Decreasing income inequality and emergence of the association between income and premature mortality: Spain, 1970–2010

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ARTICLE INFO

ABSTRACT

This study evaluates the relationship between income and mortality in Spain over a long period of declining in income inequality. The ratio between income in the richest and poorest provinces was 2.74 in 1970 and 2.10 in 2010. Pearson correlation coefficients for the association between provincial income and the measures of mortality were estimated, as well as absolute and relative differences between the mortality rates of the poorest and richest provinces. The correlation coefficient between income and infant mortality decreased from -0.59 in 1970 to -0.17 in 2010, and lost significance from 1995 onwards. The coefficient for premature all-cause mortality increased from -0.04 in 1970 to -0.40 in 2010, and acquired significance beginning in 2005. The coefficient also increased in mortality from cardiovascular, respiratory and digestive diseases. No association was found between provincial income and cancer mortality or mortality from injuries. The findings on premature mortality do not support the theory that decreasing income inequality will lead to reduced inequalities in mortality.

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1. Introduction

Several studies carried out in wealthy countries like the United States, United Kingdom and New Zealand have observed increasing geographic inequalities in mortality in the last decades of the 20th century and the early years of the 21st (McCarron et al., 1994; Sing and Siahpush, 2002; Shaw et al., 2005; Pearce and Dorling, 2006; Leyland et al., 2007; Singh and Kogan, 2007; Ezzati et al., 2008; Thomas et al., 2010; Department of Health, 2010). Mortality in the first year of life and premature mortality in the adult population have experienced a considerable decline, but the relative differences – and in some cases the absolute differences – in mortality between rich and poor areas have increased. The reason for this increase is that mortality has declined to a greater extent in richer than in poorer areas.

The authors of most of these studies have attributed this finding mainly to increasing economic inequalities among individuals and increasing differences in wealth between the poorest and richest areas. These authors believe that health inequalities cannot be lessened without reducing inequalities in income, wealth and other "upstream" determinants of health (Sing and Siahpush, 2002; Shaw et al., 2005; Pearce and Dorling, 2006; Leyland et al., 2007; Singh and Kogan, 2007; Thomas et al., 2010). Other scientists share this opinion. For example, one of the arguments used in the Marmot Review of Health Inequalities in England to explain the failure of the English strategy to reduce health inequalities, initiated in the late 1990s, was that inequalities in income and wealth were not reduced, but rather remained unchanged or even widened (Department of Health, 2010).

This explanation is questionable. The Marmot Review argues for increasing the health of the most disadvantaged up to the level of the most advantaged by redistribution of income. While there is a gradient in health with income most of the gains in life expectancy over the last century, including the most disadvantaged groups, have come from improved health at each level of income rather than from income gains (Preston, 1975). Improving health is not really about moving along a fixed income–health relationship, but is the upward shift of the entire curve with increasing levels of health at all levels of income over time.

In any case, no empirical research has been generated to support the theory that in a fairer society mortality of everyone would decrease up the level enjoyed by the best off. In fact, we cannot know how mortality inequalities would have evolved in

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those countries if income inequality had decreased. However, the generalization of this theory can receive strong empirical support if mortality inequalities have declined, or at least remained stable, in those places where income inequality has decreased. According to the Commission on Social Determinants of Health, health inequalities are the result of the cumulative impact of decades of exposure to health risks of those who live in socioeconomically less advantaged circumstances (Commission on Social Determinants of Health, 2008). In this regard, monitoring mortality inequalities over various decades allows assessment of the possible impact on these inequalities of sustained redistribution of economic resources over time.

Spain is one country where income inequality has declined in the latter decades of the 20th century. Since the first reliable estimate of personal inequality in income distribution in 1973, based on the household budget survey, income inequality declined until 2003 (Goerlich and Villar, 2009), and then began to increase beginning in 2004 (Eurostat, 2013). This period also saw a territorial convergence in the level of wealth, leading to a reduction in per capita income inequality between regions and provinces (National Statistics Institute, 2013a). Accordingly, our general objective was to analyze how the relationship between level of wealth of the area of residence and mortality evolved over a period of four decades in Spain. Our specific objectives were to show the evolution of the relationship between average provincial income and infant mortality, total premature mortality and premature mortality from the leading causes of death between 1970 and 2010, and to estimate the course of mortality inequalities during this period.

2. Methods

The indicator of average provincial income used was the gross domestic product per capita (GDPpc) in each of Spain's 50 provinces. For 1970, 1975, 1980, 1985 and 1990 we calculated the GDPpc based on estimates from the BBVA Foundation of gross domestic product and the population in each province (Fundación, 1999), and for 1995, 2000, 2005 and 2010 we used the estimates of GDPpc in each province made by the National Institute of Statistics (National Statistical Institute, 2013b).

For each of the study years, the infant mortality rate in each province was calculated based on information published by the National Institute of Statistics on births and on deaths in the first year of life. For each of those years we also calculated for each province the age-adjusted premature mortality rates – people under age 75 – for all causes and for the following causes of death: cancer, cardiovascular diseases, respiratory diseases, digestive diseases and external causes. The standard European population was used to calculate the age-adjusted mortality rates. The number of deaths by age and cause of death and the population by age were obtained from the National Institute of Statistics. In the case of mortality rates by cause of death, the first year was 1975, since provincial-level information on deaths by cause of death and age was not available before that time.

We first assessed how inequality in provincial income has evolved over time. For each year, several indicators of inequality in the distribution of average provincial income were calculated. Because the unit of analysis is the province, it has not been calculated personal indicators of income inequality such as the Gini index. Therefore, we have used other indicators of inequality comparing income level between different percentiles of the observation units. After ranking the provinces by income, we calculated the ratio between maximum and minimum provincial income and the ratios $P_{90}:P_{10}$ and $P_{80}:P_{20}$. The latter two ratios compare the provincial income of the provinces in the 90th and 80th percentiles with the provincial income in the provinces in the 10th and 20th percentiles, respectively. Second, we estimated the relationship between provincial income and mortality rates by calculating the Pearson linear correlation coefficient. In addition to indicating the magnitude of the relationship, the statistical significance of the coefficient also shows whether there is an economic gradient in mortality.

Subsequently, to assess how differences in mortality rates between the richest and poorest provinces have evolved, we grouped the provinces into quintiles based on provincial income in the central year (1990). In this way the differences are always estimated between the same provinces, since the position of the provinces based on provincial income may vary from year to year. We calculated the absolute and relative differences (ratios) between the mean mortality rates in the extreme quintiles and the difference between the mean mortality rates in the two poorest quintiles and the two richest ones. The statistical significance of the difference was estimated by Student's t, and, in the case of ratios, the data were first log transformed. Finally, to aid interpretation of the evolution of these differences, for each quintile of provincial income we estimated the percent change in the mortality rate between 1970 and 2010 and in the two intermediate periods.

3. Results

Table 1 shows that inequality in the distribution of provincial income declined during the four decades covered by the study. The ratio between income in the richest and poorest provinces was 2.74 in 1970 and 2.10 in 2010. The ratios $P_{90}:P_{10}$ and $P_{80}:P_{20}$ were 2.20 and 1.69 in 1970, and 1.64 and 1.41 in 2010, respectively.

The correlation coefficients between provincial income and mortality rates are presented in Table 2. The correlation coefficient for infant mortality decreased throughout the study years (from −0.59 in 1970 to −0.17 in 2010), and lost significance from 1995 thereafter. In contrast, the correlation coefficient for premature mortality from all causes increased (from −0.04 in 1970 to −0.40 in 2010), and became significant beginning in 2005. However, significance was observed women in 1990. The correlation coefficients for all cancers and external-cause mortality were not significant for any year. There was also no significant relationship in mortality from lung cancer and colorectal cancer. In the case of all cancers mortality, all the coefficients were positive and their

Table 1
Indicators of the distribution of provincial income.[a] Spain, 1970–2010.

Provincial income ratios	1970	1975	1980	1985	1990	1995	2000	2005	2010
Maximum to minimum	2.74	2.64	2.53	2.67	2.37	2.27	2.18	2.18	2.10
Percentile 90 vs percentile 10	2.20	2.16	1.95	1.81	1.79	1.70	1.86	1.74	1.64
Percentile 80 vs percentile 20	1.69	1.64	1.57	1.52	1.50	1.50	1.57	1.44	1.41

[a] Based on gross domestic products per capita.