An examination of the association between premature mortality and life expectancy among men in Europe

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ABSTRACT

Background A feature of the health of men across Europe is their higher rates of premature mortality and shorter life expectancy at birth than women. Following the publication of the first State of Men's Health in Europe Report we sought to explore possible reasons.

Method We analysed trends in life expectancy at birth in 19 European Union member States (EU19) between 1999 and 2008 using mortality data obtained from Eurostat. We then used Pollard's decomposition method to identify the contribution of deaths from different causes and at different age groups to differences in life expectancy.

Results Between 1999 and 2008 life expectancy at birth in the EU19 increased by 2.74 years for men and by 2.09 years for women. Most of these improvements were due to reductions in mortality at ages over 60, with cardiovascular disease accounting for approximately half these improvements for men. In 2008 life expectancy of men in the EU19 was 5.92 years lower than that of women. Deaths from all major groups of causes, and at all ages, contributed to this gap, with external causes contributing 0.96 years, cardiovascular disease 1.80 years and neoplasms 1.61 years.

Conclusion Improvements in the life expectancy at birth of men and women have mostly occurred at older ages. There has been little improvement in the high rate of premature death in younger men, suggesting a need for interventions to tackle their high death rate.

Keywords: Pollard's decomposition, premature death, Men's health, European Union.

INTRODUCTION

Although there have been few studies to date that have explored men's health at the international level (1-4) there is a growing awareness of men's health issues.(5) A recent report on the state of men's health in Europe, undertaken for the European Commission,(6) described large differences between the health of men and women. Life expectancy data for the EU27 overall showed that men's life expectancy at birth was lower than that of women in all countries but the magnitude of the difference varied. Analysis of why that gap exists revealed that annual mortality rates among men of working age (15-64 years) are more than double those of women. Of the approximately 630,000 deaths among men of working age in 2007, 198,238 deaths occurred before the age of 50 years, compared to 86,585 female deaths.

Though life expectancy has risen markedly in Europe(7, 8) and it has long been known that women tend to have a longer life expectancy than men(9) there is still an relative dearth of debate and discussion specifically regarding the reasons for men's shorter lifespan. Whilst not nearly on the same scale as the plight of the 'missing women' reported by Sen in 1990,(10) this excess male mortality is largely invisible in the epidemiology literature. It represents a massive and largely avoidable human, social and economic toll.

There is much that is already surmised elsewhere as to the possible causes of men's high rates of premature death. Masculine socialization has been linked to increased risk taking and there are many social pressures on men to perform in certain ways that may harm their health in the short- and/or long-term.(11) The majority of the causes of the variance between men and women's life expectancy start to emerge in the early 40s and are a consequence of the widely reported

propensity of men to engage in more unhealthy lifestyles and risky behavior and the accumulation over time of risk/damage. The main causes of these preventable diseases include comparatively high smoking and alcohol levels, high fat intake, diets high in red meat and low in fruit and fibre, being overweight, and a lack of physical activity.(12-14)

Across Europe there is also a concern that men, although at greater risk of premature death, are less likely to engage with preventative health care screening(6), by being less likely than women to have their blood pressure or cholesterol levels checked(15). They are also less likely to have dental or eye check-ups.(6) Among the 50% of people with diabetes undiagnosed,(16) male sex is a significant risk factor.(17)

Men's increased vulnerability to many social determinants of health tends to be under-reported.(3, 4, 18-20) Findings from reports of this topic, and in particular demonstration of variations in premature death and life expectancy among men that are demonstrated in the new European Commission report(6) highlight the impact of poor socio-economic conditions. These findings suggest that men suffer from 'heavy impact diseases' that are more rapidly fatal, with women more likely to survive, but in poorer health.(3, 21, 22)

These social factors clearly influence individual lifestyle choices and practices. When compared to women and men from more affluent backgrounds, men who live in poorer material and social conditions (including: unemployed men,(23) ethnic minorities,(24) prisoners,(25) homeless men,(26) and those with lower educational attainment (27-29)) are more likely to: eat less healthily; take less exercise; be overweight /obese; consume more alcohol; smoke; engage in substance misuse; and more risky sexual behavior (6). In Eastern European

countries in particular, high levels of alcohol intake are taking their toll through sudden cardiac death. (30-32) It is anticipated that this will be an increasingly important factor in Western death rates.(33)

The results in the first State of Men's Health in Europe Report (6) established the imperative to explore in more depth the implications of these risks for men's health. Though there have been some attempts to explore the contribution of different causes of death to changes in life expectancy within individual countries or within a small group of countries(34, 35), we now look at the larger picture, examining the contribution of deaths from different causes and at different ages to changes in life expectancy for men and for women in a 10 year time period (1999-2008) across 19 EU countries to determine their overall effect to men's lower life expectancy.

METHODS

Population and mortality data by age and cause of death were obtained from Eurostat for the 19 countries that had complete data for 1999 and 2008 (Austria, Bulgaria, Czech Republic, Denmark, Finland, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Spain, Sweden, United Kingdom). Cause of death was classified according to the 9th and 10th revisions of the International Classification of Diseases (ICD-10) and was aggregated into broad categories corresponding largely to body systems (so overcoming the potential problems arising from different versions of ICD). Where appropriate, data were age standardized using the European Standard Population as defined by the World Health Organization.(36) Differences in the life expectancy of populations over time and between sexes were decomposed into deaths from different causes and at different ages using the method developed

by Pollard(37), based on Chiang's life tables.(38) Pollard's decomposition method allows measurement of the contribution of different causes of death in each age group to differences in life expectancy at birth between sexes and over time (Box).(5)

In this study, we analysed the changes in life expectancy between 1999 and 2008 for both men and women, giving the total years added (positive values) or removed (negative values) from life expectancy at birth for every age group and cause-specific death in these two periods. In addition, a comparison was made of men's and women's changes in life expectancy at birth for the years 1999 and 2008. In this case, Pollard's decomposition gives the total years added (positive values) or removed (negative values) from life expectancy at birth for every age group and cause-specific death when comparing men to women.

Within the analysis specific focus has been given to the age ranges 0-14, 15-64 and 65+. These age ranges have been chosen to reflect, respectively, the potential impact of premature male death rates on child and adolescent mortality, the working age population, and older people.

RESULTS

In the EU19 men's life expectancy at birth was 73.27 years and for women 79.79 years in 1999. Pollard's decomposition shows an increase of 2.74 years (3.7%) for men and 2.09 years (2.6%) for women between 1999 and 2008 (Figure 1), with gains concentrated mostly in infancy and older age. Over this time period the gap between men's and women's life expectancy dropped from 6.57 years in 1999 to 5.92 years in 2008. Although the gap between men's and women's life expectancy narrowed slightly (by less than 8 months) - the gap remains wide. Of the 2.74 year increase in male life expectancy between 1999 and 2008, 0.24 years occurred between the ages of 0 and 14 years, 1·05 years between the

ages of 15-64 years and 1.46 years over the age of 65 (Figure 1). When the causes of change in life expectancy in different age groups within the male population were analysed, the major contributor was a reduction in deaths from diseases of the circulatory system, accounting for 1.45 years of the overall 2.74 years improvement, with the majority of these added years occurring over the age of 60 years (1.19 years). Reductions in deaths as a result of external causes in childhood, adolescence, and early adulthood (less than 40 years of age) contributed 74% of the overall 0.32 year gain in life expectancy as a result of this classification group. Across all age groups, fewer cancer deaths contributed 0.41 years.

Among women, gains in life expectancy between 1999 and 2008 were concentrated at older ages (Figure 1). Improvements among those of working age (15-64) contributed only 0.49 years of the overall gain, with most of this gain (1.40 years) found among those aged over 65 years. There was an improvement in deaths in the first year of life. Reductions in deaths due to diseases of the circulatory system contributed 1.39 years to the total 2.09 year increase. Improvements in other causes were relatively small: reductions in respiratory system deaths added 0.20 years to the overall increase, and reductions in cancer deaths added 0.24 years.

Although men's life expectancy improved to a greater extent than women's in this 10 year period, women still have a markedly longer life expectancy than do men. Pollard's decomposition was used to examine the 6.57 year sex difference in 1999 and the 5.92 year sex difference in life expectancy in 2008 (a 9·93% reduction) (see Table 1). The largest overall contribution to the difference was in cardiovascular deaths, with -2.23 years in 1999 and -1.80 years in 2008 (a

19.41% reduction). There has been little change with regard to neoplasms, where -1.58 years of difference were seen in 1999 as compared to -1.61 years in 2008. Infectious diseases contribute little to the difference in life expectancy overall, but there was a reduction of 17.77% (from -0.11 year to -0.09 year) in their contribution over the time period.

The age / cause specific graphs for 1999 and 2008 (Figure 2) are similar in that external causes had the largest influence on the difference in life expectancy in the young adult years, contributing 1.11 years of reduced life expectancy in men in 1999 and 0.96 year in 2008 (a 13.13% reduction, Table 1). It is possible to discern points on the graphs where changes in health reduced life expectancy rather than increased it: in the age range 30-44 years, higher female cancer death rates narrowed the gap, as did deaths from other causes in those aged over 85 years in 2008. There is a steady, but marked profile of an increasing gap between the age group 30-34 to 65-69 years, with the majority of the overall differences between men and women being seen in the over 60 years at both time points.

Analysis indicated that the 0.65 year reduction in the gap of male to female life expectancy between 1999 and 2008 was largely the result of a reduction in deaths from external causes and cardiovascular disease, but that these gains were in part countered by the increased gap between men and women in cancer deaths among those aged 75 years and older.

Between-country differences

In-depth country-by-country analyses of life expectancy changes goes beyond the scope of the present study, but an overall picture can be seen in Figure 3.

Increases in life expectancy were seen across the EU19, except for men in Lithuania, where no change was evident. In some countries the increase for men was much larger than for women, whereas in others a greater increase in life expectancy was seen for women. The picture is complicated with some countries that had poor life expectancy in 1999 showing big changes, while others did not. For example, whereas Estonia and Slovakia experienced large increases in life expectancy, their respective neighbours Lithuania and Bulgaria did not. This suggests variation in different countries' responses to opportunities to improve the health of their populations through legislation and/or investment in effective health programmes.

DISCUSSION

The results of this study show that there have been improvements in the life expectancy of men and women across these EU19 countries, mostly as a result of better health outcomes in later life. Those who have survived through their working lives are now living longer: this was especially the case for women. Though there were some increases in life expectancy in the 15-64-age range for men, it was not of an order that would have a big impact on their high rate of premature death.

Women tend to have a lower risk of premature death generally, with the majority of women's deaths the result of cancer, especially breast cancer. For men there are a far greater number of factors that influence their higher rate of premature death. With few sex-specific causes of death in the working age of 15-64 years, the majority of the causes of death should affect men and women equally. They should also, in the main, be preventable.(12, 39)

The analyses presented here give some indication as to the causes of the variance between male and female life expectancy in the early years. Further examination of temporal change identified those factors that tended to reduce sex differences in longevity and those disease states and causes of death that maintain them.

Reductions in deaths from external causes helped to narrow the gap between men's and women's life expectancy in the early years, mostly as a result of health and safety policies within the workforce and road safety legislation.(40) With more stringent enforcement, particularly in eastern European countries, deaths could be reduced even more considerably. Suicide rates have historically been higher for men than for women, and over this time period there were reductions in the majority of the countries under study, though trends suggest that these may be on the increase again as a result of the economic downturn.(23)

Our analyses demonstrate the marked improvements in life expectancy as a consequence of better cardiovascular health. Public health approaches to smoking reduction,(14) along with earlier diagnosis and more effective treatment of cardio-vascular disease are certainly contributing to these successes.(41) With women's risks of CVD most evident post-menopause, these benefits have only a small effect on their rates of premature death. For men, there was some reduction of CVD death at younger ages, but the greatest impact was seen in the older male population.

With increasing longevity, and decreases in cardio-vascular death, cancer has a growing impact on overall life expectancy. In the older age groups cancer has an

increasingly negative effect on the life expectancy gap between men and women when comparing 1999 to 2008. This suggests that the difference in overall life expectancy between men and women would have further reduced if this increase in cancer in men in the older age group had not occurred. The gap has also widened as a result of the marked improvements in women's chances of surviving breast cancer(34). It has been noted previously that men are at increased risk of those cancers that should affect men and women equally both due to higher incidence and higher mortality rates across all ages.(42-45) Survival rates are also lower for men.(46) The observed reduction in cancer deaths (0.41 years to the overall increase in male life expectancy of 2.74 years) could be seen to be the result of improvements in early detection and better treatment regimens(47) and, in significant part, the effects of reduced smoking, although the time lag involved suggests that the last of these will continue to have an impact in the next few decades (48)

Deaths related to problems with the digestive system clearly add to the life expectancy gap in the working age population, and in this domain there was very little improvement in men's life expectancy (0.08 years of the 2.74 years). The observed patterns are principally a result of increases in liver disease linked to alcohol and, to a lesser extent, hepatitis(32). Hazardous drinking also contributes to men's high rates of cardiovascular disease and some cancers (12, 14, 30, 33), although this is an area where women are rapidly closing the gap. While there may be improvements in the health of men as a result of reduction in smoking, there is evidence that the benefits are being countered by increases in other risk factors including overweight, decreased physical activity, increased sedentary behavior, and poor diet(6).

The variation in these effects among and within countries suggests that what is important is being male within particular socio-cultural and economic contexts rather than being male *per se*.

Having said all this, there has been a faster rate of improvement in men's life expectancy as compared to women over this time period, much of which seems due to men giving up smoking at a faster rate 20 to 30 years (or more) earlier. They were also the first to be told (unambiguously) when they were young enough that smoking was a health hazard. The current generation of men have been living during a time of much lower financial stress and, until recently, near full employment. Men now aged in their 60s and 70s have had a relatively stable working environment. The period we have studied ends just before a major economic recession, and since 1945 during all economic recessions men's health has improved at a slower than normal rate while women's life expectancy has tended to move ahead.(4)

The between-country differences suggest that some countries have responded positively to the challenge of poor health and are seeing improvements, whereas others have not been so effective.(35, 49)

Population projections suggest that there will be a contraction in the male working population (15-64 years) of some 24 million across the EU27 and an expansion of 32 million men over the age of 65 years by 2060.(6) Thus a diminishing younger population will have to support an increasing older population. The rapid increase in the rate of preventable death after the age of 40 years highlights a clear need to address the health-limiting circumstances that affect the health of the working age man.(49)

This will have the benefit of lowering premature mortality, increasing healthy life expectancy, slowing the development of chronic disease and thereby decreasing

the burden of care in the older population. Such approaches at the whole-population level would also have benefits for women. This focus on premature mortality is arguably as important for global and European health policy as is the improvement of child survival.(20)

Conflicts of interest: None declared

Keypoints

- This study adds clarity as to what are the reasons behind men and women's differences in life expectancy and what has constituted the reasons for the changes over the ten years from 1999 to 2008.

- There is a worrying picture of a relative static improvement in the working age bracket (15-64 years) in men, with most increases in life expectancy occurring in the over 65 year olds.

- The study also helps to explain what is bringing about the narrowing of the gaps and shows the importance of improvements in cardio-vascular health over the last ten years.

- The study suggests that more needs to be done to address the causes of the high levels of premature death in men, especially in countries where high levels of premature death are still evident.

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Box Pollard's method for decomposing life expectancy

Designating life expectancy at birth for populations 1 and 2 as e_0^1 and e_0^2, the difference between the two life expectancies can be written as

$$e_0^1 - e_0^2 = \sum_x n \left({}_nm_x^{(i)1} - {}_nm_x^{(i)2} \right) w_x$$

Where ${}_nm_x^{(i)1}$ is the central mortality rate for cause *i* between age *x* and *x+n.*

The weight w_x is given by the formula $w_x = \frac{1}{2}\left({}_xp_0^2 e_x^1 + {}_xp_0^1 e_x^2 \right)$ where ${}_xp_0$ is the life table probability of surviving from birth to age *x* and e_x is the life expectancy at age *x.*

This can also be written as $e_0^1 - e_0^2 = \sum_x \sum_i (Q_x^{(i)1} - Q_x^{(i)2}) w_x$ with $Q_x = -\ln\left(\frac{l_{x+n}}{l_x}\right)$

where l_x is the life table number of people alive at exact age *x.*

The quantities $(Q_x^{(i)1} - Q_x^{(i)2}) w_x$ give the weight of each cause in the difference observed between the two life expectancies

The sum over all ages gives the total contribution for each cause *i* in that difference whereas the sum over causes would give the relative weight of mortality at each age

Table 1 Contribution of major causes of death to sex differences in life expectancy[1] for 1999, 2008 in the EU19.

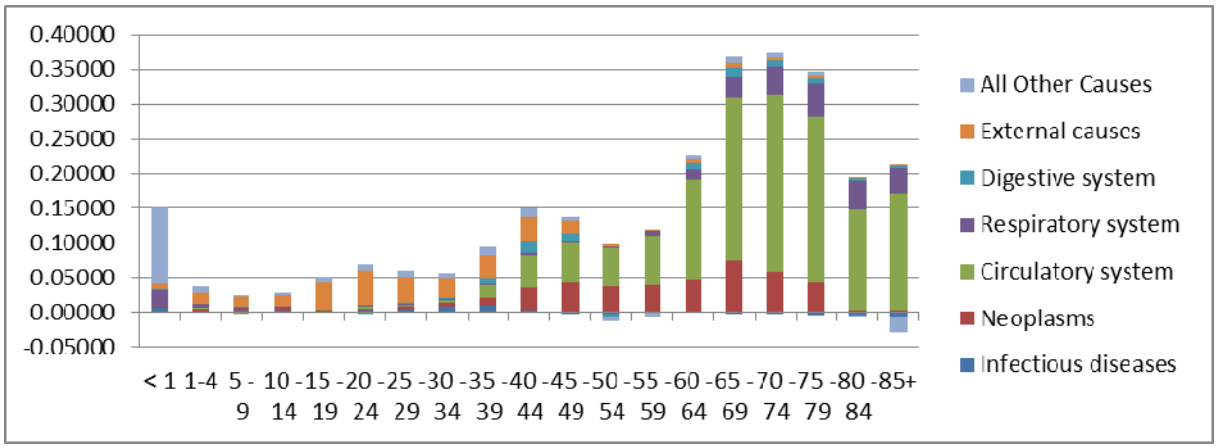
	1999	2008	Change	1999-2008 Change (%)
All Causes	-6.57	-5.92	-0.65	9.93
Infectious diseases	-0.11	-0.09	-0.02	17.77
Neoplasms	-1.58	-1.61	0.03	-2.10
Circulatory system	-2.23	-1.80	-0.43	19.41
Respiratory system	-0.59	-0.54	-0.05	8.07
Digestive system	-0.38	-0.36	-0.02	5.25
External causes	-1.11	-0.96	-0.15	13.13
All Other Causes	-0.57	-0.55	-0.02	3.39

[1]The figures represent the years each cause of death contributed to the total difference (All Causes) in life expectancy between men and women in both 1999 and 2008. The 'Change' column refers to the differences between the two time periods along with the percentage change. Notice that a negative value in the column "Change" represents a reduction of the gap between men and women.

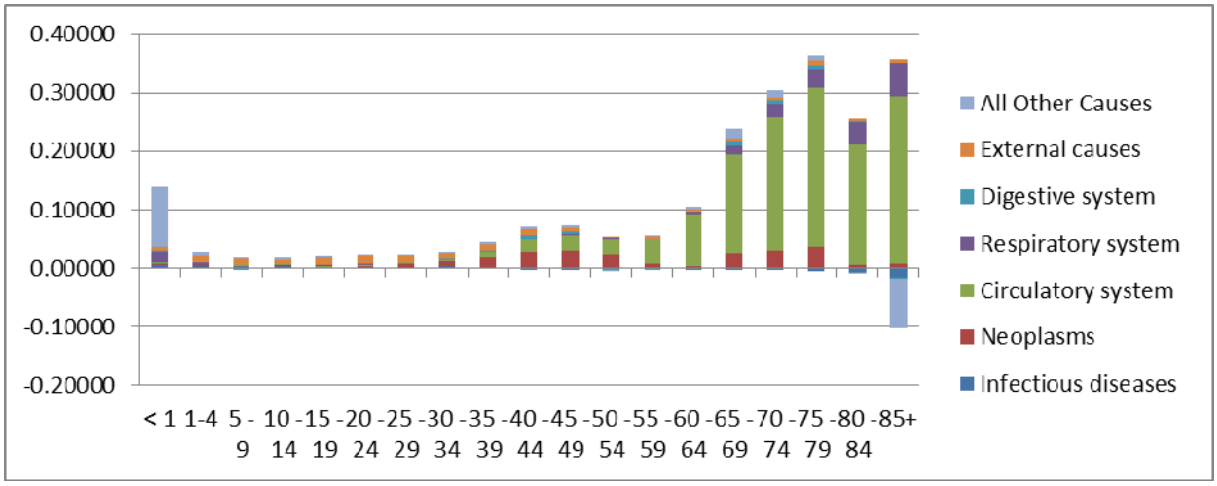
Titles & footnotes from figures

Figure 1 Pollard's decomposition of changes in life expectancy 1998-2008 for males (left panel) and females (right panel)

Males



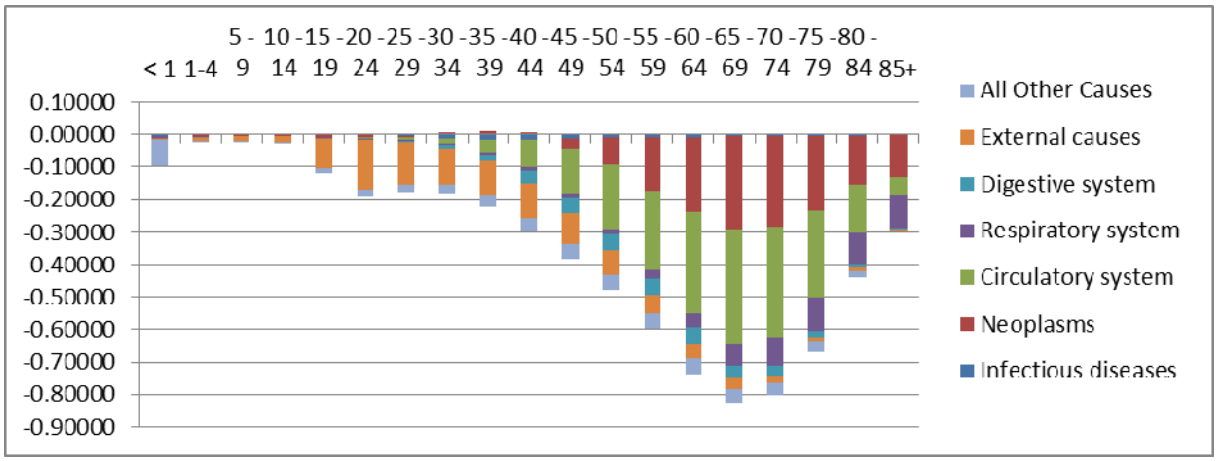
Females



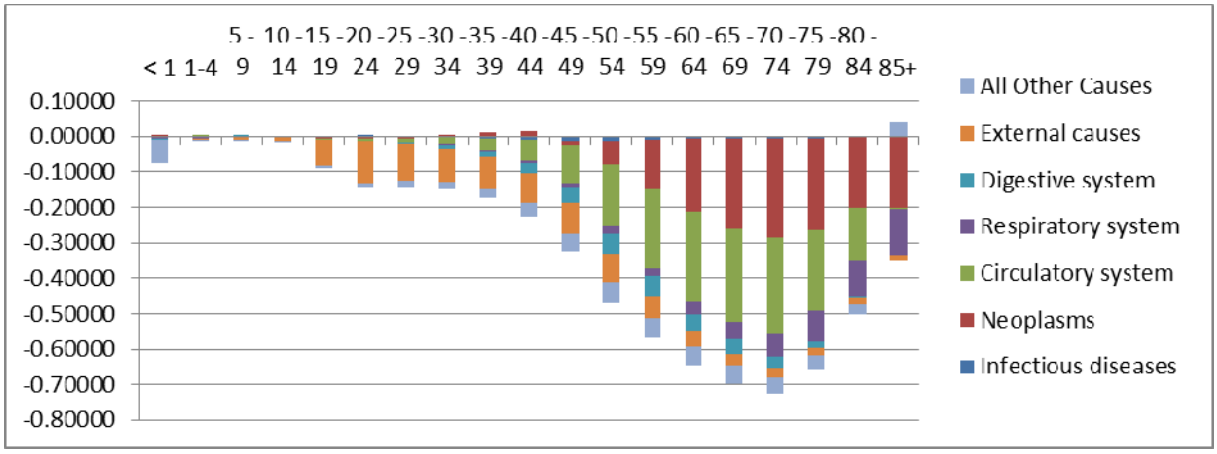
Calculated from Eurostat demo_pjangroup, demo_pjan and demo_magec (1999, 2008)

Figure 2 Pollard's decomposition of male-female differences in life expectancy, EU19, 1999 (left panel) and 2008 (right panel)

1999

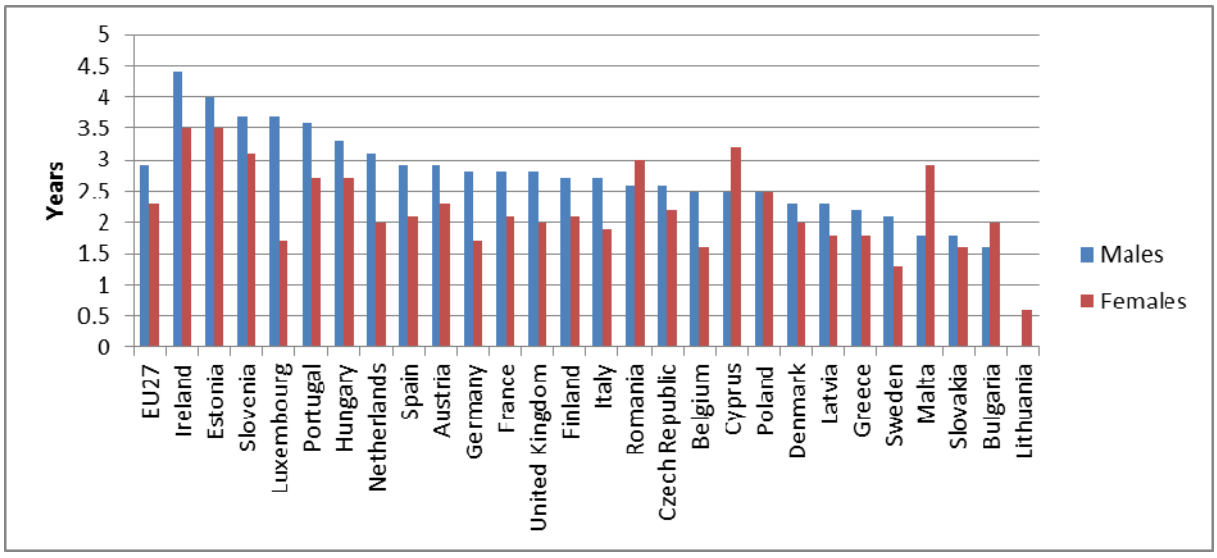


2007



Calculated from Eurostat demo_pjangroup, demo_pjan and demo_magec (1999)

Figure 3 Difference in life expectancy for men and women in years, between 1999[1] and 2008



Calculated from Eurostat demo_pjangroup, demo_pjan and demo_magec (1999, 2008)

[1] 2002 and 2008 for Latvia