Inequalities in income and long term disability in Spain: analysis of recent hypotheses using cross sectional study based on individual data

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Abstract

Objective: To compare the relation between inequalities in long term disability and income in the 17 regions of Spain.
Design: Data were taken from the survey on impairments, disabilities, and handicaps that was carried out in Spain in 1986. For each region the inequality in long term disability associated with income was calculated as the odds ratio associated with reducing monthly household income by 10 000 pesetas (about £50) (estimate of effect of inequality of income) and the odds ratio for the inequality in long term disability between those at the bottom and those at the top of the income hierarchy (relative index of inequality).
Main outcome measure: Prevalence of long term disability.
Results: Five of the eight regions where lowering income had a greater effect on long term disability were among those with the lowest income per head, while six of the remaining nine regions where the effect was smaller were among those with the highest income per head. Three regions with the highest estimate of relative index of inequality had the highest estimate of effect, and another three regions with the lowest estimate of relative index of inequality had the lowest estimate of effect. In contrast, the relative position of the remaining 11 regions varied from one measure to another.
Conclusions: These results support the theory that additional increments in material wellbeing have a negligible effect on health in countries with high socioeconomic development. However, inequality in income distribution did not determine inequality in health between those at the bottom and those at the top of the income hierarchy in many Spanish regions.

Introduction

One of the most important findings in developed countries in the past decade is that the association between income and mortality in individual people is not reproduced at an ecological level—that is, variations in mortality in different countries cannot be explained by differences in wealth as measured by gross domestic product.

In several studies using data from different industrialised countries, Wilkinson has shown not only the absence of a relation between gross domestic product and mortality but also a high correlation between life expectancy at birth and the degree of equality in income distribution.[1-3] Furthermore, countries that had more equal distributions of income had larger increases in life expectancy than those with that had less equal distributions. Wilkinson has illustrated this relation for Great Britain and Japan.[3 4] At the beginning of the 1970s both countries were quite similar in terms of life expectancy and income distribution. After two decades, however, income distribution in Japan has become more equal and life expectancy has increased extraordinarily, becoming the highest in the world. In Britain income distribution has become more unequal during this time and life expectancy has decreased in comparison with other countries.[4 5] At the same time social differences in mortality have decreased in Japan and increased in Britain.[4]

According to Wilkinson, if the association between inequality in income and health is related to the differences in health associated with social class, the largest inequalities in health will be seen in societies with the greatest inequalities in income. Lacking comparable international data on health inequalities, he describes how periods of greater or lesser social differences in mortality have coincided with periods of increased or decreased poverty in England and Wales during this century.[4]

Judge critically appraised studies comparing inequality in income and life expectancy in different countries, pointing out that many biases were not taken into account when the results were interpreted—for example, the use of inappropriate measures of inequality, the lack of comparability of data, and the failure to control for other factors that might be interacting with income.[6] Other studies have, however, confirmed Wilkinson's results by finding a relation between inequality in income and various health indicators, such as infant mortality,[7] general mortality, mortality from violent causes,[8 9] and low birth weight.[8] Furthermore, in the studies of Kaplan et al[8] and Kennedy et al[9] in the United States the information used for the analysis came from the same source, so the data were comparable.

Likewise, Wilkinson's hypothesis about the relation between inequality in income and inequality in health has been confirmed in a recent study using data on individual people from nine European countries.[10] The results have shown a strong association between differences in income and differences in perceived general health within each country.[10] However, another study, which also analysed data on the populations of several European countries, has not confirmed this hypothesis.[11] Specifically, the results have shown that inequalities in mortality and perceived morbidity by education or occupation are not smaller in countries such as the Nordic countries, whose social, economic, and health policies have traditionally been more influenced by principles of equality.

Again, one reason that may explain the contradictory results of the two studies is the problem of comparing international data because national data collection systems vary from country to country. We measured and compared the association between the

prevalence of long term disability and income in each of the 17 regions of Spain using the same data source. We then evaluated Wilkinson's hypothesis to determine whether the prevalence of long term disability and socioeconomic differences in long term disability in these regions were related to the degree of inequality in income distribution.

Subjects and methods

Source of data

The data were taken from the survey on impairments, disabilities, and handicaps that was carried out in 1986 by the national institute of statistics.[12] The people interviewed were selected in a two stage sampling process, with stratification and substratification of the first stage units corresponding to the census areas. The criterion for stratification was based on the size of the population of the municipality, while the criterion for substratification was based on the socioeconomic group of the households located in the census area. The second stage units were the households where all of the people who were interviewed lived. The total non-response rate for the survey was 5.1%. This study was restricted to people older than 15 years of age. Table 1 shows the total number of people who were interviewed in each region.

In the questionnaire, information was requested on the age and sex of each member of the household; the education, occupation, and working situation of the head of the household; and monthly household income. People were also asked if anyone had any kind of disability that affected his or her ability to carry out daily activities (box). All of the people interviewed were asked if they suffered from any of these disabilities, the possible answers being yes or no.

Only disabilities that affected a person permanently were recorded. A disability was considered to be permanent when permanency was implicit in its nature—for example, disabilities caused by mental retardation—or when the length of time the person had experienced the disability plus the length of time he or she was expected to experience it was equal to or greater than one year.[13] Only disabilities caused by an

> **Types of disabilities included in survey on impairments, disabilities, and handicaps[12]**
>
> - Seeing—inability to read a newspaper, sew, or read the time on a watch
> - Hearing—inability to follow a conversation conducted at a normal volume
> - Speaking—inability to speak so that others can understand
> - Other communication—inability to read or write
> - Personal care—inability to carry out basic personal activities (eating, washing, dressing, and so on) without the help of another person
> - Walking—inability to go from one place to another without the help of another person or of some type of prosthesis or device
> - Climbing stairs—inability to climb 10 stairs unaided without stopping
> - Running—inability to run a distance of 50 m
> - Going out of the home—inability to leave the home unless accompanied by another person
> - Other activities—inability to open and close doors or windows; inability to reach for or stoop to get an object
> - Excessive sensitivity to some environmental factor (light, sound, dust, and so on) that limits normal life
> - Inability to identify people or objects or to learn because of a mental or physical problem
> - Inability to relate to others because of a mental or physical problem

impairment in accordance with the international classification of impairments, disabilities, and handicaps were considered.[13] The disability indicator used in this study was the percentage of respondents who mentioned one or more disabilities.

The question on income was asked of the head of household, who was requested to point out which of the 10 income groups shown on the questionnaire corresponded to the monthly income of all household members (see table 2). The question included all household income after taxes, whatever its origin. The non-response rates to the question on income ranged from 0.1% to 14% (table 1).

Measures of health inequalities

We compared inequalities in the prevalence of long term disability associated with income using two indices of inequality proposed by Kunst and Mackenbach.[14][15] Firstly, for each region we calculated the association between monthly household income and the prevalence of long term disability by an age and sex adjusted odds ratio. Income was calculated as the mean household income per month, as shown in table 2, so that the estimates represent the odds ratio associated with a reduction in monthly income of 10 000 pesetas (about £50).

Secondly, we calculated a relative index of inequality that took into account the population distribution across socioeconomic groups. In calculating this index we followed the method proposed by Pamuk.[16] In this method a value is assigned to each income group, with the relative position that it occupies in the social hierarchy established in accordance with this variable being taken into account. The only information needed is the proportion of people in each income group. For example, if the highest income group com-

Table 1 Numbers of interviews in each region, with percentages of interviews without response on income

Region	No of interviews	% without response on income
Andalucia	34 507	2.7
Aragon	9351	11.8
Asturias	4809	10.2
Balearics	3584	9.7
Basque country	12 426	5.7
Canaries	6560	3.0
Cantabria	3921	0.5
Castilla-La Mancha	14 324	10.1
Castilla-Leon	24 701	6.3
Cataluna	21 071	13.9
Extremadura	7147	3.1
Galicia	15 288	4.1
Madrid	14 931	13.0
Murcia	4822	1.0
Navarre	3416	13.5
La Rioja	2780	0.1
Valencia	14 869	3.3

Table 2 Estimated mean monthly income for calculating measure of association or odds ratio

Income (pesetas)	Mean household income per month*
0-15 000	0.75
15 001-30 000	2.25
30 001-50 000	4.00
50 001-75 000	6.25
75 001-100 000	8.75
100 001-150 000	12.50
150 001-200 000	17.50
200 001-300 000	25.00
300 001-400000	35.00
≥400 000	50.00

*Based on monetary unit of analysis of 10 000 pesetas (about £50).

prises 10% of the total population the relative position of its members would be between 0 and 0.10, the average being 0.05. If the next highest income group comprises 30%, their hierarchical range is between 10% and 40%, the average being 0.25, and so on. To ensure that each region had enough people in each group of age, sex, and income this hierarchical range was calculated after grouping income into four categories. Under this index of inequality, each region's social hierarchy is the same length: the highest point has a value of 0 and the lowest a value of 1. Since an increment of one unit equals the difference between the lowest (1) and the highest (0) point in the social hierarchy, the odds ratio estimated by this method represents the prevalence of long term disability for those at the bottom of the socioeconomic hierarchy compared with that for those at the top. A larger value in one region than in another means a greater difference in the prevalence of long term disability between those at the bottom and those at the top of the income hierarchy.

Adjusted odds ratios were computed by logistic regression using the statistical package SPSS for Windows.[17]

Measure of income inequality

A larger relative index of inequality—that is, a greater difference in the prevalence of long term disability between the high and low positions in the income hierarchy—could be attributed either to the effect of a reduction in income by 10 000 pesetas or to inequality in income itself. To test this, we calculated a measure of income inequality in each region using linear regression in which the dependent variable was the mean household income per month and the independent variable was the range or relative position that income group occupies with respect to income hierarchy. The regression coefficient obtained can be interpreted as the difference in the mean household income per month between those at the bottom and those at the top of the income hierarchy.

Association between measures of health inequality and economic indicators

To measure the association between measures of health inequality and economic indicators we calculated Pearson's correlation coefficient between the odds ratio and income per head in the different regions. We then calculated this coefficient between the prevalence of long term disability and income inequality, and we estimated the correlation coefficient between the relative index of inequality and income inequality.

Results

Table 3 shows the age adjusted prevalence of long term disability, which ranged between 12.9% in Murcia and 21.1% in Madrid and Andalucia. Table 3 also shows that the odds ratios associated with a reduction in income of 10 000 pesetas ranged from 1.024 in Aragon to 1.142 in the Balearics—that is, the prevalence of long term disability increased by 2.4% for each reduction in income of 10 000 pesetas in Aragon and by 14.2% in the Balearics.

Five of the eight regions where a monthly reduction in income of 10 000 pesetas resulted in larger increases in the prevalence of long term disability—Andalucia, Castilla-Leon, Castilla-La Mancha, Extremadura, and the Canaries—were among the six regions with the lowest income per head in 1986 (table 4); only one of these eight, the Balearics, had a very high income per head. In contrast, six of the nine remaining regions where this reduction in monthly household income resulted in smaller increases in the prevalence of long term disability—Aragon, Madrid, the Basque country, La Rioja, Navarre, and Cataluna—were among the regions with the highest income per head in 1986 (table 4); only one of these nine—Galicia—had a very low income per head. Figure 1 shows the relation between income per head and the odds ratios associated with a 10 000 pesetas lower income ($r = 0.51$; $P < 0.10$), excluding the Balearics and Galicia.

The odds ratio of the bottom versus the top of the income hierarchy is also shown in table 3. Aragon had the smallest odds ratio (1.24), followed by Galicia (1.53) and Murcia (1.57), while the highest values were for the Balearics (5.66), the Canaries (4.50), and Cantabria (3.95).

The relative position occupied by these regions in accordance with the size of either measure of inequality varied in many regions. Three regions—the Balearics,

Table 3 Prevalence of long term disability, with odds ratios of long term disability associated with drop in monthly income of 10 000 pesetas and for the poorest people compared with the richest

Region	Prevalence of disability (%)*	Odds ratio with drop in income (95% CI)	Relative index of equality (95% CI)
Andalucia	21.1	1.092 (1.081 to 1.103)	2.66 (2.36 to 3.00)
Aragon	18.9	1.024 (1.006 to 1.043)	1.24 (0.98 to 1.58)
Asturias	14.4	1.074 (1.042 to 1.106)	2.51 (1.76 to 3.59)
Balearics	13.9	1.142 (1.096 to 1.190)	5.66 (3.52 to 9.10)
Basque country	18.1	1.069 (1.055 to 1.084)	3.05 (2.47 to 3.78)
Canaries	19.4	1.140 (1.109 to 1.172)	4.50 (3.35 to 6.04)
Cantabria	17.1	1.139 (1.097 to 1.182)	3.95 (2.67 to 5.84)
Castilla-La Mancha	19.9	1.095 (1.074 to 1.117)	2.43 (1.99 to 2.96)
Castilla-Leon	14.8	1.094 (1.079 to 1.109)	2.51 (2.15 to 2.92)
Cataluna	18.9	1.085 (1.073 to 1.098)	3.03 (2.57 to 3.58)
Extremadura	19.4	1.120 (1.087 to 1.153)	2.68 (2.03 to 3.55)
Galicia	15.2	1.047 (1.029 to 1.066)	1.53 (1.27 to 1.84)
Madrid	21.1	1.055 (1.043 to 1.068)	2.61 (2.16 to 3.16)
Murcia	12.9	1.065 (1.026 to 1.105)	1.57 (1.07 to 2.32)
Navarre	14.7	1.075 (1.039 to 1.111)	3.41 (2.12 to 5.46)
La Rioja	13.6	1.070 (1.035 to 1.107)	2.82 (1.79 to 4.45)
Valencia	17.0	1.113 (1.091 to 1.135)	2.69 (2.20 to 3.29)

* Adjusted for age.

Table 4 Regional income per head and inequality in income in Spain

Region	Income per head*	Inequality in income (pesetas)†
Extremadura	0.53	97 820
Andalucia	0.63	120 460
Castilla-La Mancha	0.66	110 420
Galicia	0.66	107 520
Castilla-Leon	0.78	120 860
Canaries	0.80	130 940
Murcia	0.80	110 190
Cantabria	0.81	116 020
Asturias	0.81	122 050
Valencia	0.85	112 860
Aragon	0.91	130 300
La Rioja	0.98	147 060
Cataluna	0.99	145 260
Navarre	1.02	142 610
Madrid	1.04	151 940
Basque country	1.05	146 460
Balearics	1.12	121 670

*In millions of pesetas, based on estimates of gross regional product from the National Institute of Statistics; 1 000 000 pesetas= about £5000.
†Difference in mean household income per month between those at bottom and those at top of income hierarchy.

the Canaries, and Cantabria—had the largest value for both measures, and another three—Aragon, Galicia, and Murcia—had the lowest values. Four of the eight regions with higher odds ratios—Navarre, the Basque country, Cataluna, and La Rioja—had comparatively low odds ratios associated with a 10 000 pesetas lower income, and four of the other regions with a lower relative index of equality—Castilla-La Mancha, Castilla-Leon, Andalucia, and Extremadura—had comparatively high odds ratios associated with a 10 000 pesetas lower income. Whereas in Navarre, the Basque country, Cataluna, and La Rioja the increase in the prevalence of long term disability associated with a 10 000 pesetas lower monthly income ranged between 7% and 8.5%, in Castilla-La Mancha, Castilla-Leon, Andalucia, and Extremadura it varied between 9.2% and 12%.

The difference in mean household income per month for people in the highest and lowest point in the income hierarchy ranged from 97 800 pesetas in
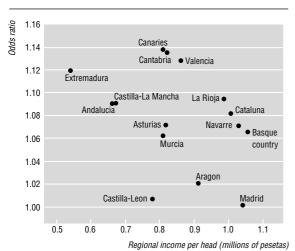

Fig 1 Relation between regional income per head and odds ratio of long term disability associated with reduction in monthly income of 10 000 pesetas in regions of Spain (excluding Galicia and Balearics) in 1986 (r=−0.51, P<0.1)
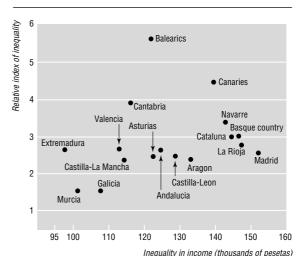

Fig 2 Relation between relative index of inequality and inequality of income in Spain in 1986 (r=0.17, P>0.1)

Extremadura to 151 900 pesetas in Madrid (table 4). Income inequality was not related to the prevalence of long term disability—Pearson's correlation coefficient was 0.10—and there was no relation between income inequality and the relative index of inequality (fig 2).

Discussion

Our results confirm the relation between income and health, but they do not show an association between variations in income inequality and health inequality. In fact, one of the most consistent observations in public health research is that people in poorer socioeconomic groups have poorer health and more health problems than those belonging to richer groups.[18][19] Our results reproduce these findings for long term disability.

Variations in the size of the association in different regions is another commonly observed finding. Several international studies of different health measures such as mortality, self reported health status, prevalence of chronic diseases, and prevalence of long term disability have also showed large variations in the size of the relation between socioeconomic group and health in the countries compared.[15][20-25] The effect of social class, education, and income probably depends on the historical, economic, and social context—that is, specific economic and social circumstances may modulate the relation between socioeconomic group and health in each country.

Thus, the economic environment may influence the relation between the prevalence of long term disability and the monthly household income in the regions of Spain. Five of the eight regions where lowering monthly income by 10 000 pesetas had the greatest effect on long term disability are among those with the lowest income per head, while six of the remaining regions where the effect was smaller are among those with the highest income per head. With two exceptions—Galicia and the Balearics—these findings suggest that in a climate of wealth additional increments of material wellbeing contribute little to individual health. This confirms the results from ecological studies with data from different countries, in which absolute wealth does not have a great impact on

the health of the population in countries with high socioeconomic development.[2]

In interpreting these results, certain considerations must be kept in mind. For example, as our study was cross sectional the association between long term disability and income could be due to a social selection mechanism related to health, such that people with long term disability would tend to become poorer over time. The possible contribution of this mechanism must be small because different longitudinal studies have shown poorer health in people with lower incomes.[26-28]

Another consideration is the different perception of health according to income. Some evidence shows that people with low incomes usually report more health problems in relation to an objective appraisal of their health.[29 30] Nevertheless, this overreporting does not explain the variation in the size of the association in the regions of Spain, since there is no reason to supposed that such overreporting would differ among regions. Likewise, these findings raise the possibility of an information bias because people tend to report their incomes as lower than they really are.[31] However, given the high correlation coefficient between mean income in each region from individual self reports in the survey and regional income per head from official sources (0.76; data not shown), we can conclude that there is no differential bias among regions in this respect.

Some recent theories have suggested that inequalities in income are increasing in developed societies because of changes in the structure of the labour market that have increased the demand for better qualified workers with more years of education and reduced the demand for less qualified workers, who are thus being eliminated from the labour force. This increase in income inequality causes a decline in the health of the population because the poorer health in people with a lower income is not counterbalanced by improved health in those with a higher income.[32] Wilkinson has emphasised that this deterioration in health is due to several factors associated with relative poverty such as anxiety, stress, and frustration.[3] He argues that in developed societies the direct physical effects of material circumstances are currently less important for health than the psychosocial aspects of low control, insecurity, and loss of self esteem.[33]

In our study, however, inequality in income was not related to the prevalence of long term disability in the regions of Spain ($r = 0.10$), even though the greatest inequality in income was seen in regions with the greatest socioeconomic development. A possible explanation for these results is that Wilkinson's observations apply only to mortality. Nevertheless, we did not find any relation between inequality in income and two indicators of mortality—life expectancy and infant mortality—in the regions of Spain (data not shown).

Two recent studies carried out in the United States found a relation between income inequality and mortality using the proportion of income received by households whose income was below a specified centile of the distribution of household income as an indicator of income inequality.[8 9] In contrast, the Gini coefficient—another measure of income inequality—showed little correlation with any of the mortality outcomes studied.[9] Similarly, the indicator of income inequality that we used might not permit detection of an association between income inequality and health.

In relation to the different prevalence of long term disability between those at the bottom and those at the top of the income hierarchy, or the relative index of inequality, we emphasise that our results do not support Wilkinson's hypothesis because the correlation between income inequality and the relative index of inequality was extraordinarily weak. In only eight regions was income inequality the fundamental factor determining the size of the relative index of inequality. In Andalucia, Castilla-Leon, Castilla-La Mancha, and Extremadura the inequality in the prevalence of long term disability between those at the bottom and those at the top of the income hierarchy was comparatively small, although the effect of a reduction in monthly household income of 10 000 pesetas was comparatively high. In Navarre, the Basque country, Cataluna, and La Rioja the situation was opposite. The difference in mean household income per month between people at the highest and lowest extremes in the income hierarchy explains these results: whereas in Castilla-La Mancha, Castilla-Leon, Andalucia, and Extremadura this difference ranges from 97 800 to 120 000 pesetas (£500 to £600), in Navarre, the Basque country, Cataluna, and La Rioja the difference was around 145 000 pesetas (about £725).

Wilkinson's hypothesis is not confirmed in the remaining regions because the effect of income on long term disability was the principal determinant of health inequality between those at the bottom and those at the top of the income hierarchy. Notable in this sense are Madrid, Aragon, the Balearics, and Cantabria, four of the regions with the highest income per head. The region of Madrid is paradigmatic; although it has the greatest inequality in income, the inequality in long term disability or relative index of inequality was not high. Similarly, Aragon has a small inequality in long term disability or relative index of inequality in spite of having a comparatively large income inequality. In both cases this is because the effect of each 10 000 pesetas lower monthly income on long term disability was low. The Balearics and Cantabria represent the opposite situation, with very high inequality in long term disability or relative index of inequality but with low or moderate income inequality. In these two regions this is because the effect of each 10 000 pesetas lower monthly income on permanent disability was high.

In our study the non-response to the question on monthly household income varied from one region to another. We found that people whose income was unknown had a better than average education compared with the other respondents in all regions, so their income was probably also higher than average. The exclusion of these people and the underreporting of income that commonly occurs among people with higher incomes will have resulted in an underestimate of the relative index of inequality. The underestimation will be greater in those regions with higher non-response rates. This probably does not alter each region's relative inequality in the prevalence of long term disability because the highest non-response rates affect regions with both high and low relative indices of equality.

The response bias about income that is found in most studies may heighten the contradictory results of the two most recent studies of health inequalities in

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Key messages

- The association between income and long term disability is higher in Spanish regions with the lowest income per head
- Inequality in income is not related to the prevalence of long term disability in the regions of Spain
- Inequality in the distribution of income does not determine the inequality in health between those at the bottom and top of the social hierarchy in many Spanish regions

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European countries.[10] [11] Mackenbach et al found that Sweden had comparatively high inequality in perceived general health by education,[11] while Van Doorslaer et al found that it had comparatively low inequality in perceived general health by income.[10] In the study by Van Doorslaer et al the data on income in Sweden were obtained by linkage to the tax register, whereas in the other countries they were obtained by self report.[34] In these countries people who have a high income will probably be most affected by non-response to questions on income, so their health inequalities will be underestimated with respect to the Swedish results.

The differences between the results of the study by Van Doorslaer et al, which found a close relation between income inequality and health inequality,[10] and the results of our study, in which no such relation was found, is important because both studies used similar methods. The only other study to date which has used individual data on income and morbidity relates exclusively to Nordic countries.[22]

Although we cannot explain the discrepancies in the results of the two studies, our study has certain advantages over studies comparing different countries. The results can be compared because we used a single data source for all regions. All of the regions have a similar social, cultural, and political system, so we avoided the many biases that can be produced in transcultural studies. One limitation is the failure to adjust monthly household income by the number of people living in the home. However, the influence that this could have on the results is minimal because the mean number of people per household in the different regions of Spain in the second half of the 1980s was similar.[35] Neither is there any reason to believe that socioeconomic differences in size of household differ from one region to another.

Conclusion

In summary, our results provide mixed support for the Wilkinson hypothesis on the importance of relative and absolute poverty for health in developed countries. We found that the association between a measure of material wellbeing—monthly household income—and a measure of health—long term disability—is higher in areas with lower socioeconomic development. We also found that inequality in income distribution does not determine health status or health inequality between those at the bottom and top of the social hierarchy.

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