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Mortality Changes in the Iberian Peninsula in the Last Decades of the Twentieth Century

In the early 1960s, the gap between Spain and Portugal in terms of life expectancy at birth was very large (6.5 years in favour of Spanish women and 7.2 years in favour of Spanish men). Excess mortality in Portugal was due mainly to high death rates among babies, children and adolescents. Today, the gap is much narrower, although Portuguese life expectancy (81.3 years for females and 74.9 years for males in 2005) is still around two years lower than in Spain, which ranks among European leaders. In this article, Vladimir Canudas-Romo *and his colleagues analyse this change by examining the impact of mortality by age and by major cause of death on the life expectancy differential between the two countries over the last fifty years. They pinpoint the areas upon which health policies should focus in order to close the gap between Portugal and its neighbour.*

The second half of the twentieth century marked a clear change in mortality patterns across Europe. The trends in mortality in Northern and Southern Europe began to converge after the 1970s (Monnier and Rychtarikova, 1991), partially due a decline in deaths from external causes and cardiovascular diseases which in most industrialized countries made it possible for life expectancy to continue increasing (Meslé and Vallin, 2002).

A comparative analysis of trends in Spain versus Portugal is important because while these countries are contiguous, they exhibit a large gap in life expectancy. In 2005, life expectancy at birth (e_0) for Spanish females was among the highest in Western Europe (83.5 years), whereas e_0 for Portuguese

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males it was among the lowest (74.9 years) (Human Mortality Database, 2007). These two countries thus represent the two extremes in mortality within Western Europe (United Nations, 2006). This differential is the largest observed between contiguous countries in the whole of Western Europe and calls for research to help explain it. A detailed comparison of mortality trends in these two countries that share the Iberian Peninsula may provide clues for understanding the convergences and divergences in mortality between European countries.

During the past decades, both countries have undergone a profound and similar process of modernization. Spain and Portugal both overthrew a dictatorial regime in the mid-1970s, both entered the EU in 1986, and both have weak welfare states. Furthermore, both countries experienced substantial immigration during the 1990s (Canudas-Romo et al., 2006, Glei et al., 2006). These economic, political and social transformations have brought radical changes in standards of living, lifestyle and attitudes, particularly for younger generations.

Furthermore, the two countries share common risk factors associated with certain types of mortality. For example, Portugal, followed closely by Spain, has been found to suffer from the highest rates of excess winter mortality in Western Europe (Healy, 2003). Thermal efficiency in housing, as well as income inequality, show a clear association with extreme temperature mortality (Keatinge et al., 2000; Healy, 2003). Regarding lifestyle habits, the diffusion of cigarette smoking began later in Portugal and Spain compared with other Western European countries, particularly for women; these two countries are likely to experience future declines in the female advantage for causes of death related to smoking (Pampel, 2005). Reports of alcohol consumption show similar high levels in the Iberian Peninsula (Ramstedt, 2002). Studies indicate that 65% of the population of southern Europe, including Spain and Portugal, follow a Mediterranean diet compared with 35% in northern Europe; this diet together with other habits and lifestyle factors was associated with lower mortality rates for certain causes (Knoops et al., 2004). Diet, lifestyle habits and standards of living have changed over time, and they have influenced the mortality patterns of the two populations under study. Many more observed and unobserved factors impact mortality patterns with age and over time. Disentangling the basic components of the mortality differentials between Spain and Portugal could shed some light on the past, present and future of mortality in the Iberian Peninsula.

The present article looks at the trends in mortality observed in Portugal and Spain in the second half of the twentieth century and the beginning of the twenty-first century based on data from the Human Mortality Database (HMD) and the World Health Organization (WHO). After presenting the data and methods used in the study, we describe trends in life expectancy as well as some alternative measures for comparing mortality in these countries. We then make a more detailed analysis to determine which age groups contribute to these differences in life expectancy and how those age contributions have changed over time. Similarly, we then examine the cause-specific components of the difference in life expectancy between the two countries during 1980-2003, and their change over time. Last, we combine the age and cause analysis to investigate the difference in life expectancy between the two countries and we discuss some of the potential sources of these differentials.

1. Data and methods

Two data sources are used in this study. Life tables from 1950 to 2005 for Portugal and Spain come from the Human Mortality Database (HMD, 2007), while cause of death mortality data from 1980 to 2003 are based on the World Health Organization Mortality Database (WHO, 2006). Whereas most of our analyses cover the period 1950-2005, we have restricted the analysis by cause of death to 1980-2003 in order to avoid some of the problems of comparability across countries and over time that arise from differences in disease classification.(1)

We use the HMD life tables by sex and by single year of age. The mortality data for these two countries are generally considered to be accurate, although there is some evidence of data quality issues such as age heaping and age exaggeration (Canudas-Romo et al., 2006, Glei et al., 2006). For this reason we have avoided over-interpretation of year-to-year and age-to-age fluctuations, instead focusing on overall trends in mortality that are likely to represent real differences.

The WHO Mortality Database contains data officially reported by WHO Member States. We extracted the number of registered deaths by cause (statistics coded according to the 9th and 10th revision of the ICD), sex and age-group (0, 1, 2, 3, 4, 5-9, …, 80-84 and age 85 and over) for 1980 to 2003. Information on causes of death according to the ICD 9th revision for Portugal was available from 1980 to 2001 and for Spain from 1980 to 1998, and data for the ICD 10th revision was available for Portugal from 2002 to 2003 and for Spain from 1999 to 2003. WHO estimates that in Portugal and Spain the coverage and completeness of mortality data for the most recent years is 100%. For the purpose of this analysis, we have aggregated causes of death into eight major categories and one group accounting for the remaining causes, for which detailed ICD codes are given in Appendix Table A.

To better understand changes in life expectancies at birth (e_0) over time and differences between Portugal and Spain, we use methods of decomposition (Pollard, 1982, 1988; Arriaga, 1984; Pressat, 1985) to account for the age-

(1) WHO uses the proportion of deaths assigned to the ICD codes for "symptoms, signs, and ill-defined conditions" (ICD-9 codes 780-799 and ICD-10 codes R00-R99) as an indicator of the quality of coding in the registration system (Mathers et al., 2005). By this measure, the quality of ICD coding has improved over time in both Portugal and Spain. Nonetheless, we recognize that the thresholds used by WHO to classify good, medium and poor data are arbitrary.

contribution and cause-specific contribution to this change. Initially, we use Arriaga's (1984) method, calculated using variables of the life table, to assess how various age groups contribute to the difference in life expectancy between Portugal and Spain within a single time period. Secondly, using the same method, we analyse the age-group contributions to the *change* over time in the inter-country gap in e_0. We start by determining the age-contribution to the change in e_0 over time for each country separately. The contribution to the change in life expectancy from time t to time t+1 at age x is represented by $\dot{e}_{0,ESP}(x,t)$ for Spain and $\dot{e}_{0,PRT}(x,t)$ for Portugal. Next, we simply subtract the Portuguese result from the Spanish value, $\dot{e}_{0,ESP}(x,t) - \dot{e}_{0,PRT}(x,t)$, to derive the contribution of age x to the change in the inter-country gap between time t and time t+1. This method allows us to determine whether the change is due to variations in Portugal or Spain, or both.

To determine the cause-specific contributions, we apply Pollard's (1982, 1988) method of cause-decomposition which uses both the life table variables, and deaths by age and cause. To calculate mortality by specific cause of death we followed a proportional assumption and calculated the force of mortality for each cause as the product of the overall force of mortality by the proportion of deaths due to each cause. The overall force of mortality is based on the survival function:

$$\mu(a) = -\ln\left|\frac{l(a+1)}{l(a)}\right| \qquad [1]$$

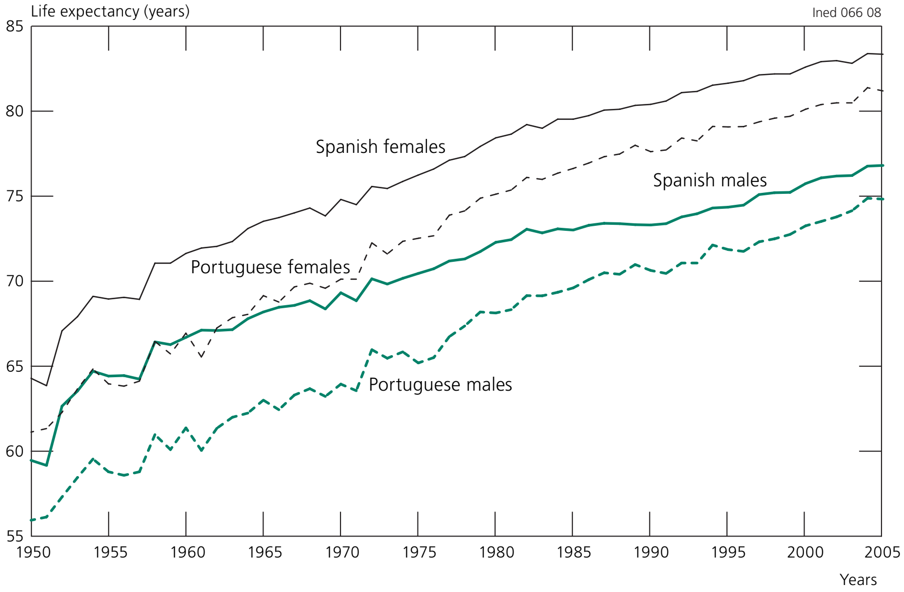
2. Disparities in mortality

The most widely used demographic measure is life expectancy at birth (e_0). Here, we examine trends in this measure as well as some alternative ways of assessing changes in mortality over time: the trend of the infant mortality rate, and the gaps and lags in e_0.

Figure 1a shows the trends over time in female and male life expectancy in Portugal and Spain. While life expectancy has increased among all groups, the pace of these gains differs by sex and by country. Compared with Spain, Portugal made greater gains in e_0 during this period, especially among males. In Portugal, female e_0 increased 20.3 years between 1950 and 2005 (from 61 to 81.3 years), while Spanish females gained 19.3 years in life expectancy over the same period (from 64.2 years to 83.5 years). Similarly, Portuguese males gained 19.1 years in e_0 (from 55.8 years to 74.9 years), while their Spanish counterparts gained only 12.5 years (from 59.4 years to 76.9 years). The intercountry gap in e_0 actually widened through the 1950s to a maximum of 6.5 years for females and 7.2 years for males in 1961. Since then, trends in e_0 appear to be converging; by 2005, the gap had narrowed to about two years.

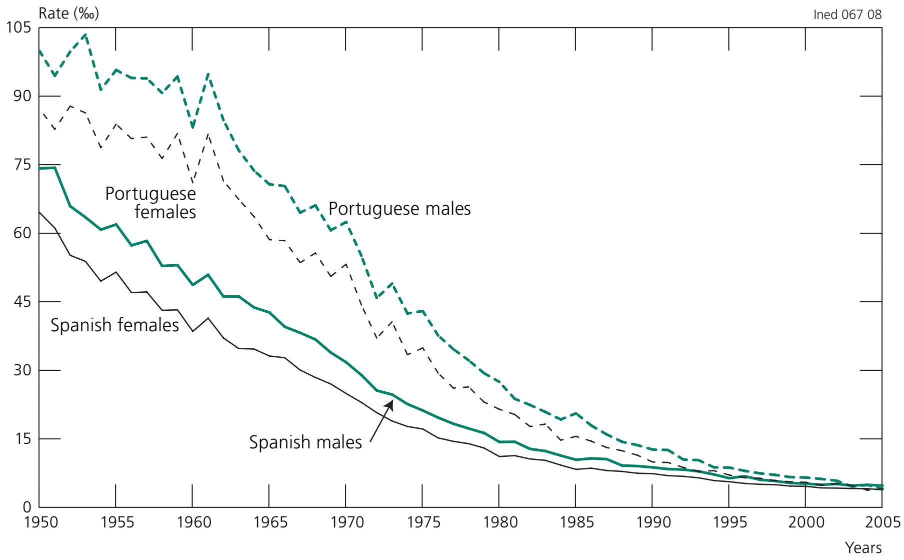
A stronger convergence in mortality between Spain and Portugal is observed when we examine the trends in infant mortality (Figure 1b). Among

Figure 1a. Life expectancy at birth in Portugal and Spain by sex, 1950-2005.



Source: Human Mortality Database.

Figure 1b. Infant mortality rate in Portugal and Spain by sex, 1950-2005

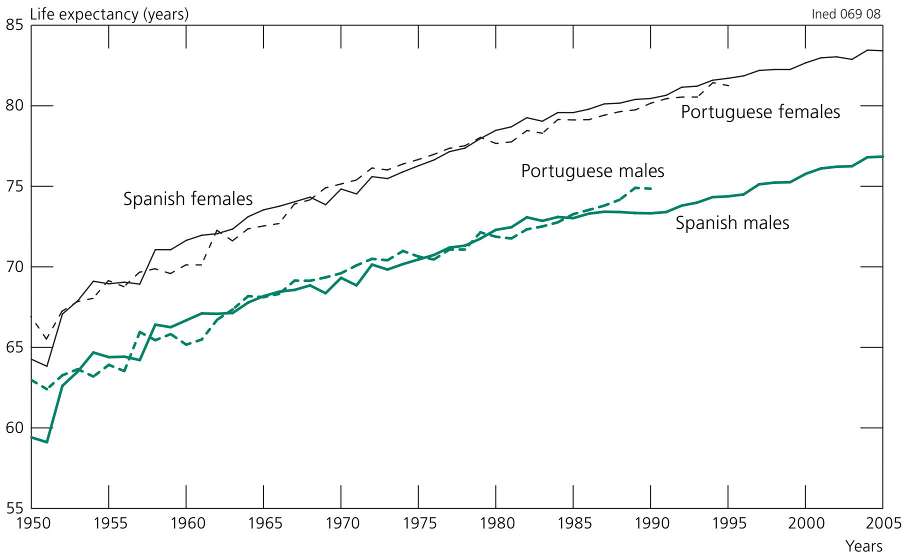


Source: Human Mortality Database.

Figure 2a. Gap in life expectancy at birth between Spain and Portugal by sex, 1950-2005

Source: Human Mortality Database.

Figure 2b. Pattern of Portuguese and Spanish life expectancy (LE) by sex, with the Portuguese female LE (1960-2005) lagged back 10 years and the Portuguese male LE (1965-2005) lagged back 15 years relative to the Spanish LE



Source: Human Mortality Database.

males, the Portuguese had 100 deaths below one year of age for every thousand babies born in 1950, whereas Spanish infant mortality was 74 per thousand; there was a similar gap for females. By 2005, both countries had converged to levels below five per thousand. In contrast, the gap in life expectancy remains substantial (Figure 1a). As shown later in section 4, the narrowing of the gap in infant mortality accounts for much of the observed convergence in life expectancy between Portugal and Spain during the late 1950s to the 1970s.

We have already discussed the inter-country gap in e_0, which tells us how much longer the Spanish are expected to live than the Portuguese at a given point in time. Alternatively, we can determine the lag (or forward lag) in e_0 (Goldstein and Wachter, 2006; Canudas-Romo and Schoen, 2005), which is defined as the number of calendar years required for Portuguese life expectancy to reach a given level of e_0 already attained by the Spaniards. In the 1950s, the female *gap* in life expectancy was, on average, 4.4 years (Figure 2a), but there was a *lag* of 10 years, meaning that it was not until the 1960s that female life expectancy in Portugal caught up to the level attained by Spanish females in 1950s. Figure 2b shows the trend in life expectancies where the Portuguese life expectancy (by sex) has been lagged (10 years for females; 15 years for males) to reach the levels observed in Spain by the early 1950s.

Notably, within each sex, the inter-country lag is virtually constant over time: for any level of Spanish e_0, it takes 10 years for females and 15 years for males in Portugal to catch up with their counterparts. A possible exception is observed in the most recent years for Portuguese males, who by 2005 reached a level of life expectancy of 74.9 years observed in Spain only nine years before (in 1996).

In general, these trends suggest that mortality decline in Portugal is following the same trajectory demonstrated earlier by Spain. So, although Figure 1a suggests that trends in e_0 are converging for these two countries, Figure 2b reveals that the pace of mortality decline is very similar when one compares Portugal and Spain at the same stage in the epidemiological transition. This paradox occurs because the annual gain in e_0 appears to be smaller at higher levels of e_0. For example, Spanish females gained 7.4 years in e_0 between 1950 and 1960, but only 1.7 years between 1995 and 2005. Their Portuguese counterparts gained 2.1 years between 1995 and 2005 which, taking account of a ten-year lag, is similar to the gains (2.1 years) made by Spanish females between 1985 and 1995. In a given calendar year, Portugal tends to make greater gains than Spain because the former country is at an earlier stage in the progression of mortality decline than the latter. Consequently, it remains to be seen if the pace of mortality improvement observed in Spain will be followed by Portugal in the coming years.

3. Age-contributions

3.1. Age-contributions to the Spanish-Portuguese disparity

Among the questions that arise when studying differences in life expectancy between Spain and Portugal is how much do different age groups contribute to this disparity? One way to answer this question is to assess the age-group contributions to the inter-country gap at sequential points in time. Alternatively, one could examine the age-group contributions to the *change* in the gap over given time intervals. In this section, we present results from the first type of analysis, and in the next section, we deal with the dynamics of the gap.

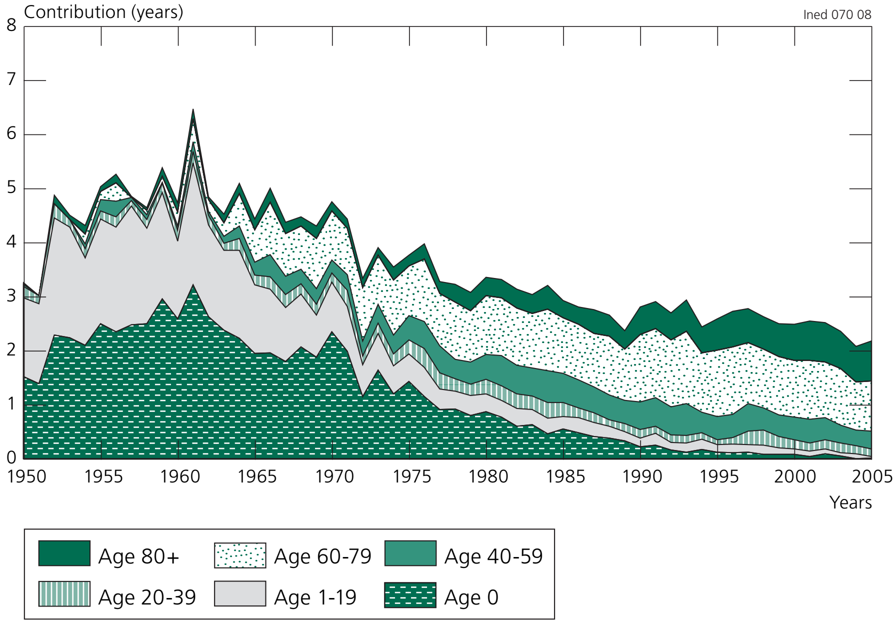
Figure 3a and 3b show the contributions by age-group (0, 1-19, 20-39, 40-59, 60-79, 80+) to the gaps in life expectancy between Spain and Portugal (separately by sex). During the first decade of the analysis period, infant mortality is the main source of the disparity between the two countries. Over time, infant mortality accounts for a smaller share of the mortality differential as older ages begin to play a larger role. These results are consistent with the argument that compared with Portugal, Spain had reached a more advanced stage of the epidemiological transition by 1950 (Omran, 1971), with a lower prevalence of infectious diseases. Both sexes exhibit the decreasing contribution of infant mortality over time. However, in the most recent years, the major contributors to the Spanish-Portuguese disparity in life expectancy are ages 20 to 79 among males versus ages 60 and above for females. Therefore, the major individual, social, and environmental factors that explain the Portuguese disadvantage are likely to differ by sex. Among males, we might look for causes that would result in higher mortality among younger as well as older adults, whereas for females, we should concentrate on factors that lead to higher old-age mortality.

3.2. Age-contribution to changes in the Spanish-Portuguese disparity

Reductions in death rates at different ages have a different impact on life expectancy, and decomposition methods can be used to quantify these effects. In this section, we follow a two-step process to decompose age-contributions to *changes* in the gap in e_0. First, treating each country separately, we decompose the age-group contributions to the change in e_0 over 10-year time intervals by sex (Table 1a and 1b).

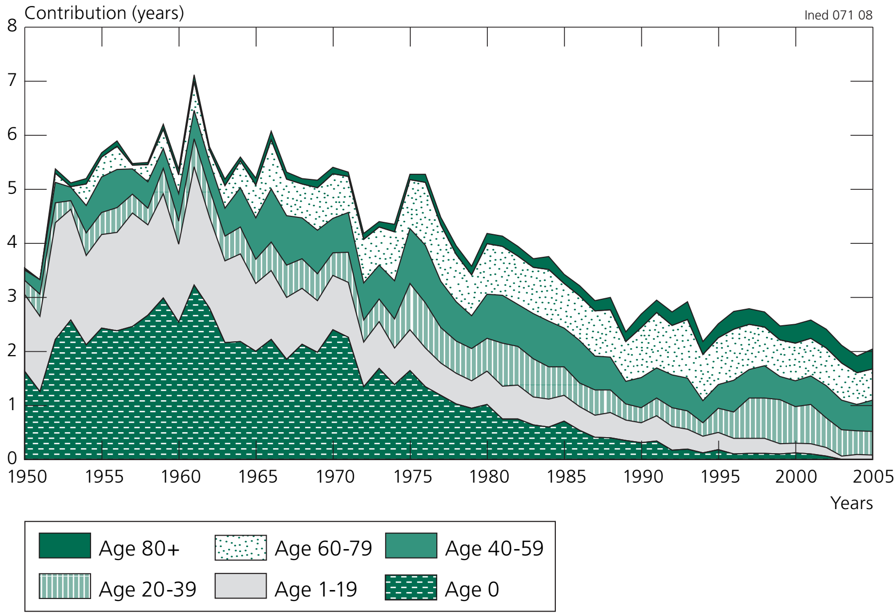
As we would expect, most age groups make positive contributions (i.e. mortality rates declined at those ages, thereby increasing life expectancy). However, ages 20-39 make a negative or small contribution during the period 1980-1990. In an earlier study, Gómez-Redondo and Boe (2005) also noted a retrogression of health at young ages in Spain during the late 1980s, especially among males. In Portugal, only men suffered an increase in mortality at these

Figure 3a. Age-contribution to the difference in female life expectancy between Spain and Portugal, 1950-2005



Source: Human Mortality Database.

Figure 3b. Age-contribution to the difference in male life expectancy between Spain and Portugal, 1950-2005



Source: Human Mortality Database.

Table 1a. Age-contribution to the change in life expectancy over time in Portugal, by sex and period (in years)

Age groups	Period						Total Change 1950-2005
	1950-1960	1960-1970	1970-1980	1980-1990	1990-2000	2000-2005	
Females							
0	1.11	1.40	2.53	0.90	0.35	0.13	6.42
1-19	2.36	1.00	0.74	0.26	0.19	0.13	4.68
20-39	1.33	0.31	0.16	0.08	0.16	0.11	2.14
40-59	0.71	0.22	0.29	0.25	0.32	0.16	1.95
60-79	0.42	0.14	1.10	0.80	1.08	0.48	4.02
80+	–0.05	0.14	0.23	0.23	0.43	0.09	1.07
Total	5.88	3.20	5.05	2.53	2.53	1.09	20.28
Life expectancy at start of period	61.03	66.91	70.12	75.17	77.70	80.22	
Males							
0	1.04	1.47	2.57	1.05	0.44	0.21	6.79
1-19	2.11	0.86	0.59	0.33	0.39	0.16	4.44
20-39	1.37	0.12	0.06	–0.09	0.15	0.50	2.11
40-59	0.77	0.11	0.20	0.48	0.42	0.09	2.07
60-79	0.22	–0.04	0.70	0.63	1.04	0.56	3.10
80+	–0.01	0.08	0.10	0.13	0.22	0.06	0.58
Total	5.50	2.60	4.22	2.54	2.65	1.59	19.09
Life expectancy at start of period	55.79	61.28	63.88	68.11	70.64	73.29	

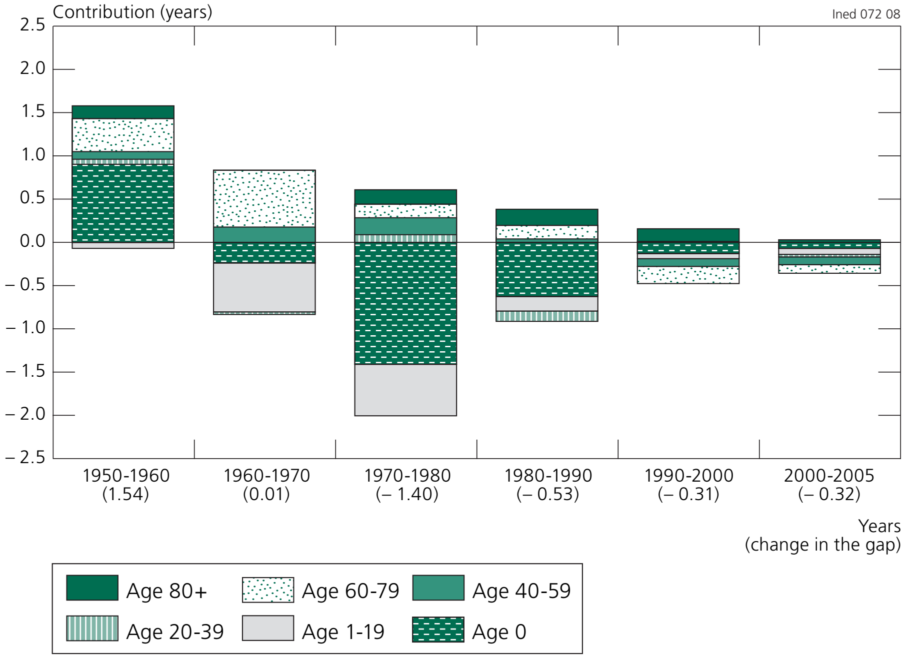
Source: Authors calculations based on the Human Mortality Database

Table 1b. Age-contribution to the change in life expectancy over time in Spain, by sex and period (in years)

Age-groups	Period						Total Change 1950-2005
	1950-1960	1960-1970	1970-1980	1980-1990	1990-2000	2000-2005	
Females							
0	2.03	1.15	1.12	0.26	0.22	0.06	4.85
1-19	2.29	0.42	0.14	0.10	0.13	0.05	3.13
20-39	1.39	0.28	0.25	–0.03	0.17	0.08	2.14
40-59	0.79	0.40	0.49	0.29	0.22	0.07	2.27
60-79	0.82	0.81	1.26	0.96	0.88	0.38	5.11
80+	0.11	0.13	0.40	0.42	0.58	0.12	1.76
Total	7.43	3.21	3.65	2.00	2.22	0.76	19.27
Life expectancies	64.23	71.65	74.86	78.51	80.51	82.73	
Males							
0	1.80	1.38	1.29	0.38	0.27	0.03	5.14
1-19	2.09	0.40	0.17	0.09	0.21	0.06	3.02
20-39	1.63	0.09	0.22	–0.46	0.53	0.27	2.29
40-59	1.12	0.23	0.33	0.21	0.34	0.19	2.41
60-79	0.61	0.44	0.81	0.61	0.81	0.47	3.75
80+	0.08	0.11	0.17	0.19	0.30	0.06	0.92
Total	7.32	2.65	3.00	1.02	2.46	1.08	17.53
Life expectancy at start of period	59.35	66.66	69.31	72.31	73.34	75.80	

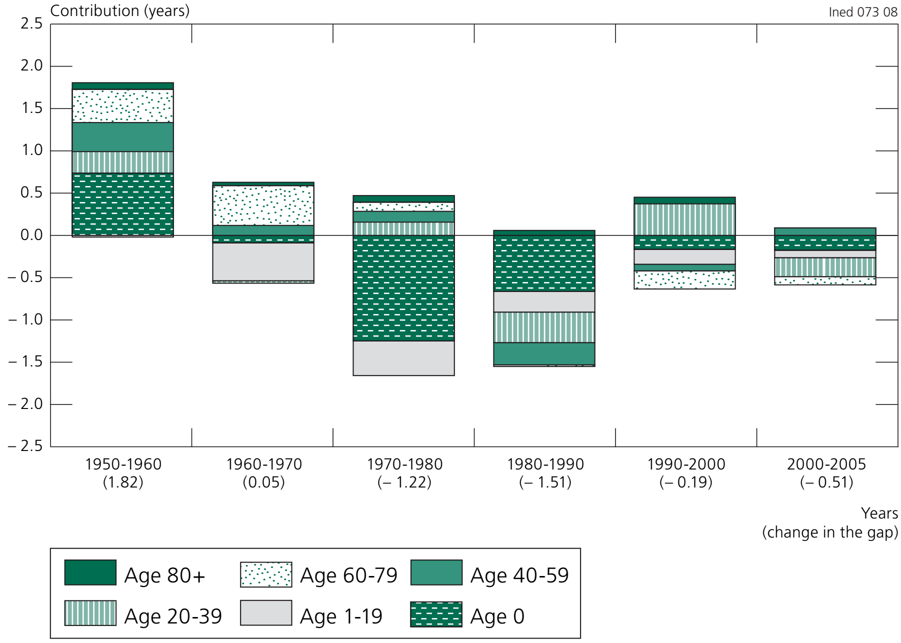
Source: Authors calculations based on the Human Mortality Database

Figure 4a. Age-contribution to the change in the gap in the female life expectancy between Spain and Portugal by period, 1950-2005



Source: Human Mortality Database.

Figure 4b. Age-contribution to the change in the gap in the male life expectancy between Spain and Portugal by period, 1950-2005



Source: Human Mortality Database.

ages, although improvements among women at these ages were very limited. During the 1950s, the age groups below 40 are the main contributors to the change in life expectancy. However, major improvements have occurred at ages 60-79 in recent decades. This transition from a dominance of child mortality reductions to a dominance of adult mortality reductions took place in the late 1970s and early 1980s in Spain, but not until the 1990s in Portugal.

In the second step, we use the information from Table 1a and 1b to calculate the age-group contributions to the change in the *inter-country gap* in life expectancy (by sex). Each age group contributes to an increase or decline in the change in e_0 gap. Figures 4a and 4b show these contributions for each period; the total change in the gap for that period is shown below on the horizontal axis. As we might expect, based on the results in section 4.1, infant and adolescent mortality (ages 0-19) accounted for the majority of the widening and narrowing in the e_0 gap during 1950-60 and 1960-80, respectively. In other words, mortality differentials at very young ages increased at first because Spain experienced faster declines in infant mortality, but later shrank as Portugal began to catch up to the levels attained by Spain. In the latter part of the twentieth century, other age groups also began to play a role in narrowing the e_0 gap. In the period 2000-2005, mortality at ages 20-79 accounts for nearly two-thirds of the reduction in the gap for both sexes. During the 1990s, ages 20-39 had a widening effect among males because mortality decline for Spaniards was larger than for the Portuguese.

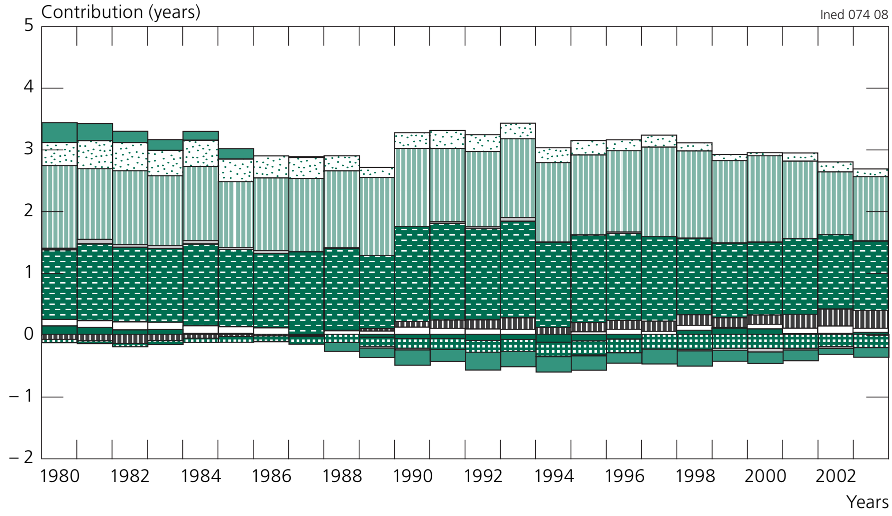
4. Differential analysis by cause of death

4.1 Cause-specific contribution in the Spanish-Portuguese disparity

For reasons of comparability and quality of data, the analyses by cause of death in the next two sections are restricted to the period 1980-2003. Similar to the age-contribution section, here we divide the cause-specific contribution into two parts accounting for the inter-country gap and its change over time. The eight causes of death selected for this analysis are those representing the biggest proportional share of the total number of deaths in the most recent years, referred to here as: diseases of the circulatory system, neoplasms, ill-defined conditions, endocrine/metabolic diseases, external causes, infectious diseases, diseases of the digestive system, and mental disorders (see Appendix). The “remaining causes” group accounts for the rest of the life expectancy gap not explained by the above-listed eight causes. Figures 5a and 5b show the contributions by causes of death to the sex-specific gaps in life expectancy between Spain and Portugal for each year from 1980 to 2003.

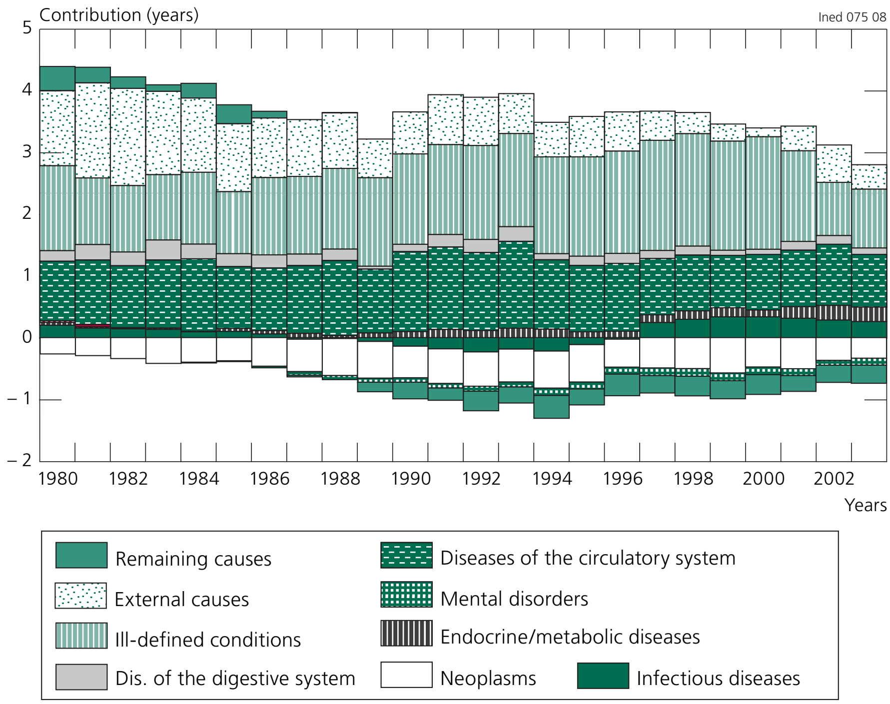
Figures 5a and 5b are analogous to Figures 3a and 3b for the age-contribution. However, whereas the age-decomposition results showed that all age groups

Figure 5a. Cause-decomposition of the difference in female life expectancy between Spain and Portugal, 1980-2003



Source: Human Mortality Database and WHO (2006).

Figure 5b. Cause-decomposition of the difference in male life expectancy between Spain and Portugal, 1980-2003



Source: Human Mortality Database and WHO (2006).

made a positive contribution to the inter-country gap, we find that some causes of death make a negative contribution. Ill-defined conditions and diseases of the circulatory system are major contributors to the inter-country gap in life expectancies (i.e., death rates for these causes are higher in Portugal than in Spain) for both sexes. Among males, external causes also contribute substantially to the inter-country gap. In contrast, the negative contribution of mental disorders indicates that death rates from this cause are lower in Portugal than in Spain. Whereas neoplasms have a narrowing effect for males, they have a slight widening effect for females. In more recent years, endocrine/metabolic diseases have contributed to the increasing gap. Diseases of the digestive system, which may be linked to health habits such as alcohol consumption widen the gap for males. Finally, infectious diseases made a positive contribution to the gap between the countries through most of the 1980s, became negative during the early 1990s, and reversed again around 1996-1997. This pattern is related to differential timing in the outbreak of the HIV epidemic, which affected Spain earlier than Portugal.

4.2. Cause-specific contribution to changes in the Spanish-Portuguese disparity

As for the cause-specific contribution to the change in the gap, we proceed with a two-step process similar to the one used in section 3.2 for the age-contribution. First, Table 2 shows, for each country separately, the cause-specific decomposition of the change in life expectancy during 1980-2003 by sex.

These analyses demonstrate the great progress in reducing mortality from diseases of the circulatory system, which accounts for a substantial proportion of the increase in life expectancy (Table 2). Diseases of the digestive system also made a notable contribution. External causes also declined substantially, although only in the second period, 1990-2003. However, mortality from neoplasms and infectious diseases increased overall, having a negative effect on life expectancy.

Second, we use the information from Table 2 to calculate cause-specific contributions to the change over time in the *inter-country gap* as shown in Figure 6. Narrowing of the gap in e_0 between Spain and Portugal during 1980-2003 resulted from a combination of different causes of death. Although external causes contributed to narrowing throughout this period, they played a bigger role for men than for women. That is, declines in mortality due to accidents and violence were greater for Portuguese males than for their Spanish counterparts. Figure 6 reveals that infectious diseases also had a narrowing effect during 1980-90, but exhibited the opposite effect during 1990-2003 as Spain made greater progress than Portugal in reducing infectious disease mortality (e.g. HIV/AIDS). We find a similar pattern for cancer mortality among males. In contrast, diseases of the circulatory system had a widening effect on the inter-country gap during 1980-90, but a narrowing effect in 1990-2003.

Table 2. Cause-specific contribution to the change in life expectancy over time in Portugal and Spain between the years 1980-1990 and 1990-2003

Cause of Death	Spain		Portugal	
	1980-1990	1990-2003	1980-1990	1990-2003
Females				
Diseases of the circulatory system	1.62	1.53	1.15	1.88
Neoplasms	0.00	0.31	–0.03	0.35
Ill-defined conditions	0.13	–0.01	0.34	0.43
Endocrine/metabolic diseases	0.08	0.16	–0.10	–0.04
External causes	–0.03	0.20	0.11	0.33
Infectious disease	0.01	0.02	0.23	–0.11
Diseases of the digestive system	0.13	0.17	0.16	0.11
Mental disorders	–0.09	–0.02	0.00	0.00
Remaining causes	0.15	0.08	0.68	–0.05
Total	1.99	2.44	2.53	2.90
Males				
Diseases of the circulatory system	1.44	1.35	1.02	1.78
Neoplasms	–0.45	0.29	–0.19	0.00
Ill-defined conditions	0.09	–0.04	0.09	0.71
Endocrine/metabolic diseases	0.00	0.06	–0.06	–0.05
External causes	–0.26	0.61	0.34	0.90
Infectious disease	–0.15	0.17	0.20	–0.24
Diseases of the digestive system	0.20	0.31	0.24	0.29
Mental disorders	–0.06	–0.02	0.04	0.00
Remaining causes	0.22	0.21	0.84	0.16
Total	1.03	2.94	2.53	3.55

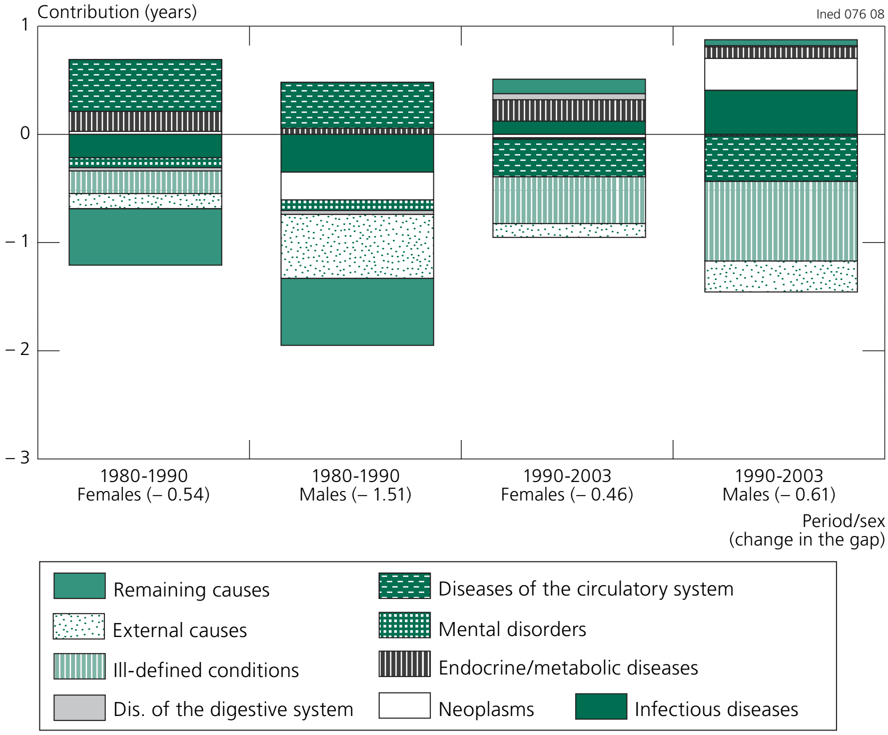
Source: Authors calculations based on the Human Mortality Database (2007) and WHO (2006).

5. Age and cause-specific contribution combined

This section combines the analysis by age and cause-of-death from sections 3 and 4. In order to assess how the results changed over the period 1980 to 2003, we present the decomposition, separately by sex, at the beginning (1980) and at the end (2003) of the series. Figures 7a and 7b show the contributions to the difference in life expectancies between Spanish and Portuguese females by age and cause of death for the two periods, and Figures 8a and 8b represent the corresponding results for males.

These results highlight an important contrast between males and females. Among females, the largest share of the inter-country gap in e_0 is due to higher mortality from circulatory diseases at older ages (age 40 and over, but especially age 60 and over) in Portugal compared with Spain, and by the end of the period, this share is even greater. Among males, cardiovascular mortality at older ages

Figure 6. Cause-specific contribution to the change in the gap in life expectancy between Spain and Portugal by sex over the periods 1980-1990 and 1990-2003.



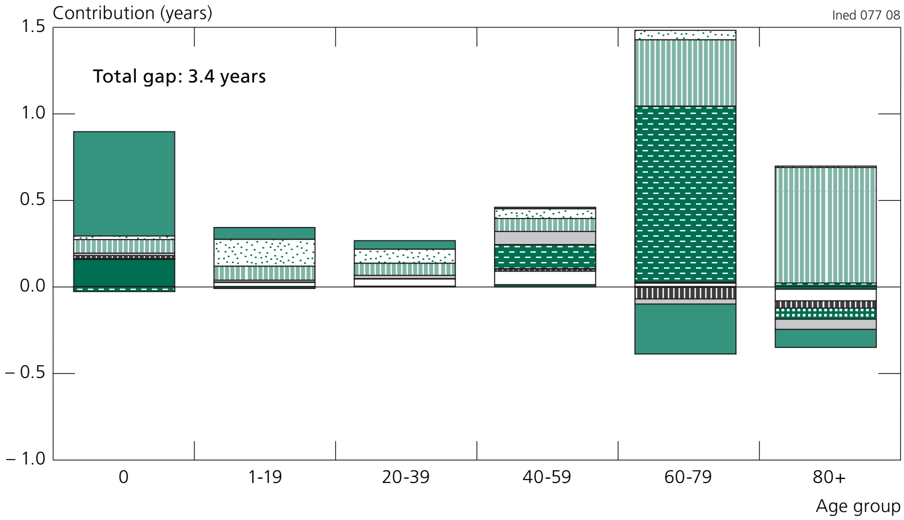
Source: Human Mortality Database (2007) and WHO (2006).

is also an important and growing contributor to the gap, but external causes are another major contributor throughout most of the lifespan (ages 1-79), although its share had decreased substantially by 2003.

Over this period, there was also a notable shift in the role of mortality from endocrine/metabolic diseases among both sexes. Whereas at the beginning of the period mortality from these causes made little or even a negative contribution, by 2003 it was making a sizeable positive contribution, especially at ages 60-79. At these ages, diabetes accounts for a large part of mortality in this category. Thus, this trend may result from larger increases in diabetes-related mortality in Portugal compared with Spain. In any case, relative to the Spanish, the Portuguese men an women now exhibit excess mortality from endocrine/metabolic diseases at ages 60-79.

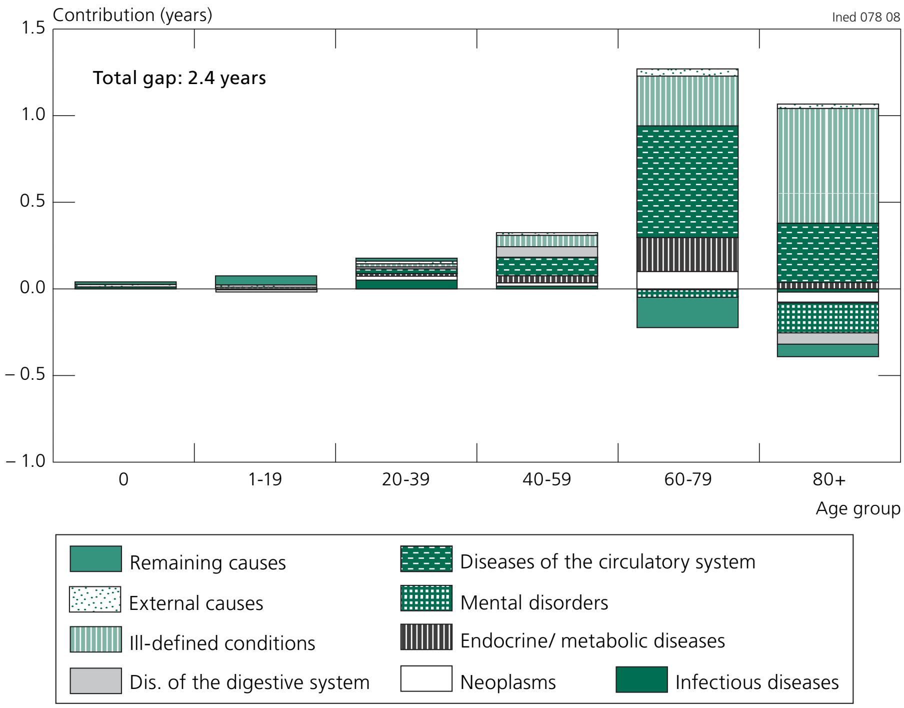
The contributions of infectious disease to the gap in life expectancy were concentrated in the first year of life in 1980, but by 2003 their share in the life expectancy difference had shifted towards ages 20 to 59. As mentioned earlier, the increase in the contribution of infectious disease in most recent years is

Figure 7a. Age and cause-decomposition of the difference in female life expectancy between Spain and Portugal, 1980



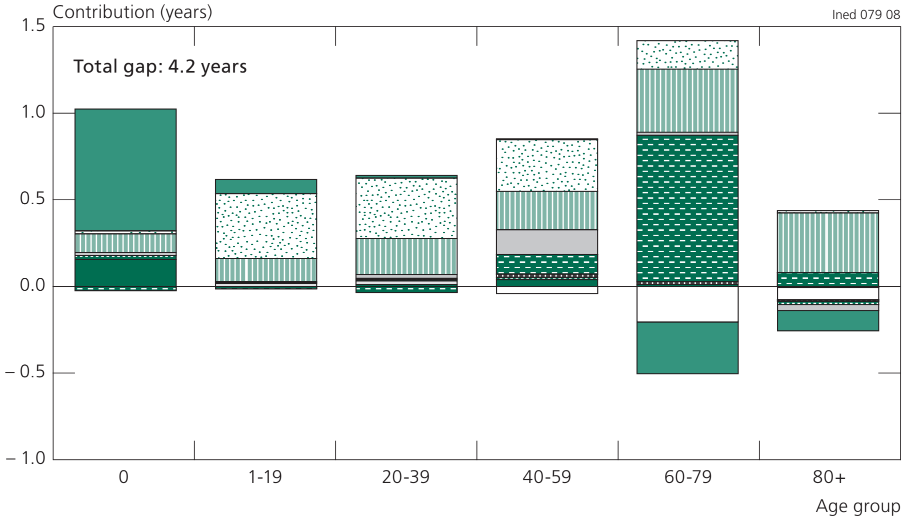
Source: Human Mortality Database (2007) and WHO (2006).

Figure 7b. Age and cause-decomposition of the difference in female life expectancy between Spain and Portugal, 2003



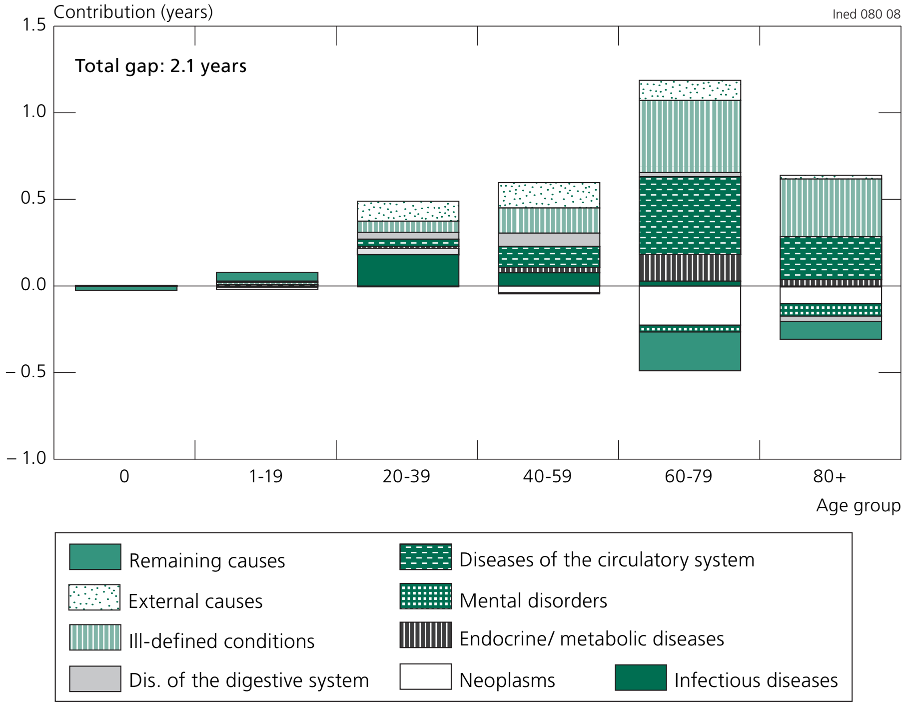
Source: Human Mortality Database (2007) and WHO (2006).

Figure 8a. Age and cause-decomposition of the difference in male life expectancy between Spain and Portugal, 1980



Source: Human Mortality Database (2007) and WHO (2006).

Figure 8b. Age and cause-decomposition of the difference in male life expectancy between Spain and Portugal, 2003



Source: Human Mortality Database (2007) and WHO (2006).

explained by the different timing of the HIV epidemic in the two countries. Finally, we note that some causes of death (e.g. mental disorders, neoplasms, remaining causes) at ages 60 and over make a negative contribution which appears to have narrowed the inter-country gap over time. In other words, the Portuguese benefit from *lower* mortality from these causes than the Spaniards. Thus, the gap would be even wider were it not for this Portuguese advantage.

6. Discussion

The present study has compared trends in life expectancy between Portugal and Spain during the second half of the twentieth century to assess the level of convergence between these neighbours sharing the Iberian Peninsula. While both countries have demonstrated outstanding improvements in mortality at all ages, there is some evidence of convergence in aggregate measures of survivorship. Relative to Spain, Portugal appears to have made greater gains in e_0 over this period, thereby narrowing the inter-country gap. Nonetheless, a two-year gap in e_0 remains and the data suggest that mortality decline in Portugal lags Spain by 10 years for females and 15 years for males. After adjustment for this difference in the progression of mortality decline, Portugal appears to be following the same trajectory as Spain.

Decomposition of the Spanish-Portuguese disparity reveals a sex difference in the age group contributions to the gap in recent years. Among males, ages 20 to 79 account for the majority of the current inter-country gap, whereas ages 60 and older account for most of the gap among females.

The major causes of death found to contribute to the e_0 gap are circulatory diseases and (among males) external causes. If all causes of death had contributed positively to the life expectancy gap, the gap between Spain and Portugal would be much larger. However, some causes (e.g. mental disorders) have had a negative effect on the gap because Spain suffers higher mortality from these causes than Portugal.

Differences in causes of death further reflect the mortality lag between Spain and Portugal. For example, gastric cancer, the main determinant of the observed decline in cancer mortality within Europe (Levi et al., 2004), remains twice as high in Portugal as in Spain. Similarly, although cardiovascular mortality in Portugal has declined to the level attained by Spain in the 1990s, cerebrovascular mortality remains higher in Portugal than in the rest of Western Europe and resembles the levels observed in Eastern Europe (Levi et al., 2002).

The incidence of HIV in Portugal and Spain is the highest in Western Europe (Gómez-Redondo and Boe, 2005). Death rates from this disease have declined substantially in all Western European countries except for Portugal (White and Cash, 2003). In recent years, infectious diseases (which includes HIV) have had a widening effect on the life expectancy disparity between the two countries. This again reflects the earlier stage of this epidemic in Portugal as compared to Spain. Nevertheless, external causes, such as vehicle accidents, suicide and homicide had a narrowing effect. Compared with their Spanish counterparts, Portuguese males have more accidents (Garcia-Rodriguez and Cayolla da Motta, 1989) and a higher incidence of suicide and undetermined causes of death (Birt et al., 2003). However, improvements in mortality due to such causes have been greater in Portugal than Spain (Treurniet et al., 2004; Chishti et al., 2003).

One limitation of this study is that comparisons of cause of death data across countries and across time can be problematic (Kunst et al., 1998; Kunst et al., 2004). In order to avoid some of these problems, we restricted our analyses to 1980-2003 and grouped causes of death into broad categories. While the quality of ICD coding was better during this period than in earlier times, there could still be shifts in coding practice over time. In particular, the proportion of deaths grouped under "ill-defined conditions" is tending to decline as causes of death are better identified.

Spanish life expectancy increased at an accelerated pace in the 1970s and early 1980s. However, this increase has slowed down in recent years (Gómez-Redondo, 1995; Chenet et al., 1997). Our results suggest that Portugal is following the accelerated increase in life expectancy observed earlier in Spain. Whether Portugal eventually catches up with its neighbour (in terms of life expectancy) remains to be seen. If Portugal is successful in reducing mortality from diseases of the circulatory system at older ages and infectious disease (e.g. HIV/AIDS) at middle adult ages, and continues to close the gap in mortality from external causes among males, it could trigger further convergence in life expectancy within the Iberian Peninsula. At the same time, if reductions in the Portuguese disadvantage for these causes of death is offset by increases in other types of mortality (e.g. diabetes, diseases of the digestive system), then a gap in e_0 may persist.

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APPENDIX

Appendix table. Cause of death grouping and ICD-9 and ICD-10 codes used for calculating the cause-specific decomposition[a]

Cause Groupings	ICD-9 codes	ICD-10 codes
Diseases of the circulatory system	390-459	I00-I99
Neoplasms[b]	140-239	C00-D48
Ill-defined conditions[c]	780-799	R00-R99
Endocrine/metabolic diseases[d]	240-278	E00-E88
External causes	E800-E999	V01-Y89
Infectious diseases[e]	001-139 and 279	A00-B99
Diseases of the digestive system	520-579	K00-K92
Mental disorders[f]	290-319	F01-F99
Remaining Causes[g]		

[a] ICD 9 was used during 1980-2001 in Portugal and 1980-1998 in Spain; ICD-10 was used in 2002-03 in Portugal and 1999-2003 in Spain.

[b] Malignant and benign neoplasms and other unspecified neoplasms, Malignant neoplasm of the breast is included in the ICD-10 code for both sexes.

[c] Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified.

[d] Endocrine, nutritional and metabolic diseases.

[e] Certain infectious, parasitic diseases and HIV. HIV was first included in the ICD codes in 1988 for Portugal and 1985 for Spain. For ICD-9, this cause of death was included in the group “endocrine, nutritional and metabolic diseases” as code 279.5 and 279.6; we have subtracted HIV deaths from this category and added them to “Infectious diseases” in order to be comparable with ICD-10 coding.

[f] Mental and behavioral disorders.

[g] The group “Remaining Causes” accounts for the rest of the life expectancy gap not explained by the above listed eight cause groupings.

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Canudas-Romo, Dana Glei, Rosa Gómez-Redondo, Edviges Coelho, Carl Boe • **Mortality Changes in the Iberian Peninsula in the Last Decades of the Twentieth Century**

Life expectancies in Portugal (81.3 years for females and 74.9 for males) and Spain (83.5 years for females and 76.9 for males) in 2005 rank among the lowest in Western Europe (Portuguese males) and the highest (Spanish females), respectively. This article studies the converging trends in mortality for these two countries of the Iberian Peninsula during the second half of the twentieth century. Portuguese life expectancy appears to follow the same trajectory as that of Spain, but lagged by several years (10 years for females, 15 years for males). Major improvements have occurred at all ages, however, helping to narrow the mortality gap between the two countries. Age- and cause-specific decomposition analyses reveal that ages 20-79 for men and ages 60 and above for women account for the largest share of the remaining inter-country gap in life expectancy. The causes of death that are the major contributors to this gap include diseases of the circulatory system and, for males, external causes.

Canudas-Romo, Dana Glei, Rosa Gómez-Redondo, Edviges Coelho, Carl Boe • **Évolution de la mortalité dans la péninsule Ibérique au cours de la seconde moitié du XX^{e} siècle**

Aujourd'hui, les espérances de vie au Portugal (81,3 ans pour les femmes et 74,9 ans pour les hommes en 2005) et en Espagne (respectivement 83,5 ans et 76,9 ans) présentent la particularité de figurer pour les hommes portugais parmi les plus basses d'Europe occidentale et pour les femmes espagnoles parmi les plus élevées. Cet article décrit les tendances convergentes de la mortalité dans la péninsule Ibérique au cours de la seconde moitié du XX^{e} siècle. L'espérance de vie au Portugal semble suivre la même trajectoire que celle de l'Espagne avec plusieurs années de retard (dix ans pour les femmes, quinze ans pour les hommes) grâce aux progrès enregistrés à tous les âges. Les analyses de la mortalité par âge et par cause montrent que c'est la mortalité entre 20 et 79 ans chez les hommes et au-dessus de 60 ans chez les femmes qui est responsable de la majeure partie de l'écart d'espérance de vie subsistant entre les deux pays. Les causes de décès qui contribuent le plus à ces différences sont les maladies de l'appareil circulatoire et, pour les hommes, les traumatismes et morts violentes.

Canudas-Romo, Dana Glei, Rosa Gómez-Redondo, Edviges Coelho, Carl Boe • **Evolución de la mortalidad en la península Ibérica durante la segunda mitad del siglo XXe**

Hoy en día, la esperanza de vida en Portugal (81,3 años para las mujeres y 74,9 años para los hombres en 2005) y en España (respectivamente 83,5 años y 76,9 años) presentan la particularidad de figurar, en lo que se refiere a los hombres portugueses, entre las más bajas de Europa occidental y, en lo que se refiere a las mujeres españolas, entre las más elevadas. Este artículo describe las tendencias convergentes de la mortalidad en la península Ibérica durante la segunda mitad del siglo XX. La esperanza de vida en Portugal parece seguir la misma trayectoria que la de España con varios años de retraso (diez años para las mujeres, quince años para los hombres) gracias a los progresos registrados en todas las edades. Los análisis de la mortalidad por edad y por causa muestran que es la mortalidad entre 20 y 79 años en los hombres y por encima de 60 años en las mujeres la causante de la mayor parte de la diferencia de esperanza de vida que subsiste entre ambos países. Las causas de muerte que contribuyen más a esas diferencias son las enfermedades del aparato circulatorio y para los hombres, los traumatismos.

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