



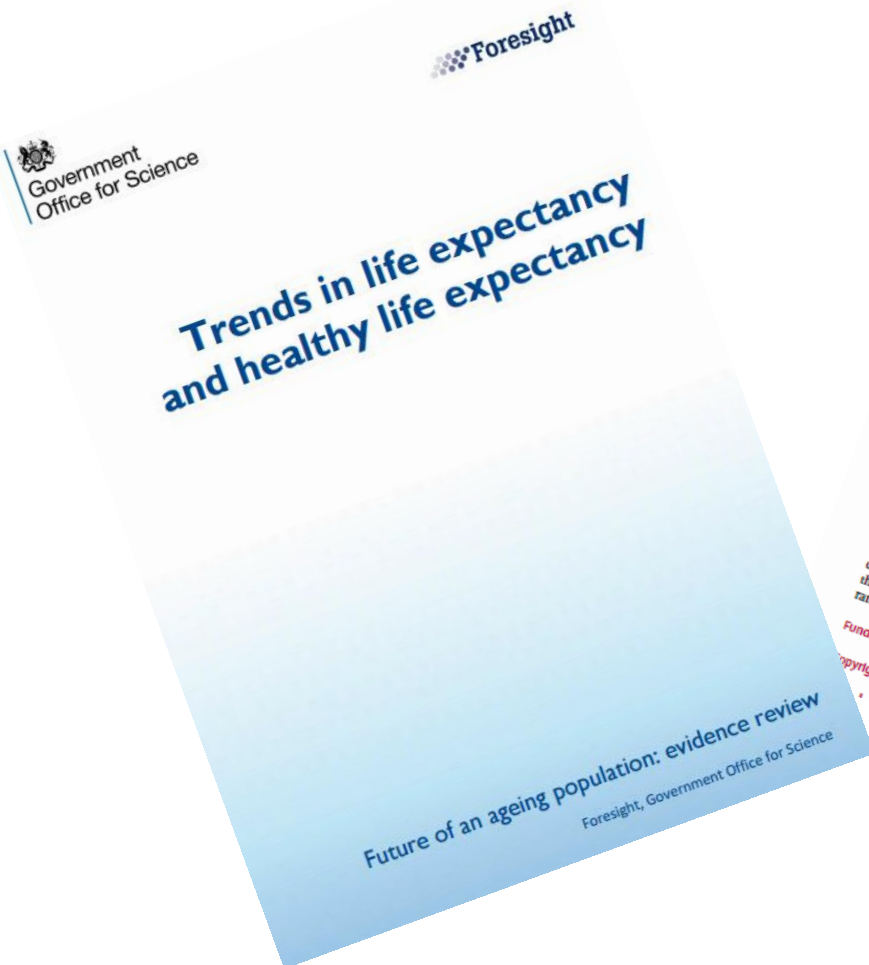
Institute  
and Faculty  
of Actuaries

# Health and longevity – can we have both?

Professor Carol Jagger



# Sources



## A comparison of health expectancies over two decades in England: results of the Cognitive Function and Ageing Study I and II

Card Jagger, Fiona E Matthews, Pia Wolfand, Tony Foxweaver, Bassem CM Stephens, Louise Robinson, Antony Arthur, Carol Brayne, on behalf of the Medical Research Council Cognitive Function and Ageing Collaboration\*

### Summary

**Background** Whether rises in life expectancy are increases in good-quality years is of profound importance worldwide with population ageing. We investigate how various health expectancies have changed in England between 1991 and 2011, with identical study design and methods in each decade.

**Methods** Baseline data from the Cognitive Function and Ageing Studies in populations aged 65 years or older in three geographically defined centres in England (Cambridgeshire, Newcastle, and Nottingham) provided prevalence estimates for three health measures: self-perceived health (defined as excellent-good, fair, or poor); cognitive impairment (defined as moderate-severe, mild, or none, as assessed by Mini-Mental State Examination score); and disability in activities of daily living (defined as none, mild, or moderate-severe). Health expectancies for the three regions combined were calculated by the Sullivan method, which applies the age-specific and sex-specific prevalence of the health measure to a standard life table for the same period.

**Findings** Between 1991 and 2011, gains in life expectancy at age 65 years (4.5 years for men and 3.6 years for women) were accompanied by equivalent gains in years free of any cognitive impairment (4.2 years [95% CI 4.2-4.3] for men and 4.4 years [4.3-4.5] for women) and decreased years with mild or moderate-severe cognitive impairment. Gains were also identified in years in excellent or good self-perceived health (3.8 years [95% CI 3.5-4.1] for men and 3.1 years [2.7-3.4] for women). Gains in disability-free years were much smaller than those in excellent-good self-perceived health or those free from cognitive impairment, especially for women (0.5 years [0.2-0.9] compared with 2.6 years [2.3-2.9] for men), mostly because of increased mild disability.

**Interpretation** During the past two decades in England, we report an absolute compression (ie, reduction) of cognitive impairment, a relative compression of self-perceived health (ie, proportion of life spent healthy is increasing), and dynamic equilibrium of disability (ie, less severe disability is increasing but more severe disability is not). Reasons for these patterns are unknown but might include increasing obesity during previous decades. Our findings have wide-ranging implications for health services and for extension of working life.

**Funding** UK Medical Research Council.  
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Articles



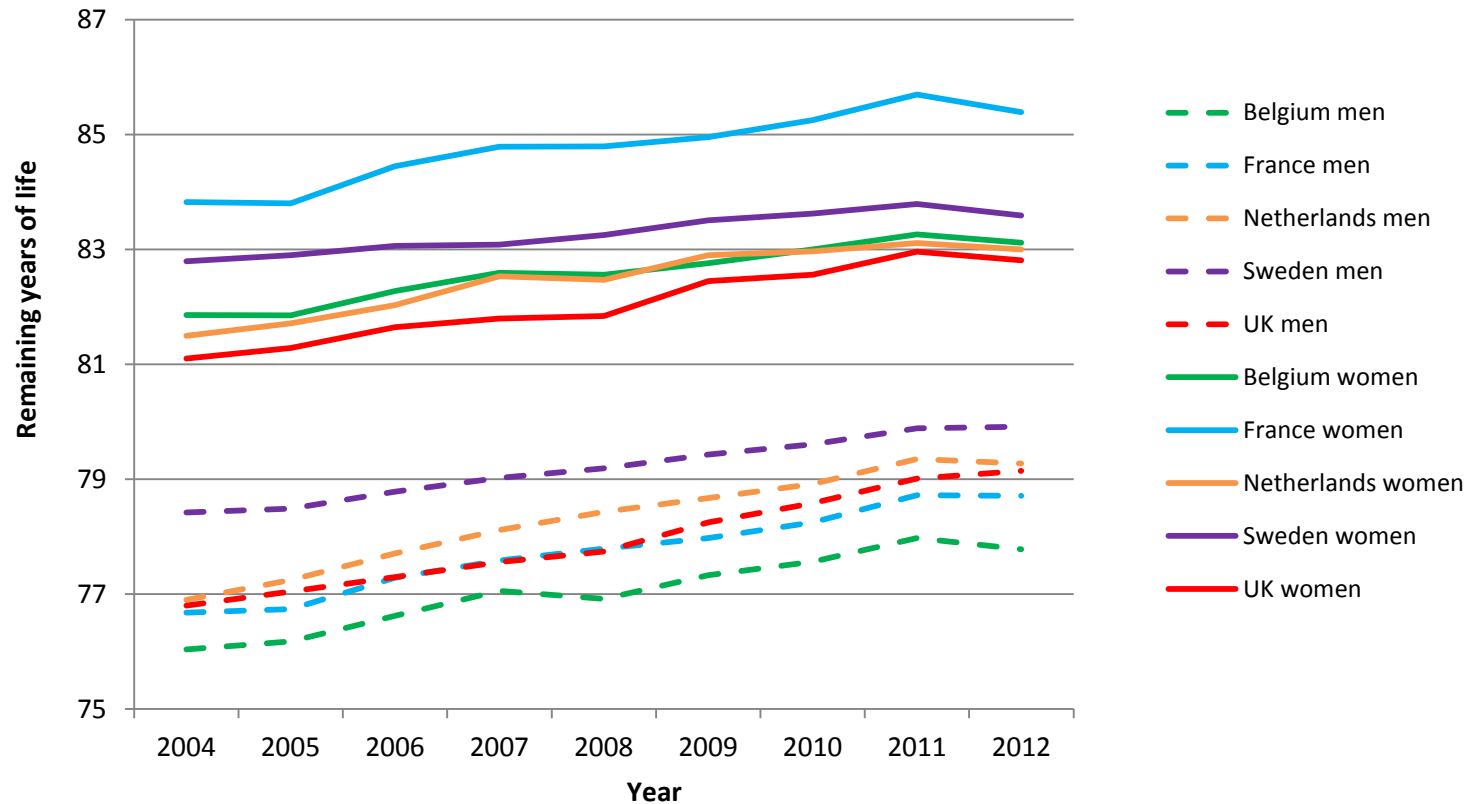
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# Summary

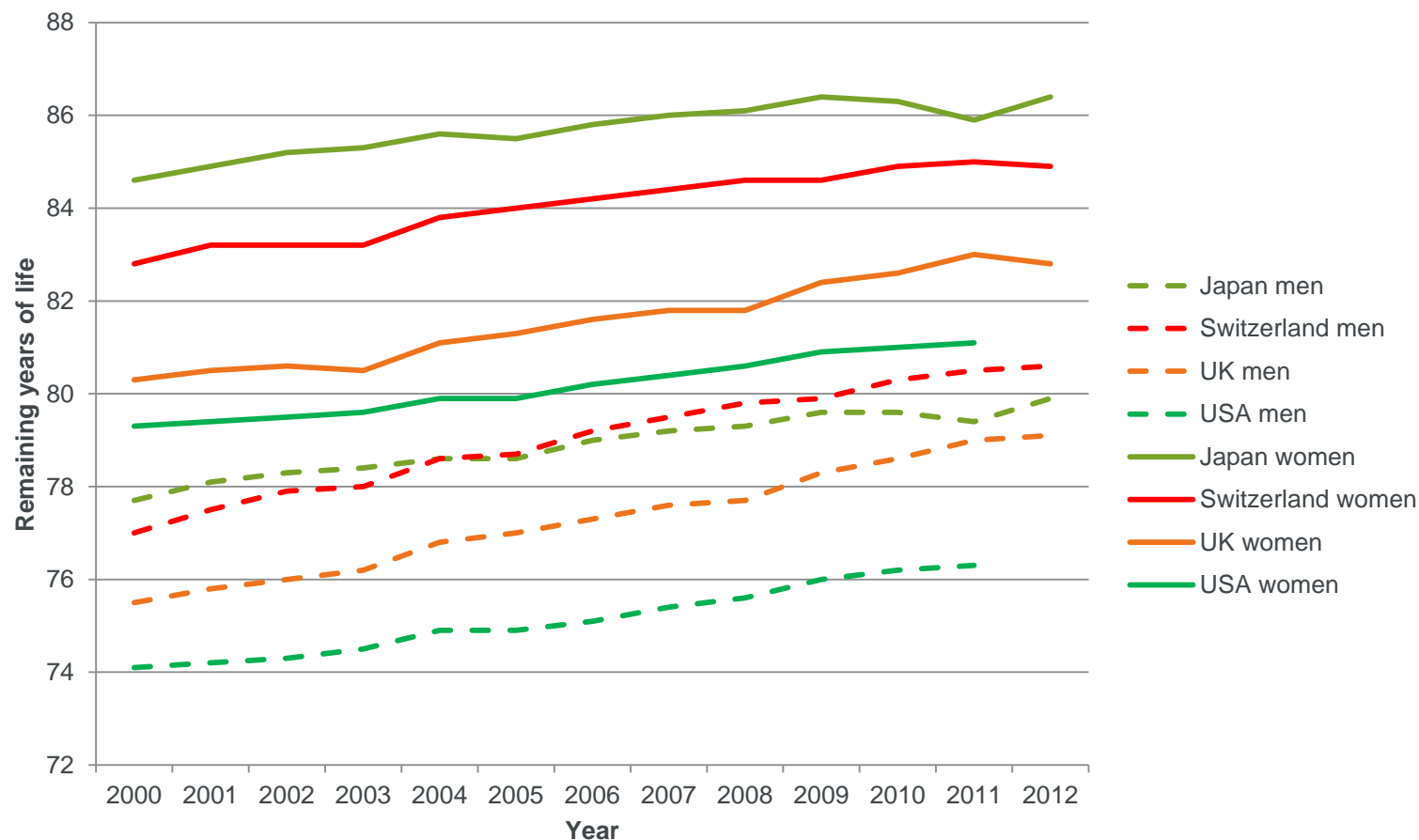
- Health expectancy increases in the UK are not keeping pace with gains in life expectancy, particularly at older ages.
- There is evidence that chronic diseases, unhealthy behaviours and the environment can influence health expectancy but many also influence life expectancy
- Influences on health expectancy must be examined alongside their effect on life expectancy to ensure that we achieve both longevity and health

# LE at birth: selected EU countries



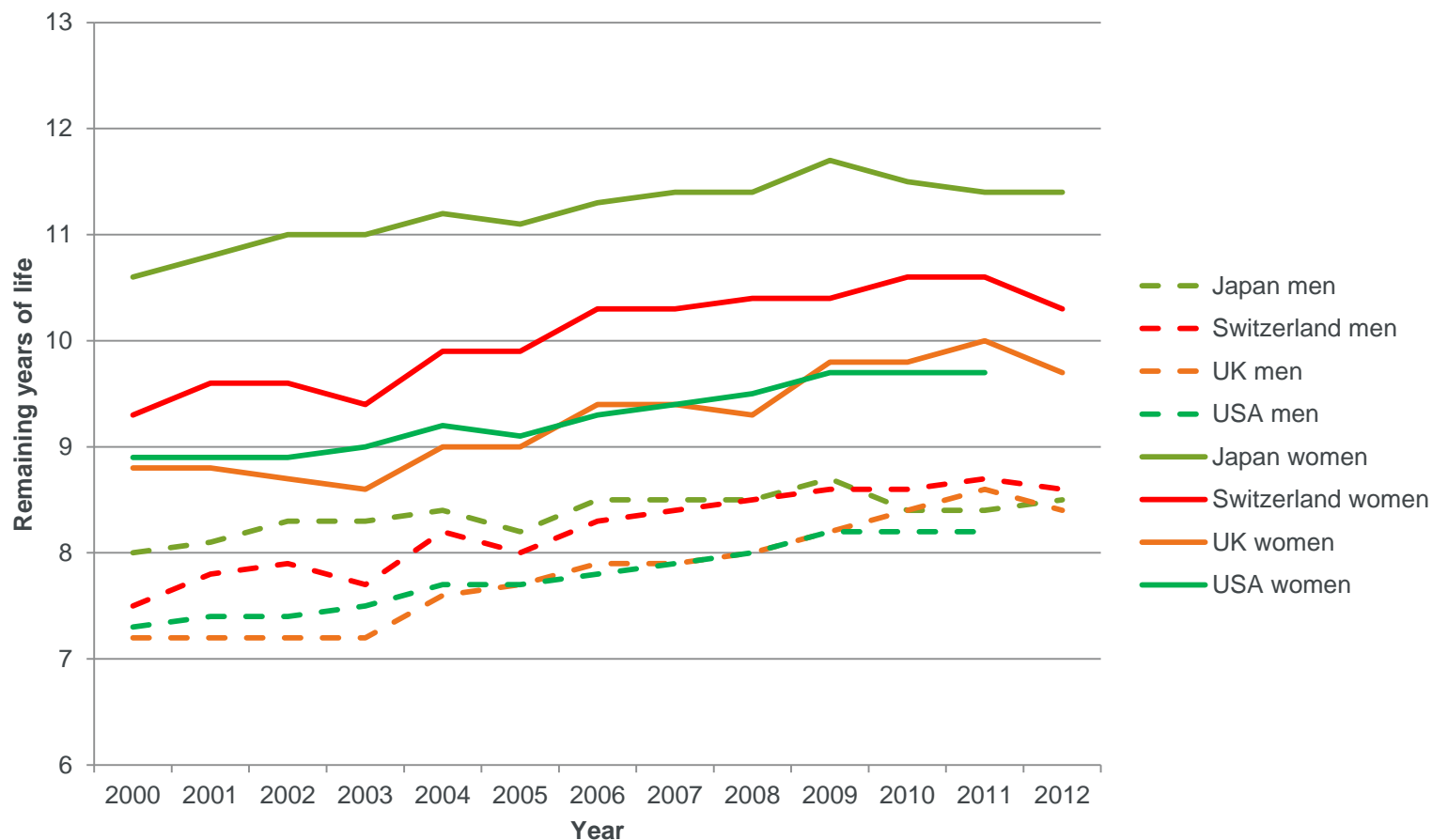
Source: Jagger Foresight evidence review

# LE at birth: selected OECD countries



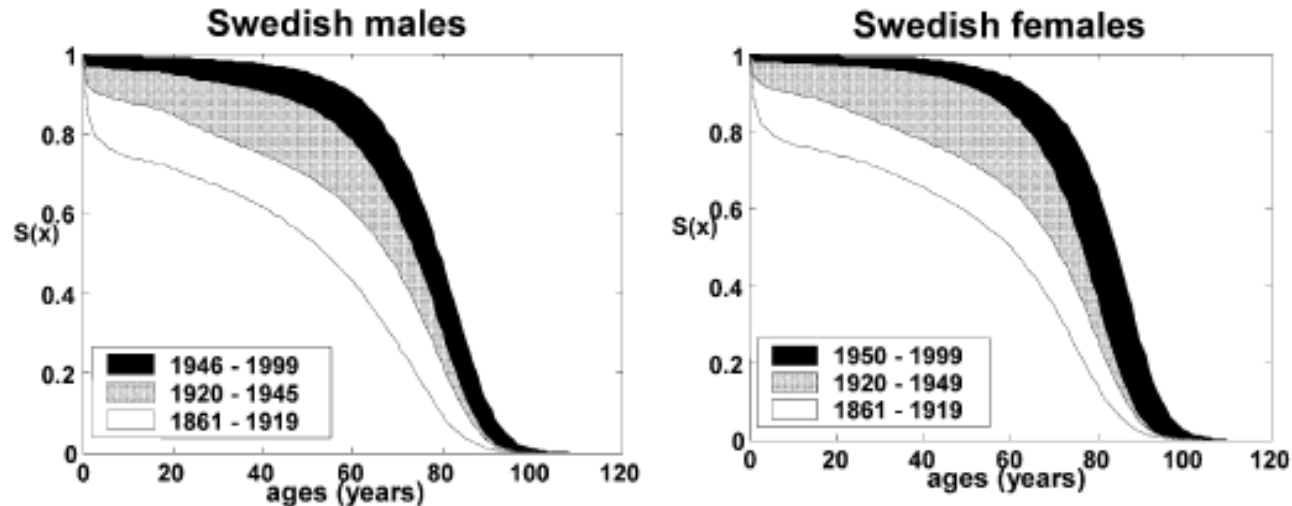
Source: Jagger Foresight evidence review

# LE at age 80: selected OECD countries



Source: Jagger Foresight evidence review

# Rectangularization of the survival curve



- 1920-1945: rectangularization
- 1946-1999: increase in maximum lifespan

*Source: Yashin et al. (2002)*

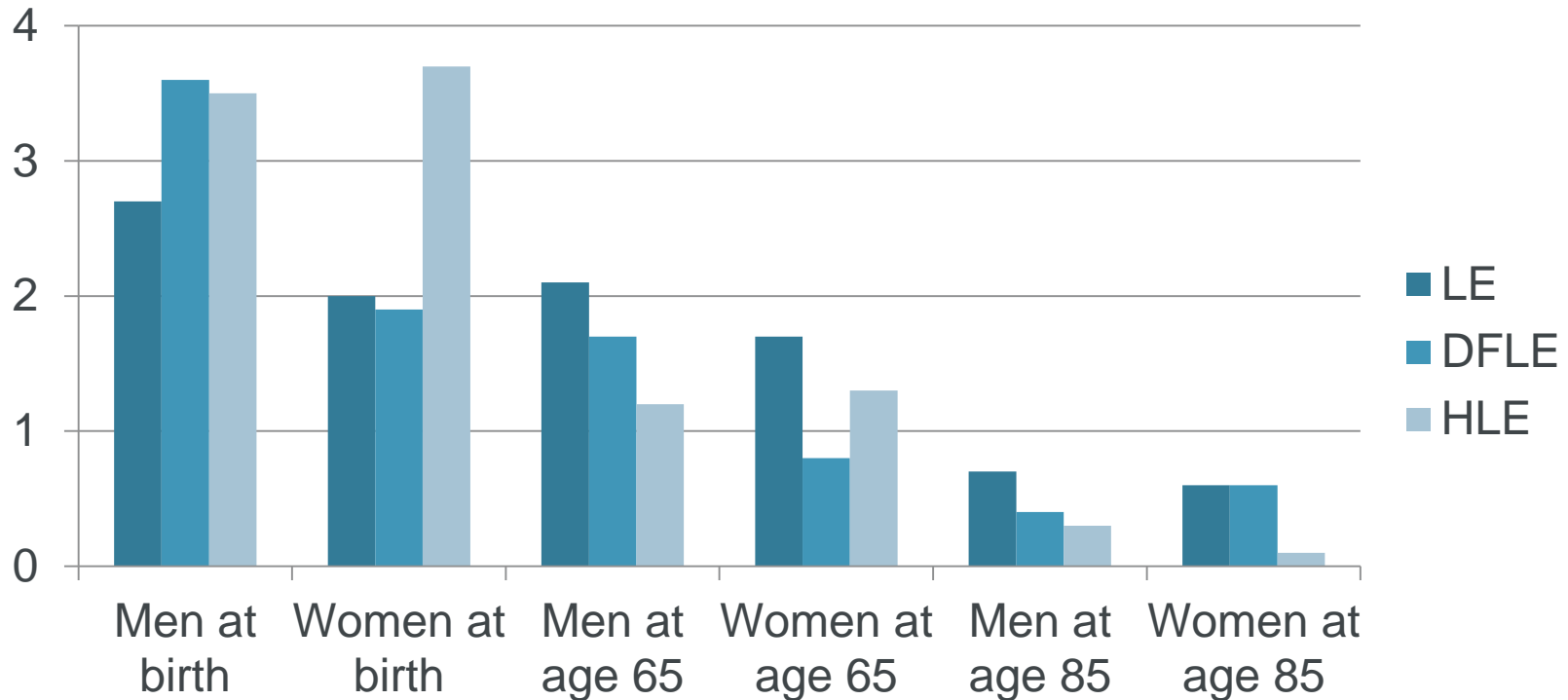
# Trends in health expectancy – less simple

- What do we mean by health?
- Less harmonization
  - across countries
  - within countries over time
- Need to look at trends in HE alongside trends in LE





# Changes in LE and HE, 2000-2 to 2009-11



- Some evidence of compression of disability and morbidity at younger ages in UK

# Male LE and HLY: selected EU countries

	Change in years between 2005 and 2010					
	Birth		Age 65		Age 85	
	LE	HLY	LE	HLY	LE	HLY
<b>MEN</b>						
Belgium	<b>1.4</b>	<b>1.7</b>	1.0	0.9	0.8	0.7
France	1.5	-0.4	1.2	0.5	0.9	0.1
Netherlands	1.7	-4.4	1.3	-1.1	0.6	-1.2
Sweden	<b>1.1</b>	<b>7.0</b>	<b>0.9</b>	<b>3.4</b>	<b>0.3</b>	<b>1.3</b>
UK	1.5	0.9	1.2	0.4	0.5	-0.1
EU25	1.6	1.1	1.1	0.3	0.7	0.0

- Compression of disability for men in Belgium (birth) and Sweden (all ages)

*Source: Jagger Foresight evidence review*

# Female LE and HLY: selected EU countries

	Change in years between 2005 and 2010					
	Birth		Age 65		Age 85	
	LE	HLY	LE	HLY	LE	HLY
<b>WOMEN</b>						
Belgium	1.1	0.5	1.1	-0.1	1.1	0.1
France	1.4	-1.2	1.4	0.2	1.4	0.7
Netherlands	1.3	-2.9	0.9	-1.6	0.6	-0.2
Sweden	<b>0.7</b>	<b>7.7</b>	<b>0.4</b>	<b>4.4</b>	<b>0.1</b>	<b>2.1</b>
UK	1.3	0.1	1.1	0.4	0.6	-0.1
EU25	1.3	0.5	1.1	0.2	0.9	0.1

- Compression of disability for women in Sweden (all ages)

*Source: Jagger Foresight evidence review*

# Male LE and HE: selected OECD countries

			Change in years over period					
			Birth		Age 65		Age 80	
	Period	Measure of ill-health	LE	HE	LE	HE	LE	HE
<b>MEN</b>								
<b>Japan</b>	1995-2004	activity limitation	2.3	1.2	1.7	0.8		
	1995-2004	ADL limitation	2.3	2.0	1.7	1.3		
	2005-2009	care needs			0.8	0.2	0.4	0.1
	1995-2004	less than good health			1.7	-0.7	1.0	-0.3
<b>Switzerland</b>	2008-2012	activity limitation	<b>0.8</b>	<b>2.9</b>	<b>0.4</b>	<b>1.4</b>	<b>-0.1</b>	<b>0.8</b>
	2008-2012	less than good health			<b>0.4</b>	<b>0.5</b>	<b>-0.1</b>	<b>0.7</b>
<b>UK</b>	2001-2010	disability	<b>2.7</b>	<b>3.6</b>	2.1	1.7	0.7	0.4
	2001-2010	less than good health	<b>2.7</b>	<b>3.5</b>	2.1	1.2	0.7	0.3
<b>USA</b>	2000-2006	activity limitation	1.0	0.7	1.0	1.0	0.3	0.3

- Compression in men evident for UK (birth) and Switzerland (all ages)

*Source: Jagger Foresight evidence review*

# Female LE and HE: selected OECD countries

			Change in years over period					
			Birth		Age 65		Age 80	
	Period	Measure of ill-health	LE	HE	LE	HE	LE	HE
<b>WOMEN</b>								
<b>Japan</b>	1995-2004	activity limitation	1.7	0.8	2.3	0.8		
	1995-2004	ADL limitation	1.7	1.7	2.3	1.2		
	2005-2009	care needs			0.8	0.5	0.6	0.4
	1995-2004	less than good health			2.4	-0.7	1.4	-0.4
<b>Switzerland</b>	2008-2012	activity limitation	<b>0.3</b>	<b>3.0</b>	<b>0.1</b>	<b>1.4</b>	-0.2	-0.2
	2008-2012	less than good health			<b>0.1</b>	<b>0.6</b>	-0.2	-0.6
<b>UK</b>	2001-2010	disability	2.0	1.9	1.7	0.8	0.6	0.1
	2001-2010	less than good health	<b>2.0</b>	<b>3.7</b>	1.7	1.3	0.6	0.6
<b>USA</b>	2000-2006	activity limitation	0.9	0.5	<b>0.7</b>	<b>0.8</b>	0.3	0.3

- Compression in women evident for UK (birth), Switzerland (birth and age 65) and USA (age 65)

*Source: Jagger Foresight evidence review*

# Most recent trends in HE

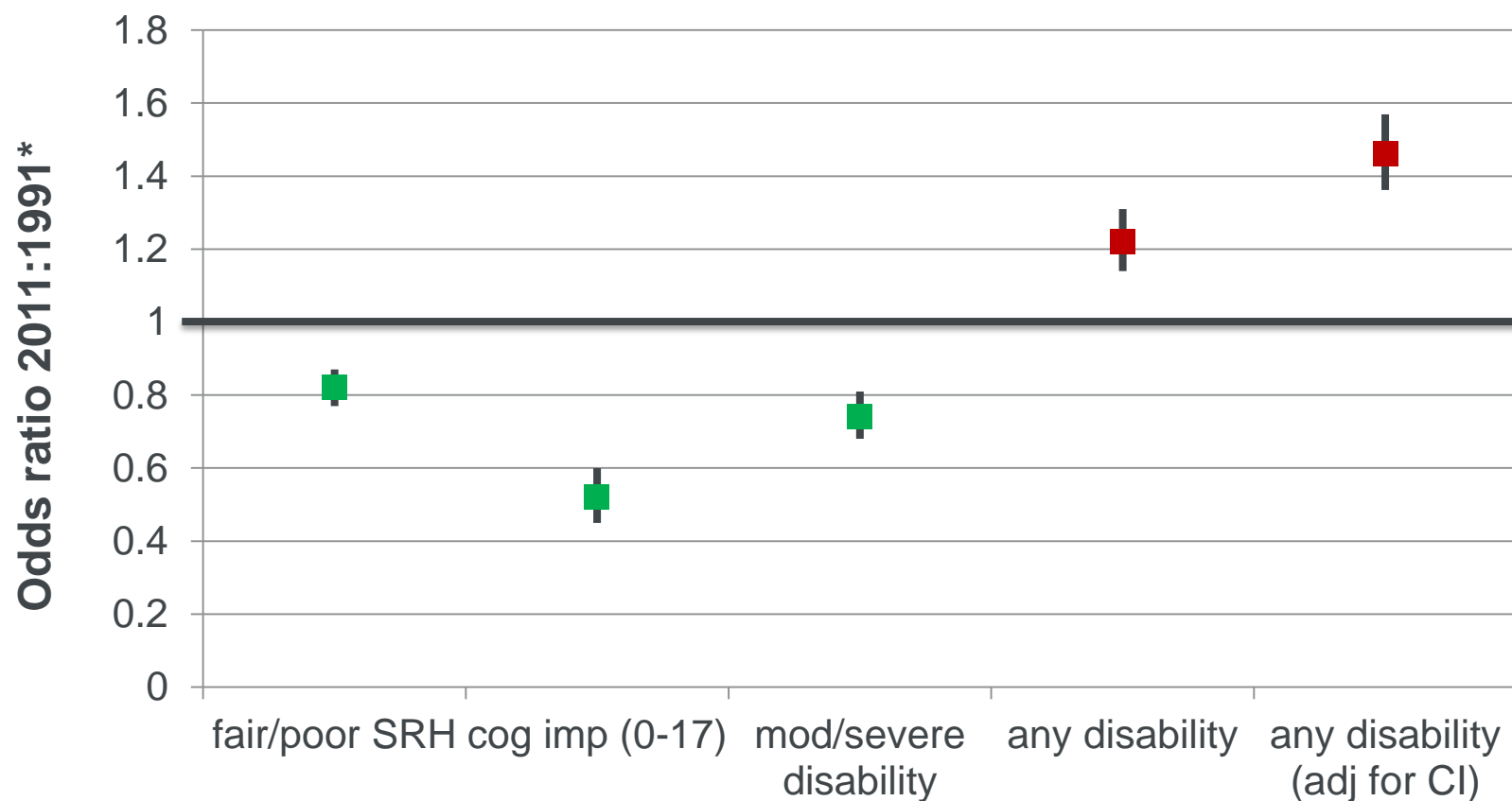


- CFAS I (1991) six areas
  - sampling from whole population geographically
- Three taken forward for CFAS II (2011)
  - Cambridgeshire (Ely and surrounding area)
  - Newcastle
  - Nottingham
- Design:
  - Equal numbers aged 65-74 and 75+ years
  - Complete population (including care homes)
- HE measures:
  - Cognitive impairment-free LE (CIFLE)
  - Disability-free LE (DFLE) based on (I)ADLs
  - Healthy LE (HLE) based on self-rated health

# Study characteristics

	CFAS I (N=7635)	CFAS II (N=7796)
	% (n)	% (n)
<b>Gender</b>		
Women	60 (4590)	54 (4246)
<b>Age group (years)</b>		
65-69	26 (1981)	25 (1939)
70-74	23 (1776)	24 (1873)
75-79	23 (1725)	21 (1624)
80-84	17 (1308)	17 (1290)
85+	11 (845)	14 (1070)
<b>Living arrangements</b>		
Alone	38 (2903)	36 (2772)
With spouse	47 (3589)	54 (4205)
With others	10 (749)	7 (535)
In care home	5 (346)	3 (197)
<b>Education (years full-time)</b>		
0-9	74 (5529)	27 (2052)
10-11	17 (1238)	51 (3923)
12+	9 (692)	22 (1704)

# Changes\* in prevalence (CFAS)



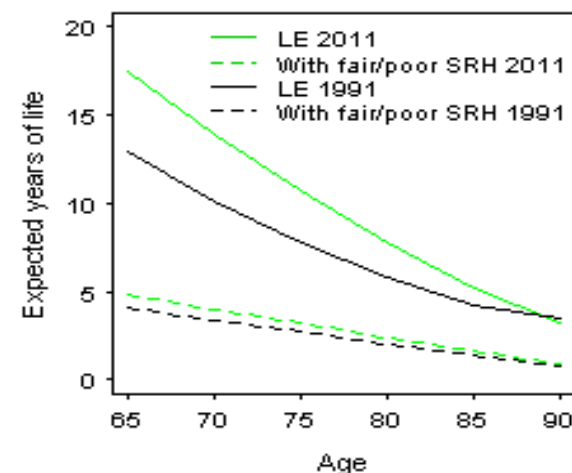
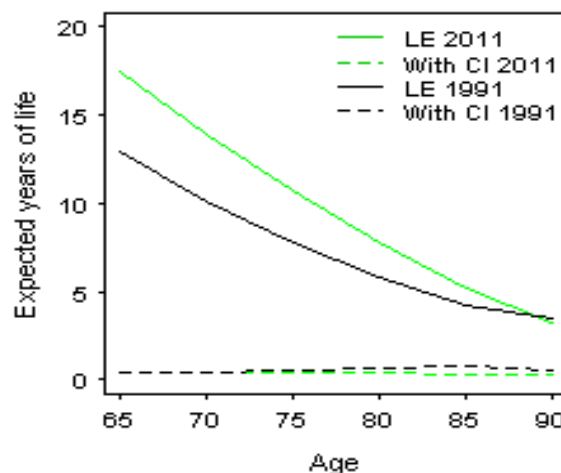
\*adjusted for age, sex, region and deprivation

Source: Jagger et al. Lancet 2016

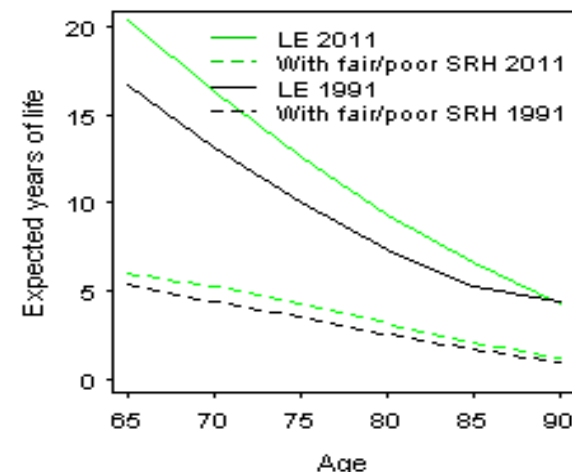
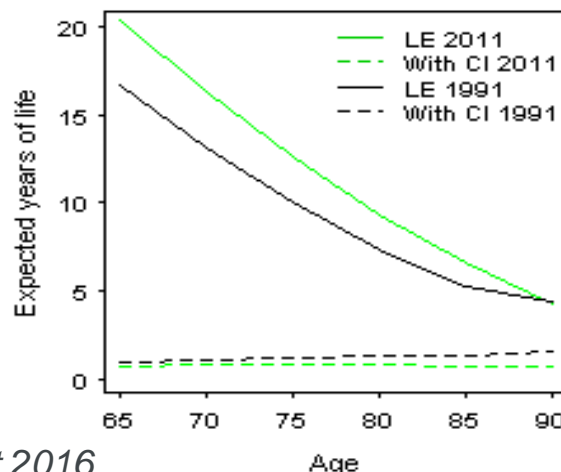


# Cognitive impairment-free LE and HLE

Men

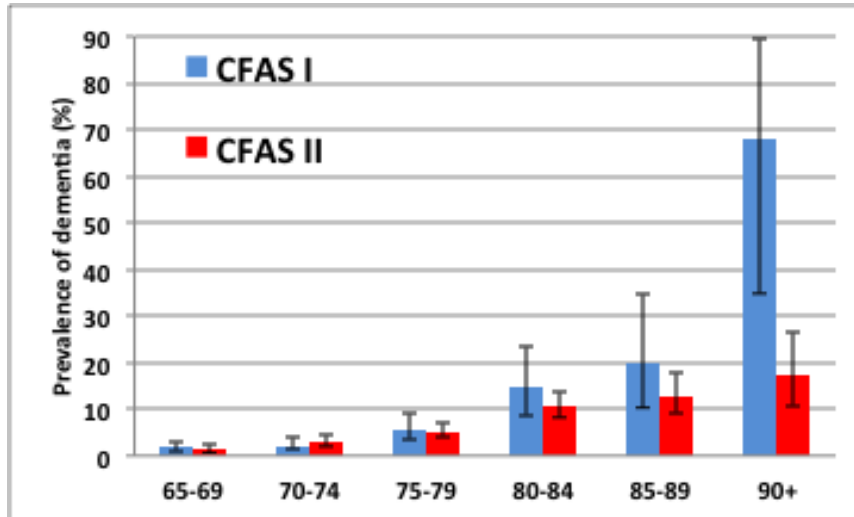


Women



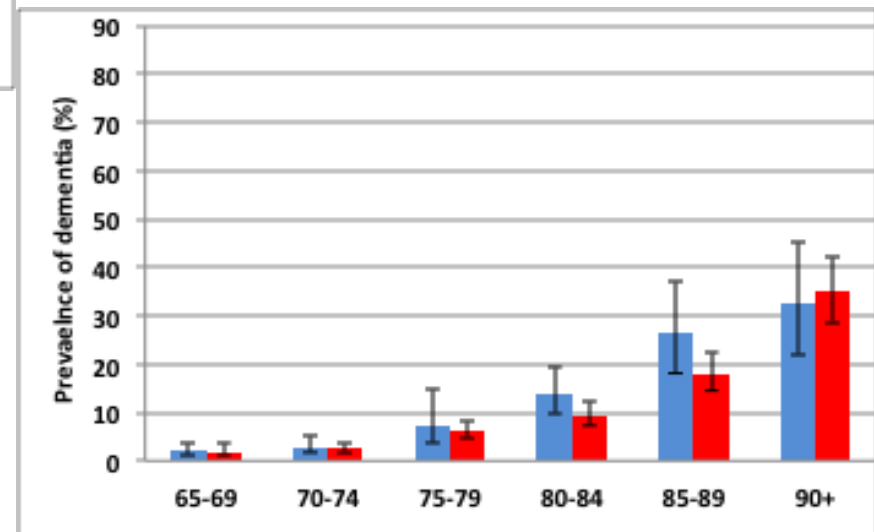
Source: Jagger et al. Lancet 2016

# Prevalence of dementia 1991 - 2011



**Men**

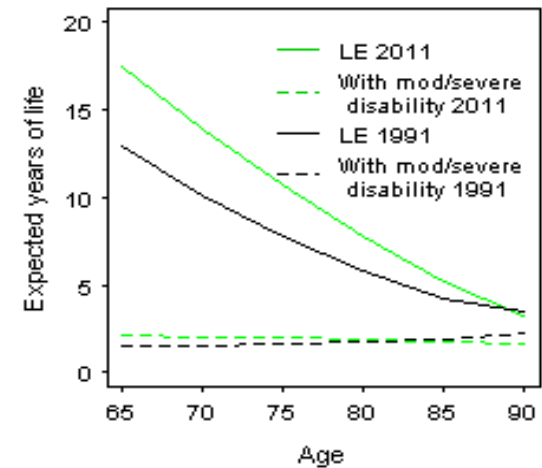
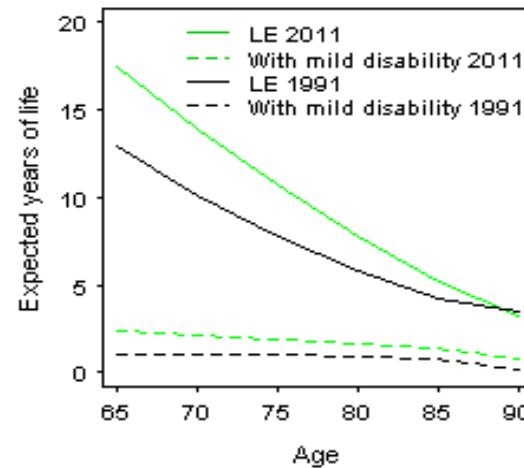
**Women**



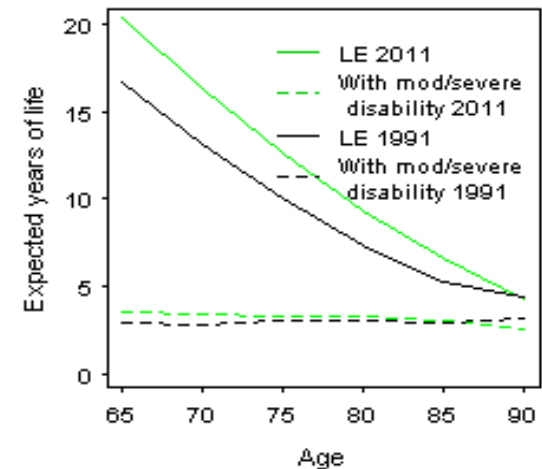
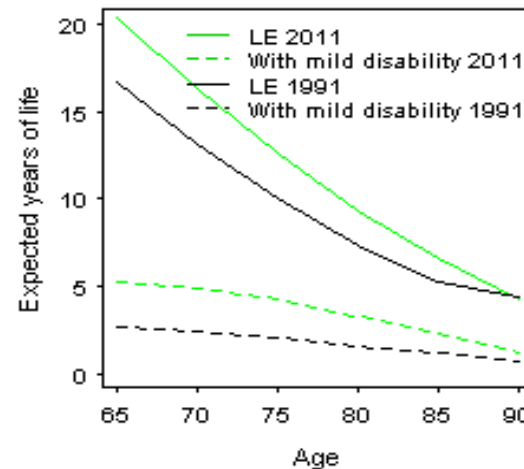
Source: Matthews et al. Lancet 2013

# Disability-free LE

Men



Women



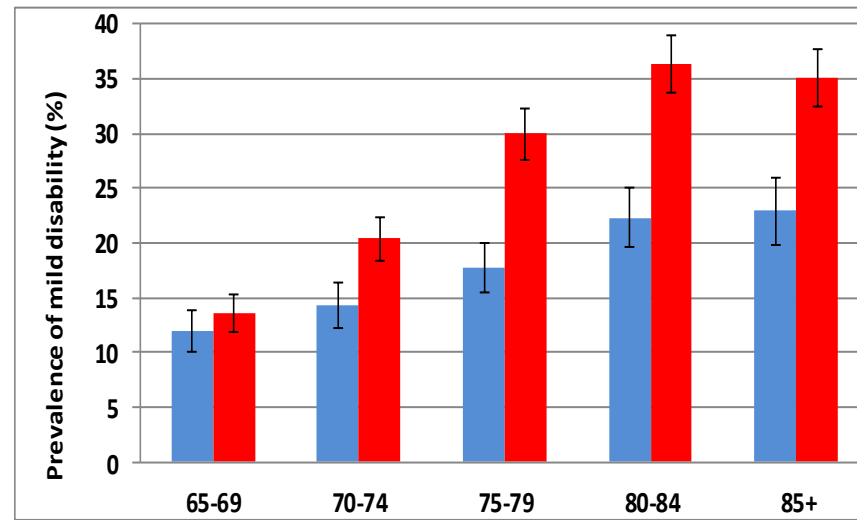
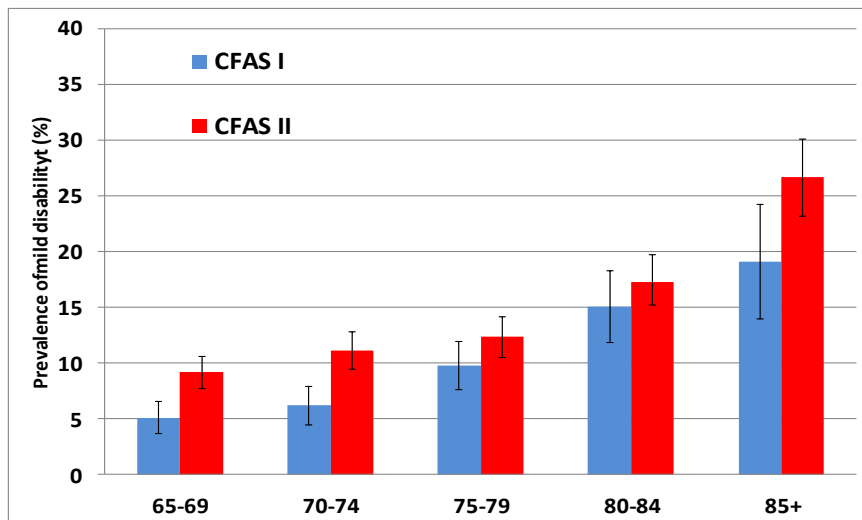
Source: Jagger et al. Lancet 2016

# Prevalence of disability 1991-2011

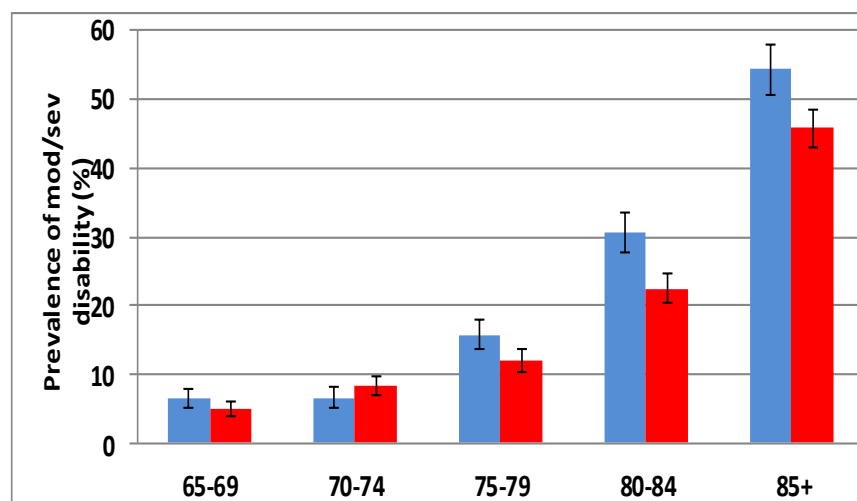
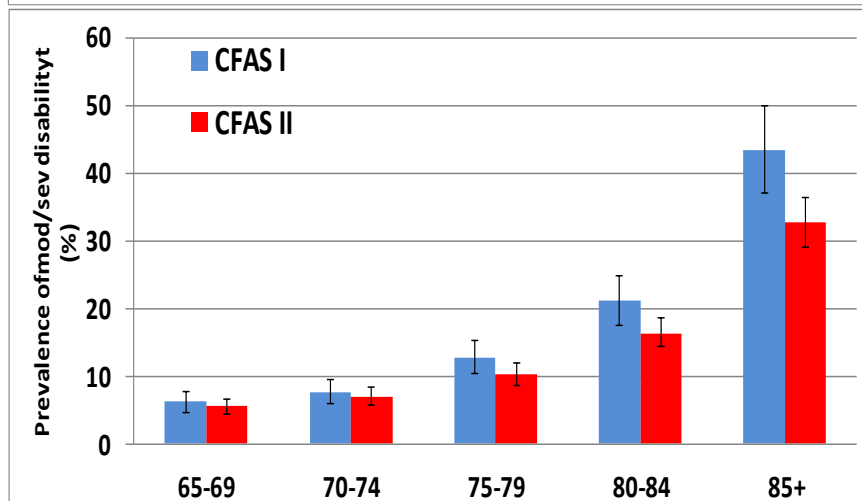
Men

Women

Mild disability



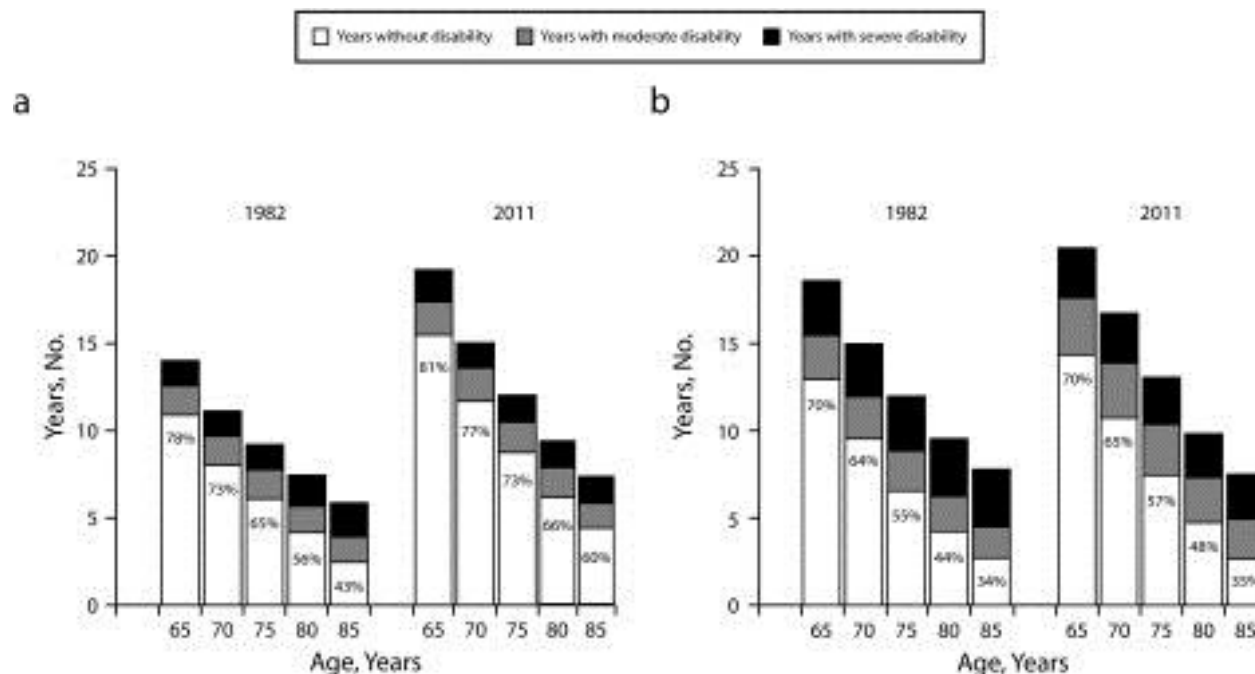
Mod/severe



# Comparisons with other countries

- HLE
  - Belgium 1997-2004 increase in HLE similar to LE (*Van Oyen et al., 2008*)
  - Denmark 1987-2005 increase in HLE greater than LE (*Jeune & Bronnum-Hansen, 2008*)
- DFLE
  - France 1990-2000 increases in mild mobility disability in (*Cambois et al. 2008*)
  - Belgium 1997-2004 greater improvements for men (and compression) than women (*Van Oyen et al., 2008*)
  - Denmark 1987-2005 compression of mobility limitations for men and women (*Jeune & Bronnum-Hansen, 2008*)
  - USA 1970-2010 greater increases in LE than DFLE (*Crimmins et al, 2016*)

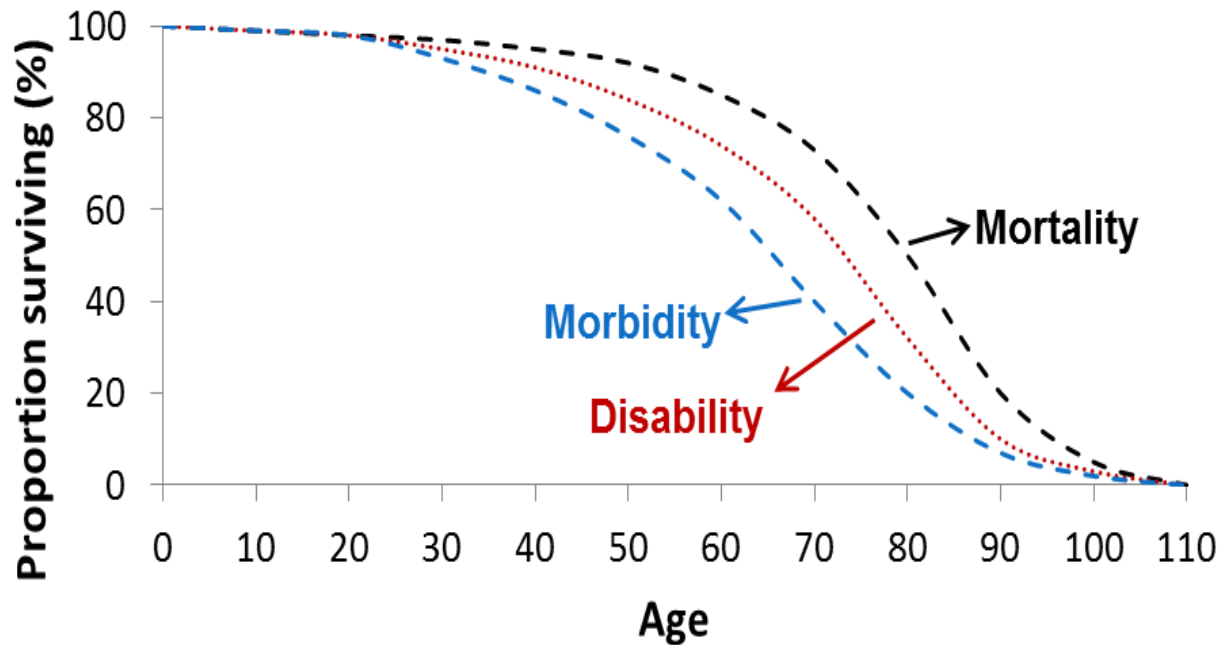
# USA DFLE 1985-2011



- Men's DFLE at age 65 increased by 4.5 years, women by 1.4.
- Years with severe disability stable for men and women
- Increase in years with moderate disability in women

*Source: Freedman et al (2016)*

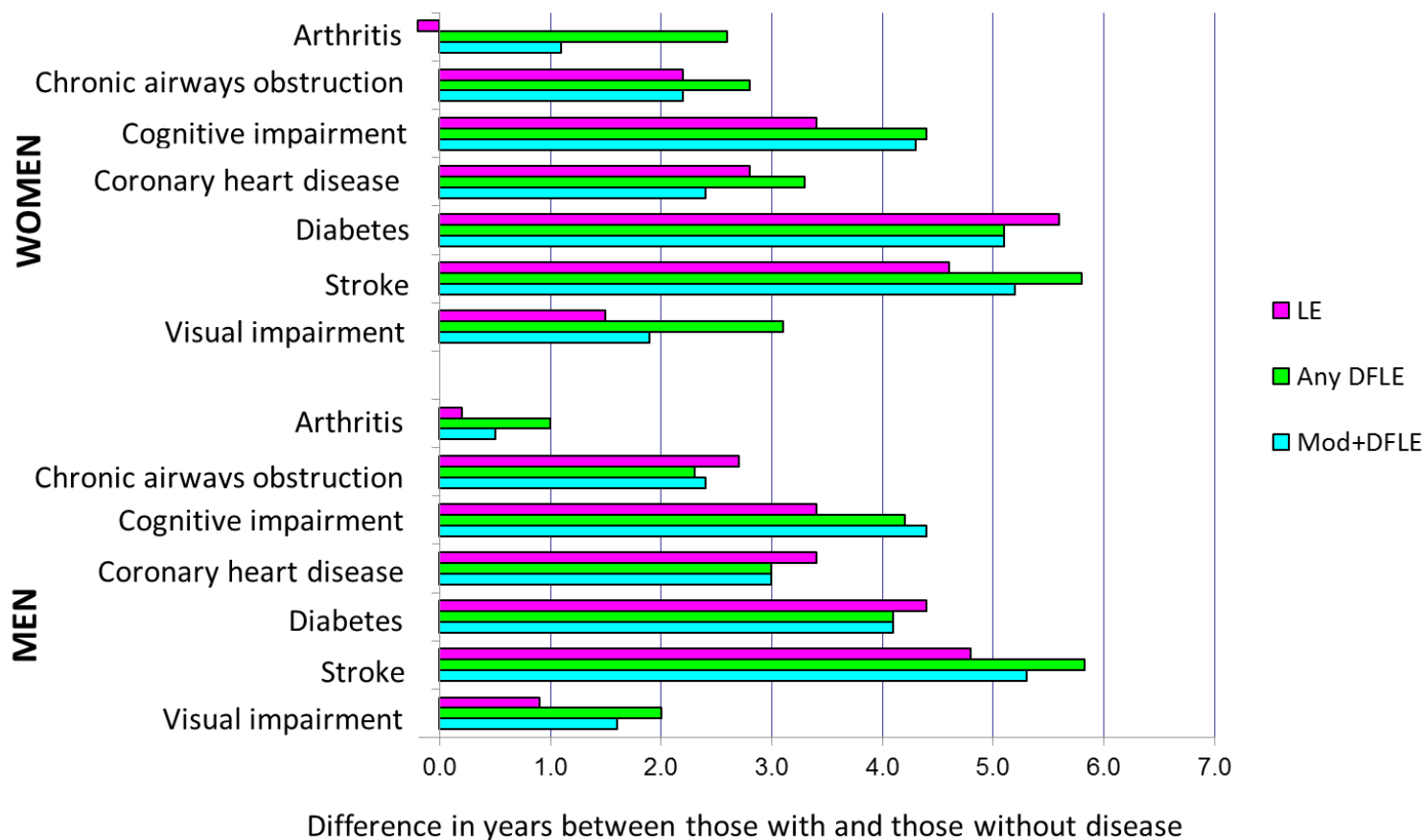
# Influences on HLE



*Model of health transitions (WHO, 1984)*

- Socio-economic factors (education, occupation)
- Chronic conditions
- Health behaviours (obesity, smoking, physical inactivity)
- Environment

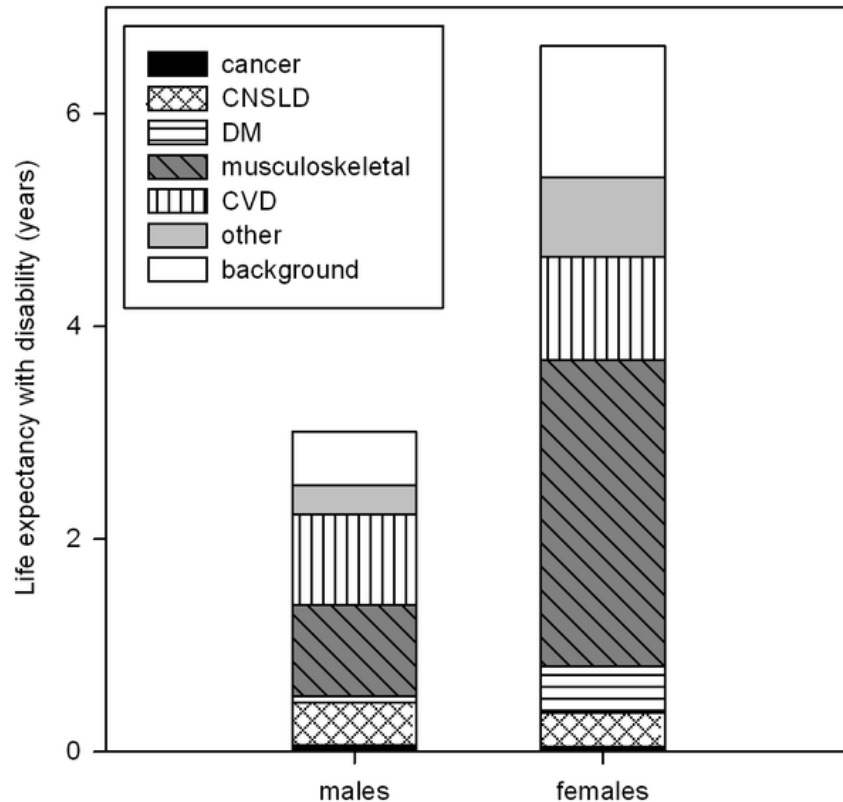
# Contribution of diseases to LE and DFLE at age 65 (CFAS I)



Source: Jagger et al (2007)



# Influence of chronic conditions

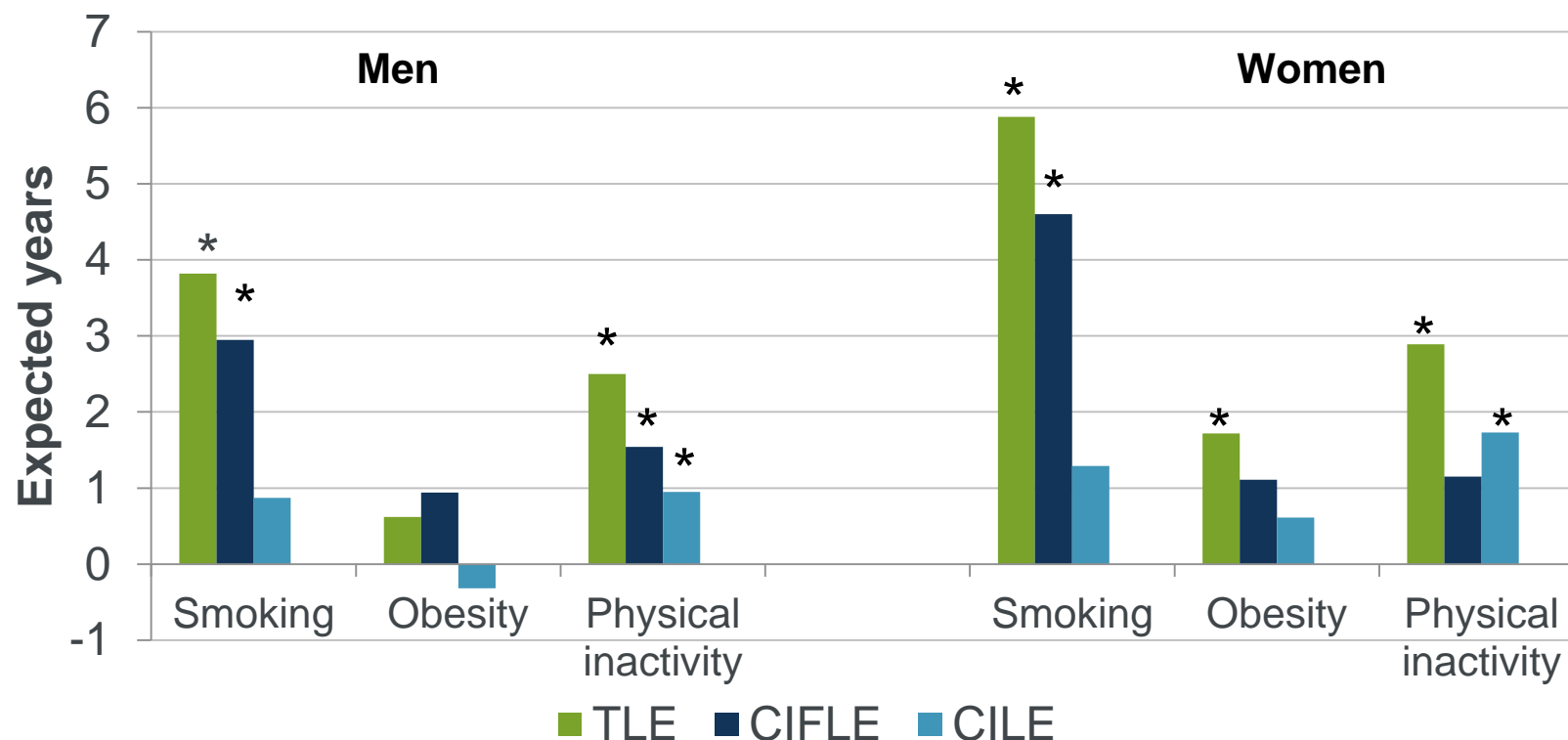


Source: Klijs et al (2011)

- Multiple conditions do not appear to reduce LE but often increase years with disability:
  - 12.2% (11.1–13.2) with no conditions,
  - 39.1% (28.3–49.8) with heart disease and
  - 47.0% (46.9–47.1) with heart disease, diabetes and hypertension.

Source: Laditka & Laditka (2016)

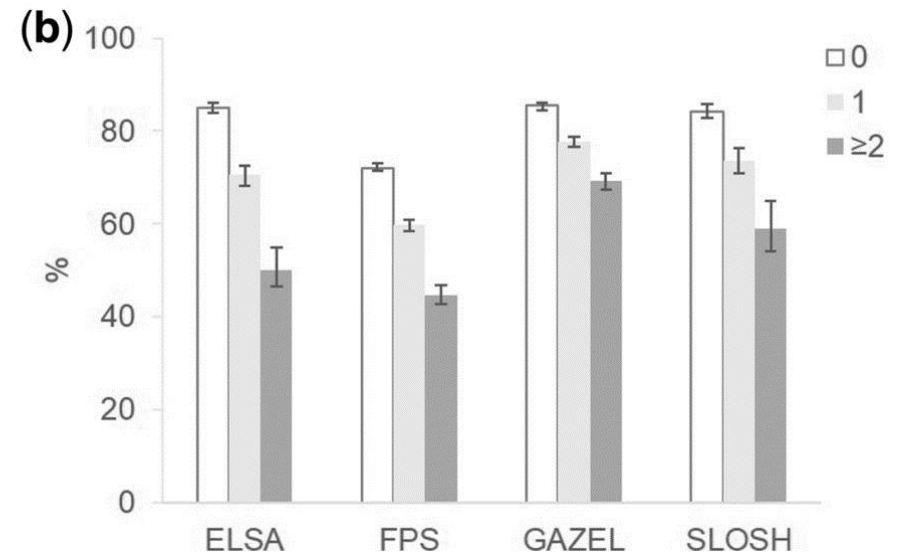
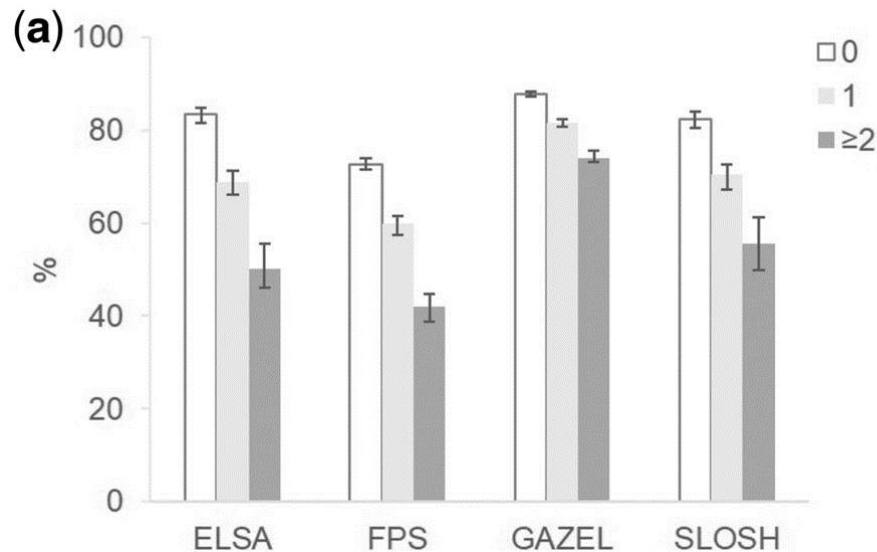
# Influence of behaviours on CIFLE



Years gained (\*= significantly>0) in total life expectancy (TLE), cognitive impairment free life expectancy (CIFLE) and life expectancy with cognitive impairment (CILE) **without** risk factor (high educated)

*Source: Anstey et al. IJE 2015*

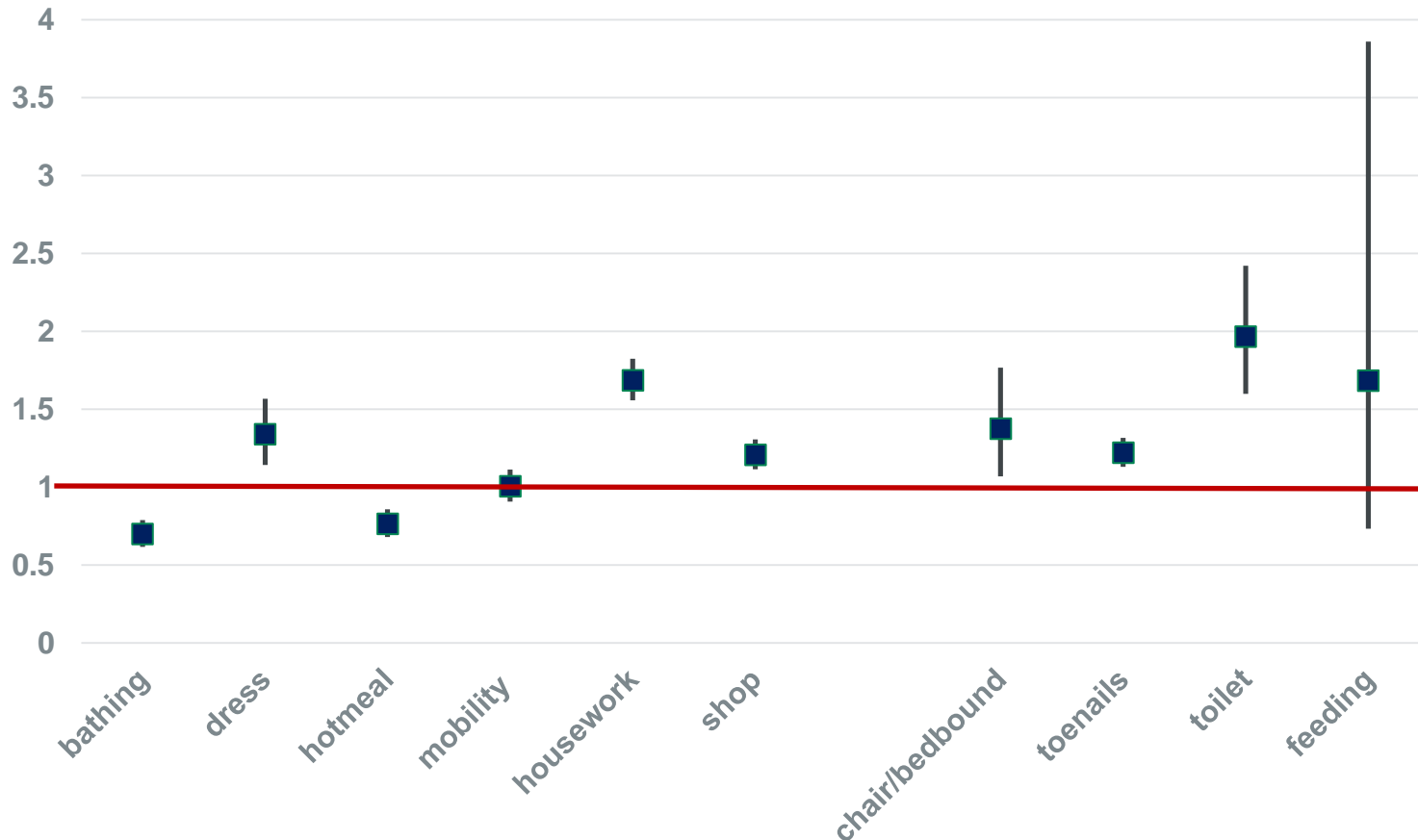
# Influence of behaviours on HLE



**Proportion of life spent in good health between the ages of 50 and 75 by co-occurrence of behaviour related risk factors by study cohort. (a) Men (b) Women**

*Source: Stenholm et al. IJE 2016*

# Influence of environment on disability



**Odds ratio (95% CI) of inability in each item in 2011 compared to 1991, adjusted for age group, sex, centre and education (CFAS)**

# Summary

- Health expectancy increases in the UK are not keeping pace with gains in life expectancy, particularly at older ages.
- There is evidence that chronic diseases, unhealthy behaviours and the environment can influence health expectancy but many also influence life expectancy
- Influences on health expectancy must be examined alongside their effect on life expectancy to ensure that we achieve both longevity and health

# Acknowledgements

## CFAS studies collaboration



## Colleagues in

- European Health and Life Expectancy Information System (EHLEIS)
- Newcastle University Institute of Health & Society
- Australian Centre of Excellence in Population Ageing Research (CEPAR)