Reversal of upward trends in mortality during the Great Recession in employed and unemployed individuals at baseline in a national longitudinal study

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Running head: Great Recession, employment status and mortality

Abstract

Due to the healthy worker effect, mortality increases in individuals who were employed or unemployed and decreases in those economically inactive at baseline. To determine if such trends continue during economic recessions, we analysed mortality in Spain before and during the Great Recession in these subgroups. We included 29,933,351 individuals who were employed, unemployed or inactive in November 2001 and aged 30-64 in each calendar-year of follow-up (2002-2011). Annual age-adjusted mortality rates were calculated in each group. The annual percentage change (APC) in mortality rates adjusted for age and educational level in employed and unemployed was also calculated for 2002-2007 and 2008-2011. In employed and unemployed men, mortality increased until 2007 and then declined, whereas in employed and unemployed women, mortality increased and then stabilized during 2008-2011. The mortality rate in inactive men and women decreased throughout the follow-up. In employed and the unemployed, the APC was reversed during 2008-2011 compared with 2002-2007 (-1.2 vs 3.2 in employed men, -0.3 vs 4.1 in employed women, -0.8 vs 2.9 in unemployed men, and -0.6 vs 1.3 in unemployed women). The upward trends in mortality among individuals who were employed or unemployed in 2001 were reversed during the Great Recession (2008-2011).

Key words: Great Recession; employed, unemployed, mortality; cancer mortality; non-cancer mortality; Spain

Abbreviations

APC: annual percentage change

CI: confidence interval

Introduction

Many studies have evaluated the relationship between economic fluctuations and mortality in wealthy countries throughout the 20th century and in the first years of the 21st century. In general, economic recessions reduce overall mortality and traffic deaths, but they are associated with an increase in suicides [1-9]. Changes in mortality from other causes of death are inconsistent between studies[1-3,5,8-15]. For example, during the last quarter of the 20th century, mortality from cardiovascular diseases declined with economic recessions in the USA and Germany[1,11], however in the case of Sweden, it has been argued whether it increased or decreased[10,12]. In the USA, cancer mortality decreased during economic recessions in 1945-70, did not vary during economic fluctuations in 1976-1995, but increased during economic recessions in 1991-2010[1-2,13]. And, in Greece, two studies on overall mortality and mortality from various causes before and after the economic crisis of 2008 showed heterogeneous findings[14-15].

These studies analysed temporal evolution of mortality by applying different analytic techniques to aggregated or individual data. Their purpose was to determine if the downward trend in population mortality changed during economic recessions. Given the large number of factors implicated in the decline of mortality, the heterogeneity of results on mortality from cancer and other chronic diseases suggests that some of the associations found could reflect could reflect the relation of other contextual variables with mortality not measured in each specific place and time period[6,13,16-19].

An alternative design to determine the possible role of economic recessions on mortality from these causes of death is to compare the evolution of mortality before and during the

economic crisis in population groups where an upward trend in mortality is expected. These population groups could be men and women who participate in the labour market at a specific time before the beginning of the economic crisis whose possible association with mortality one wants to determine. It is known that individuals who were employed or unemployed at baseline in longitudinal studies experience an increase in mortality during follow-up. Several studies published in the last century reported this finding[20-26]. Much of the evidence on this fact which is often ignored comes from the OPCS Longitudinal Study, conducted in a 1% sample of the 1971 population census of England and Wales[21-24]. Different authors analysed mortality, both in employed and unemployed subjects at the census date. Mortality in both groups increased throughout the follow-up decade[21-24].

This increase in mortality was attributed to the healthy worker effect. This phenomenon, initially observed in occupational diseases investigations, occurs because individuals with a serious disease or permanent disability, who have a higher risk of death, tend to be excluded from the labour market[27-28]. Consequently, in employed individuals mortality is lower than in the general population. In healthier cohorts, diseases increasingly develop over time[20]. For this reason, the mortality rate in employed persons at baseline increases during follow-up[21-22, 25-27, 29-30]. In some cohorts this increase in mortality has been observed during 20 or 30 years of follow-up[25,30]. Based on the analyses of the OPCS Longitudinal study, Moser et al. suggested that a healthy worker effect is also present in unemployed[23-24]. These authors showed that mortality in those who were seeking work or waiting to take a job was lower than mortality observed in the general population at the beginning of follow-up and, furthermore, mortality in these subjects increased during follow-up.

In an investigation similar to the OPCS Longitudinal Study conducted in Spain, the vital status of all persons included in the 2001 census was followed until 2011. This study allowed to analyze how mortality evolve in Spain during the Great Recession[9]. Here we expand on that research by examining the evolution of mortality in particular groups in which beforehand we hypothesized mortality could be increasing as it was in the OPCS Longitudinal Study[31]. Specifically, our objective was to determine whether the expected upward trend in mortality during follow-up among employed or unemployed at baseline (2001) changed during the 2008 economic crisis.

Methods

Data are from the Spanish Longitudinal Mortality Study of the 2001 Census, which included all residents in Spain on 1 November 2001. Almost 41 million individuals were followed up by the National Statistics Institute until 31 December 2011 to determine vital status. The census collected demographic and socioeconomic characteristics of residents. The database was prepared by the National Statistics Institute and was based on individual census records linked with the population and mortality registries using common identifiers (the national identity document, name, and date of birth). The National Statistics Institute provided us with the final data file after removing personal identifiers to maintain confidentiality. In the final cohort, 1.7% of subjects who could not be found in the population or the mortality registries, due to technical problems in the links of the identifiers, were excluded. 1% of the subjects moved out of Spain and their contribution to the risk of death was censored on that date. The sociodemographic characteristics (age, sex, educational level, employment status)

of the subjects who were excluded or censored did not differ from those of the remaining individuals.

Our analyses included 10,954,254 men and 10,979,097 women aged 30-64 in each calendar-year of follow-up. A minimum age of 30 was established because using this criterion the youngest people analysed in 2011 were aged 20 at baseline, and below that age, the percentage of subjects in the labour market was very small. Maximum age was 64 because at older ages the percentage of subjects in the labour market is very small. Subjects were asked about their employment status in the week before the census date, with the following response options: student, employed, unemployed looking for the first job, unemployed who has worked before, receiving income for permanent disability, receiving income for widowhood or orphanage, receiving income for retirement or pre-retirement, performing housework, needing help for basic activities of daily living, and other situations. Men were divided into three groups according to employment status – employed, unemployed and inactive – and women into four groups – employed, unemployed, inactive and housework, given the high percentage of women in the last category. Tables 1 and 2 show the number of deaths and person-years by calendar-year, respectively, for each group of employment status.

The underlying cause of death was coded according to the International Classification of Diseases, 10th Revision. Bearing in mind the objective of the present study, external causes of death (suicide, homicide and unintentional injuries) were not considered. By using weights from the European standard population, we estimated directly age-standardized mortality rates for all diseases during the pre-crisis period (2002-2011) and the crisis period

(2008-2011) for each group of employment status, and the annual age-standardized mortality rates for all diseases in those employed, unemployed and inactive at baseline.

The unemployment rate in Spain reached a minimum of 8.2% in 2007 to rise up to 26.1 in 2013 and then decreased[32]. The Bank of Spain dates the start of the crisis in the second quarter of 2008 and its end in 2013[33]. Between 2007 and 2013 real Gross Domestic Product per capita fell by 9%, in 2014 the recovery started with Gross Domestic Product per capita growing 1.4%[33].

We estimated annual age-adjusted mortality rates for cancer and non-cancer diseases in employed and unemployed people**,** given the healthy worker effect is much less for cancer than for nonmalignant diseases (diseases of young age that are related to health status at start of employment or long term chronic diseases that interfere with employment during periods of life when individuals are likely to be member of the workforce)[27,34]. Likewise, we tested whether in employed and unemployed there was a change in the upward trend in mortality from all diseases, cancer and non-cancer diseases after the crisis began. For this purpose, we estimated segmented Poisson regression models. The number of deaths was the outcome variable and person-years (py) were included as an offset variable, which is equivalent to modelling the mortality rate as a dependent variable. Time was defined as a continuous variable from year 2002 to year 2011. An indicator variable was used to define the crisis, with a value of zero in pre-crisis calendar-years (2002-2007) and one in crisis calendar-years (2008-2011). An interaction term between crisis and time was defined to estimate the linear trend change in mortality rate between crisis and pre-crisis periods. If β_1, β_2, β_3 are the model coefficients for time, the indicator variable, and the interaction term,

respectively, β_2 reflects the immediate level change in the mortality rate with the onset of the crisis, β_1 and $\beta_1+\beta_3$ reflect the trend in the mortality rate before and during the crisis, respectively, and β_3 reflects the difference in the trend during the crisis compared with the trend before the crisis. We included age and educational level as covariates. For presentation of the trend results, the annual percentage change (APC) in mortality rate before and during the crisis was calculated, as well as the crisis-period effect size, using the difference between the APCs during and before the crisis. We calculated the 95% CI for these estimates.

Results

Table 3 shows the number of persons by employment status and the age-standardized mortality rate before (2002-2007) and during (2008-2011) the crisis. Employed and unemployed men were 8,697,387 and 909,712, respectively; employed and unemployed women were 5,282,611 and 1,086,797 respectively. In both periods, the lowest mortality rate was observed in employed persons and the highest in those who were economically inactive at baseline. In the employed, the unemployed and those who exclusively did housework, the mortality rate during the crisis was higher than before, whereas the opposite occurred in inactive persons.

Figure 1 shows the annual age-standardized mortality rate for all diseases in the individuals who were employed, unemployed, or inactive persons in 2001, and for the total number of subjects analysed. In employed men, the mortality rate per 100,000 py increased from

219.5 in 2002 to 266.7 in 2007, and then declined to 254.2 in 2011. In unemployed men, the rate increased from 475.9 in 2002 to 562.5 in 2007, and then decreased to 531.5 in 2011. In employed women, the mortality rate rose from 92.4 in 2002 to 121.4 in 2008, and remained around that value thereafter. In unemployed women, the rate increased from 125.6 in 2002 to 162.1 in 2009, and then to 155.8 in 2010 and to 159.2 in 2011. The mortality rate in inactive men and women and in the total group of men and women decreased during the period analysed. In some years (2003, 2005 and 2007), the mortality rate showed an increase with respect to the previous year in unemployed and inactive persons, as well as in the total group of subjects.

Table 4 shows the linear trend in mortality risk from the causes of death analysed before (2002-2007) and during the crisis (2008-2011), and the comparison of these trends between periods among the employed and the unemployed. In those employed, the APCs in mortality risk were positive in 2002-2007 and negative in 2008-2011. In men, the APCs before and during the crisis were 3.2 vs -1.2 for all diseases, 3.9 vs -1.1 for cancer, and 2.5 vs -1.3 for non-cancer diseases; the difference (95% CI) between the two periods was -4.4 (-4.9 to -3.9), -4.8 (-5.6 to -4.2) and -3.8 (-4.6 to -3.1), respectively. In women, the APCs were 4.1 vs -0.3 for all diseases, 5.6 vs -0.1 for cancer, and 1.2 vs -0.9 for non-cancer diseases, with a respective difference (95% CI) between the two periods of -4.4 (-5.4 to -3.4), -5.7 (-6.9 to -4.5), and -2.1 (-3.9 to -0.4).

In the unemployed group, the APCs were positive before the crisis and negative during the crisis, except for cancer mortality in 2008-2011. In men, the APCs before and during the crisis were 2.9 vs -0.8 for all diseases, 2.7 vs 0.6 for cancer, and 3.0 vs -1.7 for non-cancer

diseases, with the respective difference (95% CI) between the two periods of -3.6 (-4.8 to -2.5), -2.0 (-3.8 to -0.2) and -4.7 (-6.2 to -3.3). In women, the APCs were 1.3 vs -0.6 for all diseases, 2.2 vs 0.2 for cancer, and 0.2 vs -1.8 for non-cancer diseases; the difference (95% CI) between the two periods was -1.9 (-3.8 to 0.1), -1.9 (-4.5 to 0.6), and -2.0 (-5.0 to 1.0), respectively.

Discussion

All-disease mortality, both in baseline employed and unemployed subjects, rose in the pre-crisis period (2002-2007), but decreased in men and was steady in women during the crisis (2008-2011). In prospective studies similar to ours, conducted in cohorts of subjects who were employed at baseline, the mortality rate showed a continuous increase[21-22,25-26,30]. However, few investigations have analysed the evolution of mortality in cohorts of subjects who were unemployed at baseline, with the exception of the analyses of unemployed men in the OPCS Longitudinal Study[23-24]. Those analyses showed that the mortality rate in men who were unemployed in 1971 was higher in 1976-81 than in 1971-75.

In our study, individuals who were employed in 2001 were the healthiest subjects. They had the lowest mortality at the beginning of follow-up, followed by the unemployed who, in turn, had a lower mortality than the inactive individuals. In the two healthiest groups – employed and unemployed – the development of diseases over time would be responsible for the increasing mortality rate observed during the pre-crisis period. In contrast, the decrease or stabilization of mortality during the economic crisis in these subjects we believe

is to be attributed to improved patient prognosis. An improvement in treatment of diseases during the economic recession, as the cause of increased survival, does not seem plausible. However, an improvement in prognosis due to changes in health behaviors and environmental factors that modify the hazard of death in person with latent or clinical chronic disease seems to us the most likely explanation.

Smoking and alcohol consumption decline during economic crises[1,35-36], probably due to the drop in purchasing power. Smoking reduces survival in patients with lung or other types of cancer[37-38] and is a risk factor for mortality in patients with cardiovascular disease[39], respiratory diseases[40] or diabetes[41]. Alcohol consumption is associated with decreased survival in patients with several types of cancer[38], and excessive alcohol consumption is known to increase the risk of mortality from many diseases, including liver cirrhosis[42] and diabetes[41]. In Spain the decrease in smoking was due to smokers quitting the habit and fewer cigarettes smoked among many who continued smoking[43], and the decline in alcohol consumption was due to a reduction in the prevalence both of persons consuming any amount of alcohol and of those who consumed it in amounts considered harmful for health[43-44]. Apart from reducing alcohol and tobacco consumption, some authors have noted that during economic crises people have more time to do physical activity[35-36] . In Spain the proportion of gym users increased during the crisis with respect to the previous period[45]. For patients with cancer, cardiovascular diseases or diabetes, physical activity is known to reduce premature mortality[46].

In our study, 26% of the women who were employed and unemployed in 2001 had university studies compared to 15% of men. Given women's higher professional

qualifications, the economic crisis may have affected their income to a lesser extent compared to men. This would explain why the mortality rate for all diseases in employed and unemployed women continued its upward trend until 2008-2009 and then stabilized, whereas in men the mortality rate rose until 2007, and then decreased. The stabilization was due to mortality from cancer, given that mortality from non-cancer diseases in employed and unemployed women decreased during the crisis. The fact that smoking prevalence in women age 45-64 increased during the crisis, although to a lesser extent than in the previous period[43], may be an explanation of this finding.

Using time series and panel regression models, some studies have found that the decline in Gross Domestic Product (or the increase in unemployment), as a reflection of economic recessions, is associated with an immediate decrease in mortality from cancer and other diseases[1-3,7-8,11]. And other studies have found increase in cancer mortality[13, 47]. For some authors, it is difficult to suggest a plausible explanation for these findings[6,13,16-19]. In their opinion, this variation could be due to other health determinants that have a spurious relationship with macroeconomic fluctuations. The contradictory findings in cancer mortality would support this spurious relationship. However, the findings of our longitudinal study suggest: a) that the economic crisis of 2008 was very likely responsible for the change in the trend of mortality from cancer and non-cancer in employed and unemployed subjects at the beginning of follow-up; and b) that the changes in cancer mortality could be explained by the same mechanisms producing changes in mortality from other diseases.

Strengths and limitations

We included in the analysis all subjects from the 2001 census. During follow-up, some employed people probably lost their job or retired, some unemployed people could have found a job, and some who were inactive could have joined the labour market. These changes, however, are beyond the realm of our study, as our purpose was to analyse the evolution of mortality in various groups of subjects according to their employment status at baseline.

The separation of subjects into different groups by employment status at baseline showed that both the level and evolution of mortality is very different in inactive persons compared with employed and unemployed. Although inactive are a small percentage, their high mortality is responsible for the trend in the mortality rate in the overall population.

The OPCS Longitudinal Study showed that mortality in men who in 1971 were inactive decreased in 1976-81 with respect to 1971-75[48]. According to Moser et al., there was a large proportion of sick people in this group[23]. In our study, 29% of the inactive men and 21% of inactive women had a permanent disability or required help to perform the activities of daily living. This explain their extremely high mortality rate at the start of the follow up. The decrease in mortality in this group during the following years would be the consequence of a process of "harvesting", that is, deaths of the persons in this group with the most severe ailments, which subsequently raise the level of health in the group. We notice, however, that in 2005 and 2007 mortality did not decrease, or even increased, compared with the previous year. This was probably due to increased influenza activity in 2005 and 2007 in

Spain[49-50], which resulted in increased deaths in persons with underlying respiratory or cardiovascular diseases.

Mortality in inactive persons also declined more during than before the crisis, especially in men (web table 1). Better evolution of chronic diseases by reduction of the factors stimulating their progress to death may explain this acceleration of mortality decline. But in that better prognosis a possible increase in informal family care of chronically ill and disable people by the rest of relatives who became unemployed during the crisis cannot be ruled out. Given that the burden of care falls on women[51], this would explain the greater reduction in male mortality. Likewise, this possible increase in informal care could have contributed to the greater acceleration of the decrease in mortality in employed men compared with employed women.

Like other investigations, we found higher mortality in unemployed individuals compared with employed[48]. One of the proposed explanations for this finding is a selection bias —the healthy worker effect-. That is, the higher mortality of the unemployed would be caused by the fact that persons with poorer health are more likely to lose their job or remain jobless[52]. Moser et al. ruled also out a selection bias in unemployed workers[53] because, although their health was poorer than that of employed people, it was better than the health of inactive people. These authors supported their reasoning by pointing out that the harvesting effect was observed in inactive people, not in unemployed in which mortality increased during follow-up. In our study we found a similar result. However, the large increase in mortality in unemployed women in 2003 and in all unemployed in 2005 and 2007, with respect to previous years, suggests the existence of many sick persons in this group. The August 2003

heat wave[54] and increased influenza activity in 2005 and 2007[49-50] surely contributed to the increased number of deaths in sick people.

A possible explanation of the change in the trend of mortality that took place when the economic crisis started, in both the employed and unemployed individuals in 2001, is a change in the incidence of disease. However, we find this explanation extremely unlikely. Most diseases that are presently important causes of death in Spanish adults are chronic processes, requiring years to become clinical processes significantly increasing the risk of death. For that reason, we believe implausible that a decrease in unhealthy behaviours had led to relevant changes in disease incidence in such a short period of time.

In conclusion, during the economic crisis, the upward trend in the rate of mortality from all diseases was inverted in the groups of employed and unemployed subjects at baseline. This is probably a consequence of improved prognosis in patients with cancer and other chronic diseases.

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Table 1. Number of deaths in people aged 30-64 by gender, employment status in 2001 and calendar-year. Spain, 2002-2011.

Employment status in 2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
MEN										
Employed	12,821	15,310	16,833	17,872	18,932	19,757	20,422	20,923	21,193	20,966
Unemployed	3,020	3,271	3,470	3,777	3,767	3,937	3,745	3,789	3,688	3,823
Inactive	15,371	13,368	11,425	10,590	9,114	8,427	7,644	6,757	6,103	5,478
All	31,212	31,949	31,728	32,239	31,813	32,121	31,811	31,469	30,984	30,267
WOMEN										
Employed	2,796	3,490	3,710	4,191	4,587	4,813	5,240	5,476	5,584	5,894
Unemployed	784	946	922	1,063	1,068	1,189	1,291	1,366	1,373	1,458
Inactive	4,823	4,221	3,651	3,471	3,138	2,949	2,714	2,448	2,295	2,283
Housework	5,244	5,563	5,592	5,567	5,407	5,589	5,424	5,375	5,272	5,146
All	13,647	14,220	13,875	14,292	14,200	14,540	14,669	14,665	14,524	14,781

Table 2. Number of person-years in people aged 30-64 by gender, employment status in 2001 and calendar-year. Spain, 2002-2011.

Employment status in 2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
MEN										
Employed	7,433.0	7,646.4	7,851.3	8,026.2	8,167.6	8,186.5	8,252.0	8,278.2	8,268.8	8,228.8
Unemployed	721.7	744.8	770.5	796.7	823.6	834.4	857.0	877.4	896.2	913.7
Inactive	1,144.2	1,047.1	980.6	923.2	885.5	868.4	887.4	922.2	974.1	1,046.3
All	9,298.8	9,438.3	9,602.4	9,746.1	9,876.7	9,889.3	9,996.4	10,077.8	10,139.2	10,188.8
WOMEN										
Employed	4,315.3	4,503.6	4,694.1	4,875.6	5,038.9	5,122.3	5,228.8	5,303.5	5,347.4	5,363.5
Unemployed	847.0	890.8	936.3	982.5	1,029.3	1,062.6	1,104.3	1,140.5	1,170.0	1,193.3
Inactive	874.3	825.6	795.2	772.2	767.4	779.4	823.6	888.7	975.5	1,082.7
Housework	3,354.1	3,298.5	3,247.0	3,174.9	3,089.7	2,988.7	2,891.2	2,783.2	2,670.7	2,559.2
All	9,390.6	9,518.5	9,672.6	9,805.2	9,925.3	9,952.9	10,047.9	10,115.9	10,163.7	10,198.6

Table 3. Number of subjects and age-standardized mortality rate before and during the 2008 economic recession in people aged 30-64 in each calendar-year by gender and employment status in 2001. Spain, 2002-2011.

Employment status in 2001	Subjects	Mortality rate (MR) per 100,000 person-years and 95% CI			
		2002-2007		2008-2011	
		MR[a]	95% CI	MR[a]	95% CI
Men					
Employed	8,697,387	253.4	252.0, 254.7	261.9	260.3, 263.4
Unemployed	909,712	525.7	519.5, 531.9	529.6	522.1, 537.1
Inactive	1,347,155	927.7	920.3, 935.2	775.2	766.1, 784.3
All	10,954,254	357.5	356.1, 359.0	323.4	321.8, 324.9
Women					
Employed	5,282,611	109.2	107.9, 110.5	120.6	119.2, 122.0
Unemployed	1,086,797	141.3	137.9, 144.7	158.9	155.0, 162.7
Inactive	1,048,518	399.6	394.3, 404.9	329.4	323.2, 335.7
Housework	3,561,171	141.8	140.4, 143.3	145.3	143.3, 147.4
All	10,979,097	152.1	151.2, 153.0	146.8	145.7, 147.8

Abbreviation: IC, confidence interval

[a] The number of deaths and the number of person-years by 5-year age groups were used to calculate the age-specific mortality rates in order to obtain the age-standardized mortality rate. Weights for age standardization came from the 2013 European Standard Population.

Table 4. Age-adjusted mortality rates per 100,000 person-years and time trends in mortality rate from all diseases, cancer and non-cancer diseases, before and during the 2008 economic crisis in employed and unemployed people in 2001, aged 30-64 in each calendar-year, by gender. Spain, 2002-2011.

Cause of death[a]	Before recession (2002-2007)				During recession (2008-2011)				Difference in APCs[b] (95% CI)	
	Rate		Trend 2002-2007		Rate		Trend 2008-2011		Difference	95% CI
	2002	2007	APC[2]	95% CI	2008	2011	APC[2]	95% CI		
Employed										
Men										
All diseases	219.5	266.4	3.2	2.8, 3.6	266.1	254.2	-1.2	-1.8, -0.6	-4.4	-4.9, -3.9
Cancer	111.6	145.2	3.9	3.3, 4.4	143.9	137.9	-1.1	-1.9, -0.3	-4.8	-5.6, -4.2
Non-cancer diseases	107.9	121.2	2.5	2.0, 3.1	122.1	116.3	-1.3	-2.2, -0.5	-3.8	-4.6, -3.1
Women										
All diseases	92.4	117.2	4.1	3.3, 4.9	121.4	120.9	-0.3	-1.4, 0.9	-4.4	-5.4, -3.4
Cancer	58.1	80.1	5.6	4.6, 6.6	83.5	84.8	-0.1	-1.4, 1.3	-5.7	-6.4, -4.5
Non-cancer diseases	34.3	37.0	1.2	-0.1, 2.6	37.9	36.1	-0.9	-3.0, 1.2	-2.1	-3.9, -0.4
Unemployed										
Men										
All diseases	475.9	562.5	2.9	2.1, 3.7	533.0	531.5	-0.8	-2.2, 0.7	-3.6	-4.8, -2.5
Cancer	205.0	235.1	2.7	1.4, 3.9	222.3	228.6	0.6	-1.6, 2.9	-2.0	-3.8, -0.2
Non-cancer diseases	270.9	327.4	3.0	1.9, 4.1	310.7	302.9	-1.7	-3.5, 0.1	-4.7	-6.2, -3.3
Women										
All diseases	125.6	149.2	1.3	-0.2, 2.8	158.4	159.2	-0.6	-2.9, 1.8	-1.9	-3.8, 0.1
Cancer	70.2	88.5	2.2	0.2, 4.2	95.3	98.6	0.2	-2.8, 3.3	-1.9	-4.5, 0.6

Non-cancer diseases	55.4	60.6	0.2	-2.1, 2.5	63.0	60.6	-1.8	-5.4, 1.9	-2.0	-5.0, 1.0

Abbreviation: IC, confidence interval

a. International Classification of Diseases, 10th revision. Codes A00-R99 (All diseases), codes C00-C97 (Cancer) and all other codes A00-B99 and D00-R99 (Non-cancer diseases).

b. The annual percentage changes (APCs) were estimated from segmented Poisson regression model for each cause of death:

Ln (D)= β0 + β1 time + β2 crisis + β3 (time x crisis) + ΣδAge + Σρ educational level + ln(PY)

D and PY represents the number of deaths and the person-years in each combination of age group and categories of educational level in each of the years of death from 2001 to 2016; β0 is the model intercept, β1 is the model coefficient for the annual time trend, β2 is the coefficient of the indicator variable for crisis, β3 is the coefficient of the interaction between the indicator variable for crisis and the annual time trend, δ denotes the effects for the different indicator variables of each of the five-year age groups and ρ denotes the effects for the different indicator variables of each four categories of educational level (primary, low secondary, high secondary tertiary).

We estimated the APCs in the mortality rate before and after the crisis as 100 x [(exp (β1))-1] and 100 x [(exp (β1+β3))-1], respectively. We calculated the 95% confidence interval of the APCs as follows: 100 x [(exp (β1±1.96XSE (β1))-1] and 100 x [(exp (β1+β3)±1.96XSE(β1+β3))-1]. SE(β1+β3) reflects the square root of the var (β1+β3), where var (β1+β3)= var (β1)+ var (β2)+ 2 cov (β1, β3).

log M = β0 + β1 time + β2 crisis + β3 (time x crisis) + βk (age, educational level)+e

where M denotes the response (mortality rate); β0 is the model intercept, β1 is the model coefficient for the annual time trend, β2 is the coefficient of the indicator variable for crisis, β3 is the coefficient of the interaction between the indicator variable for crisis and the annual time trend, βk denotes the effects for a set of covariates of interest (age, educational level) and e is the error term.

We estimated the APCs in the mortality rate before and after the crisis as 100 x [exp (β1)-1] and 100 x [exp (β1+β3)-1], respectively. We calculated the 95% confidence interval of the APCs as follows: 100 x [exp (β1±1.96XSE (β1)-1] and 100 x [exp (β1+β3)±1.96XSE(β1+β3)-1]. SE(β1+β3) reflects the square root of the var (β1+β3), where var (β1+β3)= var (β1)+ var (β2)+ 2 cov (β1, β3).

Figure 1. Age-standardized mortality rate from all diseases in different groups of subjects aged 30-64 in each calendar-year. Spain, 2002-2011. A) Men employed; B) Women employed; C) Men unemployed; D) Women Unemployed; E) Men Inactive; F) Women inactive; G) All men; H) All women.