Loss of labour productivity caused by disease and health problems: what is the magnitude of its effect on Spain's Economy?

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Loss of labour productivity caused by disease and health problems: what is the magnitude of its effect on Spain's Economy?

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Abstract The aim of this study is to estimate the economic impact of the non-medical costs of diseases and accidents in Spain. Its main premise sustains the idea that in addition to the number of deaths, the loss of quality of life and the pain suffered by patients and their family members as a result of diseases and accidents, there are other indicators that provide us with a better understanding of their socioeconomic impact. Our analysis provides estimates of the loss of labour productivity in Spain as a result of health problems in 2005. Our main finding suggests an estimated loss amounting to over 37,969 millions euros, of which 9,136 millions euros are due to premature deaths, 18,577 millions to permanent disability and 10,255 millions to temporary disability. The loss in labour productivity due to accidents and health problems was estimated to a figure equivalent to nearly 4.2% of the Gross Domestic Product of Spain in 2005. This study underscores the strong economic impact of non-medical costs of diseases. In addition, it stresses the need for better information systems for collecting data that is relevant to the topic at hand.

Keywords Health economics · Cost of illness · Labour productivity · Economic impact

JEL Classification H0 · I0 · J0

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Introduction

In addition to the number of deaths, the loss of quality of life and the pain suffered by patients and their relatives caused by disease and health problems, there are other indicators that may help us to gain greater insight into their socioeconomic impact. So, information on the economic impact of illness may be a useful tool in that it provides complementary data beyond those associated with natural or clinical units. It is important to note that in many instances the term health care expenditure could be considered the same as investment in health. The allocation or investment of resources for health care should lead to gains in terms of quality of life and/or quantity of life years, thereby avoiding a number of other disease-related costs. In this manner, health can be understood as a factor of human capital within a society where investments aimed at improving the health of the populations subsequently materialize in the form of positive economic growth [1].

Recently, the European Commission has recognized the importance of health care in the short-term economic development of the European Union (EU), and one of the key indicators of economic growth proposed in the Lisbon Strategy for Growth and Employment was Healthy Life Years. More recently, the strategy for EU health policy proposed by the European Commission for 2008–2013, Together for Health, reiterated this fact [2].

For these reasons, the main objective when allocating resources for health care will clearly be to improve the quality of life and life expectancy of citizens in a society. However, besides this objective, decision-makers should not fail to consider other components of the social welfare loss caused by disease. For this, policy makers should take into account the existence of non-medical costs of disease, since, despite their neither being included as a budget items

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nor included, at least not directly, in the national accounting figures, they will reflect a significant economic loss.

The aim of this study is to provide objective and comparable information on affairs relating to the cost of diseases and health problems. The basic idea is that the information provided, along with other economic, budget and health care-related data, should be compiled into a body of information useful to the policy makers. More specifically, this study provides an estimate of the loss of labour productivity caused by premature death and disability in Spain in 2005.

Methods and data

The theoretical framework underlying this study applies human capital models to the field of health. Under the human capital approach, an increase in the level of knowledge or human capital increases a person's productivity in the labour market, where she/he gets her/his monetary income, and in the home or non-market area, where goods are produced that become part of her/his utility function. In order to produce potential gains in labour productivity, individuals have incentives to invest in education and job training [3–5]. The idea of health as a component of human capital stock of the individual is not new [3, 6]. In fact, the first health demand model was developed by Grossman in 1972 [7]. The key element underpinning this model is the dual nature of good 'health'. Health can be treated as both a commodity and investment capital. As a commodity, good health is desired for its own sake since carrying out our normal activities and enjoying a host of experiences that cannot be purchased depend on our state of health. 'Good health' thus becomes a prerequisite for obtaining and/or maintaining high levels of well-being. Moreover, health can be considered as investment capital, since it avails individuals more days of good health, thereby increasing their earning potential. Focusing on this second aspect, negative effects on the health of an individual might cause undesirable effects on productivity at work and at home as well as loss of leisure time for people suffering from negative effects on their own health and individuals who take care of them

This study focuses on individuals on whom we have sufficient sources of data with which to base estimates. We were able to analyse losses in labour productivity as a result of mortality and morbidity (temporary and permanent disability).

According to human capital theory [7, 8], the average earnings (wage) of a worker is considered a reasonable measure of labour productivity and can be used as the basis for estimating future wages that would go unearned if a worker was to leave the labour market prematurely as a result of an illness or accident. Labour productivity is described in terms of a worker's remuneration in the labour market. Thus, our calculations were performed based on the average gross wage figures contained in the Wage Structure Survey of 2005 of the National Statistics Institute. Employment data were obtained from the Labour Force Survey conducted by INE in 2005, which defines the employment rate as the percentage of the population that is employed in relation to the total population of working age.

Data for calculating number of deaths and Years of Potential Life Lost (YPLL) were obtained from the Spanish Registry of Deaths (2005), published by the National Institute of Statistics, according to cause of death. This source provides annual figures on deaths by root cause (in accordance with the International Classification of Diseases of the World Health Organization-10th edition).

YPLL was calculated using the process referred to in the notes on methodology compiled by the Spanish Office for National Statistics (Instituto Nacional de Estadística-INE). This indicator reflects the extent to which, in theory, mortality could have been avoided and takes into account the years a person will not live if she/he dies at an age outside of the normal range established for that group. It has been calculated for ages ranging between 1 and 69 (in accordance with INE methodology), thereby leaving out deaths at older ages, on the one hand, and infant mortality in babies under 12 months (due to very specific causes which would require a separate study), on the other. Once the method for calculating YPLL for this age range was chosen, we proceeded to estimate Years of Potential Productive Life Lost (YPPLL). We calculated the number of deaths of individuals of working age or younger (under 16 year olds). The age limit for workers to remain in the labour market was set at 65 years, which was the legal age of retirement at the time of the study.

Once the age of each individual at the time of death and her/his expected gross lifetime wages are known, the present and future flow of productivity lost as a result of premature death for any of the causes under consideration can be calculated. For this purpose, the employment rate and expected earnings are applied to each case, controlling for age, gender and Spanish region up to the predetermined limit of 65 years. Future amounts are discounted at an annual rate of 3%, and a 1% annual rate of labour productivity growth is applied. This is the baseline case, carried out using a sensitivity analysis for two alternative discount rates, zero per cent and six per cent, and two new rates of labour productivity growth, zero per cent and two per cent.

The loss of labour productivity due to diseases and accidents is not produced solely by the deaths they cause. There are many survivors who are no longer able to

Table 1 Main indicators of death: absolute values and distribution by cause of death

	Deaths		Deaths in persons under 65 years		YPLL		YPPLL	
001–102 I-XX. All causes	387,355	100.00%	65,441	100.00%	1,253,529	100.00%	1,029,553	100.00%
001–008 I. Infectious and parasitic diseases (including HIV)	7,493	1.93%	2,536	3.88%	61,307	4.89%	51,528	5.00%
009–041 II. Tumours	100,206	25.87%	26,359	40.28%	429,283	34.25%	302,089	29.34%
042–043 III. Diseases of the blood and blood organs and disorders that affect immunity. Haematopoietic. system	1,316	0.34%	187	0.29%	4,687	0.37%	4,122	0.40%
044–045 IV. Endocrine, nutritional and metabolic disorders	12,421	3.21%	1,159	1.77%	19,719	1.57%	15,555	1.51%
046–049 V. Mental and behavioural disorders	12,539	3.24%	478	0.73%	10,571	0.84%	8,295	0.81%
050–052 VI-VIII. Diseases of the nervous system and sense organs	15,697	4.05%	1,675	2.56%	39,740	3.17%	33,919	3.29%
053–061 IX. Cardiovascular diseases	126,907	32.76%	11,742	17.94%	194,788	15.54%	136,249	13.23%
062–067 X. Respiratory disease	47,089	12.16%	3,087	4.72%	56,574	4.51%	41,628	4.04%
068–072 XI. Digestive disease	19,624	5.07%	4,015	6.14%	69,359	5.53%	50,780	4.93%
073 XII. Skin and tissue diseases	1,107	0.29%	50	0.08%	896	0.07%	640	0.06%
074–076 XIII. Diseases of the Musculoskeletal system and connective tissues	3,596	0.93%	226	0.35%	4,694	0.37%	3,555	0.35%
077–080 XIV. Genitourinary diseases	9,567	2.47%	521	0.80%	8,615	0.69%	6,080	0.59%
081 XV. Pregnancy, delivery and birth	18	0.00%	18	0.03%	646	0.05%	574	0.06%
082 XVI. Conditions during the perinatal period	942	0.24%	941	1.44%	1,580	0.13%	45,847	4.45%
083–085 XVII. Birth defects, malformations and chromosomal abnormalities	962	0.25%	870	1.33%	13,622	1.09%	35,138	3.41%
086–089 XVIII. Symptoms, signs and abnormal clinical and laboratory findings NEC (not including HIV)	10,969	2.83%	1,896	2.90%	40,449	3.23%	37,457	3.64%
090–102 XX. External causes of mortality	16,902	4.36%	9,681	14.79%	297,003	23.69%	256,097	24.87%

Source Prepared by author based on data contained in the registry of deaths by cause of death (2005)

perform their job tasks, either for a limited period or permanently. Data on temporary and permanent disability were obtained from aggregated records provided by the National Institute of Social Security (INSS), a Spanish agency within the Ministry of Labour, which is responsible for overseeing sick leave benefits awards. Similarly, INSS also provided us with micro-data from 25,000 cases of temporary sick leave for this study. As a result, we were able to gain additional information on the distribution of age, gender and cause of temporary disability.

Results

Mortality

There were a total of 387,355 deaths in Spain in 2005. The Years of Potential Life Lost (YPLL), as a result of premature deaths between the ages of 1 and 69, were estimated at 1.25 million. The deaths of 65,441 individuals of working age or younger accounted for over one million YPPLL.

As shown in Table 1, cardiovascular diseases and tumours were the main causes of death across the board for all age groups. This observation holds true for deaths occurring before the age of 65, although the relative proportions change (tumours were responsible for the greatest number of deaths, followed by cardiovascular diseases) and a third group, external causes, also had a considerable impact. When we turn our focus to YPLL, tumours rank first in importance, followed by external causes. Cardiovascular diseases rank third. Finally, when we analyse YPPLL, tumours continued to rank first, the gap between tumours and external causes of death narrowed and the gap between tumours and cardiovascular diseases widened.

A closer look at the data on fatalities reveals that the two groups of diseases accounting for the most deaths are cardiovascular diseases and tumours, at 33% and 26% of deaths, respectively. Next are respiratory diseases (12%) and several groups of diseases that account for between 3

Table 2 Loss in labour productivity due to death: absolute values and distribution by cause of death

	Baseline case Annual discount rate = 3%; Annual growth rate in productivity = 1%		Annual discount rate = 0%; Annual growth rate in productivity = 2%		Annual discount rate 6%; Annual growth rate in productivity = 0%	
	Values (€)	%	Values (€)	%	Values (€)	%
All causes	9,136,350	100.00	15,115,025	100.00	6,649,421	100.00
Infectious and parasitic diseases	528,848	5.79	819,525	5.42	391,251	5.88
Tumours	2,386,820	26.12	3,326,692	22.01	1,902,721	28.61
Diseases of the blood and blood organs Haematopoietic system	35,498	0.39	68,501	0.45	23,018	0.35
Endocrine, nutritional and metabolic disorders	126,188	1.38	213,592	1.41	90,765	1.37
Mental and behavioural disorders	83,816	0.92	129,109	0.85	63,881	0.96
Diseases of the nervous system and sense organs	280,926	3.07	529,407	3.50	186,669	2.81
Cardiovascular diseases	1,226,471	13.42	1,720,991	11.39	975,782	14.67
Respiratory disease	373,540	4.09	586,423	3.88	280,865	4.22
Digestive disease	480,486	5.26	655,261	4.34	383,618	5.77
Skin and tissue disease	5,025	0.05	6,786	0.04	4,146	0.06
Diseases of the musculoskeletal system and connective tissues	27,122	0.30	42,664	0.28	20,036	0.30
Genitourinary diseases	47,344	0.52	68,957	0.46	36,850	0.55
Pregnancy, delivery and birth	3,380	0.04	5,610	0.04	2,274	0.03
Conditions during the perinatal period	335,989	3.68	883,161	5.84	156,648	2.36
Congenital defects	259,451	2.84	639,968	4.23	132,017	1.99
Symptoms, signs, NEC	350,614	3.84	602,372	3.99	248,433	3.74
External causes	2,584,835	28.29	4,816,005	31.86	1,750,447	26.32

Source Prepared by author

Units: Thousands of euros

and 5% of deaths (i.e., mental illness, nervous system disorders, digestive diseases and external causes of death). This picture changes significantly if we consider the deaths of people younger than 65. In this case, tumours stand far above the other causes, accounting for 40% of deaths. Cardiovascular diseases (18%) and external causes of death (15%) fall significantly behind. Even less prevalent are digestive diseases (6%), respiratory diseases (5%) and infectious and parasitic diseases (due to the burden of HIV/AIDS) (4%). These differences become even more apparent when calculating YPLL. Tumours account for a total of 34%, followed by external causes of death (24%) and cardiovascular diseases (16%). Digestive diseases, infectious and parasitic diseases and respiratory diseases remain far behind. The results for YPPLL display a similar pattern. Tumours are responsible for approximately 29% of YPPLL and external causes of death 25%. The third most important cause is cardiovascular diseases (13%), and much less prevalent are infectious and parasitic diseases (5.0%), digestive diseases (4.9%) and respiratory diseases (4.0%). Deaths during the perinatal period cause a large number of YPPLL due to the young age of the deceased and make up 4.45% of all YPPLL.

The loss of labour productivity caused by premature deaths in Spain in 2005 has been estimated at 9,136 millions euros (Table 2). The baseline case chosen has an annual discount rate of 3% and an annual growth rate of labour productivity of 1%. There are two groups that surpass the rest, which together account for over 50% of the loss: external causes of death and tumours. External causes account for the greatest amount of losses, with an estimated cost of 2,585 millions euros (28.3% of the total). Tumours account for losses estimated at 2,387 millions euros (26.1% of total). The explanation for why the losses caused by external causes are greater than those caused by tumours, in spite of the fact that the number of YPPLL is higher for the latter, can be found in both the breakdown of gender and causes of death and labour market dynamics. Males represented 81.4% of all deaths before the age of 65 due to external causes (81.9% of YPPLL); however, this percentage drops to 64.6% (60.1% of YPPLL) in case of tumours. The explanation for why losses from external causes of death were greater than losses caused by tumours may lie in the fact that employment rates and wages are higher for men than for women. Cardiovascular diseases came in third, accounting for 1,226 millions euros (13.4%

of total losses). The average age at death for individuals in this disease group is higher than in case of tumours and external causes. Hence, the YPLL and YPPLL are manifestly lower than for the two aforementioned disease groups, and the economic impact, although very high, is less marked. As expected, the next three groups with the greatest impact on loss of labour productivity are infectious and parasitic diseases (529 million euros, 5.79% of the loss of labour productivity caused by premature deaths) along with digestive diseases (480 million euros, 5.26%) and respiratory diseases (374 million euros, 4.09%).

An examination of disease and illness subgroups reveals that the cause of death with the greatest impact on YPPLL in Spain in 2005 was 105,242 traffic accidents (10.2% of total), which exceeded 1,047 millions euros in losses (11.5% of total losses). Malignant tumours of the trachea, bronchus and lung, made up the second group with the strongest impact, are responsible for 6.0% of YPPLL and an estimated 6.0% of the loss of labour productivity. The third cause was death by suicide and self-inflicted injury, responsible for 5.1% of YPPLL and 5.8% of the loss of labour productivity. The significant burdens of breast cancer in women (responsible for 9.2% of YPPLL and 8.9% of the loss of labour productivity among women) and acute myocardial infarction in men (4.8% of YPLL and 4.7% of the loss of labour productivity) are also worth noting.

Table 2 also contains the results of applying an annual discount rate of 6% to the estimated losses where the rate of labour productivity growth would be zero and the results of applying a zero discount rate to the estimated losses and an annual rate of labour productivity growth of 2%. The estimated losses range between 6,649 and 15,115 millions euros, depending on the rates selected.

Data on the number of recipients who received permanent disability benefits in Spain in 2005 under the contributory system were obtained from the Yearbook of Labour and Social Affairs (Spanish Ministry of Labor) [9] published by the Ministry of Labour. A total of 832,794 people were classified as permanently disabilities. The total wages lost, after controlling for the age and sex of benefit recipients, was estimated at 18,577 millions euros. An important limitation was the lack of information on the specific diseases and accidents, which gave rise to the condition of permanent disability.

The main findings relating to temporary disability in Spain in 2005 are listed in Table 3. We have estimated a total of the number of 213.4 million days lost to temporary disability. Losses in labour productivity are estimated at 10,255 millions euros. The main medical conditions leading to disability are diseases of the musculoskeletal system and connective tissues (24.5% of days of temporary disability and 24.3% of the estimated loss), followed by the XVIII group—Symptoms, signs and abnormal clinical and laboratory findings (16.7% of days of temporary disability and 16.8% of the estimated loss), mental and behavioural disorders (13.8% of the days and 13.7% of the estimated loss) and external causes (10.7% of days and 10.4% of the estimated loss). It should be emphasized that respiratory system diseases are responsible for many cases of temporary disability as diseases of the musculoskeletal system, but because of its shorter duration representing a 6.7% of days lost and 6.9% of the estimated loss. Finally, it should be noted that in 4.2% of cases (5.4% of days lost and 5.1% of the estimated loss) the specific cause that led to the temporary disability could not be determined and therefore was not assigned to any group of disease.

A look at the list of specific causes reveals that seven types of disease make up 54.7% of cases and 43.9% of sick leave days. Colitis, enteritis, infectious gastroenteritis and diarrhoea represent 4.2% of temporary incapacity cases. This figure drops to 0.8% of lost working days due to the short duration of these ailments (7.6 days on average). Anxiety disorders, social phobias and depression account for 4.0% of temporary disability cases and because of their long duration (83.5 days on average) represent 8.2% of lost working days. Common colds, bronchitis and pharyngitis comprise 9.6% of cases and 2.9% of lost days (12.4 days average duration). Influenza was responsible for a total of 5.6% of temporary disability cases and 1.5% of lost days (average duration 10.9 days). Lumbago, spinal stenosis, cervical disc disorders and shoulder injuries account for 12.5% of total cases and 16.7% of the total sick days (with an average duration of 53.9 days per case). Delirium states, drowsiness and comas from unspecified causes make up 10.2% of cases and 7.3% of lost days (lasting 29 days, on average). Finally, within the group XVIII, the problems of acute and chronic respiratory failure, other general symptoms and signs and unknown or unspecified causes of morbidity total 8.6% of temporary disability cases and 6.5% of lost days (with an average duration of 30.6 days per case).

Total estimated losses

The total estimated cost amounts to 37,969 millions euros, of which more than 9,136 millions are losses from premature death, 18,577 millions euros are losses from permanent disability and 10,255 millions euros are losses from temporary disability.

The Gross Domestic Product (GDP) of Spain for 2005 amounted to 908,792 millions euros. This means that labour production losses due to accidents and health problems were estimated to a figure equivalent to 4.18% of the GDP of Spain in 2005. There are three main groups of diseases or accidents relating to estimated losses in the

Table 3 Distribution of estimated losses due to temporary disability by disease, Spain, 2005

	Total cases of TD (Thousand)	%	Total days lost to TD (Thousand)	%	Estimated losses (million euros)	%
001–102 I-XX. All causes	4,981	100.00	213,445	100.00	10,255.3	100.00
001–008 I. Infectious and parasitic diseases (1)	386	7.76	5,268	2.47	255.7	2.49
009–041 II.Tumours	37	0.75	4,604	2.16	248.6	2.42
042–043 III. Diseases of the blood and blood organs	6	0.12	775	0.36	36.2	0.35
044–045 IV. Endocrine, nutritional and metabolic disorders	18	0.35	1,444	0.68	67.8	0.66
046–049 V. Mental and behavioural disorders	308	6.19	29,510	13.83	1,400.2	13.65
050–052 VI-VIII. Diseases of the nervous system and sense organs	188	3.76	8,268	3.87	422.8	4.12
053–061 IX. Cardiovascular diseases	82	1.66	7,630	3.57	392.0	3.82
062–067 X. Respiratory disease	855	17.16	14,376	6.74	707.1	6.89
068–072 XI. Digestive disease	248	4.98	6,859	3.21	338.5	3.30
073 XII. Skin and tissue disease	56	1.12	2,029	0.95	96.4	0.94
074–076 XIII. Diseases of the musculoskeletal system and connective tissues	864	17.34	52,370	24.54	2,487.9	24.26
077–080 XIV. Genitourinary diseases	94	1.88	4,112	1.93	197.4	1.93
081 XV. Pregnancy, delivery and birth	90	1.81	5,324	2.49	252.7	2.46
082 XVI. Conditions during the perinatal period	10	0.19	414	0.19	17.9	0.17
083–085 XVII. Congenital defects, malformations and chromosomal abnormalities	5	0.11	597	0.28	29.6	0.29
086–089 XVIII. Symptoms, signs and abnormal clinical and laboratory findings NEC	1,089	21.86	35,557	16.66	1,722.4	16.80
090–102 XX. External causes	438	8.80	22,737	10.65	1,061.5	10.35
Cause of temporary disability unknown or difficult to interpret	208	4.17	11,569	5.42	520.6	5.08

Source Prepared by author based on data provided by the INSS

event of premature death: tumours, external causes of death, and to a significantly lesser extent, cardiovascular disease. These three groups caused 67.8% of the estimated losses from death. If we refer to cases of temporary disability, four groups resulted in 65.1% of the estimated losses: diseases of the musculoskeletal system and connective tissues, the group of symptoms, signs and abnormal clinical and laboratory findings, NEC, mental and behavioural disorders and external causes. Data on the distribution of medical causes of permanent disability were not available.

Discussion and conclusions

Additional studies involving estimates of the overall cost of disease and health problems have been performed in other countries [10, 11]. In spite of methodological differences between this study and the Canadian and US studies, all three cases exhibit common patterns with respect to losses due to premature mortality. Firstly, tumours and cardiovascular diseases are the main causes of premature death. In addition, the three groups of diseases having the greatest impact on job loss are malignant neoplasm, external causes and cardiovascular diseases. Lastly, the reason why external causes represent such a high percentage in the three studies is explained by the fact that deaths occur in people who are much younger than those in the two reference groups, which means that the flow of loss production due to death is much higher. The ranking of groups with the greatest impact on labour losses differs among countries (in comparable cases: premature mortality and temporary disability). However, this is not an odd finding, given the high incidence of deaths among youth in traffic accidents in Spain and the epidemiological differences among Canada, USA and Spain. When we compare the impact of labour losses to total production of the economy, the US and Canadian reports share a closer resemblance. Based on the information contained in the reports, job losses caused by diseases and accidents were estimated to a figure equivalent to nearly 4.8% of US GDP in 2006 and 4.4% of Canadian GDP in 1998.

In this study, the estimated losses resulting from premature death, permanent disability and temporary disability in 2005 were estimated at 37,969 millions euros. This figure indicates that the amount of loss of labour productivity due to accidents and health problems was estimated to a figure equivalent to nearly equivalent to 4.2% of Spanish GDP in 2005. This figure can be compared with the total health expenditure in 2005 Spanish (8.3% of GDP) or figures of the Spanish public health care expenditure that year (5.8%).

The comparison of the estimated loss with GDP and health care spending serves to highlight the amount of the potential losses. However, the author does not mean to suggest that the GDP of Spain would have been 4.2% greater if not for premature deaths and sick leave (temporary and permanent). Labour market dynamics are complex in terms of both quantity (number of jobs and work hours) as well as prices (wages), and it would be very difficult to estimate the actual effect that huge reductions in mortality and morbidity might have. From the perspective of a human capital model, the choice of wages as the means for gauging the losses in labour productivity due to mortality and morbidity seems justified. However, we should be very cautious in the way of interpreting the projection of micro-assumptions to a 'macro consequences'.

Also, it should be noted that transfers (e.g. disability benefits or pensions for early retirement due to illness) were not included in our analysis because of its social perspective. It should be recognize that from the public funding perspective, the impact of high costs on public coffers due to sick leave in Spain is of great importance. Notwithstanding, in this context, our methodological approach does not allow for treating transfer payments as a real cost.

Our study also contains a detailed analysis of the geographical distribution of estimated losses for each Autonomous Community (region) in Spain. The results show significant differences in the losses borne by each region, regardless of whether the comparison is made in terms of GDP or health expenditure. The reasons are both epidemiological and the result of labour-related differences (employment rates and wages) among autonomous regions in Spain. The results may be obtained by interested readers upon request to the author.

The theoretical approach used in the study is the human capital theory. This method was agreed upon by the researcher and the Spanish Institute for Fiscal Studies (Instituto de Estudios Fiscales) since it is the most commonly used method for performing cost of illness studies offered in the health economics literature [12–16] and is consistent with studies carried out or funded by the Institute for Fiscal Studies in areas other than health. However, there are alternative approaches, such as the *friction cost* method. Under this approach, a worker is forced to leave her/his job because illness does not cause a loss in productivity for society, as she/he will be replaced by another worker. The only loss occurs during the period the post remains vacant while a new employee is being sought [17, 18]. Following Koopmanschap and Rutten′s work [19], the friction cost (FC) approach indicates that the human capital (HC) approach overestimates the cost of short-term sick leave due to (a) the existence of diminishing marginal returns to labour; (b) the loss of production due to short-term sick leave can assumed by internal labour reserves; (c) an individual can make up for the loss of production when she/he returns to work; (d) non-urgent jobs can be cancelled. For long-term absences from work, the overestimation is even greater because it is assumed that individuals on sick leave can be replaced by someone who is currently unemployed (after a friction period). However, this approach, which is also used in the field of health economics, is not without its critics [20, 21]. Moreover, according to Liljas [21], the FC approach 'means that one of the fundamental axioms of the theory of the firm is violated, that is: firms only employ labour until the marginal value (produced by the worker) equals the marginal cost of labour. According to economic theory, therefore, the value of loss of production for an absent worker is equal to his or her gross income for that time period'. Also, 'the case of internal labour reserves is not convincing because of the very same reason. If the marginal cost for these workers exceeds their marginal value to the firm, they would, according to economic theory, not be employed'. If a individual is able to make up for the loss of production when she/he returns to work that would probably mean that the individual would either have to work 'faster' which would reduce her/his utility of being at work, or work overtime, which would reduce his or her leisure time. In addition, cancelled jobs, although non-urgent, will reduce the production of the firm. For long-term absences (permanent sick leave and premature mortality), the FC approach assumes that all long-term vacancies can be filled immediately (after a friction period) with previously unemployed individuals. If this was the case, 'it should be possible to solve the problems of unemployment in society by reducing the number of hours worked by employed workers and having unemployed workers work these hours instead' [20, 21]. Unfortunately, this does not seem to be the case. In any event, it should be noted that as has been observed in other studies [16, 22–27], the two approaches produce very different results, with lower values in the friction costs method.

The lack of available information on the diseases and accidents which led to the condition of permanent disability poses an important limitation for this study. It is remarkable that despite the importance such data hold with

respect to budgetary and social policy considerations, such information remains unavailable. Another option would have been to establish a distribution of the causes of permanent disability based on information provided by other studies. However, we must bear in mind that main study in Spain on this topic was carried out 15 years ago by the Instituto Nacional de la Salud-INSALUD [28] and subsequent studies, which examine very specific populations, are hardly representative of the national situation [29]. In the Spanish reference study [28], diseases of the musculoskeletal system and connective tissues were identified as the group responsible for the largest number of permanent disability cases, followed by cardiovascular diseases and external causes. A third group included diseases of the nervous system and sensory organs and mental and behavioural disorders. Tumours and diseases of the respiratory system made up the next group. However, given the time that has passed since the publication of that report and in spite of the expectation that the diseases that cause the greatest number of cases of permanent disability would remain the same, an attempt to achieve a quantitative result for diseases by extrapolating the distribution of 1994 results to the total permanent disability cases obtained for the year 2005 would be unreliable. Also, data on mortality and morbidity (temporary disability) in Spain are limited to the main cause of death or sick leave, and it is nor possible to study the influence of comorbidity situation on productivity losses. Another limitation of the study is the lack of information on the loss of productivity while at work. Presenteeism is a relevant source of productivity losses, especially in illnesses as low back pain, arthritis or mental disorders, among other diseases [26, 27, 30–32]. However, the nature of the sources of information, official records on sick leave, does not permit the estimation of loss of productivity associated with presenteeism.

This study draws attention to the high impact of non-medical costs of diseases. It likewise points out the potential social benefits of prevention and more effective treatment of diseases and health problems. However, it also points to the need for better information systems for collecting relevant data on other items not included in the analysis. For example, the distribution of the cost of permanent disability could not be estimated by disease group. This is an area in which greater effort must be made to generate relevant data with which policy makers can base informed decisions. By contrast, National Institute of Social Security provided us with data on a large sample (25,000) of temporary disability cases. This information contributed enormously to our study, and for the first time, we were able to estimate the distribution of labour productivity losses due to temporary disability in Spain by cause of illness or health problem.

Moreover, this analysis focuses on the loss of labour productivity due to premature mortality and of people who are on temporary disability or have been granted permanent disability. We did not attempt to assess other losses related to well-being, such as those suffered by individuals who provide care to people who are no longer self-sufficient because of a serious accident or severe health problem. The available options include placing the dependent person in a care facility, thereby generating a public or private expense, or providing home care by hiring a caretaker or having the person's family provide assistance (informal care). Thus, the figures on the cost associated with disability may be increased by adding the costs of a social health care system (or formal) for persons who are in situations of disability as a result of disease and the costs borne by the family network of informal support. These costs can be particularly high for disabling illnesses such as neurodegenerative diseases (dementia, Parkinson's disease, multiple sclerosis, stroke), musculoskeletal and cardiovascular diseases (ischaemic heart disease and chronic heart failure). There is abundant literature on informal care, although studies to date have focused on patient groups that have specific diseases and studies estimating the total cost that informal care poses to society at large have yet to be published. A recently published study estimates the economic value of informal care in Spain for the society at large in 2002 at nearly 2.4% of GDP [33].

Clearly, the allocation of health care resources should not be based solely on the impact of a particular disease, but rather on the potential health benefits of the intervention in addition to other considerations such as equity concerns, ethical implications, population preferences and the economic constraints of health care system and health policies

Although COI studies have limitations, many national and local governments continue to support their use. Public policy makers believe that information on the economic impact of diseases and health problems can prove to be a useful tool for planning health care programs [34]. In this light, information on the economic impact of illness and health problems and studies focusing on the return on investment of health interventions [1, 35–40] serve not to replace but rather to supplement the epidemiological information on health problems of populations [41]

Several Spanish health authorities have recently shown an interest in incorporating cost of illness studies of the disease as a basis for decision-making [42]. The Ministry of Health has included estimates of the cost of illness in the recent Strategic Health Plans for the handling, prevention and clinical management of diabetes mellitus, ischaemic heart disease, tumours and stroke. This interest suggests that once the limitations of such studies for the prioritization of programs have been taken into account and their

strengths at assessing the social impact of disease emphasized, they will, in fact, prove to be a useful tool for planning health policies.

Information on the cost of illness could be included as part of newly designed Health Plans, where the first step would be to provide sufficient epidemiological data for identifying key health problems by country or region. Secondly, calculation of the costs (construed in a broad sense) that diseases and health problems hold for the population would be considered a close reflection of the overall loss in well-being for the society at large. The third step would be to have information available on the technical and human resources that might be utilized in policies or measures affecting health problems. The next logical step would be to identify effective programs and measures that cut across diverse areas, that is, policies that improve the quality of life and extend life expectancy with the minimum burden to available resources. The next step would be to implement and assess the programs and measures.

It stands that a selection of measures affecting health in diverse areas (health care, employment, education, etc.) that has been scientifically proven to be effective and efficient at improving the situation of individuals who suffer from the health problems under study can be a very useful tool for creating health care policies based on resource allocation (evidence-based policy). While it is true that starting up or expanding these programs might increase health care costs, potential gains should also be taken into account (for example, in terms of loss of labour productivity that were avoided or in terms of life years saved or cases that did not result in a disability). Ultimately, choices must be made, and weighing economic factors may give rise to more rational choices to decision-makers and bring about a more transparent and efficient allocation of resources.

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