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ORIGINAL INVESTIGATION

Gender gaps in life expectancy and expected years with activity limitations at age 50 in the European Union: associations with macro-level structural indicators

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Abstract Women generally live longer than men, but women's longer lives are not necessarily healthy lives. The aim of this article is to describe the pattern of gender differences in expected years with and without activity limitations across 25 EU countries and to explore the association between gender differences and macro-level factors. We applied to the Eurostat life table's data from the Statistics of Income and Living Conditions Survey to estimate gender differences in life expectancy with and without activity limitations at age 50 for 2005. We studied the relationship between the gender differences and structural indicators using meta-regression techniques. Differences in years with activity limitations between genders were associated with the life expectancy (LE) and the size of the gender difference in LE. Gender difference in years with activity limitations were larger as the gross domestic product, the expenditure on elderly care and the indicator of life-long learning decreased, and as the inequality in income distribution increased. There was evidence of disparity in the associations between the more established EU countries (EU15) and the newer EU10 countries. Among the EU15, gender differences were positively associated with income inequality, the proportion of the population with a low education and the men's mean exit age from labour force. Among the EU10, inequalities were smaller with increasing expenditure in elderly care, with decreasing poverty risk and with decreasing employment rate of older people. The association between structural indicators and the gender gap in years with activity limitations suggests that gender differences can be reduced.

Keywords Gender inequality · Health expectancy · Life expectancy · Healthy life years · Global Activity Limitation Index

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Introduction

It is well known that males and females differ in terms of their life expectancy and overall health. Males have a higher mortality than females in terms of both total mortality and for most causes of death (Barford et al. 2006). Men's higher mortality is due in part to gender differences in risk-taking and health-related behaviour (e.g., males have higher rates of cigarette smoking and heavy drinking) and gender differences in employment. Several biological hypothesis have also been proposed including more active female immune functioning, the protective effect of estrogen, compensatory

effects of the second X chromosome, reduction in the activity of growth hormone and the insulin-like growth factor 1 signaling cascade, and the influence of oxidative stress on aging and disease (Austad 2006). There is a remarkable discrepancy between the health and the mortality of men and women. Despite the lower mortality at all ages compared to men, women's longer lives are not necessarily healthy lives and men tend to report a better self-assessed health and fewer disabilities. This phenomenon is called the male–female health-survival paradox (Oksuzyan et al. 2008). Proposed explanations for this paradox are rooted in biological, social and psychological interpretations. In addition to the above mentioned factors, there may be a reluctance or delay for men to seek and to comply with medical treatment. It cannot be excluded that part of the differences in morbidity may be due to methodological challenges such as differential participation or underreporting of health problems by gender.

Studying cross-sectional differences in composite indicators, such as health expectancies, which combine both mortality and morbidity, may contribute to the better understanding of the dynamics of population health and gender differences. Health expectancies, predominantly disability-free life expectancies (DFLE), are available for over 50 countries worldwide including many European countries, but cross-national comparisons have been difficult because of a lack of consistency of health measures and calculation methods (Robine et al. 2003). Both of these factors have been minimized with the healthy life years (HLY) indicator. In particular harmonisation at the point of data collection, by the use of a single survey across the EU25, called the Statistics of Income and Living Conditions (SILC), has aided comparability of the underlying measure of disability.

In most study reports on life and health expectancy, the indicators are presented stratified by gender. However, few go beyond the mere description and explore the role of determinants on the gender difference (Bélanger et al. 2005; Crimmins et al. 2002; Pérès et al. 2005). The aim of this article is to describe the pattern of the gender difference in life expectancy, the life expectancy with and without activity limitations at age 50 across 25 EU countries and to explore the association with macro-level factors that may explain any diversity in gender difference in life expectancy with activity limitations between countries.

Methods

Data

Life expectancy in a particular health state, e.g., life expectancy without disability or life expectancy with disability is defined as the average number of years a person at a certain age is expected to live in the particular health state. To assess these health expectancies, two types of data are needed. Data on mortality enable the estimation of the total life expectancy. Data on the prevalence of different health states are applied to the life table to estimate the person time lived in the different health states.

Full life and health expectancy tables were downloaded from the EHEMU Information System (http://www.ehemu.eu/database/). The disability data came from SILC-2005 survey. The SILC survey is a European wide survey. The implementation of the SILC survey by the European Member States is based on a common framework regulation to enhance the between-countries comparability. The framework defines the survey design (a nationally representative probabilistic samples from the community dwelling population), the use of common concepts (household and income) and classifications, the use of harmonized lists of target variables and common requirements (for imputations, weighting, sampling errors calculations). A description of the methodological details can be found in the comparative quality report (Eurostat 2008). The participation of households was above 80% in nine member states and above 60% in all other countries with the exception of the Netherlands. Participation rate did not differ by gender.

The SILC contains the Minimum European Health Module (MEHM), devised by the Euro-REVES group (Robine and Jagger 2003). The Minimum European Health Module has three questions, including a disability measure, the Global Activity Limitation Index (GALI) (Van Oyen et al. 2006). To ensure a maximum harmonization of the Minimum European Health Module questions in the SILC at the point of the data collections, all Member States received (1) definitions of the concepts included in the GALI and (2) translation guidelines for the translation of the item to the underlying concepts. Checks were made on whether there were any cultural issues that were likely to impair understanding or reporting (Robine and Jagger 2003). The GALI instrument ("for at least the last 6 months, have you been limited because of a health problem in activities people usually do?") aims to capture long-term limitation (>6 months) in usual activities, caused by ill-health with three severity levels: none, limited but not severely and severely limited (except for Denmark where there were only two response categories: limited or not). The Disability-Free Life Expectancy based on the GALI is called the HLY. The HLY was selected in 2004 to be one of the structural indicators of the EU. The HLY at age 50 years is the average number of years a person of age 50 years is expected to live without activity limitations. As no distinction is made by the severity level of the activity limitations, the difference between the life

expectancy and the life expectancy without limitations defines the life expectancy with activity limitations.

We obtained from the Eurostat website (http://epp.eurostat.ec.europa.eu/) the relevant macro-level factors, structural indicators, for each country. The indicators cover broad areas of wealth and expenditure (GDP, poverty risk for aged 65+, inequality of income distribution, expenditure on elderly care), labour force participation [employment rate of older at age 55–64 years (gender specific), long-term unemployment rate (gender specific), mean exit age from labour force (gender specific)], and level of education [life-long learning (gender specific), low education attainment]. We defined four additional indicators as male–female differences for each of the sex-specific indicators. Definitions of the indicators and their quality grade are given in Table 1. Most indicators chosen included all adult age groups. Those for the older population (expenditure on elderly care and poverty risk for aged 65+) were chosen to reflect the country's provision for older people specifically. Data on the macro-level factors relates to 2005 with the exception of the expenditure on elderly care for which the most recent data was available for the year 2004.

Methods

The life expectancy with and without activity limitations at age 50 years were calculated using the Sullivan method, which integrates age-specific disability prevalence with the life table (Jagger et al. 2007; Sullivan 1971). Variance estimation of the life expectancies was calculated from complete life tables. Variance estimates of the life expectancy with and without activity limitations were calculated from abridged life tables with an open ended last age group of 85 years and over. As the variance due to mortality is negligible compared to the variance due to morbidity, we ignored the variance due to the mortality data when estimating the variance of the health expectancies (Jagger et al. 2007).

To investigate the relationships between either the gender differences at age 50 in the life expectancy or in life expectancy with activity limitations and country-specific structural indicators meta-regression models were fitted (Sutton and Abrams 2001). Within the meta-regression analysis the uncertainty around the country specific gender difference is accounted for.

Graphical data exploration indicated possible differences in the association between the gender difference in life expectancy with activity limitations at age 50 and the structural indicators in the original (EU15) and the more recent (EU10) European Member States (Table 2). In a first set of models each structural indicator was entered univariately, fitting separate models for the original (EU15) and more recent (EU10) countries. Although no formal tests for outliers or influential data points were carried out,

Table 1 Definition and quality grade of structural and sustainable indicators

Indicator	Definition	Quality grade[a]
Gross domestic product (GDP)	GDP per capita in purchasing power standards (EU-25 = 100)	A
Expenditure on elderly care	The share of social protection expenditure devoted to old age care (covering care allowance, accommodation, and assistance in carrying out daily tasks) as a percentage of GDP	Not available
Poverty risk for 65+ yrs	Persons aged 65 years and over with an equivalised disposable income below the risk-of-poverty threshold, which is set at 60% of the national median equivalised disposable income after social transfers, as a percentage of all aged 65 years and over	C
Inequality of income distribution	The ratio of total income received by the 20% of the population with the highest income (top quintile) to that received by the 20% of the population with the lowest income (lowest quintile)	C
Employment rate of older populations	Employed persons aged 55–64 years as a percentage of the total population of the same age group	A
Long term unemployment rate	Long-term unemployed (12 months and more) as a percentage of the total active population	A
Mean exit age from the labour force	Mean exit age from the labour force weighted by the probability of withdrawal from the labour market	Not available
Life-long learning	Percentage of the adult population aged 25–64 years participating in education and training over the 4 weeks before the survey	Not available
Low education attainment	Percentage of the population aged 25–64 years having completed at most lower secondary education (International standard classification of education level of two or less)	Not available

[a] *A* Data collected from reliable sources applying high standards of methodology/accuracy, with a common methodology for the EU and comparable over time; *C* Data might have to be interpreted with care as there may be incomparability across countries (including the lack of data) and breaks in series which hampers comparison over time source: Eurostat website (http://epp.eurostat.ec.europa.eu/)

Table 2 Gender differences in life expectancy, in expected years without and with activity limitations at age 50 in the EU, EU15 and EU10 countries, SILC 2005

Country	Life expectancy			Expected years without activity limitations			Expected years with activity limitations		
	Males	Females	Dif[a]	Males	Females	Dif	Males	Females	Dif
EU15									
Austria	29.08	33.71	4.63	14.53	15.66	1.13	14.55	18.04	3.49
Belgium	28.67	33.38	4.71	18.42	18.66	0.24	10.25	14.73	4.48
Denmark	28.29	31.94	3.65	23.64	24.12	0.48	4.66	7.82	3.16
Finland	28.48	34.15	5.67	12.86	13.87	1.01	15.62	20.28	4.66
France	29.58	35.36	5.78	18.01	19.74	1.73	11.56	15.63	4.07
Germany	28.96	33.42	4.46	13.56	13.55	−0.01	15.40	19.86	4.46
Greece	29.43	33.03	3.60	19.78	20.81	1.03	9.65	12.21	2.56
Ireland	29.49	33.24	3.75	18.91	20.17	1.26	10.59	13.07	2.48
Italy	30.37	35.30	4.93	20.63	20.86	0.23	9.74	14.45	4.71
Luxembourg	28.78	33.60	4.82	17.99	18.16	0.17	10.79	15.44	4.65
Netherlands	29.14	33.28	4.14	20.21	20.4	0.19	8.93	12.88	3.95
Portugal	28.12	32.93	4.81	14.9	12.67	−2.23	13.22	20.25	7.03
Spain	29.48	35.02	5.54	19.16	18.62	−0.54	10.32	16.40	6.08
Sweden	30.28	34.05	3.77	20.22	20.31	0.09	10.06	13.74	3.68
United Kingdom	29.47	32.69	3.22	19.74	20.78	1.04	9.72	11.91	2.19
EU10									
Cyprus	29.52	32.86	3.34	15.92	13.71	−2.21	13.60	19.15	5.55
Czech Republic	25.60	30.71	5.11	14.77	16.26	1.49	10.84	14.46	3.62
Estonia	22.42	30.53	8.11	9.05	10.42	1.37	13.37	20.10	6.73
Hungary	22.72	29.40	6.68	10.78	11.39	0.61	11.94	18.01	6.07
Latvia	21.31	29.32	8.01	11.02	12.74	1.72	10.29	16.58	6.29
Lithuania	21.74	29.90	8.16	11.49	11.86	0.37	10.25	18.04	7.79
Malta	29.07	32.75	3.68	21.68	22.58	0.90	7.39	10.16	2.77
Poland	24.62	31.22	6.60	16.48	20.16	3.68	8.14	11.07	2.93
Slovakia	23.68	29.95	6.27	12.28	13.07	0.79	11.40	16.89	5.49
Slovenia	26.81	32.44	5.63	15.34	17.25	1.91	11.47	15.19	3.72

[a] Dif: gender difference (females−males)

scatter plots (available upon request) of all relationships were assessed visually to ascertain if any relationships were the result of just one or two data points. In a second set of models, the member state specific level of life expectancy of males and females was additionally entered. In a last model the statistical significance of the interaction between the structural indicator and the EU15/EU10 countries was assessed.

Results

Tables 2 and 3 summarise the gender differences in life expectancy and expected years with and without activity limitations at age 50 in 2005. Life expectancy was always larger in females. The differences ranged between 3.2 and 8.2 years (median 4.8 years). The gender differences were larger in the newer EU (EU10) countries (median: 6.4 years) compared to the more established EU (EU15) countries (median: 4.6 years). Gender differences in life expectancy without activity limitations were also positive except in a few countries [Cyprus (−2.2 years), Portugal (−2.2 years) and Spain (−0.5 years)] were the expectation of life in good health at age 50 is greater in men. The gender difference in life expectancy without activity limitations ranged from −2.2 to 3.7 years and were in general larger in the newer EU countries compared to the more established EU countries (median: 1.1 vs. 0.2 years). Gender differences in years with activity limitations were between 2.2 and 7.8 years, with higher differences in the newer EU countries (median: 5.5 years) compared to the more established EU countries (median: 4.1 years).

The gender gap in life expectancy and in years with activity limitations tended to be larger in countries with

Table 3 Distribution of the gender differences in life expectancy, in expected years without and with activity limitations at age 50 in the EU, EU15 and EU10 countries, SILC 2005

	Life expectancy	Expected years without activity limitations	Expected years with activity limitations
EU25			
Minimum	3.22	−2.23	2.19
Percentile 25	3.77	0.19	3.49
Median	4.82	0.79	4.46
Percentile 75	5.78	1.26	5.55
Maximum	8.16	3.68	7.79
EU15			
Minimum	3.22	−2.23	2.19
Percentile 25	3.76	0.13	3.33
Median	4.63	0.24	4.07
Percentile 75	4.88	1.04	4.66
Maximum	5.78	1.73	7.03
EU10			
Minimum	3.34	−2.21	2.77
Percentile 25	5.24	0.66	3.65
Median	6.44	1.14	5.52
Percentile 75	7.68	1.66	6.24
Maximum	8.16	3.68	7.79

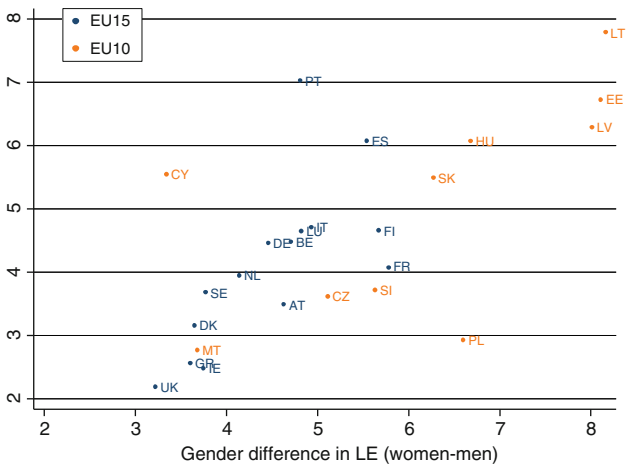

Fig. 1 Association between difference in LE (ΔLE) and differences in expected years with activity limitations (ΔAL) at age 50 years, SILC 2005

shorter life expectancy (Fig. 1). Furthermore, countries with large gender differences in life expectancy also tended to have larger gender differences in years with activity limitations. For the older EU Member States (EU15) there was a greater estimated increase in the gender difference in years with activity limitation ($\beta = 1.17$, $P < 0.01$), for a 1-year increase in the gender difference in life expectancy, than for the newer European Member States (EU10) ($\beta = 0.64$, $P = 0.020$).

The differences between genders in expected years with activity limitations were smaller as the expenditure on elderly care or the mean exit age from the labour force (males only, not statistical significant) increased, whereas the gender differences were larger as the inequality in income distribution increased (Table 4).

The analysis was repeated after stratification EU15/EU10 (Table 4). The stratified analysis decreased the power if the association did not differ between the two groups of EU countries (e.g., GDP, inequality of income distribution, life-long learning among men). However, the power increased when the associations were inconsistent (e.g., expenditure on elderly care, low education attainment, employment rate of older women and gender difference in life-long learning). The high coefficient of the expenditure on elderly care in the newer EU (EU10) countries was related to the narrow range (between 0.0 and 0.5%) whereas the values within the older EU (EU15) countries ranged up to 2.6%. An opposite direction of the association was observed for low education attainment, employment rate of older women and men, unemployment rate women and men and the gender difference in the unemployment rate, life-long learning women and gender difference in life-long learning.

Because the size of the gender gap in years with activity limitations was associated with the gender difference in life expectancy, the life expectancy of women and men were added to the model (Table 5). In a final model (Table 6), the statistical significance of the heterogeneity of the association between the more established (EU15) and newer (EU10) EU countries was tested using an indicator variable to identify EU15/EU10 countries and interaction terms.

In contrast to the older EU countries (EU15), within the newer EU countries, the life expectancy of men and life expectancy of women was not significantly associated with the gender difference in expected years with activity limitations (Table 5). Within the older EU countries, the effect of the life expectancy of men was stronger compared to the life expectancy of women. After the inclusion of the life expectancy in model, the gender gap in years with activity limitations among the older EU (EU15) countries increased with increasing income inequality, with increasing proportion of the population with low education and with an increasing mean exit age from the labor force among men. Among the newer EU (EU10) countries the gender gap in years with activity limitations increased with increasing poverty risk for the 65 years and older and with increasing employment rates among men and women. The gender difference in years with activity limitations was negatively associated with the expenditure on elderly care, indicating that the gender gap was larger in countries with a lower expenditure on elderly care.

Table 4 Univariate association of the structural indicators on the gender difference in expected years with activity limitations at age 50 by EU15 and EU10 countries, SILC 2005

	EU	EU15	EU10
Gross domestic product	−0.01*	−0.01	−0.04
Expenditure on elderly care	−0.99*	−0.55	−7.02
Poverty risk for 65+ yrs	0.01	0.00	0.03
Inequality of income distribution	0.46*	0.28	0.53
Low education attainment	0.00	0.05**	−0.04
Employment rate of older women	0.03	−0.01	0.09
Employment rate of older men	−0.03	−0.04	0.07
Gender difference employment rate	0.03	0.02	0.07
Long term unemployment rate women	−0.14	0.10	−0.11
Long term unemployment rate men	0.25	0.28	−0.07
Gender difference long term unemployment rate	−0.12	0.03	−0.90
Life-long learning women	0.26*	−0.04	0.00
Life-long learning men	−0.43**	−0.05	−0.24
Gender difference life-long learning	−0.05	−0.14	0.50
Mean exit age from the labour force women	0.16	0.08	0.35
Mean exit age from the labour force men	−0.44	−0.20	−2.35
Gender difference mean exit age	0.16	0.52*	1.33

* Significant at $P = 0.05$,
** Significant at $P = 0.01$

Table 5 Life expectancy adjusted association of the structural indicators on the gender difference in expected years with activity limitations at age 50 by the more established (EU15) and newer (EU10) EU countries, SILC 2005

Structural indicator	EU15			EU10		
	LE♀	LE♂	INDIC	LE♀	LE♂	INDIC
None	1.14**	−1.59**	/	0.00	−0.39	/
Gross domestic product	1.12**	−1.60**	−0.01	0.08	−0.77	0.08
Expenditure on elderly care	1.13**	−1.58**	−0.00	−0.74	0.01	−6.30**
Poverty risk for 65+ yrs	1.15**	−1.62**	0.02	−0.75	−0.27	0.10**
Inequality of income distribution	1.20**	−1.74**	0.41*	−0.11	−0.32	0.09
Low education attainment	0.94**	−1.42**	0.04**	0.00	−0.40	0.00
Employment rate of older women	1.15**	−1.59**	0.00	−0.55	0.05	0.07*
Employment rate of older men	1.40**	−1.85**	0.03	0.07	−0.49	0.09**
Gender difference employment rate	1.21**	−1.74**	−0.02	0.54	−0.85	−0.07
Long term unemployment rate women	1.11**	−1.58**	0.05	−0.13	−0.40	−0.20
Long term unemployment rate men	1.10**	−1.54**	0.08	−0.10	−0.44	−0.23
Gender difference long term unemployment rate	1.13**	−1.61**	0.05	−0.13	−0.29	−0.64
Life-long learning women	1.08**	−1.53**	−0.01	0.01	−0.40	0.00
Life-long learning men	1.09**	−1.54**	−0.02	0.31	−0.48	−0.11
Gender difference life-long learning	1.07**	−1.51**	−0.04	−0.51	−0.04	0.31
Mean exit age from the labour force women	1.27**	−1.61**	0.22			
Mean exit age from the labour force men	1.56**	−2.04**	0.38*			
Gender difference mean exit age	1.07**	−1.43**	0.14			

* Significant at $P = 0.05$, ** Significant at $P = 0.01$. *LE* Coefficient of the life expectancy at age 50, *INDIC* coefficient of the structural indicator

There was evidence that the association between the structural indicators and the gender difference in years with activity limitations was significantly different for the more established EU countries (EU15) compared to the newer EU (EU10) countries in terms of GDP, the expenditure on elderly care, poverty risk for the 65 year and older and the employment rate of older women (Table 6). For the poverty risk for the 65 years and older, and for the employment rate of older women, the positive association was stronger in the newer EU countries. The negative association between the gender difference in life expectancy with activity limitations and the expenditure on elderly care was

Table 6 Evaluation of the heterogeneity between the more established (EU15) and newer (EU10) EU countries in the association of the structural indicators on the gender difference in expected years with activity limitations (ΔAL_{50}) at age 50, SILC 2005

	LE♀	LE♂	INDIC	EU	LE♀*EU	LE♂*EU	INDIC*EU
Structural indicator							
None	1.13**	−1.58**	/	3.12	−1.14	1.18*	/
Gross domestic product	1.11**	−1.59**	−0.01	2.66	−1.03	0.82	0.08*
Expenditure on elderly care	1.13**	−1.58**	0.00	17.03	−1.88**	1.60**	−6.31**
Poverty risk for 65 + yrs	1.16**	−1.62**	0.02	20.98	−1.90**	1.35**	0.08*
Inequality of income distribution	1.18**	−1.69**	0.40	4.23	−1.27	1.35*	−0.34
Low education attainment	0.91**	−1.36**	0.04*	3.68	−0.93	0.96	−0.04
Employment rate of older women	1.15**	−1.59**	0.00	7.30	−1.71*	1.64**	0.07*
Employment rate of older men	1.40**	−1.85**	0.03	1.07	−1.34	1.36**	0.06
Gender difference employment rate	1.19**	−1.71**	−0.02	−5.33	−0.65	0.85	−0.05
Long term unemployment rate women	1.10**	−1.57**	0.06	7.40	−1.23	1.17*	−0.26
Long term unemployment rate men	1.09**	−1.53**	0.08	8.68	−1.20	1.09	−0.31
Gender difference long term unemployment rate	1.12**	−1.60**	0.05	3.74	−1.25	1.31*	−0.70
Life-long learning women	1.07**	−1.52**	−0.01	2.90	−1.10	1.13	0.01
Life-long learning men	1.07**	−1.53**	−0.01	−3.72	−0.80	1.06	−0.09
Gender difference life-long learning	1.06**	−1.50**	−0.04	9.12	−1.58	1.47*	0.35
Mean exit age from the labour force women	1.27**	−1.61**	0.22	95.57	−3.52*	1.83	−0.62
Mean exit age from the labour force men	1.56**	−2.04**	0.38*	112.98	−3.08**	2.22*	−1.26
Gender difference mean exit age	1.07**	−1.43**	0.14	71.85	−3.91	1.69	−0.87

* Significant at $P = 0.05$, ** significant at $P = 0.01$. *LE* Coefficient of the life expectancy at age 50, *INDIC* Coefficient of the structural indicator. *EU*: 1 = EU 10 country; 0 = EU15 country

larger in the newer EU countries. For the GDP, the association with the gender difference in life expectancy with activity limitations was negative in the older EU15 countries, whereas it was positive in the newer EU10 countries.

Discussion

In this article we evaluated the association of the gender differences in life expectancy with activity limitations within the EU with macro-level structural indicators. The life expectancy with activity limitations was estimated using the GALI. The GALI instrument has been validated both within countries by comparing subpopulations with different cultural backgrounds and between different European countries. The GALI appears to be reliable and to reflect levels of function and disability both across Europe and in a similar way between countries (Cox et al. 2009; Jagger et al. 2010). Given the focus of the article on gender difference within European countries in life and health expectancy at age 50 and its association with macro-level structural indicators, it is essential that the validity of the GALI is homogeneous across gender. This question has been addressed using data from the Belgian Health Interview Survey, reporting no evidence of heterogeneity of the validity of the GALI by gender (Van Oyen et al. 2006).

We observed that the size of the gender differences in life expectancy with and without activity limitations at age 50 is larger in the newer EU (EU10) countries compared to older EU member states that comprise the EU15. Countries with a large gender difference in years with activity limitations tend to have a smaller life expectancy and a larger gender inequality in the life expectancy.

Overall, within the EU, the gender gap in years with activity limitations decreased as the GDP, the expenditure on elderly care and the life-long learning among men increased while the gender inequality in years with activity limitations increased with an increasing inequality in the income distribution. The association between the gender difference in years with activity limitations and some of the structural indicators (GDP, expenditure on elderly care, poverty risk for people 65 years and older, employment rate of older women) was not the same comparing the new (EU10) and old (EU15) European countries. For the GDP, the effects were opposite. For the other indicators with a significant interaction, the effect in the newer (EU10) EU countries was larger compared to the older (EU15) EU countries.

International research on health expectancies is often hampered by imperfect harmonization of the health measures and the exclusion of the institutional population. The focus of the article on gender differences helps reducing

these effects as the same instruments applied to men and women in each country. However, studying gender differences cannot completely eliminate these effects due to country-specific differences in male and female institutionalization rate, health status and social roles for which men and women might feel restricted (paid work, household or caring activities).

We first discuss the fact that the SILC survey is limited to the community dwelling population and no information is available on the health status of the institutionalized population. This limits the use of the assumption that all institutionalized people are disabled (Sullivan 1971). However, ignoring the differences in health status between the people in the general population and in institutions probably leads to an overestimation of the expected years without activity limitations and an underestimation of the years with activity limitations. It is unknown if this error occurred similarly in both genders in which case it would not affect the gender differences. Even so, the over- or under-estimation may be larger in countries with a higher proportion of the population in institutions and this may have an influence on the observed associations with the macro-level factors.

A second limitation is related to the fact that the harmonization at the point of data collection may not have been perfect. This was e.g., the case with the instrument used in Denmark and this may have resulted in an overestimation in the expected years without limitations and an underestimation of the expected years with activity limitations (Jagger et al. 2008). Although the focus on gender differences could diminish this problem, data analysis were repeated after exclusion of Denmark to evaluate the possible effect of this methodological problem (detailed results are available upon request from the corresponding author). Removing the information from Denmark did not change the distribution of the gender differences in the expected years with activity limitations and the difference between the older and more recent EU countries remained similar. The conclusion of the univariate analysis did not alter both at the level of all member states or when the analysis was limited to the older EU countries.

After exclusion of the Danish data, the analysis could also focus on the moderate and/or severe activity limitations and evaluate the robustness of using different outcome levels. Countries with large gender differences in life expectancy also have large gender differences in the expected years with moderate or with severe activity limitations. The gender gap in expected years with activity limitations was larger in the newer EU (EU10) countries and this is a result of both the larger gender gap in expected years with moderate and with severe limitations.

One should always be cautious when interpreting ecological associations. However, the directions of the associations between the gender inequality in years with activity limitations and the structural indicators are as expected, e.g., in countries with either a more extreme income inequality, an increased risk of poverty at older ages; a lower GDP or less expenditure on health care the inequality in years with activity limitations by gender tend to be larger. There is increasing evidence of a reduced health and health expectancy in less privileged social populations (Cambois et al. 2001; Matthews et al. 2006). The impact of social conditions seems to be more important for men. Next to methodological reasons, e.g., social position measures such as occupational status and education are reflecting better the social situation of men when measured at the household level, the greater negative health impact of the social position in men can also be a result of other mechanisms such as (1) differences in type of industrial evolution resulting in more unhealthy work related exposures and outcomes, (2) negative life styles such as smoking, alcohol and violence with a more extreme uptake among males in lower social groups. This may however, change due to the increasing participation of women in the labour force during recent decades and the evidences of the physically and psychologically health damaging impact of women's implication in both professional and domestic activities, especially in the less privileged social groups (Hunt and Ellen 1993; Lahelma et al. 2002). On the other hand, in countries where men take more opportunities for life-long learning, the health dynamics between males and females favour the catching up of males, reducing the gender gap.

Conclusion

We have shown that the gender differences in life and health expectancy at age 50 diverge among the European countries with larger differences in the EU10 compared to the EU15. The fact that association between macro-level structural indicators and the gender gap in years with activity limitations is not homogenous between the more established EU15 countries and the ten new EU countries indicates that there is room for improvement. Special attention should be given to the expenditure on elderly care, poverty risk at older ages and inequalities in income distribution.

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