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Comparison of socio-economic indicators explaining inequalities in Healthy Life Years at age 50 in Europe: 2005 and 2010

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Background: The first estimates of Healthy Life Years at age 50 (HLY50) across the EU25 countries in 2005 showed substantial variation in healthy ageing. We investigate whether factors contributing to HLY50 inequalities have changed between 2005 and 2010. **Methods:** HLY50 for each country and year were calculated using Sullivan's method, applying the age-specific prevalence of activity limitation from the European Union Statistics on Income and Living Conditions (EU-SILC) survey to life tables. Inequalities in life expectancy at age 50 (LE50) and HLY50 between countries were defined as the difference between the maximum and minimum LE50 or HLY50. Relationships between HLY50 and macro-level socio-economic indicators were investigated using meta-regression. Men and women were analysed separately. **Results:** Between 2005 and 2010 HLY50 inequalities for both men and women in Europe increased. In 2005 and 2010 HLY50 inequalities exceeded LE50 inequalities, particularly in the established EU15 countries in 2010 where HLY50 inequalities (men: 10.7 years; women: 12.5 years) were four times greater for men and three times for women than LE50 inequalities (men: 2.4 years; women: 4.1 years). Only material deprivation significantly explained variation in EU25 HLY50 in both years with, additionally, long-term unemployment in 2010. **Conclusions:** Our results suggest that inequalities in HLY50 across Europe are large, increasing and partly explained by levels of material deprivation. Moreover long-term unemployment has become more influential in explaining variation in HLY50 between 2005 and 2010.

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Introduction

Life expectancy (LE) in the European Union continues to steadily rise,¹ but differently between countries.² However, with the growth of the older population, particularly the very old, LE is no longer sufficient as the sole measure of population health and there is a need to monitor quality as well as quantity of remaining life to ensure that the extra years of life are healthy ones. Consequently LE is increasingly being supplemented by health expectancy which combines mortality and morbidity in one indicator.³ Within Europe a disability-free life expectancy (DFLE), Healthy Life Years (HLY), was first identified as a structural indicator in the Lisbon Strategy⁴ and continues as a sustainable development indicator (SDI) in the subsequent Europe 2020 strategy,⁵ being the headline SDI for the public health theme.

The first estimates of HLY at age 50 (HLY50) in 2005 showed large inequalities across Europe which exceeded inequalities in LE at age 50 (LE50), and with variation in HLY50 being associated with various macro (country level) structural indicators: Gross Domestic Product

(GDP) and expenditure on elderly care (both positively associated with the number of HLY50 for men and women), long-term unemployment rate (negatively associated), and both life-long learning and low education attainment (positively associated with HLY50 for men only).⁶ Since 2005 the levels of many of these factors have not only changed but changed differentially between countries, not least because of the economic crisis. Moreover some of the variation in HLY50 between countries may have been the result of differences in the wording of the underlying health measure, the Global Activity Limitation Indicator (GALI) due to suboptimal translation.^{7,8} In 2005, the GALI was a new indicator and in subsequent years several countries changed the wording of their GALI seeking to better conform to the English standard. Most change took place in 2008 when Eurostat coordinated a joint harmonization exercise which significantly improved the comparability of translations.⁹ It is of interest therefore, to assess whether the same factors are associated with variation in more recent values of HLY50, or whether some factors have gained in importance.

The aim of this article is 4-fold. First we repeated the same study as previously⁶ but 5 years later with more comparable survey data, to assess how inequalities in HLY50 and LE50 for men and women across EU countries have changed between 2005 and 2010. We focus on HLY50 for comparability with the previous analysis⁶ and since social inequalities in self-reported health increase in early old age.¹⁰ Second, we use HLY50 as an indicator of the ability to reach retirement age without disability (and therefore as an indicator of the potential to extend working life of older people) and compare this for countries in 2005 and 2010. Third, we investigated the extent to which the macro-level indicators that were associated with inequalities in HLY50 in 2005 are still major explanatory factors for the variation in HLY50 in 2010. Finally we explore whether the new indicator of material deprivation, known to be linked to ill health,¹¹ is also associated with inequalities in HLY50 in 2010. We concentrate on the 25 countries that made up the European Union in 2005 as well as subgroupings of the 'established' EU15 and 'newer joined' EU10 countries. This is to allow comparison with the results obtained from the previous study.⁶

Methods

Healthy Life Years

Estimates of LE50 and HLY50 for each EU country for 2005 and 2010 and for men and women separately were obtained from the Eurohex database.¹² HLY for each of the EU countries were calculated by Sullivan's method¹³ which applies the age-specific prevalence of disability to a standard life table for the same period as the survey providing disability data. The prevalence of disability was estimated from the GALI question in the EU-SILC survey. Each country translated the standard GALI question into their own languages for their respective surveys. The standard GALI question in English has the form: 'For at least the past 6 months, to what extent have you been limited because of a health problem in activities people usually do? Would you say you have been; 1. severely limited, 2. limited but not severely, or 3. not limited at all?'. To calculate HLY, we define disability as any limitation. The HLY indicator derived from the GALI question reflects the consequences of health conditions on the individual's ability to carry out activities that people usually do.

Explanatory variables

To investigate factors associated with inequalities in HLY and for comparability with the previous analysis,⁶ we used structural and/or sustainable indicators for each country obtained from the Eurostat

database.¹⁴ These indicators represent various aspects of a country's socio-economic status and difficulties which may be linked to the general level of health of the country's population. Globally they belong to three broad domains, well known for their impact on health: wealth, work and education, but they also cover four of the ten themes of the SDI: socio-economic development, social inclusion, demographic changes and public health. Specifically, we included: GDP, poverty risk for those aged over 65 years, inequality of income distribution, employment rate of older workers, long-term unemployment rate, life-long learning, low education attainment and material deprivation. We omitted two indicators that had been included previously: expenditure on elderly care as this was not available after 2008 and mean exit age from the labour force which had problems with quality.¹⁵ Material deprivation was included for the first time in 2010 (but could be calculated for 2005) and relates to households having an enforced lack of at least three of nine economic and durable items. Definitions of the indicators along with their quality grade (which assesses comparability across countries) are given in the supplementary material (table S1).

Statistical analysis

Level of inequality for LE50 and HLY50 was defined as the difference between the maximum and minimum LE50 or HLY50 among countries. Significant changes in the indicators between 2005 and 2010 were assessed by a Wilcoxon signed rank test. Relationships between HLY50 and the indicators were investigated using meta-regression,¹⁶ employing permutation tests to adjust the *P* values for multiplicity.¹⁷ All analyses were performed separately for men and women.

In 2005 the EU was made up of 25 countries, Romania and Bulgaria becoming members in 2007. All analyses were first performed on the EU25 as a whole and then sub-group analyses for the established EU15 and newer joined EU10 countries, for comparison with previous results.⁶ We also performed separate analyses for all EU27 countries for 2010 to compare estimates.

Results

First we document how inequalities in HLY50 and LE50, explained by the range of values for the countries, have changed between 2005 and 2010. Inequality in LE50 between the EU25 countries grew slightly for women (from 6.1 to 6.4 years) with larger increases in the newer EU10 members (from 3.6 to 4.6 years) than in the established EU15 (from 3.5 to 4.1 years) (table 1). LE50 inequalities for men in the EU25 remained relatively unchanged (from 9.0 to 8.9 years) but, as for women, larger increases were seen in the new EU10

Table 1 Values and inequalities (range) of life expectancy (LE50) and healthy life years (HLY50) at age 50 for men and women in 2005 and 2010, EU25, established EU15 and newer EU10 countries

	Country grouping	Measure	Men 2005	Men 2010	Change men 2005–10	Women 2005	Women 2010	Change women 2005–10
LE50	EU25	Value	28.6	29.8	1.2	33.5	34.6	1.1
		Range	9.0 (21.3, 30.3)	8.9 (22.6, 31.5)	–0.1	6.1 (29.3, 35.4)	6.4 (30.4, 36.8)	0.3
LE50	EU15	Value	29.4	30.6	1.2	34.0	35.1	1.1
		Range	2.2 (28.1, 30.3)	2.4 (29.1, 31.5)	0.2	3.5 (31.9, 35.4)	4.1 (32.7, 36.8)	0.6
LE50	EU10	Value	24.3	25.5	1.2	30.7	31.8	1.1
		Range	8.2 (21.3, 29.5)	8.8 (22.6, 31.4)	0.6	3.6 (29.3, 32.9)	4.6 (30.4, 35.0)	1.0
LE50	EU27	Value	N/A	29.4	N/A	N/A	34.3	N/A
		Range	N/A	8.9 (22.6, 31.5)	N/A	N/A	7.0 (29.8, 36.8)	N/A
HLY50	EU25	Value	17.4	17.9	0.5	18.2	18.6	0.4
		Range	14.5 (9.2, 23.7)	15.5 (9.9, 25.4)	1.0	13.5 (10.6, 24.1)	16.3 (9.7, 26.0)	2.8
HLY50	EU15	Value	18.0	18.6	0.6	18.5	19.1	0.6
		Range	10.8 (12.9, 23.7)	10.7 (14.7, 25.4)	–0.1	11.3 (12.8, 24.1)	12.5 (13.5, 26.0)	1.2
HLY50	EU10	Value	14.6	14.2	–0.4	16.9	15.9	–1.0
		Range	12.6 (9.2, 21.8)	13.3 (9.9, 23.2)	0.7	12.1 (10.6, 22.7)	14.1 (9.7, 23.8)	2.0
HLY50	EU27	Value	N/A	17.7	N/A	N/A	18.4	N/A
		Range	N/A	15.5 (9.9, 25.4)	N/A	N/A	16.3 (9.7, 26.0)	N/A

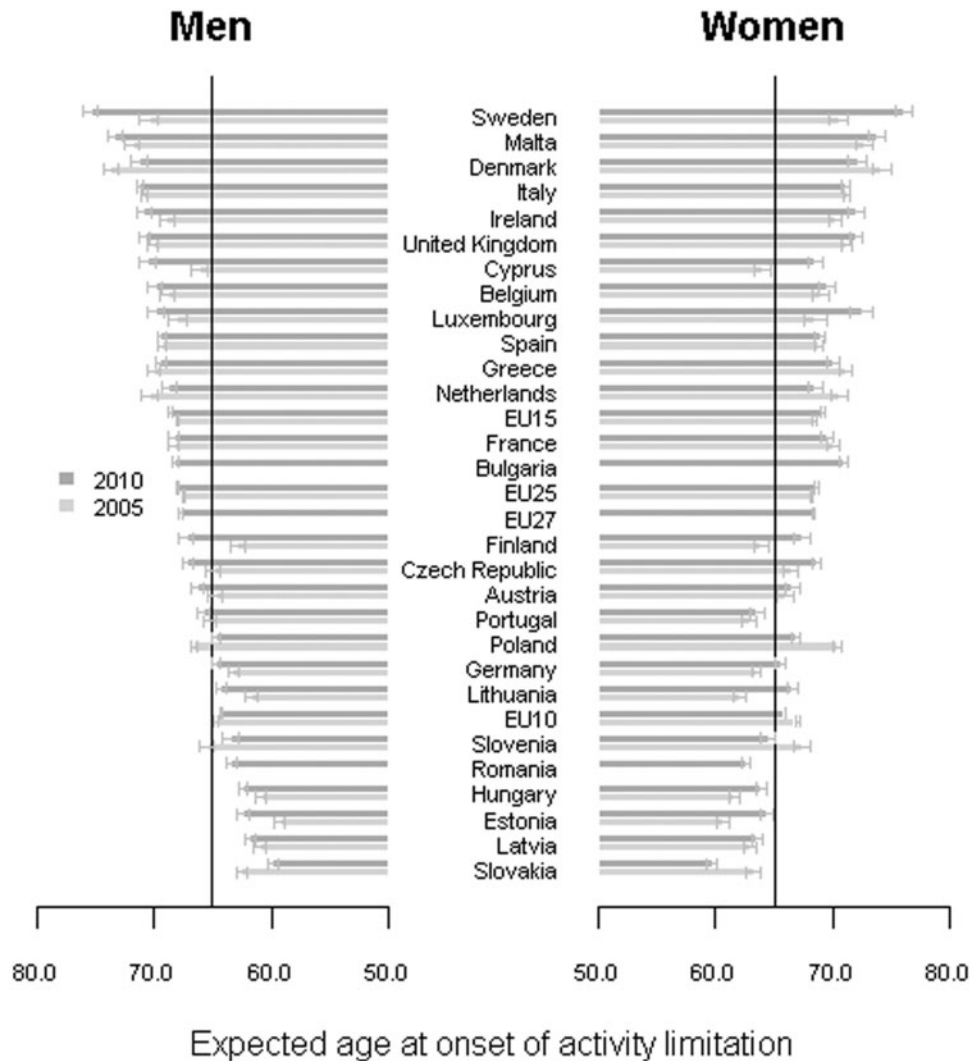


Figure 1 Age of onset of activity limitation in the EU27 countries in 2005 and 2010, by gender

(8.2–8.8 years) to the established EU15 (from 2.2 to 2.4 years) countries.

In both 2005 and 2010, HLY50 inequalities exceeded those in LE50 for men and women; HLY50 inequalities were more than twice those of LE50 for EU25 women, more than three times for women in new (EU10) and established (EU15) countries, 1.5 times for men in the EU25 and the EU10 and more than four times for EU15 men (table 1). Between 2005 and 2010 HLY50 inequalities for men and women increased by more than the increases in LE50 inequalities. HLY50 inequalities increased by 2.8 years for EU25 women, more in the new EU10 (2.0 years) than the established EU15 countries (1.2 years), and by 1.0 year for EU25 men, with again greater increases in the new EU10 (0.7 years) than the established EU15 countries (decrease of 0.1 years) (table 1). Inequalities in LE50 and HLY50 for the EU27 in 2010 were identical to those for the EU25 except for LE50 for men (EU25: 6.4 years, EU27: 7.0 years).

Figure 1 shows the approximate average duration of life free from activity limitation (HLY50+50) for each country in relation to 65 years (the state retirement age in over half the EU countries) to assess the potential of further extending working life. In 2005, the average duration of life free of activity limitation for men was below 65 in nine EU25 countries (three EU15, six EU10) and by 2010 this had reduced to eight (one EU15, seven EU10) (figure 1). For women in 2005, the average duration of life free of activity limitation was below 65 in nine EU25 countries (three EU15, six EU10) reducing by 2010 to six (one EU15, five EU10). A further seven countries had an

average duration of life free of activity limitation between 65 and 68 years in 2010 and are therefore 'at risk' as countries increase their state retirement age.

Explaining inequalities in HLY50

Values of the indicators used in the meta-regression analyses for each country are shown in supplementary tables S2 (2005) and S3 (2010). Between 2005 and 2010 significantly worse values were observed for the following indicators: poverty risk of people aged 65 years and over (median increase = 2.4%, $P = 0.012$), employment rate of older women workers (median decrease = 4.5%, $P < 0.0001$), low education in men (median increase = 4.4%, $P < 0.0001$) and women (median increase = 3.1%, $P < 0.0001$); material deprivation in women (median increase = 1.1%, $P = 0.024$) and significantly better values for long-term unemployment in men (median decrease = 0.6%, $P = 0.049$). In 2005, only material deprivation showed a significant (negative) association ($P = 0.018$) with HLY50 for men in the EU25 with weaker evidence for women ($P = 0.089$) (table 2) and this remained in 2010 with the association strengthened, particularly for women ($P = 0.015$). Thus, a 10% increase in the proportion of the population classified as materially deprived was associated with a reduction of HLY50 for EU25 men of 1.25 years (95% CI: 0.68–2.36 years) in 2005 and 2.19 years (95% CI: 1.01–2.27 years) in 2010, whereas a 10% increase in the proportion materially deprived was associated with a reduction in HLY50 for women of 1.27 years (95% CI: 0.41–2.13 years) in 2005

Table 2 Meta-regression analyses of factors associated with HLY50 in Europe (EU25), by gender and year (2005, 2010)

EU25	2005				2010			
	Men		Women		Men		Women	
	Coefficient (SE)	P value*	Coefficient (SE)	P value*	Coefficient (SE)	P value*	Coefficient (SE)	P value*
GDP	0.042 (0.017)	0.114	0.038 (0.018)	0.266	0.044 (0.017)	0.080	0.047 (0.016)	0.050
Poverty risk for people ≥65 years (%)	0.066 (0.077)	0.949	0.011 (0.079)	1.000	0.149 (0.104)	0.635	0.056 (0.105)	0.997
Inequality of income distribution	1.119 (0.851)	0.662	0.120 (0.998)	1.000	2.352 (0.960)	0.112	0.803 (1.169)	0.986
Employment rate of older workers (%)	0.067 (0.075)	0.959	-0.038 (0.058)	0.991	0.193 (0.082)	0.209	0.026 (0.063)	1.000
Long term unemployment rates (%)	-0.68 (0.292)	0.200	-0.185 (0.264)	0.989	-0.71 (0.228)	0.033	-0.821 (0.270)	0.052
Life-long learning (%)	0.258 (0.122)	0.279	0.149 (0.092)	0.584	0.275 (0.120)	0.176	0.169 (0.077)	0.230
Low education attainment (%)	0.099 (0.042)	0.108	0.077 (0.043)	0.424	0.107 (0.043)	0.094	0.080 (0.046)	0.454
Material deprivation (%)	-0.15 (0.043)	0.018	-0.127 (0.044)	0.089	-0.21 (0.060)	0.005	-0.197 (0.057)	0.015

* P < 0.05 shown in bold

Table 3 Meta-regression analyses of factors associated with HLY50 in new EU10 and established EU15 countries, by gender and year (2005, 2010)

	2005				2010			
	Men		Women		Men		Women	
	Coefficient (SE)	P value	Coefficient (SE)	P value	Coefficient (SE)	P value	Coefficient (SE)	P value
EU10								
GDP	0.131 (0.071)	0.648	0.080 (0.086)	0.979	0.213 (0.077)	0.155	0.136 (0.086)	0.701
Poverty risk for people ≥65 years (%)	0.068 (0.095)	0.991	-0.008 (0.105)	1.000	0.207 (0.123)	0.590	0.120 (0.123)	0.938
Inequality of income distribution	1.635 (1.592)	0.900	1.058 (2.123)	0.999	3.045 (1.422)	0.422	2.063 (1.786)	0.883
Employment rate of older workers (%)	-0.035 (0.123)	1.000	-0.205 (0.073)	0.202	0.203 (0.157)	0.805	-0.099 (0.097)	0.934
Long-term unemployment rates (%)	-0.134 (0.413)	1.000	0.187 (0.386)	0.999	-0.819 (0.300)	0.163	-1.195 (0.351)	0.026
Life-long learning (%)	0.414 (0.422)	0.928	-0.023 (0.363)	1.000	0.256 (0.397)	0.992	0.018 (0.287)	1.000
Low education attainment (%)	0.162 (0.054)	0.239	0.125 (0.053)	0.453	0.197 (0.060)	0.103	0.149 (0.050)	0.215
Material deprivation (%)	-0.119 (0.077)	0.761	-0.102 (0.083)	0.912	-0.167 (0.126)	0.766	-0.143 (0.110)	0.822
EU15								
GDP	0.003 (0.021)	1.000	0.010 (0.023)	0.999	0.008 (0.017)	1.000	0.026 (0.019)	0.696
Poverty risk for people ≥65 years (%)	0.025 (0.102)	1.000	0.010 (0.110)	1.000	0.000 (0.138)	1.000	-0.105 (0.161)	0.988
Inequality of income distribution	-0.117 (0.882)	1.000	-0.925 (0.970)	0.930	-0.949 (1.251)	0.980	-1.908 (1.324)	0.652
Employment rate of older workers (%)	0.096 (0.073)	0.827	0.006 (0.066)	1.000	0.092 (0.080)	0.876	0.052 (0.072)	0.980
Long-term unemployment rates (%)	-1.092 (0.522)	0.280	-0.200 (0.374)	0.997	-0.073 (0.319)	1.000	-0.345 (0.344)	0.888
Life-long learning (%)	0.091 (0.123)	0.989	0.092 (0.089)	0.905	0.127 (0.107)	0.843	0.125 (0.073)	0.501
Low education attainment (%)	0.004 (0.050)	1.000	-0.036 (0.060)	0.995	-0.013 (0.046)	1.000	-0.086 (0.062)	0.698
Material deprivation (%)	-0.041 (0.154)	1.000	-0.063 (0.150)	0.999	-0.129 (0.122)	0.906	-0.213 (0.129)	0.562

and 1.97 years (95% CI: 0.85–3.09 years) in 2010. Additionally in 2010, long-term unemployment rate was negatively associated with HLY50 for men ($P=0.033$), though not significantly so for women ($P=0.052$).

In the sub-group analyses, there was a significant association between HLY50 and long-term unemployment rate only for EU10 women in 2010 (table 3) whereas none of the indicators showed evidence of associations with HLY50 for men or women in the EU15 in 2005 or 2010 (table 3). Including Bulgaria and Romania in 2010 analyses weakened associations between HLY50 and material deprivation ($P=0.059$) and long-term unemployment rate ($P=0.053$) for men and removed associations for women (table S4, supplementary material).

Discussion

Between 2005 and 2010 we found that inequalities in LE50 in the EU25 increased slightly for women but remained unchanged for men, though the largest increases were observed in the newer EU10 countries. Inequalities in HLY50 exceeded those in LE50 in both 2005 and 2010 and, moreover, increased between 2005 and 2010 and by more than the increases in LE50 inequalities. Moreover by 2010 harmonization of the underlying health

question had improved substantially thus providing a more reliable estimate of the magnitude of HLY50 inequalities across the European Union. The average duration of life free from activity limitation in 2010 was 68.6 years for women and 67.9 years for men in the EU25 overall and, despite the increases in HLY50 inequalities, this was below age 65, state retirement age, for fewer EU15 countries in 2010 than 2005, suggesting a greater readiness for extending working life. Material deprivation was significantly associated with HLY50 for both men and women and in 2005 and 2010, levels of this indicator having significantly increased over the time period. Long-term unemployment was also significantly associated with HLY50 but only for men. The latter is despite a small but significant decrease on average in this indicator over the period, though there have been rises in long-term unemployment rates in a number of countries due to the economic crisis.^{19,20}

There are limitations and strengths to our study. We could not utilize exactly the same indicators as previously to explain variation in HLY50⁶ as two of these indicators (expenditure on elderly care, mean exit age from the labour force) were unavailable in 2010 or had quality issues, and had to be omitted. The sub-group analyses may have low power to detect associations due to the smaller sample size,¹⁸ as evidenced by the fact that the coefficient for the association

between long-term unemployment and HLY50 for men for the EU10 was slightly higher than that for the EU25 as a whole though did not reach significance as the standard error was much greater. Indeed these subgroupings (EU10, EU15) are not perfect as the EU10 group includes the non-Eastern European countries (Malta and Cyprus) which have HLY more in line with the established EU15 countries (figure 1). A further limitation is that our analyses are cross-sectional, so that causality of the associated factors cannot be inferred. Furthermore, the main limitation is that, despite a major improvement in 2008, the GALI instrument which underlies HLY is still not totally harmonized as, by 2010, only 14 countries including Romania and Bulgaria were fully comparable and a further seven partially comparable.⁹ Although this will be less problematic in the future (by 2012 only two countries were not fully comparable). Full comparability will not remove cultural variation in reporting health and limitation which may contribute to HLY50 inequalities. Research surveys such as Survey of Health, Ageing and Retirement in Europe (SHARE)¹⁹ might be better placed to address harmonization, being centrally developed and translated, but they may not be as sustainable. In contrast, regular European surveys coordinated by Eurostat are much more sustainable but the legal framework under which the surveys are conducted gives much freedom and responsibility to the countries which can lead to comparability issues. A strength of our study is that the GALI, though still imperfect, is currently the optimal pan-European health measure as it is one of the most validated survey instruments, including translation cards and protocols. Moreover, further improvement and harmonization of the GALI is planned to coincide with the current roadmap on modernization of social surveys which should report at the end of 2015. Further strengths of our study are that we included only indicators that were measured in the same way across countries and that we use a more conservative meta-regression approach than previously, as now recommended,¹⁷ as standard meta-regression analyses are subject to increased Type 1 error rates, i.e. false positives, or detecting an association when none exists. The use of this more conservative meta-regression approach along with updates to some underlying data (life tables and country level structural indicators) by Eurostat results in some of the factors previously identified as significantly associated with HLY50 in Ref. 6 no longer being strongly associated (table 2).

Our findings on health inequalities across the EU confirm and update others, though mostly these are based on different health measures, or mortality, and analysed separately, rather than together as in health expectancy. We highlighted an association between HLY50 and both long-term unemployment rates and material deprivation. Other studies have indicated substantial inequalities in LE and DFLE between socioeconomic groups defined by education,^{20–25} occupation^{26–29} or income^{2,30} within European countries with differences in DFLE between educational groups being largest in Eastern and Northern Europe and smallest in Southern Europe.²⁰ It has been suggested that socioeconomic status as a determinant of health is manifested through its influence on behaviours and habits and by determining access to healthcare³¹ and that housing³² and working conditions also contribute substantially to health inequalities across Europe.³³ Our findings suggest that when material deprivation is included, standard socioeconomic factors, as found above, have less effect. Moreover, levels of material deprivation were highest in the newer joined (EU10) countries whereas Greece, Italy, Portugal and Ireland had the highest levels of material deprivation in the established EU15, these being the countries most affected by the economic crisis.

We found that higher long-term unemployment was associated with lower HLY50 in the EU25 countries, which resonates with other reports that poor health, chronic diseases and lifestyle factors at the individual level are associated with being out of the labour market.³⁴ This study and ours suggest that social policies to encourage employment among older persons may need to take account of ill-health and activity limitation that increase with age, particularly in

those countries where the onset of activity limitation precedes age 65 (the state retirement age). Nevertheless, our analyses are cross-sectional and thus we cannot infer the direction of causality between employment and health. Others have shown that changes in lifestyle encouraged within the workplace may contribute to development of the health differentials between the employed and unemployed.³⁵ In order to prevent widening of employment-related health inequalities, passages into employment should be facilitated and opportunities for health promotion should be improved among those trapped in or moving towards the labour market periphery. Pre-retirement is a time when older people are contemplating change and health promotion during this time may be beneficial for maintaining health post-retirement. Moreover, labour market programmes that keep and reintegrate workers in jobs could mitigate some adverse health effects of economic downturns.³⁶

Conclusions

Our results show that inequalities in HLY50 for the EU25 over the period 2005–10 have widened further, particularly in the newer (EU10) countries. Country level material deprivation (most evident in EU10 countries) and long-term unemployment were factors contributing to inequalities in HLY50 across the EU25, although the associations were relatively weak. Further research should include a wider range of country level indicators as well as utilizing longitudinal data in different European countries to better understand the causal pathways that link material deprivation and ill-health. Nevertheless, it is important to continue monitoring and analysis of inequalities in HLY at peri-retirement ages to maximize healthy ageing for all European citizens.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Conflicts of interest: None declared.

Key points

- Life expectancies at age 50 for European countries are converging but Healthy Life Years are diverging suggesting that not all countries are ageing healthily with implications for health and social care provision.
- Material deprivation explains some of the inequality in Healthy Life Years across Europe and, if this is a causal association, the current economic crisis could result in even greater inequalities in Healthy Life Years.
- Continued monitoring of Healthy Life Years at peri-retirement ages, especially in terms of the inequalities between countries and in relation to changes in state retirement age, are important to evaluate the effect of healthy ageing policies and ultimately to ensure the extra years of life are healthy ones for all European citizens.

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