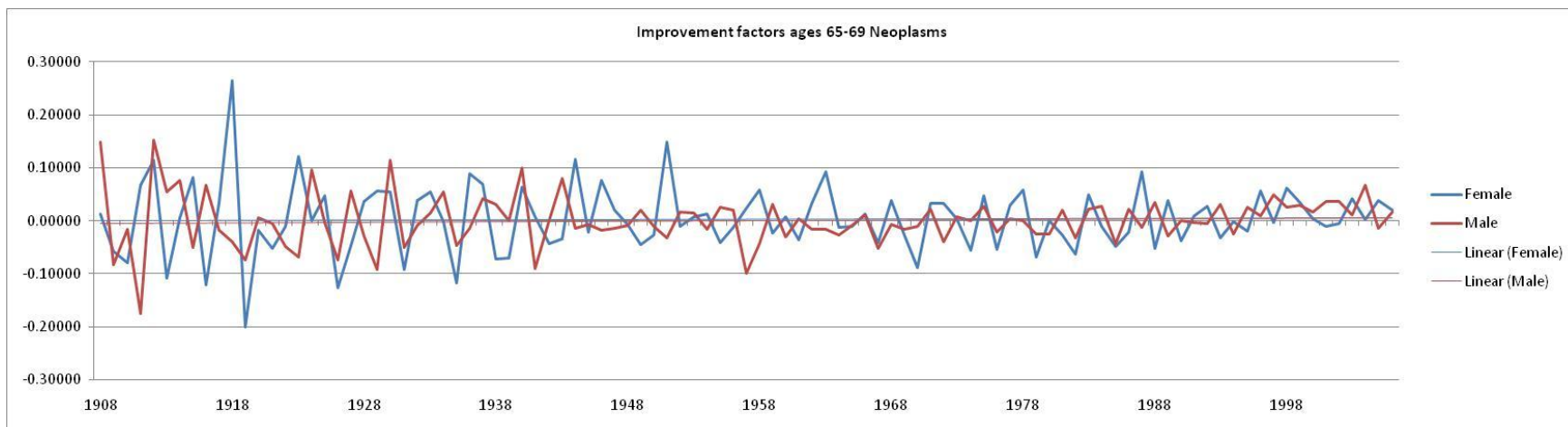


Mortality rates by cause

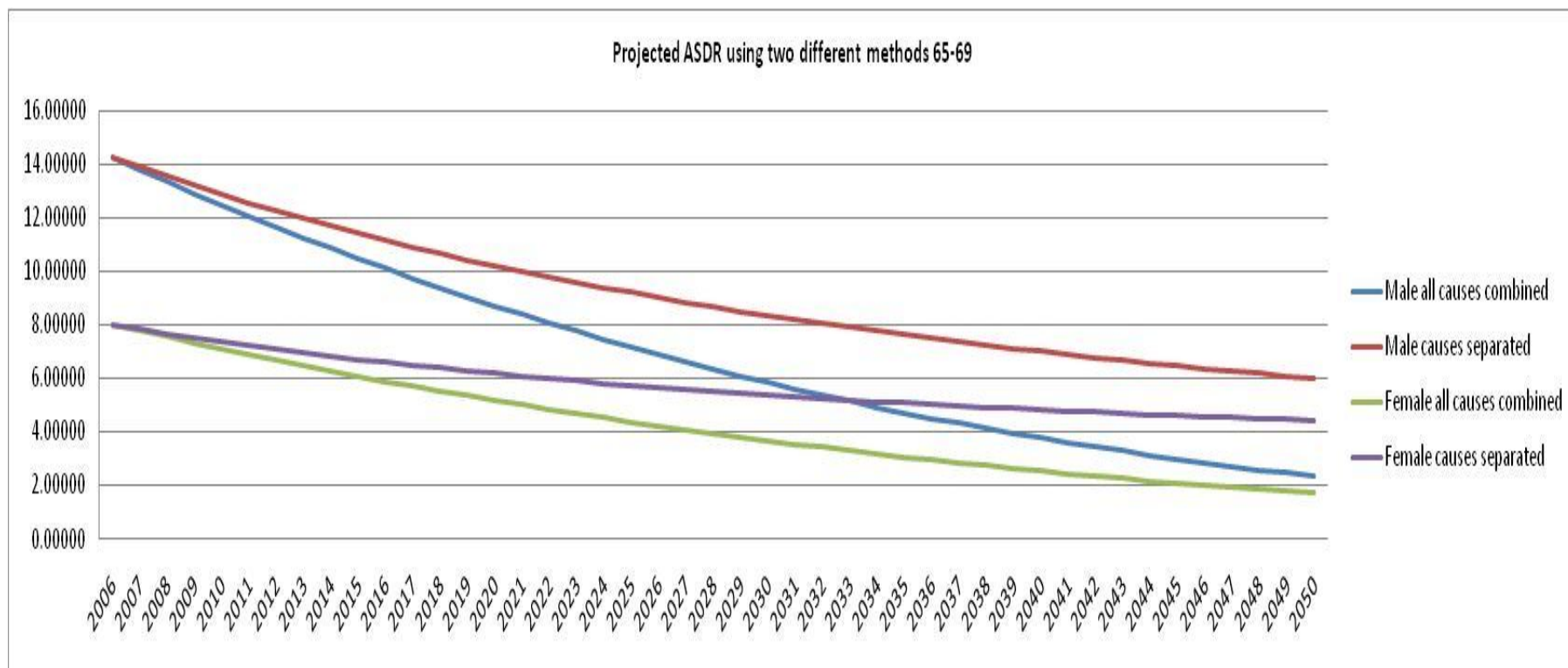




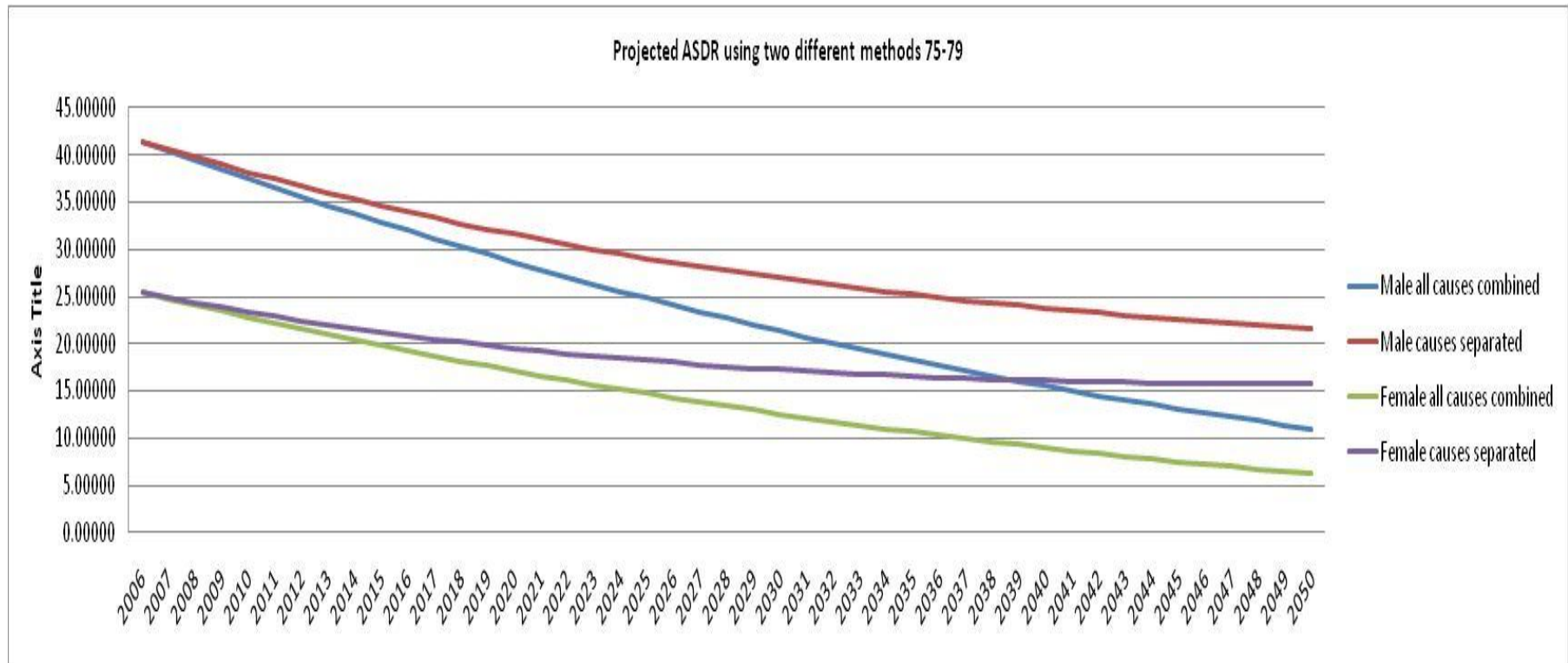
Mortality improvement comparison



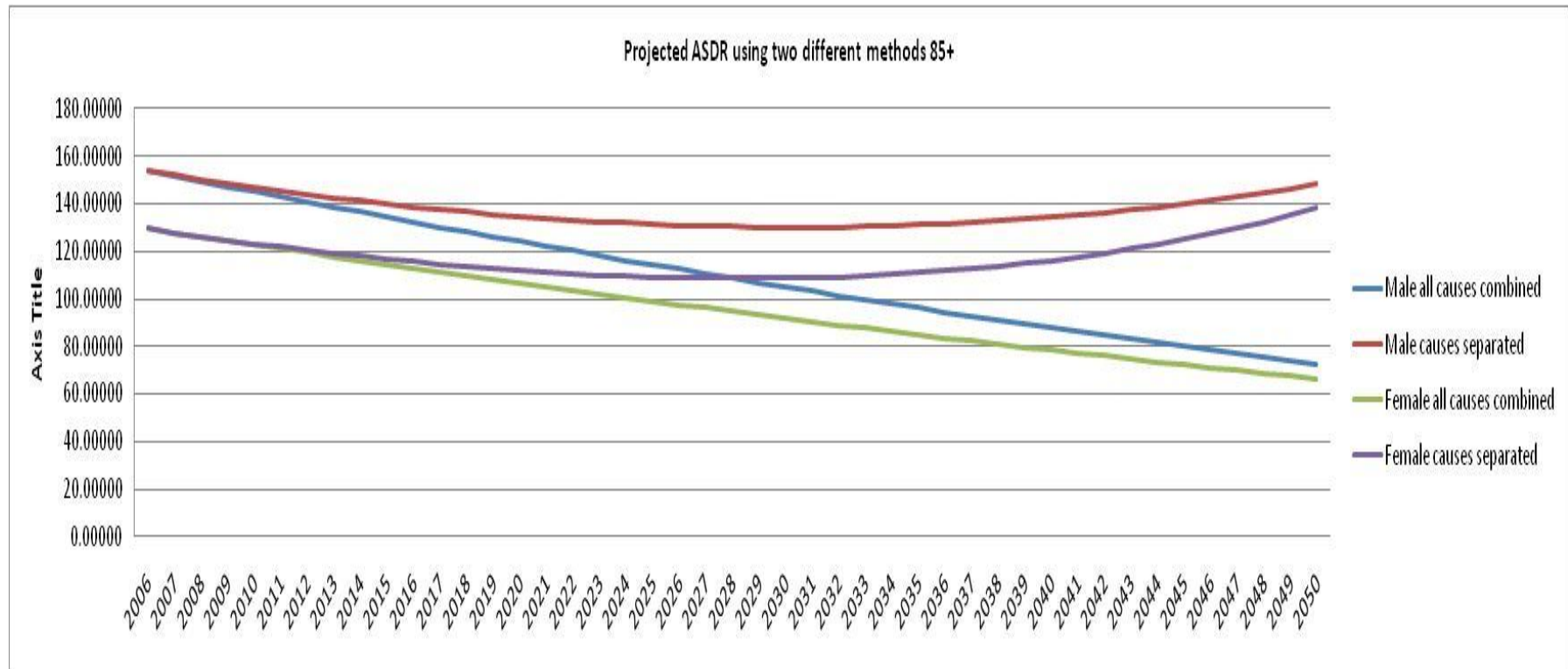
Projected age-specific death rates using two different methods



Projected age-specific death rates using two different methods



Projected age-specific death rates using two different methods





Expectation of life past and projected using two methods

Calculated expectation of life			
Male			
	e_{65}	e_{75}	e_{85}
1907	75.52	80.59	87.39
1957	76.55	81.54	88.02
2006	82.94	85.68	90.48
2050 ¹	93.58	94.44	96.90
2050 ²	86.15	87.63	90.73
Female			
	e_{65}	e_{75}	e_{85}
1907	76.89	81.67	87.84
1957	79.40	82.99	88.70
2006	86.12	87.99	91.67
2050 ¹	95.62	96.32	97.85
2050 ²	87.61	88.94	91.19



Living to 100 Symposium

1. Making the lives of busy Actuaries a little easier!
2. Ultimate aim is to provide easy access to global longevity research.
3. So why 'Living to 100'?



Living to 100 Symposium

- Convened by Society of Actuaries
- Every three years. Last one 2008. Next one is in January 2011.
- Includes papers and attendance from non-actuaries interested in the field of longevity.
- Brings together the latest thought on longevity issues in the US.





Living to 100 Symposium

Session 1

- Good overview of the US market.
- Lots of similarities with Australia e.g. low level of public awareness and inadequate savings
- Some differences particularly Long Term Care.





Living to 100 Symposium

Session 2A

- Indian perspective
- Mexican perspective
- Income inequality and life expectancy



Session 2B

- Phased Retirement
- Public policy and individual options
- Premature risk

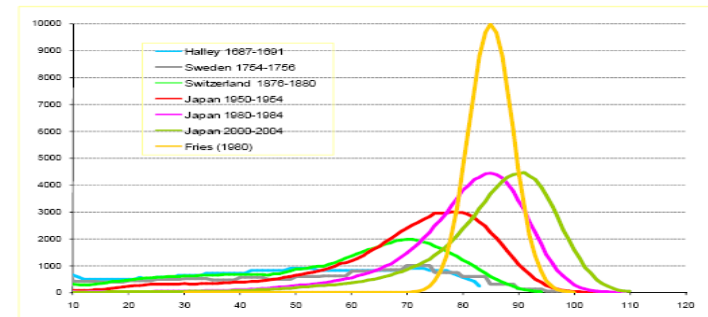
Living to 100 Symposium

Session 3

- Biology of Human Longevity – very non-Actuarial approach!
- Is there a limit to ultimate life expectancy in humans?

GRAPH 5

Distribution of Adult Life Durations: Selected Empirical Data 1687-2004 and the Hypothetical Pattern Predicted by Fries



Session 4A

- New statistical models for mortality projection
- Practical issue of data availability



Living to 100 Symposium

Session 5A

- Implications of increased longevity on retirement planning.
- Use of immediate annuities as well as investment products.
- Other insurance – deferred annuities and layered annuity strategies.
- Longevity risk pricing for longevity bonds, swaps, caps and floors.
- Allows for financial market being incomplete.



Living to 100 Symposium

Session 6A

- Lee-Carter models
- Unofficial standard model for projecting mortality in later ages (one of two models used by CMI)
- Three highly technical papers that require good working knowledge.



$$\begin{aligned}
 P(x_0|x_1, t) &= \mathfrak{Z} = \int_{-\infty}^{\infty} P(x_0|x, \tau) P(x|x_1, t-\tau) dx \\
 \hat{P}(k) &= \int dx P(x) e^{-iwx} \Rightarrow \\
 \frac{\partial \hat{P}(k)}{\partial t} &= \int ik \hat{F}(k_1, k) - \frac{1}{\alpha} \hat{\sigma}^{\alpha}(k-k) \\
 |k|^\alpha \hat{P}(k_1) dk &\wedge \frac{d^2}{dx^2} (\sigma^2(x) P(x)) \\
 &= \frac{d^2}{dx^2} \int \sigma^2(y) e^{-ik_1 y} \hat{P}(k_1) dk_1 \cdot \\
 &\quad \left(\int e^{ik(x-y)} dy \right) = - \int \int \sigma^2(y) \\
 &\quad (k_1 - k)^2 e^{ik(x-y)} \hat{P}(k_1) e^{-ik_1 x} \\
 &\quad dk dk_1 dy \wedge \delta(x) = \int dw e^{iwx}
 \end{aligned}$$



Questions & comments?