Review of socio-economic inequalities in life expectancy and health expectancy in Europe

FACTAGE – WP 2

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Isabel Mosquera, Yolanda González-Rábago, Unai Martín and Amaia Bacigalupe

University of the Basque Country UPV/EHU

OPIK - Research Group on Social Determinants of Health and Demographic Change

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FACTAGE

ABSTRACT

Nowadays Europe is experiencing a demographic ageing that is already producing important changes in public policies, especially in the design of the pension system. Based on the increase of life expectancy (LE), many European governments have modified their pension policies focusing on the retirement age, delaying it around 2 or 3 years in most of the countries. However, as some important studies have stated, the general rise in LE among the elderly population is not uniformly distributed. Great inequalities in LE are found according to the socioeconomic status, being lower in the more deprived groups. The same occurs in the case of health expectancy (HE), as those groups with a lower social position live more years in a poorer health status and with more limitation in the daily life. Until now, comparative research has been scarcely carried out on this topic, so results cannot be easily compared. In order to contribute to a better understanding of this issue, a systematic review of the literature has been conducted to identify socioeconomic inequalities in LE and HE at age 50 and over in Europe. The review was limited to studies referred to the 28 members of the European Union, Norway and Switzerland, and published since 2000, including data from the 1990 decade. The literature search was carried out using health and social science databases (Embase, Pubmed, Sociological Abstracts and Social Sciences Citation Index-SSCI) in November 2016. A total of 29 studies, published in 30 articles, were included in the review.

The results show that, across Europe, people in a more advantaged position can expect to live longer lives, more years in good health and less in bad health, and therefore a smaller percentage of their lives in bad health. Thus, this population is more likely to reach retirement age in good health than those in a worse social position, and this usually happens along the whole social scale. Inequalities in LE and in HE by educational level are highly consistent, showing that people at age 50 with a lower educational attainment had shorter lives and in poorer health than those with a higher educational level, both in men and women. Similar results were found when analysing social class or occupation. Social inequalities in LE and HE of elderly population were observed across all countries, although they seemed to be higher in some regions than in others.

These social inequalities should be taken into account when introducing any reform in the systems. However, several European countries have not considered the perspective of equity in these reforms. Thus, pension policies will continue to have a different impact on the older population, being more favourable to social groups with higher LE and HE. Therefore, a differential pension age should be considered when designing pension policies.

Authors:

Isabel Mosquera isabelmaria.mosquera@ehu.eus

Yolanda González-Rábago yolanda.gonzalezr@ehu.eus

Unai Martín unai.martin@ehu.eus

Amaia Bacigalupe amaia.bacigalupe@ehu.eus

University of the Basque Country UPV/EHU

OPIK - Research Group on Social Determinants of Health and Demographic Change

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1. Introduction

Currently, Europe is facing a demographic ageing of the population because of low fertility rates and an increase in life expectancy (LE). Although population ageing is a long-term trend that began some decades ago, the transformation of the age structure is getting more intensive in the last period. There is an increase of the share of population aged 65 years and over of 2.4 percentage points for the EU-28 as a whole in the period 2006-2016, representing 19.2% of the whole population in 2016. The highest numbers are found in Italy (22.0%), Greece (21.3%) and Germany (21.1%). Over many years, a combination of low levels of fertility (known as 'ageing at the bottom') with an increase in LE ('ageing at the top') has entailed a greater dependency ratio. In fact, from 2000 to 2015 LE in the EU-28 increased by 2.4 years for women and 3.4 years for men (1).

This ageing has entailed a series of political challenges that, focused mainly on the 'ageing at the top', have involved some important changes in public policies, especially those related to the public pension system across Europe. European governments have modified their pension policies focusing on the retirement age, delaying it around 2 or 3 years in most of the countries. Thus, countries such as Denmark, France, Germany or Spain have raised it from 65 to 67 years, while Great Britain and Ireland to 68 years. This expansion has been linked to the development of the expected LE (2).

However, these political changes have failed to consider that a rise in LE does not necessarily involve an increase in the capacity of a person to continue in the labour market. Although LE is a widespread indicator used as a summary of the health of a population, the LE expansion fails to inform us about the evolution of the quality of life or the levels of morbidity of older population (3). Thus, several different hypotheses have been proposed regarding the evolution of health in this context of mortality decrease. Hypotheses have ranged from those that claim that the mortality reduction has occurred at the expense of an increase in morbidity (4) to those that consider that the improvement in mortality has come with an improvement also of health and, therefore, a compression of the period of life lived in disability (5), and going through other intermediate scenarios (6).

Thus, especially since the decade of seventies of the 20th century, LE has been usually analysed in combination with other indicators known as health expectancies (HE) to examine the health of a population (3). Different measures have been developed to include different ways to measure health in the expectancy to live, such as disability free life expectancy (DFLE), healthy life expectancy (HLE), quality-adjusted life expectancy (QALE), or health-adjusted life expectancy (HALE), among others (7).

The reforms in the pension systems across Europe have not taken into account that LE and HE are not distributed in a uniform manner in society either. The existence of social inequalities in health is well known, occurring both between countries and within social groups inside each country, by which disadvantaged socioeconomic groups have higher mortality and worse health than advantaged ones (8;9). As social inequalities in health take place along the whole life, it can be understood that not all social groups, once they reach 65 years of age, can expect to live the same amount of years and in the same conditions. Inequalities in LE and the focus only on the average of LE to modify pension policies could have strong implications for the redistributive properties of current pensions systems (10)[1] .

Until now, some studies have examined inequalities in LE and HE in different periods and contexts. Inequalities in LE and HE have been analysed across Europe placing their attention either on the situation in individual countries (11;12) or in several of them (13;14). Nevertheless, it is difficult to compare results from studies, as there are differences, both conceptual and methodological, among them.

Firstly, the health indicator used in the construction of HE may modify the magnitude of the described inequalities. On the one hand, health status can be measured from different approaches. For example, an approach based on the functional perspective of health -e.g. using the Global Activity Limitation Indicator (GALI)-, based on a biomedical perspective, such as the existence of chronic problems, or based on a subjective and integral perspective, e.g. health self-assessment. The use of one or other approach changes the magnitude of the inequalities (15). On the other hand, socioeconomic position can be measured in different ways (educational level, social class, income, deprivation), which are not comparable to one another. Additionally, it is difficult to compare results on a certain variable between countries, due to different implications of having a high occupational status or a low educational level in each country. For instance, the sociological meaning of low educational level -in terms of corresponding living conditions- may not be the same in Northern Europe than in countries such as Spain (16). Moreover, inequalities in HE are different according to the health indicator used, for example, expected lifetime without chronic diseases, in good perceived health or without functional limitations (17).

Secondly, comparisons between countries may be biased by differences in data collection. This data collection refers to health data and the comparability of these data among surveys, and mortality data (18). In the latter, a key aspect that can cause comparability problems is the way in which

[1] There will be a chapter on the fairness of a pension system in a forthcoming FACTAGE report within WP4 – Comparative assessment of differential health and mortality.

socioeconomic data have been obtained for the deceased, as there are different methodologies that have an influence on the comparability of the results.

Thirdly, the magnitude of inequalities can be different according to the way of constructing the life table and integrating the health data in it. Assumptions made when applying the different methodologies such as Chiang's and Silcock's, as well as the size of the age intervals used or the final age interval chosen (when an abridged life table is calculated) can make a difference, although small, on the estimates of LE (19). Regarding the integration of health data in the mortality table, the several methods proposed (Sullivan, multistate methods, double decrements, simulations, etc.) generate different results and, therefore, hinder the direct comparison of HE.

Given these difficulties, future research on the topic should take into account both conceptual and methodological challenges in the study of inequalities in LE and HE in order to improve the comparability of the results. Until now, several authors have examined social inequalities in LE in some of the European countries focusing on the early 2000s (14) or even considering as well HE back to 1995 (13). This report aims to contribute to a better understanding of this issue widening its scope in terms of time and geographical contexts. Therefore, its objective is to identify socioeconomic inequalities in LE and HE in the 28 members of the European Union, Norway and Switzerland in studies published since 2000, including data from the 1990 decade. Previous studies examining health inequalities have classified countries according to their geographic situation (20), their degree of inequality (21) or their levels of health and risk factors (22). This report has used a similar geographic classification to that of Hu et al.(23) to organize its results.

2. Method

A systematic literature review was conducted. The literature search was carried out using health and social science databases (Embase, Pubmed, Sociological Abstracts and Social Sciences Citation Index-SSCI) in November 2016. The search was limited to papers published on the subject of review since 2000 in English, Spanish, Portuguese and French. The search strategies combined Medical Subject Headings (MeSH) and free text terms regarding socioeconomic position, life expectancy, health expectancy, older adult and retirement. As an example, the search strategy used in Embase is presented in Table 1.

The inclusion criteria applied were that the publication was a primary or secondary study that analysed socioeconomic inequalities in LE and HE at age 50 and older in the 28 member countries of the European Union, as well as Norway and Switzerland, with data corresponding to the period

from 1990 to 2016. Studies were excluded when assessing LE or HE in patients with specific symptoms/diseases or under specific treatments. Conference abstracts were also excluded. Inclusion and exclusion criteria were piloted before their application to the whole set of identified references.

Table 1. Search strategy used in the search in Embase.

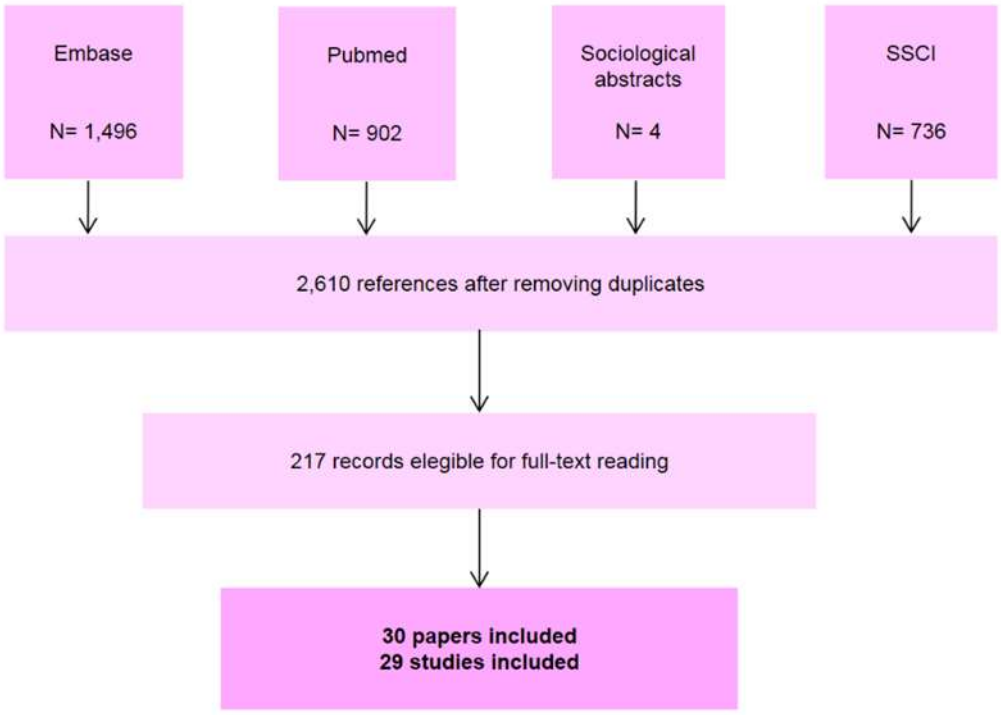
#	Search	Hits
1	exp life expectancy/	43360
2	healthy life expectanc*.mp.	281
3	disability adjusted life expectanc*.mp.	22
4	health adjusted life expectanc*.mp.	50
5	disability free life expectanc*.mp.	129
6	life expectanc* in good health.mp.	10
7	quality adjusted life expectanc*.mp.	829
8	exp quality adjusted life year/ or quality adjusted life year*.mp.	19982
9	healthy life year*.mp.	139
10	active life expectanc*.mp.	161
11	health expectanc*.mp.	193
12	healthy working life expectanc*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]	2
13	year* of healthy life.mp.	161
14	year* of life without functional disabilit*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]	0
15	life expectanc* without mobility limitation*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]	0
16	year* of life without cognitive disabilit*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]	0
17	life expectanc* without cognitive problem*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]	0
18	life expectanc* without cognitive limitation*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]	0
19	life expectanc* without functional problem*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]	0
20	life expectanc* without adl restriction*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]	0
21	functional independence life expectanc*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]	0
22	cognitive independence life expectanc*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]	0

23	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22	61649
24	exp social class/ or exp socioeconomics/	240653
25	socioeconomic factor*.mp.	8242
26	socioeconomic position*.mp.	2384
27	socioeconomic inequalit*.mp.	1488
28	socioeconomic inequit*.mp.	101
29	socioeconomic equalit*.mp.	7
30	socioeconomic equit*.mp.	20
31	exp health disparity/	13317
32	health inequalit*.mp.	4463
33	health inequit*.mp.	1100
34	health equalit*.mp.	80
35	health equit*.mp.	1600
36	exp income/	99265
37	exp education/ or educational level*.mp.	1383938
38	deprivation.mp.	88830
39	exp ethnic group/ or exp ethnicity/	175482
40	24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39	1832101
41	exp Austria/	21104
42	exp Belgium/	22247
43	exp Bulgaria/	8117
44	exp Croatia/	8763
45	exp Cyprus/	1780
46	exp Czech Republic/	11605
47	exp Denmark/	44973
48	exp Estonia/	3284
49	exp Finland/	33703
50	exp France/	113323
51	exp Germany/	175623
52	exp Greece/	24709
53	exp Hungary/	20001
54	exp Ireland/	31619
55	exp Italy/	102441
56	exp Latvia/	1955
57	exp Lithuania/	3506
58	exp Luxembourg/	1148
59	exp Malta/	1315
60	exp Netherlands/	71853
61	exp Poland/	47235
62	exp Portugal/	15610
63	exp Romania/	12140
64	exp Slovakia/	4446
65	exp Slovenia/	4051
66	exp Spain/	80840
67	exp Sweden/	71799
68	exp United Kingdom/	408268
69	exp Norway/	37971
70	exp Switzerland/	36929

71	exp European Union/	26363
72	41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71	1301873
73	23 and 40 and 72	1783
74	limit 73 to ((english or french or portuguese or spanish) and yr="2000 - Current")	1496

All titles and/or abstracts of the identified references were screened by at least two researchers. After the selection of the included studies (Figure 1), the information regarding year(s) of data assessed, context, excluded population, study design, independent and dependent variables, life table calculation method, inequality measure and main results was extracted and included in a table. In this table, studies were organized by European regions, in a similar manner to a classification used in a previous review of income inequalities in LE (23). The main findings were summarized in a narrative manner.

Figure 1. Study selection flow diagram.



3. Results

The review included 29 studies, which were described in 30 articles. Out of these 29 studies, 4 were reviews that compared inequalities in several countries. The primary studies were carried out mainly in the UK -4 studies-, and Sweden, Netherlands and Germany -each 3 studies-. The situation in France, Switzerland and Norway was analysed in 2 studies each. At last, there was one study of each of the following nations: Denmark, Finland, Ireland, Italy, Lithuania and Spain (Table 2).

Table 2. Table of included studies.

ADL: activities of daily living, DFLE: disability free life expectancy, DLE: disability life expectancy, GALI: Global Activity Limitation Index, HE: health expectancy, LE: life expectancy, QALY: quality adjusted life years, WLE: working life expectancy.

Context	Year of publication	First author	Year(s) of data assessed	Excluded population	Study design	Independent variable	Dependent variable	Life table method
Nordic countries								
Denmark	2015	Brønnum-Hansen (12)	2006/07-2010/11 (second and fourth waves of SHARE data)	Those under 50	Cross-sectional	Education	LE and HE at age 50 (DFLE)	Sullivan's method
Finland	2015	van Raalte (24)	1971-2010 (five-year periods)	Immigrants Occupational category others (those who are not included in upper non-manual, lower non-manual or manual occupation)	Time series	Occupation	LE at age 50	Wilmoth (Human Mortality Database)
Norway	2015	Kinge (25)	1961-2009		Time series	Education	LE at ages 85, 90 and 95	
Norway	2012	Moe (26)	1961-2009	Those younger than 65	Time series	Education	LE at age 65	Chiang's method
Sweden	2016	Lundborg (27)	1961-2009	Those twin pairs in which one or both were not alive	Cross sectional	Education	LE at age 60	
Sweden	2009	Batljan (28)	1992-1999			Education	LE at birth and at age 65	
Sweden	2005	Burstrom (29)	1980-1997	Individuals not classified into any of the four socio-economic groups		Occupation	LE and QALY at ages 20, 25, 35, 45, 55, 65 and 75	Follow-up data 1980-1997

Context	Year of publication	First author	Year(s) of data assessed	Excluded population	Study design	Independent variable	Dependent variable	Life table method
United Kingdom and Ireland								
Great Britain	2014	Wohland (30)	1991-2001		Ecological cohort	Unemployment Social class Ethnicity Retirement migration Population density Rurality Deprivation	LE at birth and at age 85 DFLE at birth and at age 85	Standard abridged period life table methodology Sullivan's method
England and Wales	2007	Jagger (11)	1992-2004	Those younger than 65	Cross-sectional	Education	LE at ages 65 and 85 DFLE (mobility and ADL disability) at ages 65 and 85	Interpolated Markov Chain (IMaCH) software
Melton Mowbray, Leicestershire and the surrounding Area, England	2006	Matthews (31)	1988-2003	Those younger than 75 Those living in residential care in 1988	Ecological / Cross sectional	Area deprivation score Housing tenure Income Receiving means tested benefits Social class Self-perceived difficulties managing on income	LE at age 75 DFLE at age 75	IMaCH software
Cambridgeshire, Newcastle, Nottingham and Oxford, England	2000	Melzer (32)	1991	Those younger than 65	Cross sectional	Social class	DFLE at age 65-69 LE with disability at age 65-69 LE total at age 65-69	Sullivan's method
Ireland	2013	Abdalla (33)	2007-08	Irish Travellers under 15	Cross sectional	Ethnicity	LE at ages 15 and 65 HE at ages 15 and 65 (based on poor self-reported perceived general health) DFLE at ages 15 and 65	Chiang's method Sullivan's method (and Mather's for confidence intervals)

Context	Year of publication	First author	Year(s) of data assessed	Excluded population	Study design	Independent variable	Dependent variable	Life table method
Continental Europe								
Germany	2013	Kibele (34)	1995-2008	Women Men aged 64 or less, civil servants and self-employed with lower mortality, or foreigners.	Time series	Pension income Type of former occupation	Age standardised death rate Remaining LE at age 65	
Germany	2008	Shkolnikov (35)	2003	Women Men younger than 65, of non-German citizenship, with a migration background, living abroad and covered by foreign health insurance	Cross-sectional	Lifetime earnings Type of medical insurance Broad occupational group Residence in eastern or western Germany	Mortality at age 65 and over LE at age 65 and over	
Germany	2007	von Gaudecker (36)	2002	Women Men younger than 65, those with a foreign residence or those living on social assistance most of their working life	Cross-sectional	Lifetime earnings	Period LE at age 65	Chiang's method
Amsterdam, Netherlands	2015a	Uitenbroek (37)	1996-2007			Ethnicity	Mortality in these age groups: 15-45, and 45-65 LE at birth and at age 65	Chiang's method
Amsterdam, Netherlands	2015b	Uitenbroek (38)	2010-2014		Cross-sectional	Ethnicity	LE at birth and at ages 1, 20, 40, 55, 65, 70, 75, 80, 0-40, 40-60, 60-80	Chiang's method
Amsterdam, Netherlands	2002	Uitenbroek (39)	1st January 1994-1st January 2000	Illegal immigrants (group not well represented in the civil registry)		Ethnicity	LE at birth and at age 50	Chiang's method

Context	Year of publication	First author	Year(s) of data assessed	Excluded population	Study design	Independent variable	Dependent variable	Life table method
Switzerland	2014	Spoerri (40)	2000-2008	Those under age 30 or never married Persons with no educational attainment information	Cross-sectional	Marital education	Mortality risk Remaining LE at ages 30, 50, 65 and 80	Chiang's method
Switzerland (German speaking part)	2006	Spoerri (41)	1990-1997	Those younger than 30 and those residents in the Italian or French speaking parts of the country	Cross sectional	Educational level	LE at ages 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 and 80	Chiang's method
Mediterranean countries								
France	2011	Cambois (17)	2003	Institutionalized population	Cross-sectional	Occupation	LE and HE (without chronic diseases, in good perceived health, without functional limitations, without GALI or without ADL restrictions) at ages 50, 65 and between both ages	Sullivan's method
France	2001	Cambois (42;43)	1991-1992	Women	Cross-sectional	Occupation	LE, DFLE and DLE at ages 35 and 60	Sullivan's method
Italy	2005	Minicuci (44)	1992 and 1996	Those younger than 65 and older than 84		Education	LE at ages 65, 70, 75 and 80 (not provided according to educational level) DFLE at ages 65, 70, 75 and 80	Multistate life table method (IMaCh software)
Spain (Madrid and Barcelona)	2001	Martínez-Sánchez (45)	1993-1994	Those younger than 25 Institutionalized population	Cross sectional	Education	LE and HE (based on good perceived health) at ages 25, 45 and 65	Sullivan's method

Context	Year of publication	First author	Year(s) of data assessed	Excluded population	Study design	Independent variable	Dependent variable	Life table method
Former Soviet Union								
Lithuania	2008	Kalediene (46)	1989 and 2001	Those under age 25	Time series	Education	LE at ages 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 and 80	Pollard´s method
Comparative studies								
Austria Belgium Bulgaria Czech Republic Denmark Estonia Finland France Germany Hungary Iceland Ireland Italy Latvia Lithuania Luxembourg Netherlands Norway Poland Portugal Slovakia Slovenia Spain Sweden Switzerland UK	2016	Loichinger (47)	1983-2013		Cross-sectional	Country Education (since 2007 for 11 countries: Bulgaria, Czech Republic, Denmark, Estonia, Finland, Hungary, Italy, Norway, Poland, Slovenia & Sweden) Country	WLE at age 50 LE at birth and at age 50 HE at age 50	Sullivan's method

Context	Year of publication	First author	Year(s) of data assessed	Excluded population	Study design	Independent variable	Dependent variable	Life table method
Austria Denmark France Italy (Turin, Tuscany) Spain (Madrid and Barcelona)	2014	Mäki (14)	Early 2000s (2001-2002 in Austria; 1999-2005 in France)	Those younger than 50 and older than 79	Cross sectional	Education	Partial LE between ages 50 and 79	
Finland Sweden	2012	Zarulli (48)	1971-1975 and 1996-2000	Those younger than 65	Time series	Education	LE at age 65 Modal age at death Life span disparity measure	Chiang's method
Finland Denmark Ireland Austria Belgium Greece Italy France Spain Portugal	2011	Majer (13)	1995-2001		Cross sectional	Education	Partial LE at age 65 Partial DFLE between ages 50 and 65, and at age 65	Multistate life table method

The most assessed socioeconomic variable was education, which was classified in three categories[2] in most of the publications (11-14;25;27;28;47). The exceptions were studies developed in Lithuania (46) and Switzerland (41), with four categories[3], and analyses carried out in Spain (45), Italy (44), Norway (26), and Finland and Sweden (48), where the educational level was classified in two[4]. Other variables of socioeconomic position were occupation (17;24;29;34;35;42;43), income (31;34-36), ethnicity (33;37-39), occupational social class (31;32), deprivation of residence area (30;31) and marital education, that is, the combination of the educational level of both members of a couple (as opposed to the majority of studies in which the variable was the individual educational level) (40).

The included studies revised mainly inequalities at ages 50 and 65, especially regarding LE, although there was also evidence up to age 95 (25). Regarding HE, it was measured mostly as health state LE, using different health variables related to self-perceived health (17;33;45), chronic diseases (17) and limitations (11-13;17;30-33;42-44), while one study provided data on QALE (29).

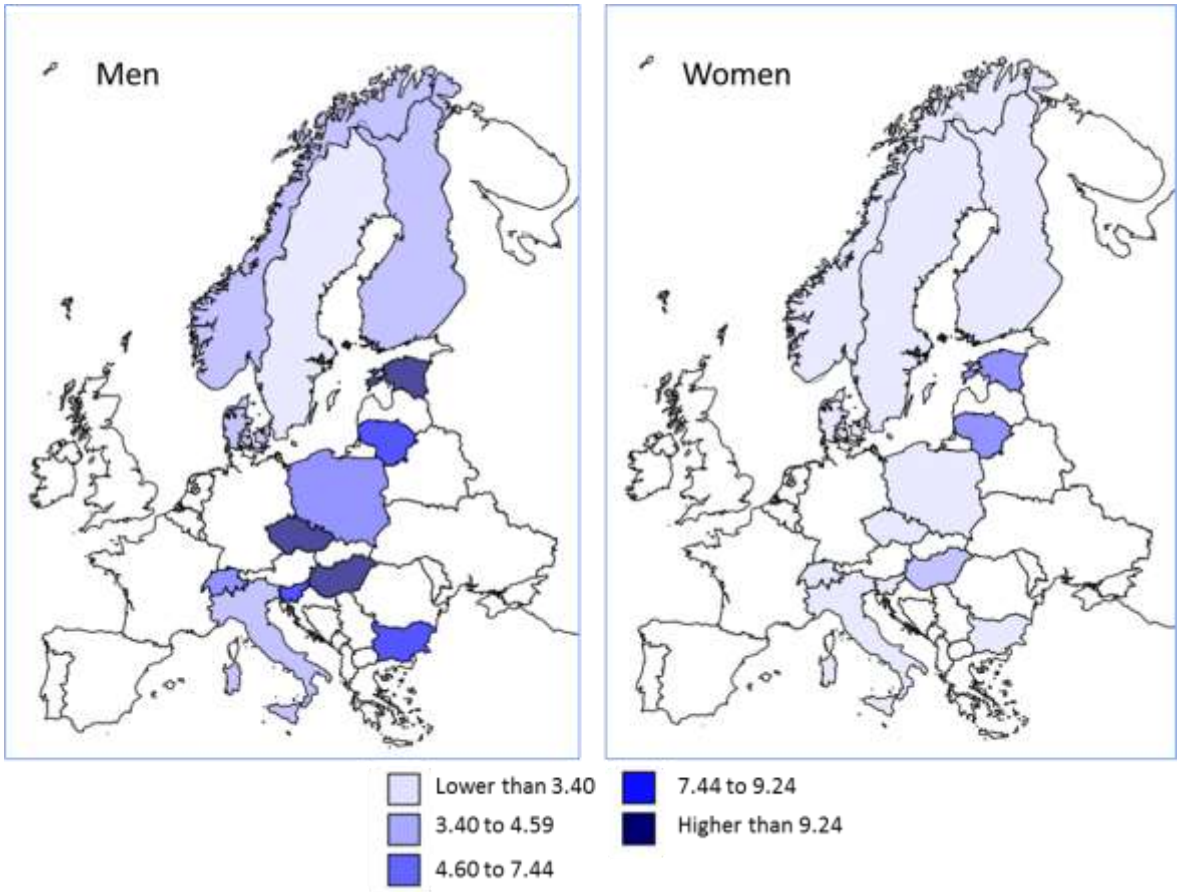
As an overview of the situation across Europe, in terms of the observed inequalities in LE by educational level, at age 50 lower educated men could expect to live between 2.6 and 11.3 years less than those higher educated, depending on the country. Among women, differences were smaller, ranging from 1.6 to 6.9 years (Figure 2). At age 65, men of a low educational level had a LE 1.1 to 3.8 years shorter than those with university studies. In women, figures were between 0.6 to 5.2 years (Figure 3).

[2]Lower secondary education or lower, upper secondary education and tertiary education, according to the International Standard classification of Education (ISCED97); or considering number of years of schooling (0-9, 10-11 and 12 and more).

[3]In the study of Lithuania (Kalediene et al. 2008): i) primary or no education group –up to 4 years of school and no diploma of graduation or no education; (ii) lower secondary education group – 11–12 years of school;(iii) incomplete university with no graduation diploma, upper secondary or college; and (iiii) university education group – graduates with diplomas or degrees from an institute or university.
In the study of Switzerland (Spoerri et al. 2006): "compulsory schooling or less" (up to 9 years of education), "vocational training" (12 years), "upper secondary education" (13 to 16 years, including high school, teachers training colleges, technical colleges and upper vocational education) and "university education" (19 years or more).

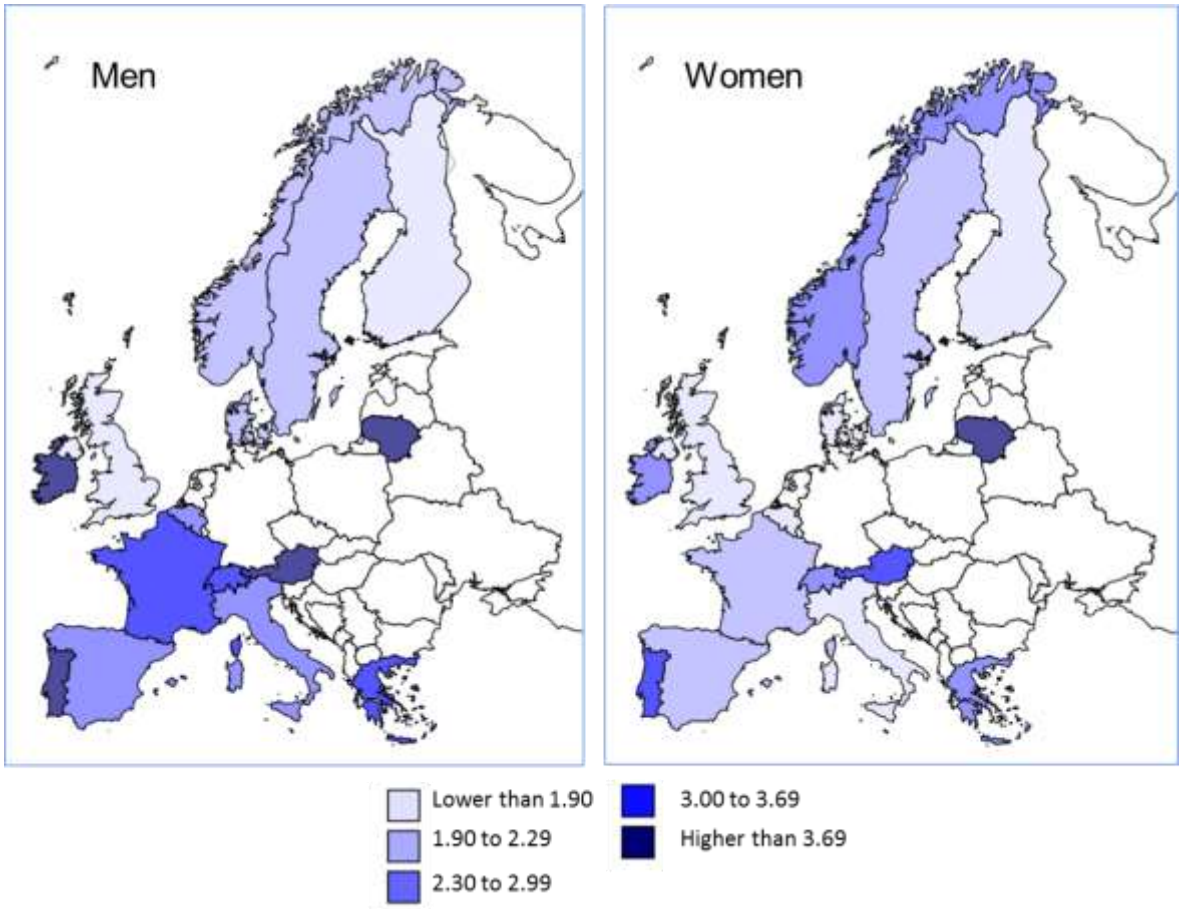
[4]In the study of Spain (Martínez-Sánchez et al. 2001): lower (up to 11 years of schooling) and higher (12 years or more of schooling).
In the study of Italy (Minicuci et al. 2005): low (less than 5 years of schooling) and medium/high (5 or more years of schooling).
In the study of Norway (Moe et al. 2012): lower education (ISCED97 levels 0-2) and higher education (ISCED97 levels 3-6).
In the study of Finland and Sweden (Zarulli et al. 2012): The 'high' education category refers to individuals with completed university or college education, whereas the 'low' education category refers to those with lower than secondary education (or whose education is unknown).

Figure 2. Inequalities (absolute differences in years) in LE at age 50 by education in Europe.



Educational level classified in three categories (47), except in Switzerland (41) and Lithuania (46) where four were considered.
Data provided in the Appendix (Table A1).

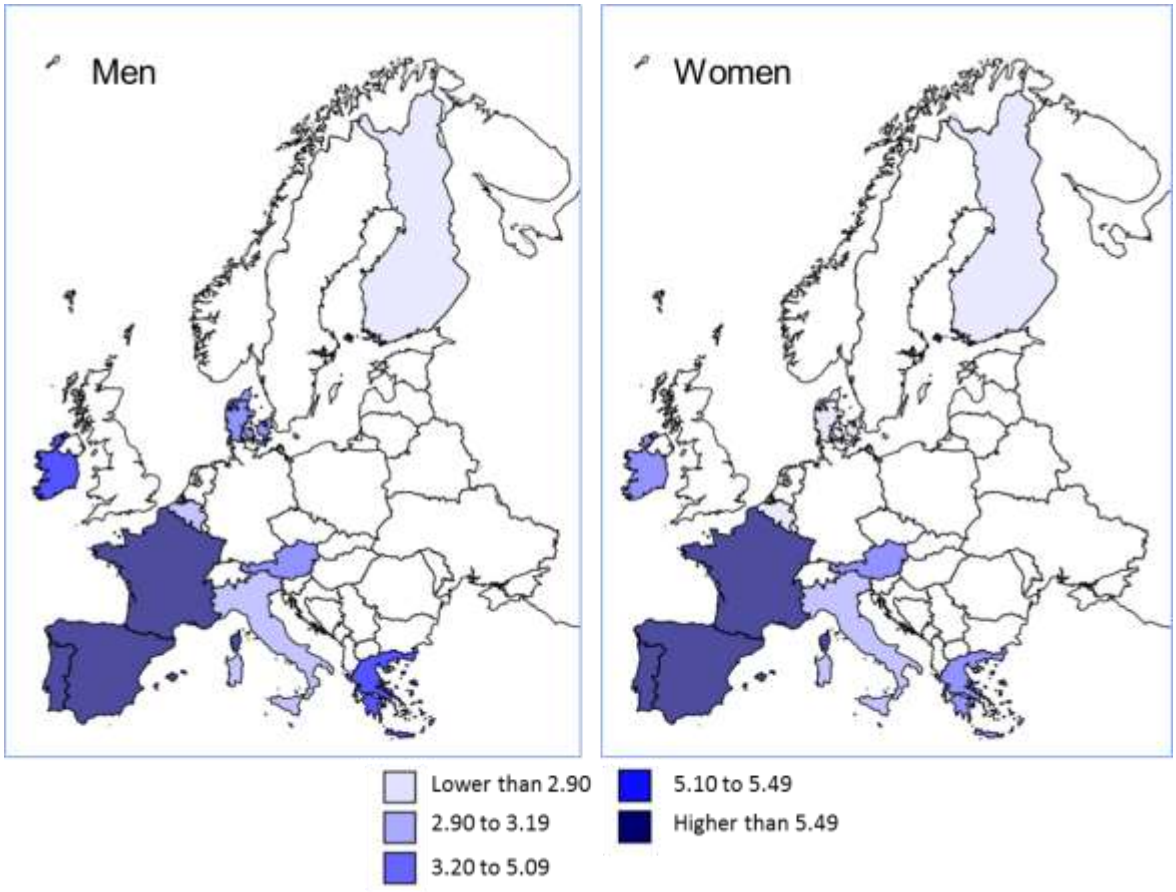
Figure 3. Inequalities (absolute differences in years) in LE at age 65 by education in Europe.



Educational level classified in three categories (13), except in Norway (26), with two categories, and Switzerland (41)and Lithuania (46), with four categories.
Data provided in the Appendix (Table A2).

Analysing HE and more specifically DFLE at age 65, inequalities by education were similar in men and women. Thus, men with university studies lived without disability 2.6 to 6.2 years more than the lowest educated, and in women inequalities ranged from 2.3 to 6.3 years (Figure 4). Moreover, people with lower educational levels lived more years in bad health and a higher percentage of their life in bad health (11;44), which can also be seen between extreme groups regarding occupation (17;42) and social class (32).

Figure 4. Inequalities (absolute differences in years) in DFLE at age 65 by education in Europe.



Educational level classified in three categories (13), except in Italy (44), which had two categories. Data provided in the Appendix (Table A3).

Below there is a more detailed explanation of the inequalities observed in each of the European regions, using a classification similar to that of Hu et al.(23). Six regions were examined: Nordic countries; United Kingdom (UK) and Ireland; Continental Europe; Mediterranean countries; Western Balkans, Central and Eastern Europe; and Former Soviet Union.

3.1. Nordic countries

Studies evaluated inequalities in LE and HE in comparative studies (13;14;47;48) and individual studies carried out in Denmark (12), Finland (24), Norway (25;26) and Sweden (27-29) according to two axes of social inequality: educational level and occupation, even if most of the studies revised inequalities in LE by education. They found differences in LE at age 50 that ranged from 2.6 years in Sweden to 4.6 years in Denmark among men, and between 1.6 years in Finland and 4.0 years in Denmark among women (12;47). These inequalities always favoured the higher educated. At age

65, LE was also lower among the less educated population, between 1.5 years (13) and 3.2 years (48) in Finnish men, and ranging from 0.6 years in Finnish women (13), to 3.2 years in Swedish women (48).

Two studies examined inequalities in LE according to occupation (24;29). In Finland, among men, manual workers had a 4.1 years shorter LE at age 50 than those upper non-manual workers, while the difference among women was 2.2 years (24). In Sweden, in males, LE at age 65 was 2.2 years less in unskilled manual workers than in higher non-manual workers, being 1.4 years among females (29).

HE was also unequal among the different socioeconomic groups, with shorter LE without limitations at age 50 in lower educated population compared to those with a higher education (7.8 years in men, 6.3 years in women in Denmark) (12). At age 65 there was a difference by education in DFLE of 2.5 years in women and 2.6 years in men from Finland, and of 2.6 and 3.2 years in women and men in Denmark respectively (13). A study from Sweden examined inequalities in quality-adjusted life years (QALY) by occupation. At age 65, the difference between the highest (higher non-manual) and lowest socio-economic group (unskilled manual) was 3.33 and 2.05 QALYs in men and women respectively (29).

3.2. United Kingdom and Ireland

Both individual studies (11;31-33) and comparative studies (13) analysed social inequalities in LE and HE according to four different inequality variables: educational level, ethnicity, occupational social class and deprivation of residence area. The studies of Majer et al. (13) and Jagger et al.(11) showed differences in LE at age 65 that ranged from 1.1 years of British men to 3.7 years of Irish men, and between 1.6 and 2.7 years in British and Irish women respectively. At age 85, people with a higher education lived longer lives as well (11).

Ethnicity generated also inequalities in LE at age 65, up to 6.3 years in men and 7.5 years in women in the case of Irish Travellers (a disadvantaged indigenous minority group) when compared to the general population (33). On the other hand, smaller differences were identified between extreme groups according to occupational social class, deprivation of the residence area or income. Thus, in the UK LE at age 75 was 1.2 years shorter among men from the manual social class than in men of the non-manual class, and only 0.3 years in the case of women. Moreover, men living in more deprived areas were expected to live 0.9 years less at age 75 than those in more advantaged areas, and in the case of women, differences favoured those living in areas with a higher deprivation, with

a 0.5 years longer LE at that age. Regarding income, the most advantaged population lived 0.2 years less than those in the worst position at age 75 (31).

Focusing on DFLE, education determined also important inequalities at age 65. Therefore, in Ireland Majer et al. (13) found a difference of 5.1 years and 4.7 years in men and women respectively. In the case of the UK, Jagger et al. (11) observed a mobility DFLE 2.5 and 2.7 years shorter in men and women of a lower educational level when compared with those with a higher education. At age 85, mobility DFLE continued being lower in the lower educated population, being around 1 year (11).

Moreover, ethnicity also established inequalities in DFLE at age 65, with Irish Travellers expecting to live less years without disability than the general population (5.8 years in men and 7.6 years in women) (33). In the UK, a low occupational social class entailed living less without disability in population aged 65 to 69 (3.5 years in men and 2.7 years in women) (32). Another study found inequalities in DFLE at age 75 smaller than 1 year among different social classes (31).

3.3. Continental Europe

Individual studies developed in Germany (34-36), the Netherlands (37-39) and Switzerland (40;41), and comparative studies (13;14) revised inequalities in LE and DFLE according to education, income, occupational social class and ethnicity. Education made a difference in LE in countries such as Austria, Belgium or Switzerland. Thus, having a lower educational status entailed living between 2.8 and 3.8 years less at age 65 in men and between 1.7 and 3.0 years less in women (13;40). At age 50 in Switzerland, LE was 5.4 and 3.1 years shorter in lower educated men and women respectively compared with those with a higher education, and inequalities continued at age 80, with expected longer lives for those with university studies (1.6 years in men and 2.2 years in women) (41). When considering the marital education, LE increased the higher the spouse's education was. At age 50, tertiary educated men married to women with tertiary education lived longer lives (4.2 years) than men with compulsory education married to women with this same level. In women, the difference was 2.8 years (40).

In Germany, three studies examined inequalities in LE at age 65 in men by income. They found differences ranging from 2.3 years (35) to 4.9 years (34), favouring those in a most advantaged position. Similarly, studies analysing inequalities in LE at age 65 in German men according to occupational social class found differences from 2.4 to 2.6 years between social classes (34;35). However, the shorter expected lifetime for men from a lower social class was reversed and favoured them at age 80 (35).

The immigrant background was revised with a particular interest in the Netherlands, in its capital specifically. All the studies found that immigrant population could expect to live longer than the Dutch population at any age (50, 65, 80), with differences ranging from 1.7 to 10.2 years in men and between 0.9 and 6.9 years in women (37-39).

Finally, only two countries, Austria and Belgium, provided data on DFLE by educational level (13). It was found that, at age 65, in Austria lower educated population, both men and women, could expect to live without disability 4.7 years less than those with a higher education. In Belgium, the differences were 2.9 and 2.3 in men and women respectively.

No studies with data from Luxembourg or examining differences in LE or HE by deprivation were identified.

3.4. Mediterranean countries

Three studies compared the situation in several countries (13;14;47) and some carried out in France (17;42;43), Italy (44) and Spain (45) examined LE and HE focusing on inequalities by education and occupation. Thus, a comparative study comparing LE at age 65 in France, Greece, Portugal and Spain found the highest differences among the lower educated in Portugal (3.8 and 3.0 years less men and women respectively) when compared to those with a higher education. The smallest differences were observed in Italy, with 2.3 years in men and 1.3 years in women (13). Moreover, a study developed in the Spanish cities of Madrid and Barcelona showed differences, although smaller: 1.2 and 1.9 in men and women from Madrid, and 0.1 and 0.6 years in men and women from Barcelona respectively (45).

Regarding inequalities by occupation, in France at age 50, those with a higher level occupation could expect to live longer than those with a lower level, 4.8 years less in men and 2.1 less in women (17). In a previous study, it was found that at age 60, manual workers had a shorter LE than managers (3.1 years) (42;43).

With respect to the DFLE, it was also unequal by education, ranging between 4.3 and 6.2 years in Italian and Portuguese men respectively, and from 4.2 to 6.3 in women from the same countries (13). Additionally, another study from Italy, with only two categories of educational level (less than 5 years of schooling, and 5 or more years of schooling), observed smaller differences, around 3 years (44). HE at age 65 was also shorter in lower educated population from Madrid and Barcelona (45).

Moreover, DFLE at age 60 was 4.2 years less in manual workers (42;43), and LE without activities of daily living (ADL) restrictions at age 65 was 3.9 and 2.6 years less in inactive men and women, when compared to the highly qualified occupations (17).

No analysis providing data from Malta or Cyprus was identified. Additionally, no study offered data on inequalities in LE or HE regarding ethnicity, social class or deprivation.

3.5. Western Balkans, Central and Eastern Europe

A comparative study examined LE at age 50 by education in five countries of this region: Bulgaria, Czech Republic, Hungary, Poland and Slovenia (47). All nations presented relevant inequalities, with worse results among the lower educated people. Differences varied between 7.1 years in Polish men and 10.3 in Czech men. In women, differences were smaller, ranging from 2.3 years in the Czech Republic to 4.5 years in Bulgaria.

No data on Croatia, Slovakia and Romania were available. Moreover, no study provided data on HE or on differences in LE according to axes of inequality other than education.

3.6. Former Soviet Union

In this region there are two studies, a comparative study, that provides information on Estonia (47), and a project carried out in Lithuania (46), which analyse inequalities in LE by education. Both studies showed great inequalities. In Estonia, lower educated men had a LE at age 50 11.3 years shorter than those with higher education. In the case of women, the difference was 5.9 years (47). On the other hand, the project from Lithuania found also relevant differences in LE at age 50 (7.8 years in men and 6.9 in women). Additionally, LE at ages 65 and 80 showed differences, more important in the case of women, being 5.2 years at age 65 and 3.8 years at age 80. In men, differences were 3.8 and 1.6 years at ages 65 and 80 respectively (46).

No data on the situation in Latvia were available and no study provided information on HE or on differences in LE by any other axis of inequality.

4. Discussion

This study has explored socioeconomic inequalities in LE and HE at age 50 and over across European countries. In a very systematic way, the results show that along Europe, populations in a more advantaged position can expect to live more years, more years of these in good health and less in bad health, and therefore a smaller percentage of these years in bad health. Thus, this population has more probabilities of reaching retirement age in good health than those in a worse social position, and that usually happens along the whole social scale.

Inequalities by educational level are especially remarkable, both in LE and in HE. In Europe, lower educated people at age 50 expected to live between 2.6 and 11.3 years in the case of men and between 1.6 and 6.9 years in the case of women less than the higher educated. Moreover, people with a high educational level lived more years without disability, between 2.3 and 6.3 years, depending on the examined country. Similar results were found when analysing social class or occupation.

Results from the six European regions showed social inequalities in LE and HE at different ages. Although it was not possible to compare by country, nor even by region, some geographical contexts seemed to experience higher inequalities, such as Western Balkans, Central and Eastern Europe and Former Soviet Union, in comparison with Nordic countries, UK and Ireland, Continental Europe and Mediterranean countries. Thus, difference between social groups by educational level reached 11.3 years of LE at 50 in Estonian men, 10.3 in Czech men, 7.8 years in Lithuanian men and 7.1 years in Polish men (46;47). On the other hand, differences in population from Sweden were smaller, reaching 2.6 years, and being 4.6 years in Denmark and 5.4 years in Switzerland (12;41;47).

Although there are many possible variables that can be examined as axes of social inequality, most of the studies have placed their attention on educational level. There are many advantages of using educational level as a proxy of socioeconomic position: it can be easily obtained from datasets, it remains more stable throughout life than other variables, and it strongly determines employment conditions and income. However, there are certain issues to be considered when comparing data by education. First, the meaning and attainment of educational level varies in different countries (49) and for different birth cohorts. Thus, due to later socio-economic modernization in some countries, especially in Southern Europe, level of education may be less important as a social stratifier compared to previously advanced countries, resulting in lower inequalities, as showed in a study comparing Spain and other Western European countries (16). Besides, older cohorts are over-represented in the lower educated population, so countries with a higher share of aged population will also have a bigger proportion of low educated population (50). Second, lower educated groups tend to decrease in size and composition during the last decades, becoming a

more selective group of vulnerable population than it was before. Thus, this change in educational composition affects the comparability across time and countries (51;52). Third, educational attainment may not reflect appropriately variations in health status caused by a change in the social position (for example, workers that become pensioners) (49). Fourth, as with other indicators of socioeconomic position, the number of educational categories will have an influence on the magnitude of the inequality observed, expecting it to be higher the more categories there is. However, this was not the case observed for similar periods in two studies carried out in Finland, but using a different life table method (13;48).

Other measures used to stratify population have been occupation or income. Being a manual worker entailed having shorter LE and DFLE than being a higher non-manual worker (17;24;29). However, the classification in manual and non-manual occupations may not have the same meaning in economies with a large number of low waged non-manual service jobs (49), including under manual and non-manual groups workers of different labour conditions depending on the workforce structure. This may lead to the over-estimation of the differences in LE and HLE inequalities between countries with a different composition of occupational groups. Moreover, unemployed people are frequently not included in occupation-based classifications, therefore entailing an underestimation of socioeconomic differentials (53). A study from France did consider this group in the comparisons carried out (17), while another from Sweden classified them according to their previous socioeconomic status (24). Nevertheless, occupation fails to be a good indicator in the case of women for several reasons, such as women without a gainful employment being frequently assigned their husband's occupation (54). Additionally, the female participation in the labour market differs depending on their birth cohort (55), and occupation-based indicators defined according to men's workforce distribution may not be adequate to classify women's occupations, as they are more concentrated in some sectors of the workforce (49).

Income has been used to overcome this limitation of assigning women to an occupational social class. However, this is only valid when women work outside their house, as in the case of occupation, and, more specifically, when their employment is full-time, as women are more frequently employed part-time than men, resulting this in a general lower income in women (49). In any case, income is a sensitive issue and people may be reluctant to provide this information, so very frequently the quality of this variable is questionable. It is related to the age of individuals (56), usually following a curvilinear trajectory, and its meaning may also vary for different age groups (49). That may lead to over-estimate the effect on LE and HE in countries with a higher income in the young stage of the workers' career. Income was the axis of inequality chosen in studies carried out in Germany and a project from the UK. German men in a most advantaged position lived longer

lives (34-36), while, with a very slight difference, the opposite happened among the population in the UK (31).

Other studies in this review analysed inequalities considering area level measures of socioeconomic position, instead of using individual ones. There is some evidence that there is a stronger association of certain health results with indicators such as an area-base deprivation measure than with occupation or education (57). Both men and women living in less deprived areas could expect to live longer and healthier lives than their counterparts from more deprived areas (58). This was not the case among women in a study carried out in UK, which found that the socioeconomic advantage on LE and DFLE at age 75 was larger for men than for women (31).

Studies from Ireland and Netherlands examined inequalities according to ethnicity. While in Ireland, Travellers expected to live shorter and less healthy lives than the general population (33), in Amsterdam, immigrant population had a longer LE than those with a Dutch origin (37). The first case shows the typical disadvantage of indigenous minorities in health terms (33) and the second is an example of the healthy migrant effect. According to Uitenbroek (37), this effect has two sides: on the one hand, an immigration of people from abroad and, on the other, an emigration of original Dutch population to suburban areas of the city.

This review has limitations, namely those related to the difficulties in comparing data across studies. The inclusion of studies that differ conceptually and methodologically hinders any possibility of really comparing specific results. Nonetheless, the inclusion of this variety of studies is also a strength as it highlights the existence of inequalities in LE and HE whichever axis of social inequality, country or life table method is considered. Another strength of the review is the search in databases from both a health and social science scope.

Even though its difficulty of comparison, what remains clear is that social inequalities in LE and HE exist, regardless of the indicator considered. Thus, social inequalities in LE and HE should be borne in mind when introducing any reform in pension systems, because they entail relevant differences between social groups in length of life, quality of life and health status during retirement. Although these inequalities are not declining (12;59), the reforms in pension systems carried out in several European countries have failed to consider the perspective of equity. Therefore, the persistence of social inequalities in LE and HE suggests that pension policies will continue having a different impact on older population, being less favourable to the social groups with shorter LE and HE. Thus, in line with previous recommendations (60), a differential pension age should be considered in the development of pension policies.

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6. Appendix

Table A1. Inequalities (absolute differences in years) in LE at age 50 by education in Europe.

Country	Men	Women	Reference (first author, year)
Denmark	3.5	2.7	Loichinger, 2016 (47)
Finland	3.4	1.6	Loichinger, 2016 (47)
Norway	3.4	2.5	Loichinger, 2016 (47)
Sweden	2.6	2.2	Loichinger, 2016 (47)
Switzerland	5.4	3.1	Spoerri, 2006 (41)
Italy	3.8	2.1	Loichinger, 2016 (47)
Bulgaria	8.7	3.3	Loichinger, 2016 (47)
Czech Republic	10.3	2.3	Loichinger, 2016 (47)
Hungary	9.8	3.7	Loichinger, 2016 (47)
Poland	7.1	3.0	Loichinger, 2016 (47)
Slovenia	8.2	3.3	Loichinger, 2016 (47)
Estonia	11.3	5.9	Loichinger, 2016 (47)
Lithuania	7.8	6.9	Kalediene, 2008 (46)

Table A2. Inequalities (absolute differences in years) in LE at age 65 by education in Europe.

Country	Men	Women	Reference (first author, year)
Denmark	2.1	0.8	Majer, 2011 (13)
Finland	1.5	0.6	Majer, 2011 (13)
Norway	2.2	2.5	Moe, 2012 (26)
Sweden	1.9	2.0	Batljan, 2009 (28)
United Kingdom	1.1	1.6	Jagger, 2007 (11)
Ireland	3.7	2.7	Majer, 2011 (13)
Austria	3.8	3.0	Majer, 2011 (13)
Belgium	2.8	1.7	Majer, 2011 (13)
Switzerland	3.5	2.7	Spoerri, 2006 (41)
France	3.0	2.1	Majer, 2011 (13)
Greece	3.4	2.5	Majer, 2011 (13)
Italy	2.3	1.3	Majer, 2011 (13)
Portugal	3.8	3.0	Majer, 2011 (13)
Spain	2.9	1.9	Majer, 2011 (13)
Lithuania	3.8	5.2	Kalediene, 2008 (46)

Table A3. Inequalities (absolute differences in years) in DFLE at age 65 by education in Europe.

Country	Men	Women	Reference (first author, year)
Denmark	3.2	2.6	Majer, 2011 (13)
Finland	2.6	2.5	Majer, 2011 (13)
Ireland	5.1	4.7	Majer, 2011 (13)
Austria	4.7	4.7	Majer, 2011 (13)
Belgium	2.9	2.3	Majer, 2011 (13)
France	5.6	6.1	Majer, 2011 (13)
Greece	5.4	5.0	Majer, 2011 (13)
Italy	3.0	3.0	Minicuci, 2005 (44)
Portugal	6.2	6.3	Majer, 2011 (13)
Spain	5.5	5.6	Majer, 2011 (13)