Social differentials in trends and patterns of adult mortality in Denmark

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Vienna
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Henrik Brønnum-Hansen
Survival curve for Danish women

Future?

Survival, \( I(x) \)

Age, \( x \)

Rectangularization

Derectangularization

1901:1905

2009:2013

Henrik Brønnum-Hansen, 2016
Danish women - modal age at death

Future?

- Compression of mortality
- Lifespan extension

Deaths, d(x)

Age, x
Since 1986 the difference in life expectancy between the lowest and highest income quartile (equivalent disposable income) increased from 5.5 to 9.6 years for men and from 5.3 to 5.7 years for women.
Purpose: to investigate how changes in the mortality pattern differs between socioeconomic groups in Denmark

Focus on men’s life expectancy and disparity, and whether the compression of lifespan differs between low and high income groups
Danish men, 1986

Deaths, d(x)

Age, x

Modal age at death

Lowest income quartile, e(77)=6.3

Highest income quartile, e(82)=6.5

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Comparison of the changes from 1986 to 2014 between lowest and highest income quartile demonstrates

- No change in the difference (5 years) in modal age at death, but
- a distinct different change in the shape of the distribution of age at death
Survival curves by income quartile (lowest and highest) in 1986 and 2014

Comparison of the changes from 1986 to 2014 between lowest and highest income quartile demonstrates

Rectangularization of the shape of the survival curve seems to occur for the highest but not the lowest income quartile
Quantification of mortality patterns:

• Life disparity
• Threshold age that separates ‘early’ and ‘late’ deaths

Following methods developed by Vaupel, Zhang, Raalte and others
Life disparity, $e^\dagger$, is defined as life expectancy lost due to death:

$$ e^\dagger = \int_{0}^{\infty} e(x) \, d(x) \, dx $$

Life disparity at age $a$, $e^\dagger(a)$, is defined as life expectancy lost due to death among survivors to age $a$:

$$ e^\dagger(a) = \frac{1}{\ell(a)} \int_{a}^{\infty} e(x) \, d(x) \, dx $$

Threshold age, $a^\dagger$, is defined as the (unique) solution to the equation:

$$ e^\dagger(a) + e(a)(H(a) - 1) = 0, $$

where $H(a)$ is the cumulative hazards function:  $H(a) = \int_{0}^{a} \mu(x) \, dx$

Zhang and Vaupel have shown that $a^\dagger$ is separating ‘early’ and ‘late’ deaths in the sense that postponing deaths before age $a^\dagger$ (‘early’ ages) decreases life disparity, i.e. compresses lifespan disparity

(Zhang Z, Vaupel JW. The age separating early deaths from late deaths. Demographic Research 2009;20:721-30)
Results
Men

Life disparity, e†

<table>
<thead>
<tr>
<th>Year</th>
<th>Lowest income quartile</th>
<th>Highest income quartile</th>
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</thead>
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<tr>
<td>1986</td>
<td>11.9</td>
<td>8.5</td>
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<tr>
<td>2014</td>
<td>12.0</td>
<td>11.4</td>
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1986 2014

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Life disparity, $e^+$

Men

Life disparity, $e^+$

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Threshold age, $a^+$

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</thead>
<tbody>
<tr>
<td>Lowest income quartile</td>
<td>66</td>
<td>69</td>
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<tr>
<td>Highest income quartile</td>
<td>71</td>
<td>81</td>
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Summary of results

For the lowest income quartile:
• Life expectancy at birth increased by 4.4 years since 1986
• No change during the last 28 years in life disparity
• Threshold age increased by 3 years since 1986

For the highest income quartile:
• Life expectancy at birth increased by 8.4 years since 1986
• Life disparity decreased by 2.9 years during the last 28 years
• Threshold age increased by 10 years since 1986

Conclusions
Changes in various measures of the adult mortality pattern differ markedly between males in the lowest and highest income quartile
• Modal age at death increased by 5 years for both groups,
• but the compression of the distribution of lifespan in the highest income quartile didn’t occur for the lowest income quartile
Thank you!