Sex differences in life expectancy and lifespan dispersion: long-term patterns and emerging crossovers

José Manuel Aburto¹,², Ridhi Kashyap³, Alyson van Raalte², Virginia Zarulli¹

¹Interdisciplinary Centre on Population Dynamics, Denmark
²Max Planck Institute for Demographic Research, Germany
³University of Oxford, UK
Mortality trends by sex in Austria

Life expectancy at birth

- **Women**: Show a steady increase in life expectancy from 1950 to 2016.
- **Men**: Also show an increase, but the rate is slower compared to women.

Lifespan Inequality

- **Women**: Experience a decrease in lifespan inequality from 1950 to 2016.
- **Men**: Show a similar trend to women, with a decrease in lifespan inequality.
Dropping the time dimension

Life expectancy at birth vs lifespan inequality - Austria

Sex
- Females
- Males

Life expectancy vs Lifespan inequality
Is this what we would expect?
Life expectancy and disparity

Life expectancy (years)

Lifespan variation (years)

30 40 50 60 70 80 90

0

5

10

15

20

25

30

All female
Life Tables of HMD

Vaupel et al. (2009) BMJ Open
Negative correlation seems to hold over sex, and across different mortality regimes.
Sex differences in life expectancy and disparity

1. Large differences at low levels of life expectancy
2. Slopes are different in mid-high life expectancies
3. Crossover(s)
30 HMD Countries

Life expectancy vs. Lifespan inequality for various countries, showing data points for females (orange) and males (blue). The chart illustrates differences in life expectancy and lifespan inequality across countries.
Coefficient of variation

Life expectancy

Sex
- Females
- Males
Absolute female advantage in $e_0$ and lifespan equality
And on a relative scale
Why is this happening?

Do these trends matter?
Hypotheses for the crossover and beyond

• **Period explains everything**
  - Declining influence of infant mortality
  - Men always had greater variation in adult mortality

• **Behavioural differences**
  - Emerging then declining male disadvantage caused by emerging then declining midlife mortality differences

• **Female survival advantage at old ages**
  - Potential 2\textsuperscript{nd} crossover
Age Decompositions

Life expectancy at birth vs lifespan inequality - Austria

Sex
- Females
- Males

Before the crossover
During the crossover
Well after the crossover
Comparing mortality patterns before, during, and after crossover

- Before: $e_0 = 70.3$ yrs, Higher ♀ e↑
- During: $e_0 \sim 73.6$ yrs, Same e↑
- After: $e_0 = 79.3$ yrs, Higher ♂ e↑

<table>
<thead>
<tr>
<th>Age</th>
<th>1955</th>
<th>1968</th>
<th>1993</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Females</td>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td>1985</td>
<td>0.001</td>
<td>0.010</td>
<td>0.100</td>
</tr>
<tr>
<td>1996</td>
<td>0.001</td>
<td>0.010</td>
<td>0.100</td>
</tr>
<tr>
<td>2017</td>
<td>0.001</td>
<td>0.010</td>
<td>0.100</td>
</tr>
</tbody>
</table>
Comparing mortality patterns before, during, and after crossover

♀ \( e^t \approx 14.4 \)
♂ \( e^t \approx 13.4 \)
♀ \( e^t \approx 12.7 \)
♂ \( e^t \approx 12.7 \)
♀ \( e^t \approx 11.1 \)
♂ \( e^t \approx 11.4 \)

\( e_0 = 70.3 \) yrs
\( e_0 \approx 73.6 \) yrs
\( e_0 = 79.3 \) yrs

Sex
- Orange: Females
- Blue: Males

Age

\( dx \)
Comparing mortality patterns before, during, and after crossover

- $e_0 \sim 70.3$ yrs
  - Higher $♀$ e↑

- $e_0 \sim 73.7$ yrs
  - Same e↑

- $e_0 \sim 79.3$ yrs
  - Higher $♂$ e↑
Decomposition of life expectancy

Before

During

After

Contribution to $e_0$ difference

Age Group

1955

1968

1993

1985

1996

2017
Decomposition of life disparity

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Contribution to $e^t$ difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>1955</td>
</tr>
<tr>
<td>During</td>
<td>1968</td>
</tr>
<tr>
<td>After</td>
<td>1993</td>
</tr>
</tbody>
</table>

The diagram shows the decomposition of life disparity over different age groups and time periods.
Hypotheses for the crossover and beyond

- **Period explains everything**
  - Declining influence of infant mortality
  - Men always had greater variation in adult mortality

- **Behavioural differences**
  - Emerging then declining male disadvantage caused by emerging then declining midlife mortality differences

- **Female survival advantage at old ages**
  - Potential 2\textsuperscript{nd} crossover
Summary

• Different shape of mortality for men and women
  • To large extent, already known
• But: (1) illustrates the importance of considering the period when thinking about the life expectancy & disparity relationship
• (2) Another argument for why we need to monitor variation
Thank you for your attention
vanraalte@demogr.mpg.de

This project has received funding from the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation programme (grant no. 716323 - LIFEINEQ)