Papeles de Trabajo

PROJECTING HEALTHCARE EXPENDITURE IN SPAIN UNDER DIFFERENT SCENARIOS: METHODOLOGY AND RESULTS (*)

Authors: *Ángela Blanco Moreno*
Instituto de Estudios Fiscales

Rosa Urbanos Garrido
Universidad Complutense de Madrid

Israel John Thuissard Vasallo
Ministerio de Sanidad, Política Social e Igualdad

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ABSTRACT

Following the methodology used by the EU Ageing Working Group, in this paper we estimate the foreseen evolution of Spanish healthcare expenditure until 2060 under different scenarios, which assume changes in demographic and health status variables, as well as in income elasticity of the demand for health care services. The effect of proximity to death is also considered in the estimations.

Demographic variations account for expected changes in the volume and structure of Spanish population. Regarding the evolution of health status, two alternative hypothesis are assumed about health improvements: i) the so-called 'dynamic equilibrium hypothesis' assumes that healthy life expectancy grows at the same rate as total life expectancy; ii) the 'compression of morbidity hypothesis' assumes that healthy life expectancy grows at a higher rate than total life expectancy, hence implying that the number of years spent with diseases or disabilities decreases over time.

We also consider two classical scenarios about the evolution of the average healthcare expenditure: i) in the first scenario average healthcare expenditure per capita remains unchanged as a share of GDP per capita; ii) in the second one, it remains unchanged as a share of GDP per worker. We add a third scenario which takes into account the forecasted evolution of Spanish economy, by assuming that health expenditure has an income elasticity evolving from 1.1 in 2011 to 1 in 2060, being 1 for the period 2008 to 2011.

We suggest that the highest healthcare costs associated with those who die should be incorporated into the projection models. Therefore, we estimate the cost of survivors and decedents by age and sex from available data.

The results show that health expenditure will grow in real terms to reach, in 2060, between 6.4% and 8.8% of GDP, depending on the scenario used to calculate projections. It implies that public health expenditure will grow at an average annual rate ranging from 1.78% to 2.40%. The expected evolution of the volume and structure of Spanish population (all the remaining factors constant) will place the percentage of public expenditure on health over the GDP at 7.88% in 2060.

The growth of health expenditure is reduced, as expected, when the effect of proximity to death is included. This effect diminishes as health status improves. The impact of different health status evolution assumptions on the projected share of public healthcare expenditure over GDP is quite significant. The difference between the compression of morbidity scenario and the expansion of morbidity hypothesis ranges from 1.35 to 1.57 points of GDP in 2060, depending on the final scenario used. If elasticity is assumed to vary over time, the estimations obtained increase with respect to those linked to a constant elasticity. Differences range from 0.32 to 0.39 points of GDP, depending on the health status hypothesis considered.

Keywords: health expenditure, projections, cost of death.

JEL Class: H51, I18.

1. INTRODUCTION

Developed countries have successfully achieved important improvements in life expectancy. Simultaneously, birth rates have notably decreased during latest decades. As a consequence, most of modern societies have progressively changed their population structures, with significant increases in the volume and proportion of elderly people. The ageing phenomenon is a major challenge for public sectors linked to the sustainability of Welfare States, particularly in the European Union.

One of the research lines that is currently open in the European Union and also in the OECD, which has also been a cooperation field between both institutions, is the measurement of the impact of ageing on public finances. This has been the purpose of the different rounds of projections made by the Aging Working Group (AWG) of the European Commission, in cooperation with the OECD, regarding specific social policies since 2001.

The health expenditure projections made by the European Union are mainly focused on the impact of the expected demographic change. Thus, the initial work developed in 2001 estimated the sole effect of changes in the volume and structure of the population on health spending, although it pointed out the need to incorporate other factors[1].

In order to capture the pure ageing or pure demographic effect, the methodology employed by the AWG consists on computing, for a base year, the amount of per capita expenditure related to different age and sex groups of population. Then, the resulting expenditure profiles are applied to the foreseen demographic structure by assuming that patterns of use of healthcare services remain constant over time and unit costs[2] evolve in line with GDP per capita.

The computation of the expenditure profiles occasionally includes what has been called the “cost of death”. There is strong evidence that a large share of health spending consumed by a person is concentrated on his/her final years of life. Some evidence suggests that the demand for health services depends, ultimately, on health status and the proximity to death and not on age *per se*. Even more, there is no unanimity in the literature with regard to whether the age, once the effect of health status and the cost of death are controlled, is a determinant of healthcare expenditure[3,4].

Consequently, in order to estimate accurate expenditure projections, the "cost of death", i.e. the highest healthcare costs associated with those who die, should be incorporated into the projection model. It involves taking into account the number of decedents and survivors in each age and sex group and their respective average costs.

The AWG included the "cost of death" scenario in the projections carried out since 2001 for those countries where information was available. However, it was considered as a variant of the so called pure demographic scenario (baseline scenario); the difference being the way the unit cost of healthcare was calculated, that took into account the remaining years of life of individuals of each age and sex group[5]. We consider that the "cost of death" hypothesis should be incorporated to all the scenarios developed for projecting healthcare expenditure.

In this paper, we follow the AWG methodology to calculate projections of Spanish public healthcare expenditure until 2060 under different scenarios, which take into account the "cost of death" hypothesis. Spain has a National Health System (NHS) created in 1986 to provide those health benefits en-

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[1] Report by the EPC on budgetary challenges posed by ageing populations: the impact on public spending on pensions, health and long-term care for the elderly and possible indicators of the long-term sustainability of public finances. 2001. Available at: *http://ec.europa.eu/economy_finance/publications/publication7196_en.pdf.*

[2] For a given group of inhabitants, unit cost means the average per capita public expenditure on healthcare corresponding to that group.

[3] European Commission DG ECFIN (2006).The 2005 EPC projections of age-related expenditure (2004-2050) for the UE-25 Member States: underlying assumptions and projections methodologies. European Economy, Special Report No 4/2005. Brussels.

[4] DG Economic and Financial Affairs. Working Paper (2009). The 2009 Ageing Report: economic and budgetary projections for the EU-27 Member States (2008-2060); EUROPEAN ECONOMY 7|2008. The 2009 Ageing Report: Underlying Assumptions and Projection Methodologies; EUROPEAN ECONOMY 2|2009. 2009 Ageing Report: Economic and budgetary projections for the EU-27 Member States (2008-2060); EUROPEAN ECONOMY 2|2009. 2009 Ageing Report: Economic and budgetary projections for the EU-27 Member States (2008-2060) | Statistical Annex.

[5] Generally, unit costs are differentiated between decedents (those who die within a calendar year) and survivors.

visaged in the General Health Act, which were further developed by the NHS Cohesion and Quality Act in 2003. From 1963 (still under a Social Security model) to 1986, the growth of public health expenditure in nominal terms presented a cumulative annual rate of 23.9%. As a consequence, the initial percentage of public health expenditure over the GDP (0.9%) increased until 4.2%. From 1986 to 2008, the cumulative annual rate fell to 10.0%, still high enough to increase the share of public health expenditure on the GDP up to 6.5% in 2008[6].

For years, health expenditure rates of growth have been an issue of concern in Spain as in other developed countries. Spanish expert working groups in both State and Regional Institutions have analyzed this topic and made recommendations leading to control expenditure growth and to pace the evolution of this expenditure to that of GDP.

Within this framework, studies focused on estimating projections of health expenditure may be useful to valuate the depth of sustainability problems of health care systems. It is also useful to develop these analyses on the basis of a harmonized methodology that allows for comparison within the European Union. For this reason the Spanish results are derived from the methodological framework applied by the AWG and the OECD.

This paper is organized as follows. Following this introduction, section 2 is devoted to estimate healthcare expenditure profiles by age and sex groups for the Spanish population. It also includes the estimation of the "cost of death" profiles. This information is the basis of our projections and is accompanied by a review of data sources and methodology. Section 3 describes the projection method and section 4 shows the main results. Finally, section 5 concludes with main implications for policy making deriving from the analysis. Secondary tables are shown in the appendix, as well as the equations used to project expenditure in the alternative scenarios.

2. HEALTHCARE EXPENDITURE PROFILES: METHODOLOGY AND RESULTS

2.1. Basic profiles: data sources and methodology

Expenditure data for the base year (2008) are taken from Eurostat and the Spanish Statistics of Public Expenditure on Health (EGSP). According to Eurostat data relying on the OECD System of Health Accounts (SHA), Spanish public expenditure on health covering services of curative, rehabilitative and long-term care accounted in 2008 for 70,799,300 Euros[7]. Our projections only focus on curative and rehabilitative healthcare (long-term care is therefore excluded). Thus, in 2008 Spanish healthcare expenditure accounted for 65,099,350 Euros. Table 1 shows data used in the analysis.

Table 1
SPANISH PUBLIC EXPENDITURE ON HEALTH
(SERVICES OF CURATIVE AND REHABILITATIVE CARE)-THOUSAND EUROS 2008

Source	Selected health care function	Thousand Euros
	1. INPATIENT CURATIVE AND REHABILITATIVE SERVICES	
SHA	Inpatient curative and rehabilitative care	19,991,240
	2. OUTPATIENT CURATIVE AND REHABILITATIVE SERVICES	
EGSP	Primary Health Care	10,443,678
SHA&EGSP	Specialized outpatient services	11,946,702
	3. PHARMACEUTICALS AND OTHER MEDICAL NON-DURABLES	
SHA	Pharmaceuticals and other medical non-durables	14,621,650
	4. PATIENT TRANSPORT AND EMERGENCY RESCUE	
SHA	Patient transport and emergency rescue	1,085,280

(*Keep.*)

[6] Including LTC since 2003, that accounts for 0.5% of GDP, approximately.

[7] Resources devoted to *Education and training of health personnel* and *Research and development in health* are not included in this figure. However, we include both components into the final figure of public expenditure on health.

(*Continuation.*)

Source	Selected health care function	Thousand Euros
	5. THERAPEUTIC APPLIANCES AND OTHER MEDICAL DURABLES	
SHA	Therapeutic appliances and other medical durables	200,390
	6. REST OF PUBLIC EXPENDITURE	
SHA	Rest of public expenditure on health (services of curative and rehabilitative care)	6,810,410
	7. TOTAL	
SHA	Total	65,099,350

Sources: EGSP and own calculations on the basis of Eurostat Database. *http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=hlth_sha3m&lang=en*.

Note: Inpatient curative and rehabilitative care, as estimated on the basis of the Discharge Records in the National Health System (CMBD) with DRGs costs, accounts for 16,064 million Euros. We have distributed the 19,991 million Euros, estimated by the Spanish SHA for this concept, according to the age-sex structure of the CMBD database.

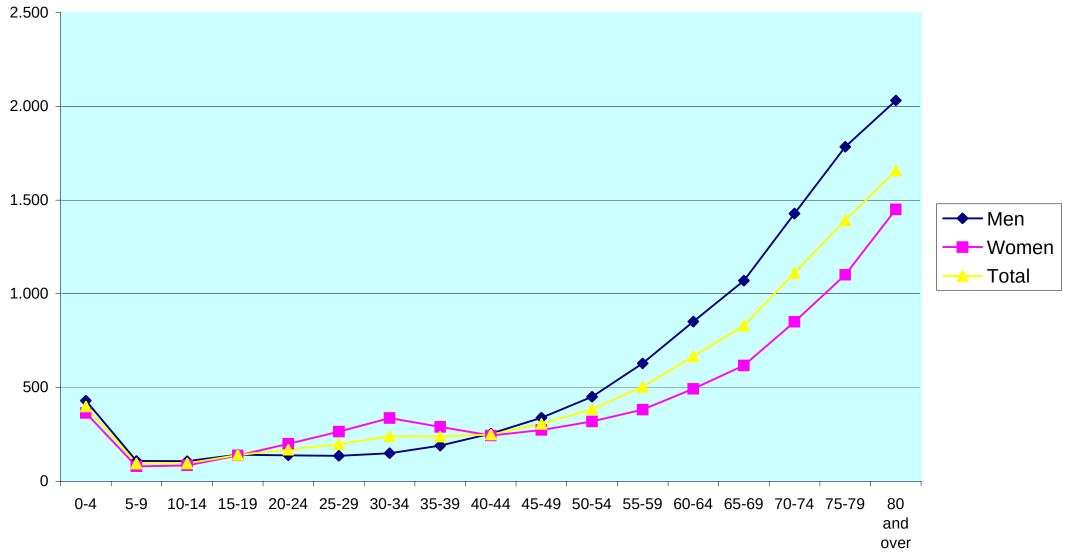
Spanish population has been divided into five-year-groups (from 0-4 years to 80 years or more) for men and women, according to data from the demographic scenario used by the AWG[8]. We distribute health expenditure across population groups from two basic data sources: the Hospital Discharge Records in the National Health System (CMBD) –that includes DRGs cost–, which is used to distribute in-patient healthcare expenditure, and the Spanish National Health Survey (SNHS). We will employ the SNHS 2006, which is the latest available, at the moment of calculating these data. The expenditure distribution for each operational category is described as follows.

1) *Inpatient services*

The expenditure included in this category refers to health care received by patients who are admitted to the hospital in the base year (and who stay at least one night). As it has been mentioned, data used to calculate inpatient expenditure profiles are taken from CMBD 2008. This database collects information about every hospital discharge taking place in publicly owned hospitals. In particular, it includes information about demographic characteristics of individuals (age, sex) and about clinical aspects of admission. Individuals registered in CMBD are classified into diagnosis related groups (DRG's), and hospital costs are assigned to each DRG. On the basis of these data, we have distributed total inpatient expenditure (19,991 million Euros in 2008) across population according to the proportion that cost of each age-sex group represents over CMBD total cost.

Graph 1

PUBLIC EXPENDITURE ON INPATIENT SERVICES. EUROS PER CAPITA (2008)



[8] Spanish population projections by the Spanish Statistical Office go from 2009 to 2049, while the AWG demographic projections reach 2060.

Graph 1 shows the expenditure profiles for inpatient services referred to men, women and total population. As we can see, profiles for men and women are very similar for youngest groups of population. Compared to men, per capita expenditure is higher for women aged 20-39 as a consequence of pregnancy processes. However, men aged over 40 use hospital care more intensively than women in the same age groups. This is consistent with evidence showing that probability of being admitted in hospital is lower for women compared to men, even when need is similar[9]. Data are shown in the appendix (Table 1).

2) *Specialized outpatient services*

Public expenditure on specialized outpatient services has been distributed across population groups according to the data provided by the Spanish National Health Survey (SNHS) 2006. Firstly, we have estimated the number of visits to a specialist for each age (i) and sex (g) group for the whole year 2008 by following expression (1):

$$VEP_{ig} = \left(P_{ig} \times mnve_{ig} \times \%PUVE_{ig}\right) \times c \qquad (1)$$

where:

VEP_{ig} = expected number of public visits to the specialist for each age (i) and sex (g)[10] group.

P_{ig} = population in each ig group.

$mnve_{ig}$ = mean number of visits made by users in each ig group during the preceding four weeks.

$\%PUVE_{ig}$ = percentage of population in each ig group which makes use of public specialized health services during the preceding four weeks.

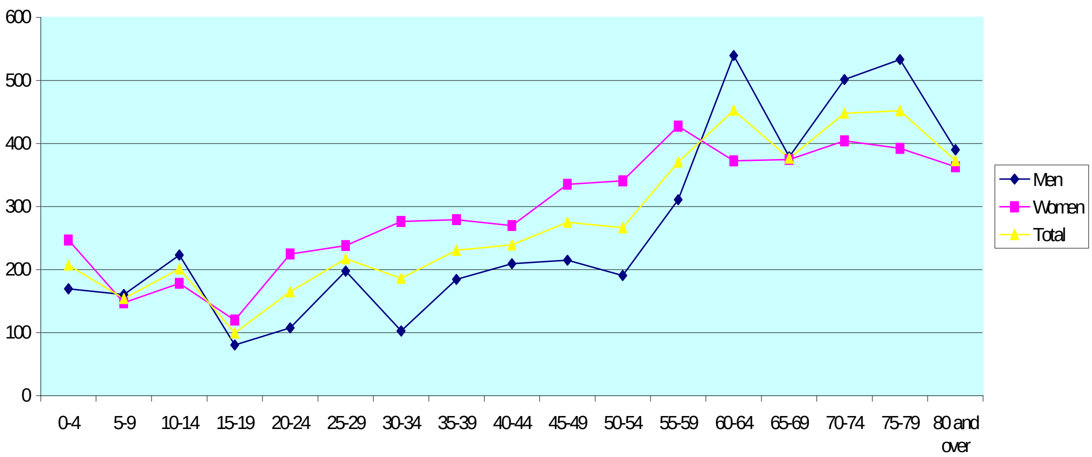
c = 13, being the multiplier to estimate the number of visits for the whole year.

The visits included are those taking place in specialized centers, including emergency visits to the hospital. The SNHS only provides information about the public or private nature of the last registered visit. Therefore, we assume that if the last visit is classified as a public one, the rest of visits made by an individual are also public. Once the number of visits for each age and sex group has been estimated, expenditure on specialized outpatient services (11,947 million Euros in 2008) has been distributed across population according to the proportion that visits of each age-sex group represents over total number of visits.

Graph 2 shows expenditure profiles for specialized outpatient services. In this case, women aged between 15 and 59 years use this kind of services more than men, but this situation reverts from 60 years on, except for groups aged 65-69 and people aged 80 and over. Data are shown in the appendix (Table 2).

Graph 2

PUBLIC EXPENDITURE ON SPECIALIZED OUTPATIENT SERVICES. EUROS PER CAPITA (2008)



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[9] Redondo-Sendino *et al.* (2006); Ruiz-Cantero *et al.* (2004).

[10] We use the letter g to indicate the sex group instead of s in order to avoid confusion with the letter s for survivors when we introduce the survival status l (l= s (survivors) or l=d (decedents)) in the equation.

3) *Primary healthcare*

The procedure followed to distribute primary healthcare expenditure (10,444 million Euros in 2008) is similar to that used for specialized outpatient services. The estimated number of visits to the general practitioner for each ig group and for the whole year 2008 is expressed by (2):

$$GPV_{ig} = \left(P_{ig} \times mngpv_{ig} \times \%PUGP_{ig}\right) \times c \qquad (2)$$

where:

GPV_{ig} = expected number of public visits to the GP for each age (i) and sex (g) group.

P_{ig} = population in each ig group.

$mngpv_{ig}$ = mean number of visits to the GP made by users in each ig group during the preceding four weeks.

$\%PUGP_{ig}$ = percentage of population in each ig group which makes use of public primary healthcare during the preceding four weeks.

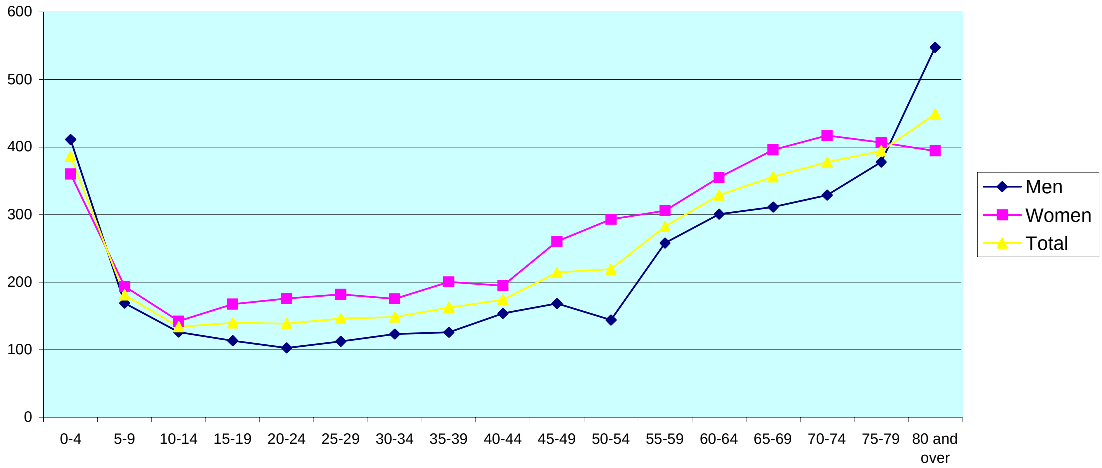
$c = 13$, being the multiplier to estimate the number of visits for the whole year.

Visits to the GP are well identified in the SNHS, but again we only have accurate information about the public or private nature of consumption for the last visit registered. Therefore, again we assume that if the last visit to the GP took place in a NHS center, the rest of visits whose nature remains unknown may also be considered as publicly financed.

Graph 3 shows distribution of public expenditure on primary healthcare across population groups. It can be observed that, in this case, per capita expenditure is higher for women than for men except for the youngest and eldest group, which confirms that women are more prone than men to visit a GP. Data are shown in the appendix (Table 3).

Graph 3

PUBLIC EXPENDITURE ON PRIMARY HEALTHCARE. EUROS PER CAPITA (2008)



4) *Pharmaceutical expenditure*

This category of expenditure only refers to prescription drugs. In order to calculate the percentage of total expenditure generated by each population group, we have firstly estimated the number of prescriptions written by NHS physicians for each group, by using expression (3).

$$PP_{ig} = \left(P_{ig} \times mnp_{ig} \times \%PUp_{ig}\right) \times c \qquad (3)$$

where:

PP_{ig} = expected number of prescriptions written by NHS physicians and consumed by each age (i) and sex (g) group.

P_{ig} =population in each ig group.

mnp_{ig} =mean number of drugs consumed by user population in each ig group, which have been prescribed by NHS physicians in the preceding two weeks.

$\%PUp_{ig}$ = percentage of population in each ig group which declares having consumed drugs prescribed by NHS physicians in the preceding two weeks.

c =26, being the multiplier to estimate the number of visits for the whole year.

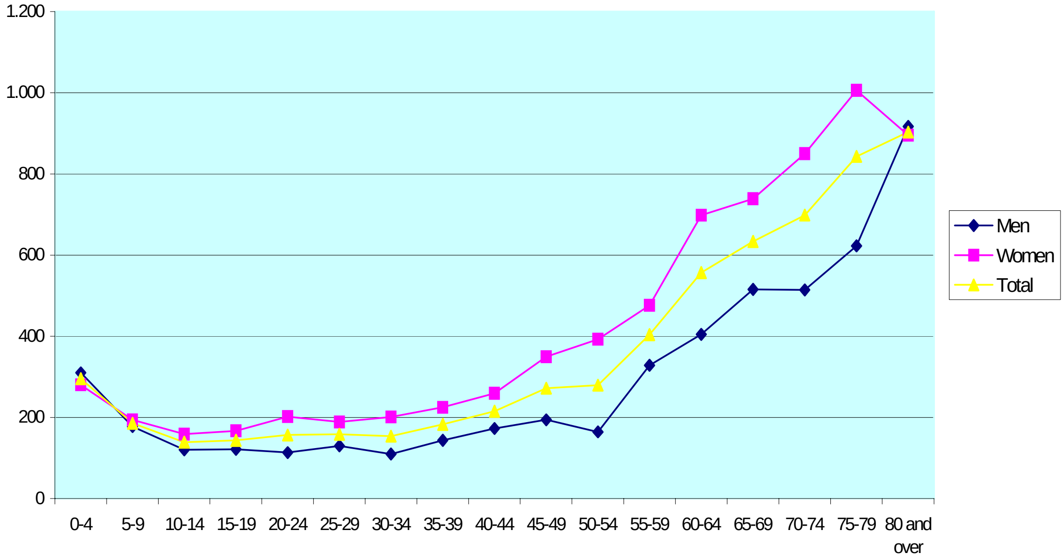
We use data from the SNHS in order to estimate the mean number of prescriptions. Individuals interviewed declared whether they consumed prescribed drugs, which refer to twenty different groups of pharmaceutical products. The number of prescriptions is computed for all those individuals who declare having consumed prescribed drugs and simultaneously having visited a physician in the NHS. We also calculate the number of prescriptions for those people who declare a positive consumption of prescribed drugs but refer no medical consultations in the preceding four weeks only when they are exclusively covered by a public insurance scheme.

Once we have estimated the number of prescriptions for each age and sex group, cost differences have been calculated across population groups. It is important to highlight that, for Spanish pensioners, pharmaceutical copayment (0%) differs from that borne by the rest of Spaniards (40%)[11]. According to the Indicators of Pharmaceutical Benefit for the National Health System, in 2008 the cost per prescription was 1.46 higher for pensioners compared to active people. Therefore, the number of prescriptions consumed by pensioners is weighted by using that index. The distribution active/pensioners in each ig group is taken from official data provided by the National Institute of Social Security.

Graph 4 shows the final estimated distribution of public expenditure on prescription drugs. As it can be seen, per capita expenditure is higher for females than for males in all the age groups, with the exception of the youngest and the eldest group. Data are shown in the appendix (Table 4).

Graph 4

PUBLIC EXPENDITURE ON PRESCRIPTION DRUGS. EUROS PER CAPITA (2008)



5) *Patient transport and emergency rescue*

This category of expenditure is basically intended to finance the ambulance transport of patients to and from the hospital. For this reason it has been distributed across population groups according to the estimated percentages for inpatient services.

[11] This is the general case, although people covered by public mutualities have a different scheme of copayments.

6) *Therapeutic appliances and other medical durables*

This component of expenditure has been distributed across population groups according to the percentages for specialized outpatient services, since it is mainly linked to this kind of attention.

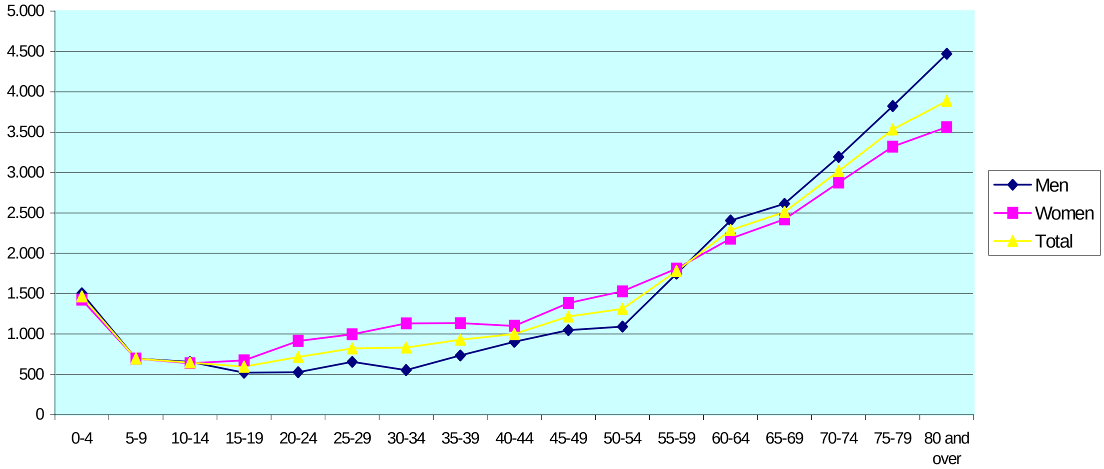
7) *Other concepts*

Here we include public health, collective health services, capital expenditures, education and training of health personnel and research and development in health. The corresponding amount is distributed according to the estimated percentages for the six categories of expenditure above mentioned.

Finally, the distribution of Spanish public expenditure on health across population groups is shown in Graph 5. Per capita expenditure is higher for males compared to females from the 60-64 age group, which reflects the high cost of hospital and specialized outpatient services, more intensively used by men.

Graph 5

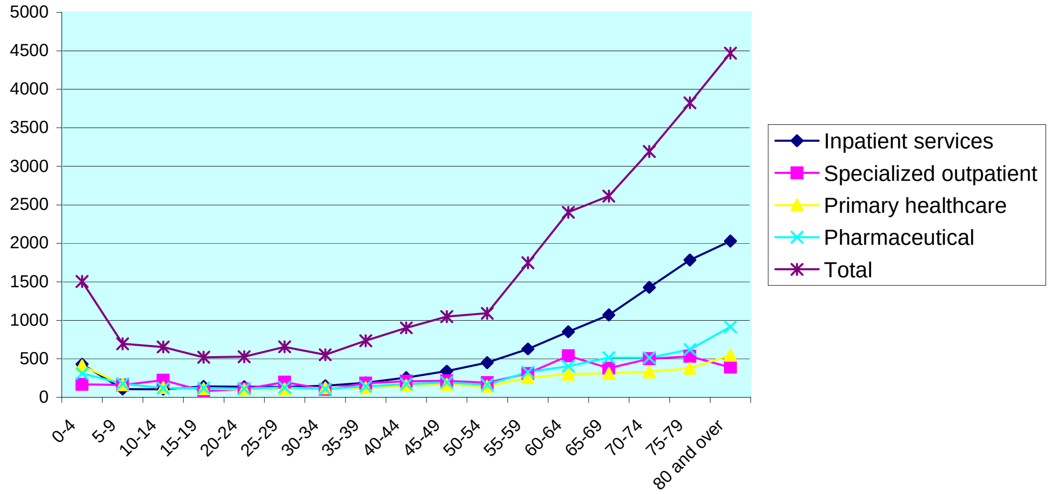
PUBLIC EXPENDITURE ON HEALTH. EUROS PER CAPITA (2008)



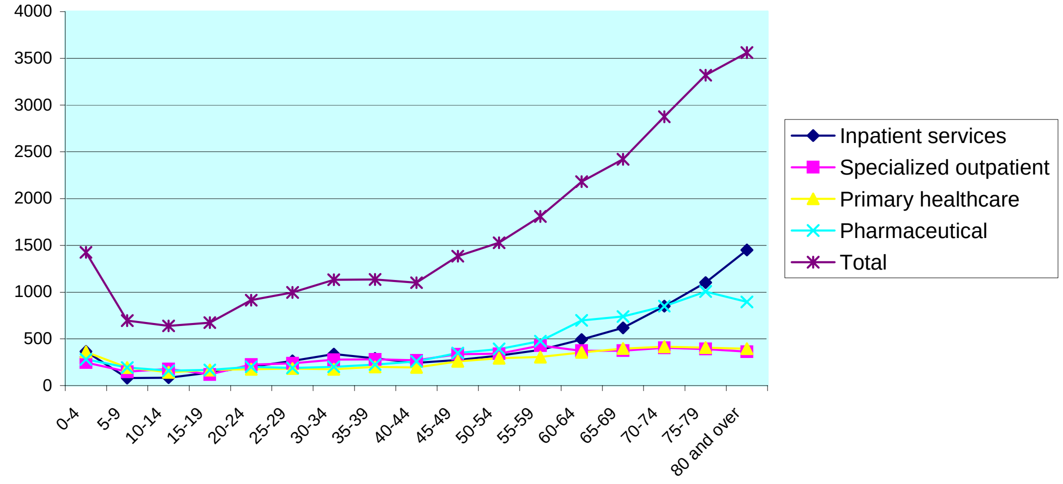
Graphs 6-8 show the summary of the expenditure distribution by age groups for all the expenditure categories, again distinguishing between men, women and total population. The profiles show that per capita cost is relatively high in the first years of life, but tends to descend sharply from age 4. From that age group the cost is stabilized to mid-thirties for men, and for mid-twenties for women. A particularly pronounced increasing trend is observed for women from the age group between 35 and 39 years. This sharp rise is also seen in men, but it starts a decade later. In addition, the different trends followed by profiles referred to inpatient services and specialized outpatient attention could suggest that both services could be considered as substitute for people aged over 64. Data are shown in the appendix (Table 5).

Graph 6

EXPENDITURE PROFILES (MEN). EUROS PER CAPITA (2008)



Graph 7
EXPENDITURE PROFILES (WOMEN). EUROS PER CAPITA (2008)



Graph 8
EXPENDITURE PROFILES (TOTAL POPULATION). EUROS PER CAPITA

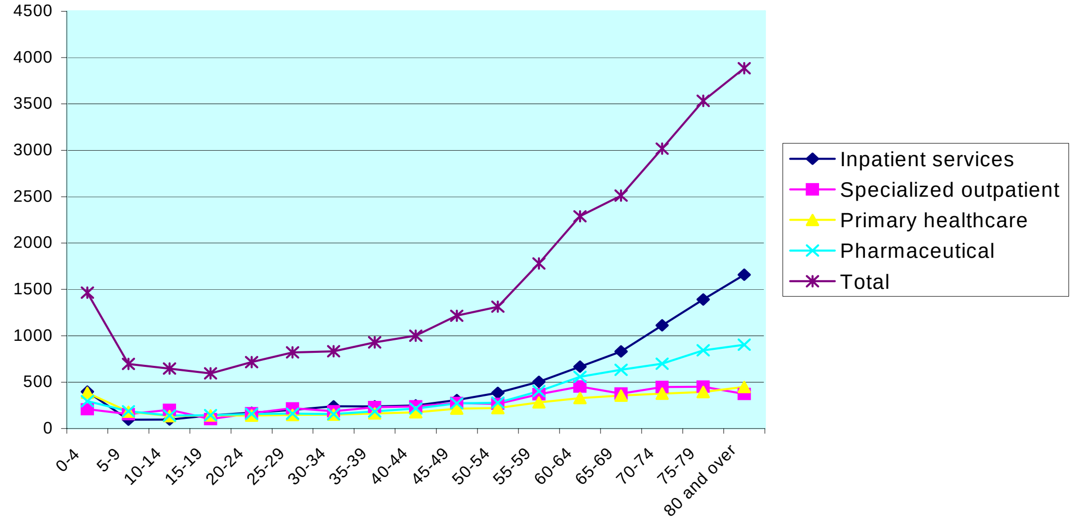


Table 2 shows the per capita cost ratio for people aged 65 or over and the rest of population by expenditure categories. As it can be seen, each person over 64 absorbs 3.01 times more health expenditure than people under 65, which is consistent with previous evidence[12]. The cost distribution shows that healthcare expenditure is particularly concentrated on the elderly for inpatient services and prescription drugs. Additionally, public expenditure is distributed more evenly throughout life for women compared to men.

Table 2
PER CAPITA COST RATIO AGED 65+/AGED 64-

	Men	Women	Total
Hospital			
0-64	285	275	280
65 and over	1547	1038	1254
Coefficient	5.44	3.78	4.48

(*Keep.*)

[12] IEF (2005). Informe para el Análisis del Gasto Sanitario. Available at: *http://www.ief.es/documentos/recursos/publicaciones/libros/Libros_blancos/GastoSanitario.pdf.*

(*Continuation.*)

	Men	Women	Total
Especialized services			
0-64	199	272	235
65 and over	448	382	410
Coefficient	2.25	1.41	1.75
Primary healthcare			
0-64	169	228	198
65 and over	386	403	396
Coefficient	2.29	1.77	2.00
Prescriptions			
0-64	182	287	234
65 and over	632	873	771
Coefficient	3.47	3.04	3.30
Total expenditure			
0-64	952	1207	1078
65 and over	3467	3081	3245
Coefficient	3.64	2.55	3.01

Source: own elaboration.

2.2. Incorporating the cost of death

In order to incorporate the cost of death to the projections of public expenditure on healthcare, age and sex unit cost profiles must be calculated distinguishing by decedents and survivors (see equations for the projections in the main text and in the appendix). Therefore, information is needed about the survival status of each individual, together with his/her pattern of use of health services and the related cost. However, in Spain that kind of information is only available for inpatient care, but not for the rest of provided healthcare. According to the AWG demographic scenario, Spanish population in 2008 was 45,283,259 people –321,458 decedents and 44,961,801 survivors–. Decedents can be divided as follows: 152,946 who died in a public hospital and 168,512 at home[13]. Within the people who died at home, we estimate that 12,406 were discharged from palliative care at hospital and derived to palliative care provided at home[14]. We also estimate that within the people who died at home 26,859 received inpatient care (other than palliative care) during the year. The rest of people dying at home only received outpatient care during the base year.

So that:

$$D = DINP + DOUT$$

$$DINP = DINP1 + DINP2 + DINP3$$

where:

D = total decedents (321,458 people).

DINP = decedents that have been inpatients during the year (192,211).

DINP1 = decedents that have been inpatients during the year and have died in hospital (152,946 people).

DINP2 = decedents that have been inpatients during the year and have been sent home under palliative care (12,406 people).

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[13] We consider a decedent in a private hospital to have the same cost for the public health system as a decedent at home.

[14] According to SECPAL (2001), a 0.3% of population requires palliative care, which in 2008 would be 135,850 people. The public system covers a 32%, and 86.14% represents people receiving care provided at hospitals. From them, a 33.13% (12,046 inpatients in 2008) are discharged from hospital and derived to palliative care at home. We assume that they are people aged 44 or over, according to the Spanish available literature on palliative care: see GISBERT *et al.* (2005), NABAL *et al.* (2001), MOLINA *et al.* (2005), CENTENO *et al.* (1999), RIPOLL (2002, 2004, 2005), Ceiis (2004). In this document, the term “inpatients’ is used as inpatients for curative and rehabilitative care, given that in Spanish SHA, rehabilitative care cannot be disentangled from curative care.

DINP3 = decedents that have been inpatients during the year, have been sent home as survival discharges and died at home with no intensive use of health resources (26,859 people).

DOUT=decedents that have only been outpatients during the year (129,247 people)[15].

According to data from CMBD, the cost of inpatient care corresponding to decedents who died at hospital accounted for 1,451 million Euros. According to our calculations, the cost of inpatient care corresponding to decedents that have been inpatients during the year and have been sent home under palliative care accounted for 114 million Euros (we assume that the unit cost of each patient in this category is, on average, identical to that of people dying at hospital). For those people who died at home with no intensive use of health resources, we assume that unit cost equals to that of survival inpatients. The estimated expenditure for this group accounts for 220 million Euros in 2008[16]. Finally, we assume that the unit cost of those dying at home who do not receive inpatient care equals to per ca-pita expenditure on outpatient specialized services, primary healthcare, prescription drugs and the rest of expenditure categories (except inpatient care). As a result, this final group would receive 244 million Euros.

Therefore:

Decedent group	Unit cost for inpatient care
DINP1 = decedents that have been inpatients during the year and have died in hospital (152,946 people).	Inpatient care: according to data from CMBD.
DINP2 = decedents that have been inpatients during the year and have been sent home under palliative care (12,406 people).	Inpatient care: assuming a unit cost by age and sex identical to that of people dying at hospital.
DINP3 = decedents that have been inpatients during the year, have been sent home as survival discharges and died at home with no intensive use of health resources (26,859 people).	Inpatient care: assuming a unit cost equal to that for inpatient survivors.

Note: please notice that cost for outpatient services is the same for each decedent.

Decedent group	Unit cost for outpatient care
DOUT = decedents that have only been outpatients during the year (129,247 people).	Outpatient care: unit cost equals to per capita expenditure on outpatient specialized services, primary healthcare, prescription drugs and the rest of expenditure categories (except inpatient care).

Moreover:

S=SINP+SOUT.

S=total survivors (44,961,801 people).

SINP=survivors that have been inpatients during the year (2,817,345 people).

SOUT=survivors that have only been outpatients during the year (42,144,455 people).

Survivor group	Unit cost for inpatient care
SINP = survivors that have been inpatients during the year (2,817,345 people).	Inpatient care: according to data from CMBD.

Decedent group	Unit cost for outpatient care
SOUT = survivors that have only been outpatients during the year (42,144,455 people).	Outpatient care: unit cost equals to per capita expenditure on outpatient specialized services, primary healthcare, prescription drugs and the rest of expenditure categories (except inpatient care).

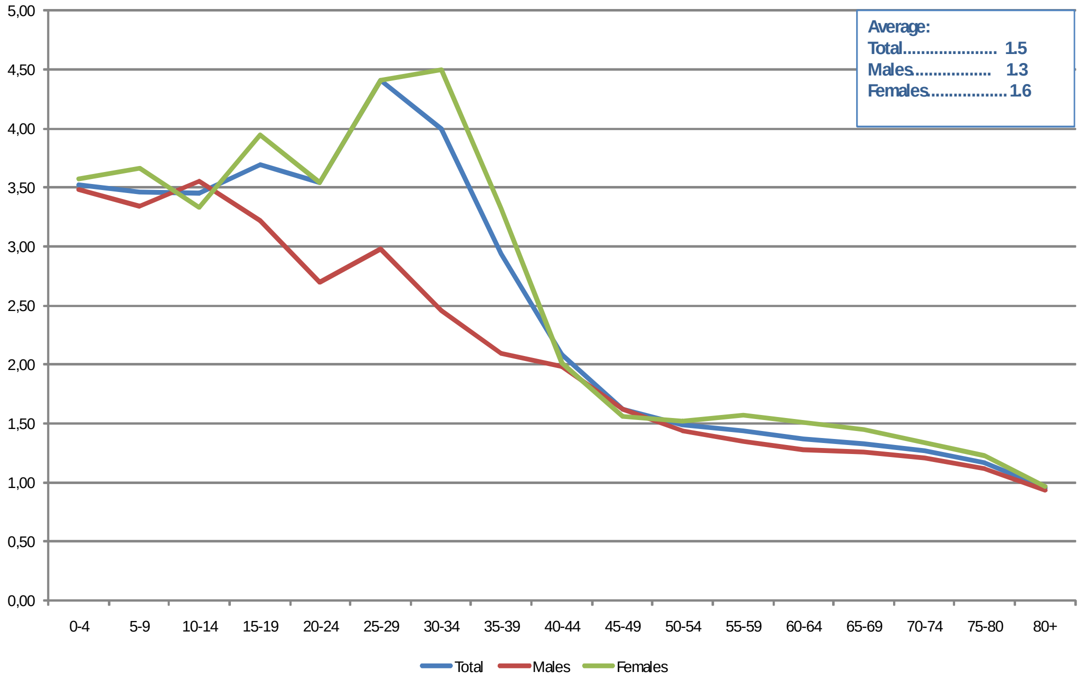
[15] We assume that cost for outpatient services is the same for all the inhabitants.

[16] We subtract from the cost corresponding to inpatient survivors the amount devoted to palliative care.

Our data reveal that decedents in 2008 (0.7% of total population) show a higher rate of use of inpatient care than survivors: 60% of decedents were admitted to hospital, while this percentage was 6% for survivors. Additionally, Graph 9 shows that the cost of inpatient care delivered to decedents was, on average, 1.5 higher than that provided to survivors: 1.3 for males and 1.6 for females.

Graph 9

UNIT COST RATIO DECEDENT/SURVIVOR FOR HOSPITAL DISCHARGE BY AGE AND SEX (2008)
(curative and rehabilitative care)



Source: own elaboration on the basis of Institute of Health Information (MoHSP). Administrative Records of the National Information System on Hospital Discharges (CMBD) and Diagnosis-Related Group (DRG) (2008).

Tables 6-8 in the appendix show the distribution of total population across age and sex groups, according to their survival situation and their healthcare utilization during the base year. Tables 10-12 show the distribution of healthcare expenditure across age, sex and survival status' groups. On average, in 2008 decedents had a unit cost 5.4 times higher than survivors. We show this ratio in Table 4 (see also Graph 10). These estimates are led by the ratio associated to hospital discharges, and for this reason they may be overestimated. Furthermore, we are not capturing the differences in the cost of death of those decedents with severe conditions who were not hospitalized. The cost ratio varies depending on age and sex. It shows similar values and a rising trend for males and females until the group of 5 to 9 years old. It reaches the maximum in the group of population aged 5 to 9 for males, and aged 10 to 14 for females. At this point, it shows a decreasing trend, the minimum being for the group of population aged 80 or more: 1.6 for males and 2.1 for females.

Table 3

UNIT COST RATIO DECEDENT/SURVIVOR FOR TOTAL EXPENDITURE BY AGE AND SEX (2008)

	Total population	Males	Females
Total	5.4	5.8	5.1
0-4	8.7	8.3	9.3
5-9	14.4	14.7	14.0
10-14	14.1	13.4	15.1
15-19	12.1	12.8	12.8

(*Keep.*)

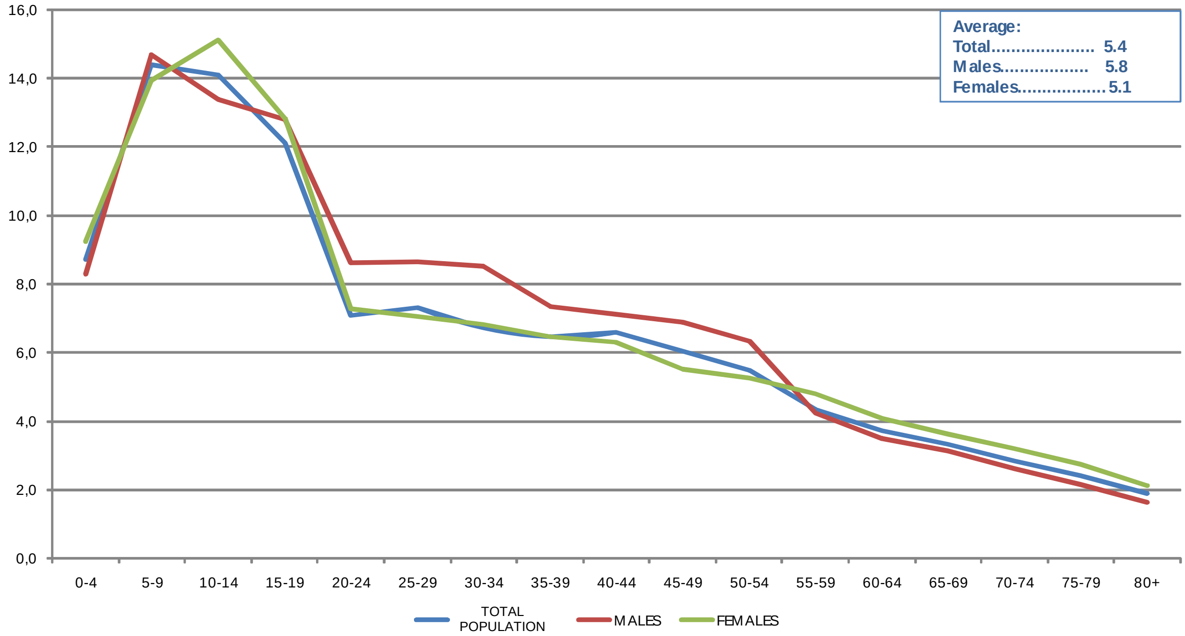
(*Continuation.*)

	Total population	Males	Females
20-24	7.1	8.6	7.3
25-29	7.3	8.6	7.1
30-34	6.7	8.5	6.8
35-39	6.5	7.4	6.5
40-44	6.6	7.1	6.3
45-49	6.0	6.9	5.5
50-54	5.5	6.3	5.3
55-59	4.4	4.3	4.8
60-64	3.7	3.5	4.1
65-69	3.3	3.2	3.6
70-74	2.8	2.6	3.2
75-79	2.4	2.2	2.8
80+	1.9	1.6	2.1

Source: own elaboration on the basis of Tables 13-15.

Graph 10

UNIT COST RATIO DECEDENT/SURVIVOR FOR TOTAL POPULATION BY AGE AND SEX (2008) (healthcare services)



Source: own elaboration on the basis of Tables 13-15 in the appendix.

3. PROJECTING HEALTH EXPENDITURE: METHOD AND DESCRIPTION OF SCENARIOS

The estimation of public expenditure on health for a given year is based on the following expression[17]:

[17] As we are focusing on public expenditure on health, we are not capturing the interaction between public and private health-care demand. In Spain, private health insurance is allowed to cover the same contingencies as the public system. This double coverage may generate savings in public expenditure that have been estimated to be a 0.24% of public expenditure in health [BADENES, N. y LÓPEZ, A. (2007)]. Microsimulation models have to be considered to incorporate this kind of behavior.

For a given year t (t=2008... 2060):

$$HE_t = \sum_i \sum_g \sum_l c_{iglt} \cdot P_{iglt} = \sum_i \sum_g \sum_l \tilde{c}_{iglt} \cdot \Delta q_t \cdot \Delta p_t \cdot P_{iglt} \qquad (4)$$

where:

HE_t = total health expenditure.

c_{iglt} = unit cost (per capita health expenditure) at current prices for each age(i), sex (g) and survival status(l) group.

P_{iglt} = population in each igl group.

$\tilde{c}_{iglt}$ = unit cost at 2008 prices for each age (i), sex (g) and survival status (l) group, after the marginal effect of changes in health status.

q_t = use of health care services by each group volume.

p_t = implicit price of public healthcare services.

$\Delta q_t = \frac{q_t}{q_{2008}}$.

$\Delta p_t = \frac{p_t}{p_{2008}}$.

From equation (4) several drivers of health care expenditure are identified[18]:

1. *Demographic effect*: due to changes in the volume and age-sex distribution of population.
2. *Cost of death effect*: related to the cost ratio decedents/survivors for healthcare.
3. *Health status effect*: expenditure profiles are considered as a proxy of morbidity distribution. Therefore, expected changes in morbidity will have impact on health care expenditure.
4. *Global volume effect*: it includes the variation in quantity and quality of care, caused by changes in technology or in medical practice related to the design and operation of the healthcare delivery system. This effect is assumed to be the same across population groups.
5. *Price effect*: due to variations in prices of public healthcare.

Estimations of population (volume and age-sex structure) for the period 2009 to 2060 are taken from the demographic scenario of the AWG for Spain[19], updated in 2010[20]. According to these estimations, the Spanish population will grow from 45,283,259 in 2008[21] to 47,507,846 in 2060 (see Graphs 11 and 12), which represents an average annual growth rate of 0.09%. The foreseen changes in the Spanish population pyramid can be seen in Graphs 13 and 14. In 2008, Spain registered a percentage of population aged 65 and more of 16.7%, and it will be 32.4% in 2060. Focusing on population aged 80 and more, the corresponding percentages are 4.5% and 15.4%.

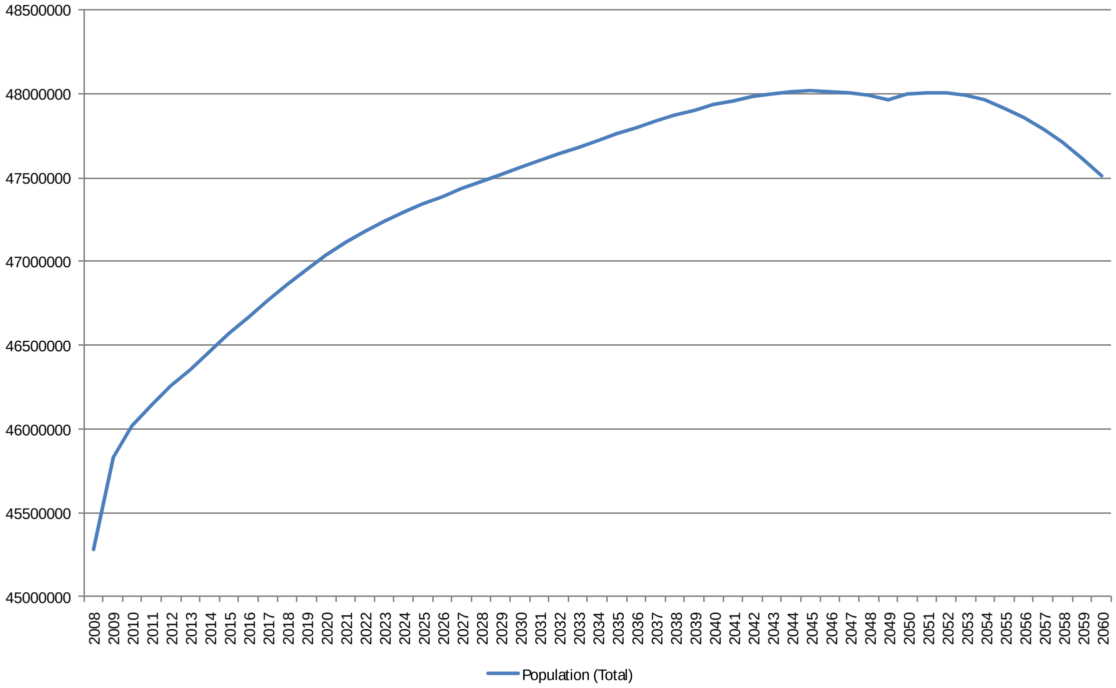
[18] With this equation we cannot entirely disentagle the price effect from the volume effect. This is the case when a cost-saving technology legitimately expands treatment indications and/or eligibility, increasing consequently total costs.

[19] We describe the demographic and macroeconomic scenarios in the appendix.

[20] *http://www.ine.es/jaxi/menu.do?type=pcaxis&path=%2Ft20%2Fp251&file=inebase&L=* (download 03/01/2011). These estimations are consistent with the projections made by the Spanish Statistical Office for the period 2009-2049.

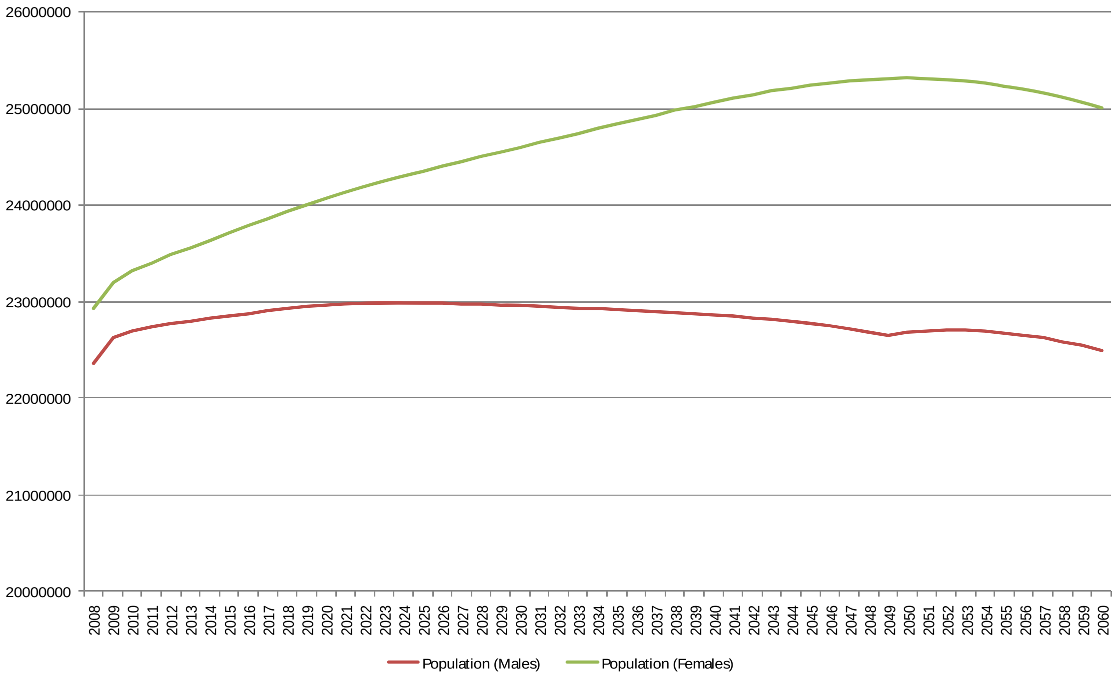
[21] This figure correspond to that of the Now-Cast estimations and not to the official figure of the Padrón Municipal de Habitantes in Spain.

Graph 11
SPANISH POPULATION (total)



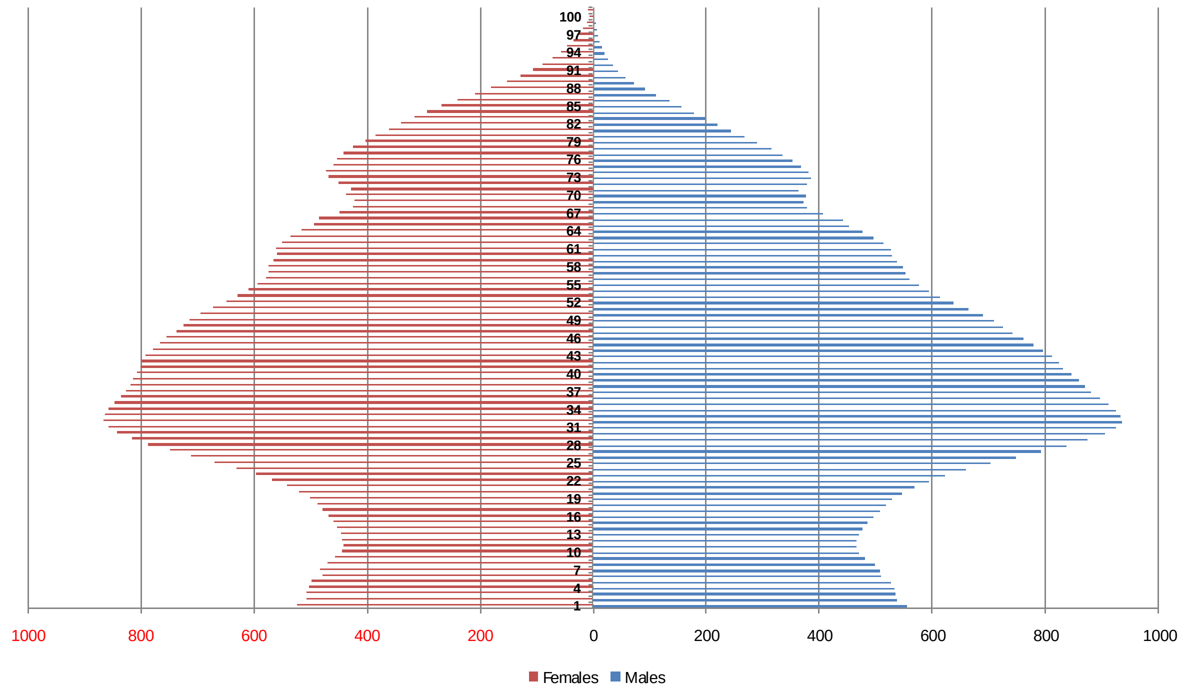
Source: demographic scenario of the AWG for Spain (Baseline scenario, Year: 2008, updated in 2010).

Graph 12
SPANISH POPULATION (males and females)



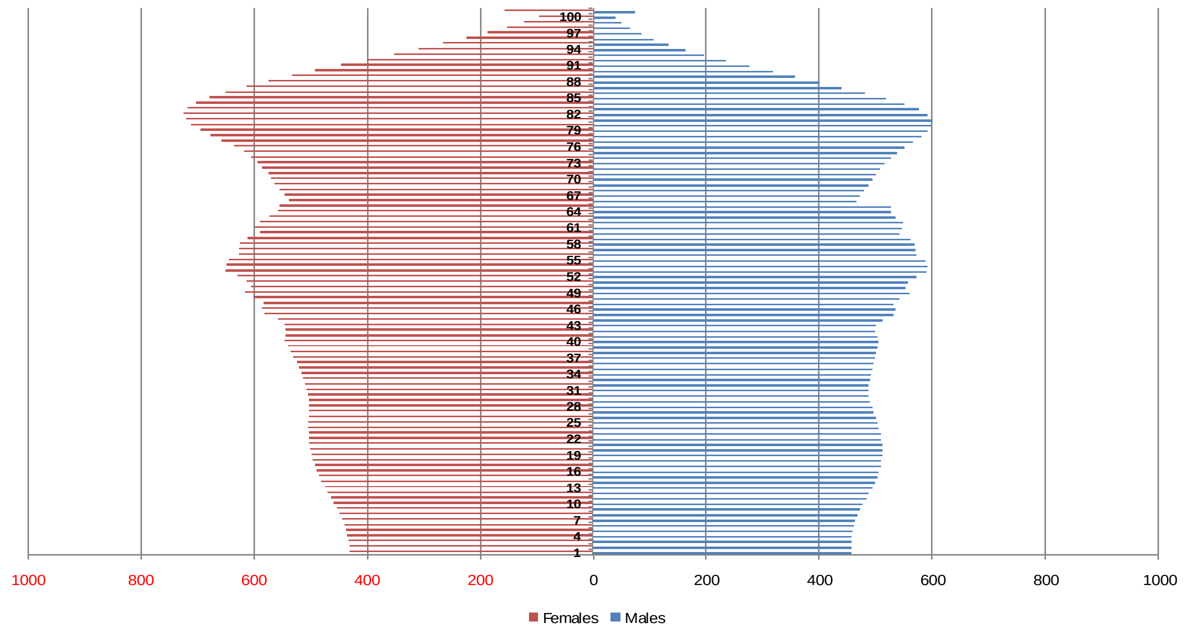
Source: demographic scenario of the AWG for Spain (Baseline scenario, Year: 2008, updated in 2010).

Graph 13
SPANISH POPULATION PYRAMID 2008 (total population=100,000)



Source: demographic scenario of the AWG for Spain (Baseline scenario, Year: 2008, updated in 2010).

Graph 14
SPANISH POPULATION PYRAMID 2060 (total population=100,000)



Source: demographic scenario of the AWG for Spain (Baseline scenario, Year: 2008, updated in 2010).

The *highest healthcare costs associated with those who die* is captured by considering the number of decedents and survivors in each age and sex group and differentiating their respective average unit costs in the base year, as shown in section 2.2. We will calculate each scenario with and without the "cost of death" assumption.

Regarding the *health status*, we consider the scenarios followed by the AWG:

i) *Expansion of morbidity hypothesis* (*EoM*): the gains in life expectancy up to 2060 are assumed to be lived in bad health; we model this hypothesis keeping constant the age and sex profiles:

$$\tilde{c}_{iglt} = c_{igl\,2008} \quad \forall\, i, g, l$$

ii) *Dynamic equilibrium hypothesis* (*DE*): healthy life expectancy grows at the same rate as total life expectancy; thus, the number of years lived in bad health remains constant over time. This hypothesis is modelled by shifting the age and sex profiles as follows[22]:

$$\tilde{c}_{igt} = c_{(i-\Delta e_{igt})g\,2008} \qquad \text{for} \quad i \geq 35$$

$$\Delta e_{igt} = e_{igt} - e_{ig\,2008}$$

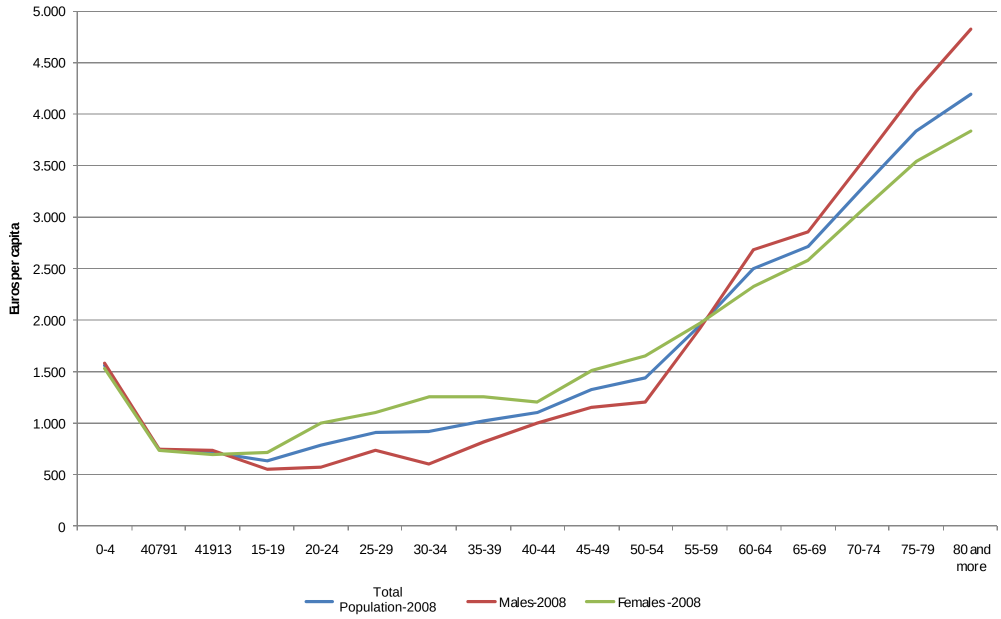
$$e_{igt} = \text{life expectancy at age } i \text{ for sex } g \text{ in year } t$$

iii) *Compression of morbidity hypothesis* (*CoM*): healthy life expectancy grows at a higher rate than total life expectancy; therefore, the number of years lived with diseases or disabilities will decrease. We model this assumption by shifting the age and sex profiles as a function of life expectancy as follows:

$$\tilde{c}_{igt} = c_{(i-2\Delta e_{igt})g\,2008} \qquad \text{for} \quad i \geq 35$$

Graph 15

HEALTH EXPENDITURE: AGE AND SEX PROFILES (2008)



Source: own elaboration.

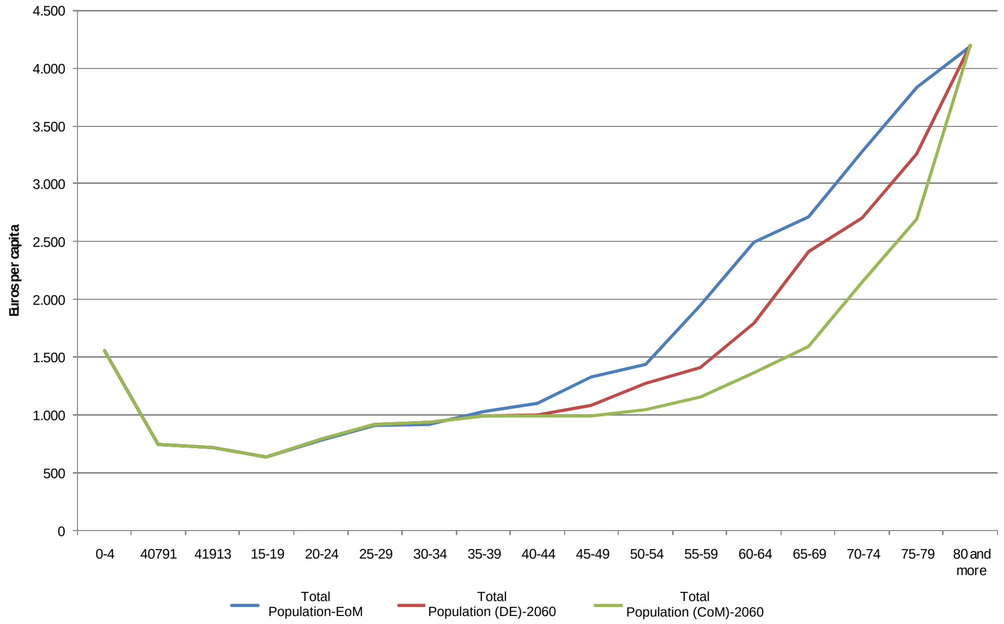
The age and sex profiles for 2008, which are kept constant over the period 2008 to 2060 under the expansion of morbidity assumption, are shown in Graph 15. We make these profiles evolve according to the dynamic equilibrium and the compression of morbidity assumptions as shown in Graphs 16 to 18. It should be remarked that improvements in life expectancy are assumed to be linked to improve-

[22] Following the AWG, we assume that changes in life expectancy have an effect on health status of people aged from 35 years old.

ments in morbidity which, at the same time, are associated to declines in unit costs. The equations used to model the relationship between unit cost and morbidity exclude the effect of endogenous factors related to the health system's response to new patterns of morbidity arising from ageing[23].

Graph 16

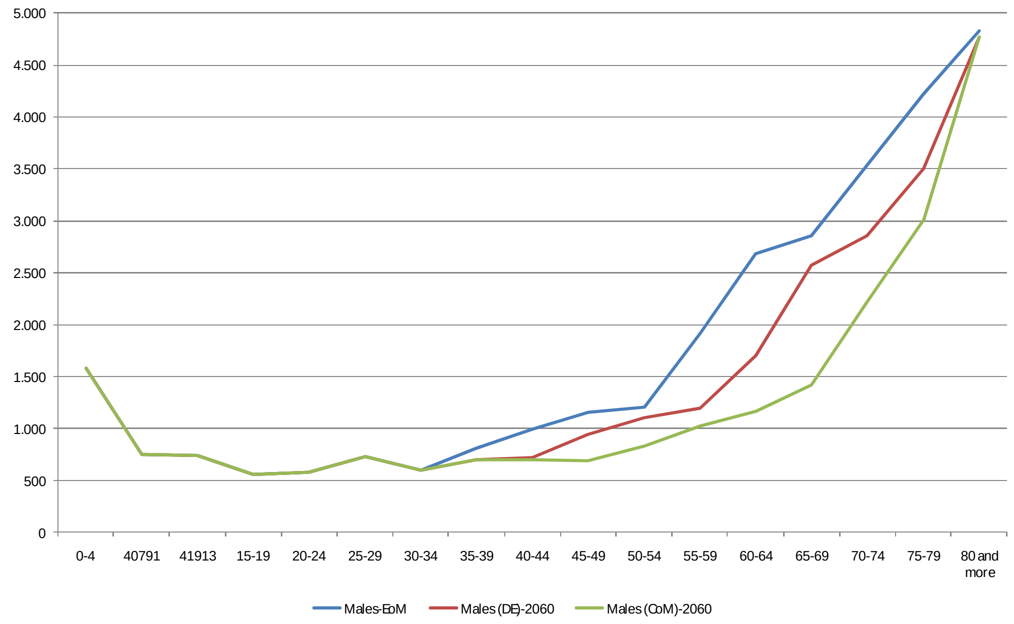
AGE PROFILES FOR HEALTHCARE EXPENDITURE UNDER ALTERNATIVE MORBIDITY HYPOTHESIS (YEAR 2060)



Source: own elaboration.

Graph 17

AGE PROFILES FOR HEALTHCARE EXPENDITURE (MALES). YEAR 2060

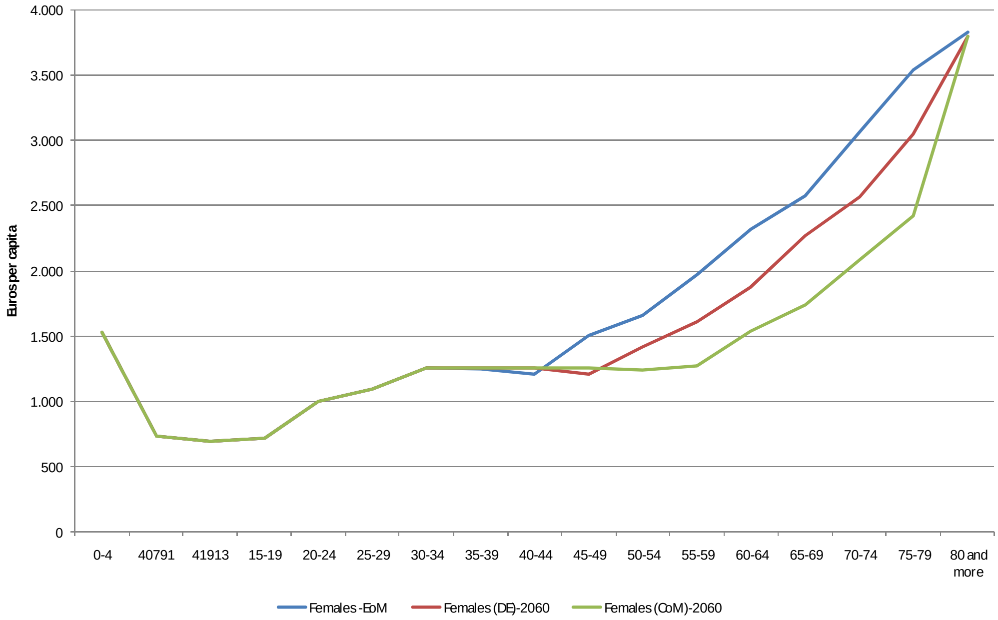


Source: own elaboration.

[23] For further details on this issue see LÓPEZ-CASASNOVAS, G. (2010).

Graph 18

AGE PROFILES FOR HEALTHCARE EXPENDITURE (FEMALES). YEAR 2060



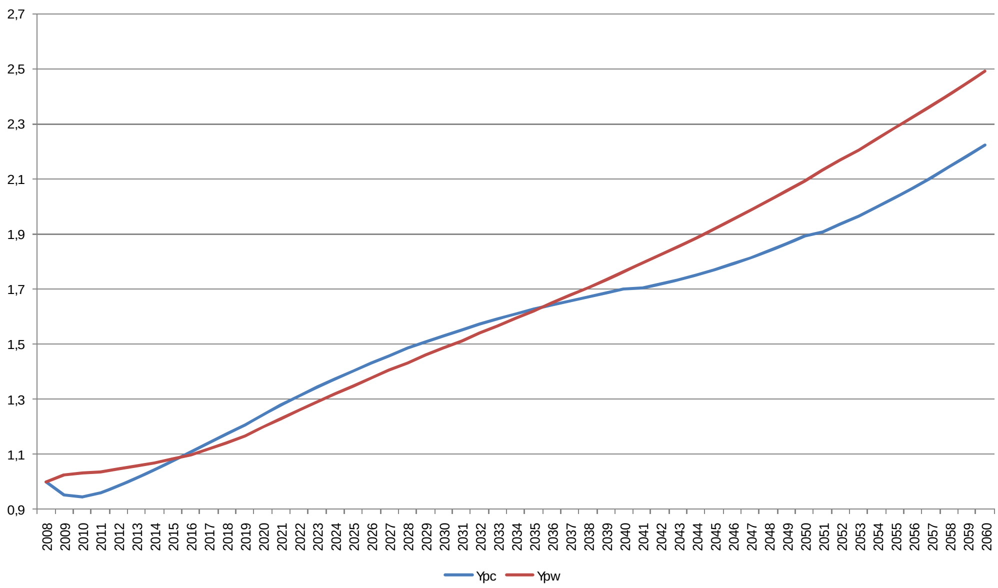
Source: own elaboration.

The *global volume effect* can be thought of as implicitly encapsulating the impact of all non-demographic drivers of expenditure affecting uniformly quantity and quality of care attributed to each inhabitant. We assume that variations in global volume effect are linked to the evolution of unit cost at constant prices. The AWG elaborates projections under three different cost scenarios:

1. Unit cost evolves at the same rate as GDP per capita (*Ypc*).
2. Unit cost evolves at the same rate as GDP per worker (*Ypw*).
3. Income elasticity of healthcare demand is equal to 1.1 in the base year and converges in a linear manner to 1 by the end of projection horizon in 2060.

Graph 19

VARIATION OF GDP *PER CAPITA* AND *PER WORKER*. BASE 2008=100



Source: macroeconomic scenario of the AWG for Spain (Baseline scenario, Year: 2008, updated in 2010).

We replicate the first scenario and use the second as sensitivity analysis on the global volume effect hypothesis. Graph 19 shows the evolution of GDP per capita (*Ypc*) and GDP per worker (*Ypw),* according to the AWG forecasts.

Finally, we modify the third scenario to adapt it to the Spanish GDP evolution depicted in the Stability Programme 2009-2013[24], by taking into account the following considerations:

a) In 2010, the Spanish Government developed action plans to reduce public deficit, which involve the health sector: i) cut down of public staff that, according to the Labour Force Survey, started in the 4th quarter of 2009 for the hospital sector and in the 3rd quarter of 2010 for non-hospital sector; ii) 5% reduction of salaries paid by public sector; iii) measures to control pharmaceutical spending, that have led to negative increases in this cost item. Compensation of employees and pharmaceutical spending accounted in 2008 for 64% of public expenditure on health. The rest of cost items which are intermediate consumption and gross fixed capital formation are also affected by the general actions to reduce the budgetary gap.

b) In 2009 and 2010 real GDP in Spain has decreased. In such a context, it could be argued that income elasticity of healthcare demand will not remain constant.

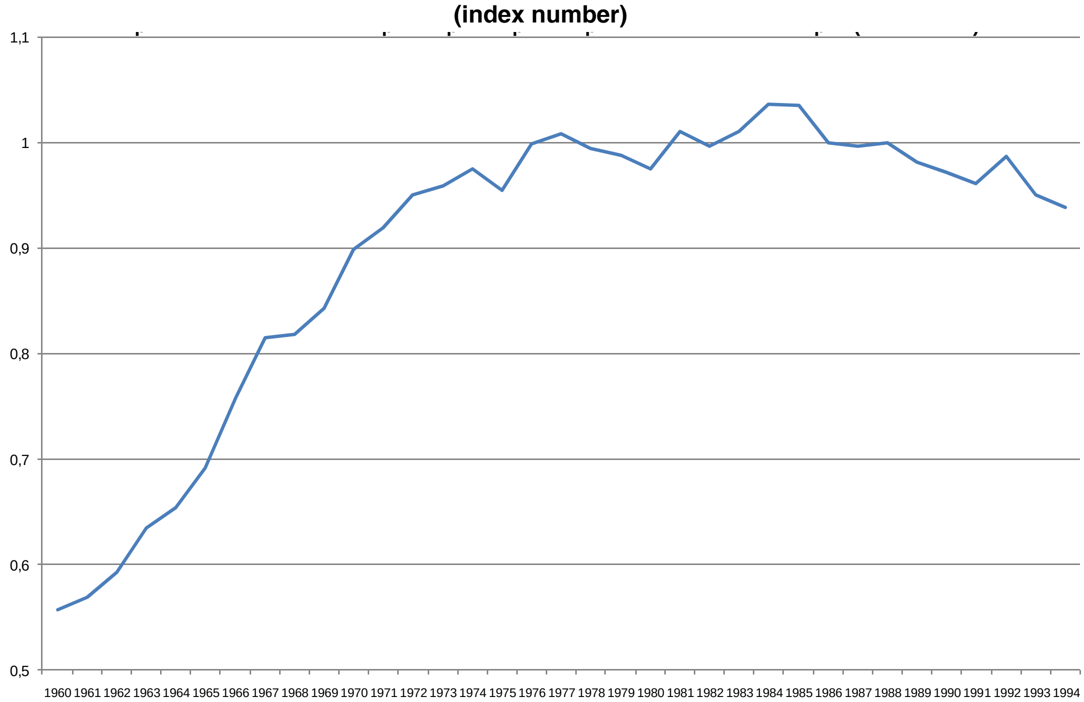
c) Spain would start to recover the GDP growth path in 2011.

Therefore, we will assume that income elasticity of healthcare demand is equal to 1 in 2008 to 2010 and that it will grow to 1.1 in the year 2011, converging since then in a linear manner to 1 by the end of projection horizon in 2060.

Projections of health care expenditure will be expressed in real terms. The *price index for public health care* is usually assumed to evolve at the same rate as the price for GDP, so the variation of the relative prices equals one[25]. The Spanish available estimations indicate that this is the case since 1975. Nevertheless estimates end up in 1994 (Graph 20).

Graph 20

VARIATION OF THE RELATIVE PRICE IMPLICIT IN PUBLIC EXPENDITURE ON HEALTH CARE IN SPAIN (index number)



Source: BLANCO, A. and BUSTOS, A. (1996). Diez años de sistema nacional de salud. Un método de análisis basado en la Contabilidad Nacional de España y previsiones hasta el año 2000. WP SGPS-96003. Directorate General for Budgets. Ministry of the Treasury. *http://www.pap.meh.es/sitios/sgpg/es-ES/Presupuestos/Documentacion/Documents/DOCUMENTOS%20DE%20TRABAJO/SGPS96003.pdf.*

[24] Spanish Ministry of Economy and Finance (2010). Stability Programme Update. Spain. 2009-2013. Available at: *http://www.meh.es/Documentacion/Publico/GabineteMinistro/Varios/Stability_programme_Spain_2009-2013_english_version.pdf.*

[25] Hence, the indicator 'public expenditure on health as a share of GDP' at constant prices will measure the sustainability of public expenditure on health.

The next section shows the results of projections under the alternative scenarios considered which are described in the appendix.

4. RESULTS: PROJECTIONS OF SPANISH HEALTHCARE EXPENDITURE

Starting at 6.0% of GDP, health expenditure will grow in real terms to reach, in 2060, between 6.4% and 8.8% of GDP, depending on the scenario used to calculate projections (Table 4). That means that public health expenditure will grow at an average annual rate ranging from 1.78% to 2.4%.

The first scenario, which isolates the pure demographic or pure ageing effect, shows that the expected evolution of the volume and structure of Spanish population will place the percentage of public expenditure on health over the GDP at 7.88% in 2060[26].

Table 4
HEALTH EXPENDITURE AS A SHARE OF GDP (%) IN 2008 AND 2060

Scenarios	2008	2060	Difference
Scenario # 1: EoM(GDPpc)	6.00	7.88	1.88
Scenario # 2: DE(GDPpc)	6.00	7.12	1.12
Scenario # 3: CoM(GDPpc)	6.00	6.48	0.47
Scenario # 4: EoM&CoD(GDPpc)	6.00	7.79	1.78
Scenario # 5: DE&CoD(GDPpc)	6.00	7.06	1.06
Scenario # 6: CoM&CoD(GDPpc)	6.00	6.44	0.43
Scenarios	**2008**	**2060**	**Difference**
Scenario # 7: EoM(GDPpc)e	6.00	8.27	2.27
Scenario # 8: DE(GDPpc)e	6.00	7.48	1.48
Scenario # 9: CoM(GDPpc)e	6.00	6.80	0.80
Scenario # 10: EoM&CoD(GDPpc)e	6.00	8.17	2.17
Scenario # 11: DE&CoD(GDPpc)e	6.00	7.42	1.41
Scenario # 12: CoM&CoD(GDPpc)e	6.00	6.76	0.75
Scenarios	**2008**	**2060**	**Difference**
Scenario # 13: EoM(GDPpw)	6.00	8.82	2.82
Scenario # 14: DE(GDPpw)	6.00	7.97	1.97
Scenario # 15: CoM(GDPpw)	6.00	7.25	1.25
Scenario # 16: EoM&CoD(GDPpw)	6.00	8.72	2.71
Scenario # 17: DE&CoD(GDPpw)	6.00	7.91	1.91
Scenario # 18: CoM&CoD(GDPpw)	6.00	7.20	1.20

Notes: All the scenarios are described in the appendix.
Source: own elaboration.

The estimated rates of growth under the alternative scenarios are moderate compared to those registered in Spain in the past. Nevertheless, they reveal a similar change in the share of public expenditure on health as the calculated by the AWG in 2009 (Table 5).

[26] Our results are slightly higher than those obtained by CASADO and PUIG (2008). These authors estimate, by using a similar method, that the cumulative rate of growth for healthcare expenditure during the period 2005-2016 would be 16.68%. In our case, the rate for the period 2008-2016 is 19.24%.

Table 5

AWG RESULTS FOR SPAIN (REPORT 2009)

	2007	2060	Difference
Pure demographic scenario	5.5	7.3	1.8
Constant health (dynamic equilibrium) scenario	5.5	6.5	1.0
Death-related costs scenario (with pure demographic scenario)	5.5	7	1.5
Income elasticity scenario	5.5	7.6	2.1
Income elasticity scenario (pure demographic scenario with GDP per worker)	5.5	8.1	2.6

Source: DG Economic and Financial Affairs (2009).

In the short term, the projections foresee a stabilization of the health expenditure as a share of GDP, as a consequence of the economy evolution assumed in the macroeconomic scenario. However, when expenditure is expressed in constant Euros, the results show a slight fall.

The growth of health expenditure is reduced, as expected, when the effect of proximity to death is included. This effect diminishes as health status improves, as can be seen in Graphs 21 to 26. It has to be pointed out that the overestimation of public expenditure on health when the cost of death is ignored is much lower than that obtained by other studies[27]. In our case, the overestimation ranges from 0.04 to 0.11 percentage points (pp), depending on the health status hypothesis considered. According to other projections by the AWG, this difference accounted for 0.4 pp (projections for 2004-2050) and 0.3 pp (projections for 2007-2060)[28].

However, the impact of different health status evolution assumptions on the projected share of public healthcare expenditure over GDP is quite significant. The difference between the compression of morbidity scenario and the expansion of morbidity hypothesis ranges from 1.35 to 1.57 points of GDP in 2060, depending on the final scenario used. In other words, the accumulated rate of growth of public health expenditure as a share of GDP for the whole period ranges from 7.9% –when the compression of morbidity is assumed– to 31.3% –when the expansion of morbidity scenario is considered–. If cost of death is included, those percentages range from 7.2% to 29.7%.

If elasticity is assumed to vary over time, the estimations obtained increase with respect to those linked to a constant elasticity. Differences range from 0.32 to 0.39 points of GDP, depending on the health status hypothesis considered.

Finally, when unit costs evolve at the same rate as GDP per worker, the projections are higher than those obtained when unit costs evolve at the same rate as GDP per capita. This scenario estimates the evolution in health care expenditure under the assumption that health care is a highly labour-intensive sector and, consequently, unit costs are driven by changes in labour productivity, rather than by growth in national income.[29] As wages are projected to grow in line with productivity and thus generally faster than GDP per capita, this scenario provides an insight into the effects of unit costs in the health care sector being driven mostly by increases in wages and salaries[30] (Graph 19).

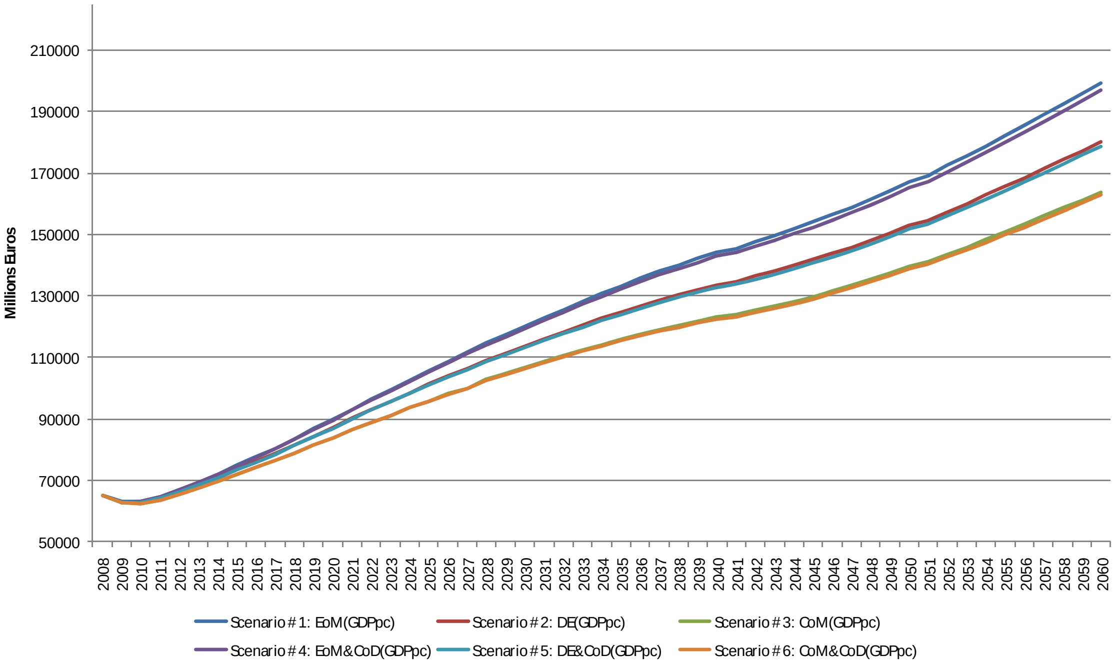
[27] SESHAMANI and GRAY (2004); STEARNS and NORTORN (2004); SHANG and GOLDMAN (2008); LÓPEZ-CASASNOVAS (2010).

[28] This could be a consequence of using partial information in the estimation of the cost of death. As we have pointed out, the ratio cost decedents/survivors only can be accurately measured for inpatient care. Nevertheless, the Spanish estimations for the AWG have always employed the same data source (CMBD), the only difference being the improvement in data quality over time.

[29] Linking the evolution of the growth of per capita health expenditure to general productivity is supported by the argument that healthcare services production is a labour intensive activity and so that health expenditure might evolve in line with wages. This assumption relies in Baumol hypothesis that “distinguishes between two types of sectors depending on the level of labour productivity growth, i.e. high and low productivity sectors. In general, labour intensive sectors, such as health care, are characterized by a low labour productivity growth. As, in the long-run, nominal wages in both sectors are related, wages in the low productivity sector rise to the same extent as in the high productivity sector, which results in growing price differentials between the two. In addition, if demand for the low productivity sector good is inelastic, as in the case of health care, the ratio of expenditure on these goods to GDP increases over time. Following this argument, one can explain increasing health care expenditure to GDP over time. The difficulty consists in the lack of reliable sectoral estimates of labour productivity, but may be partially offset by decomposing the overall spending growth into increases in volume and price” [DYBCZAK, K. and PRZYWARA, B. (2010) page 7].

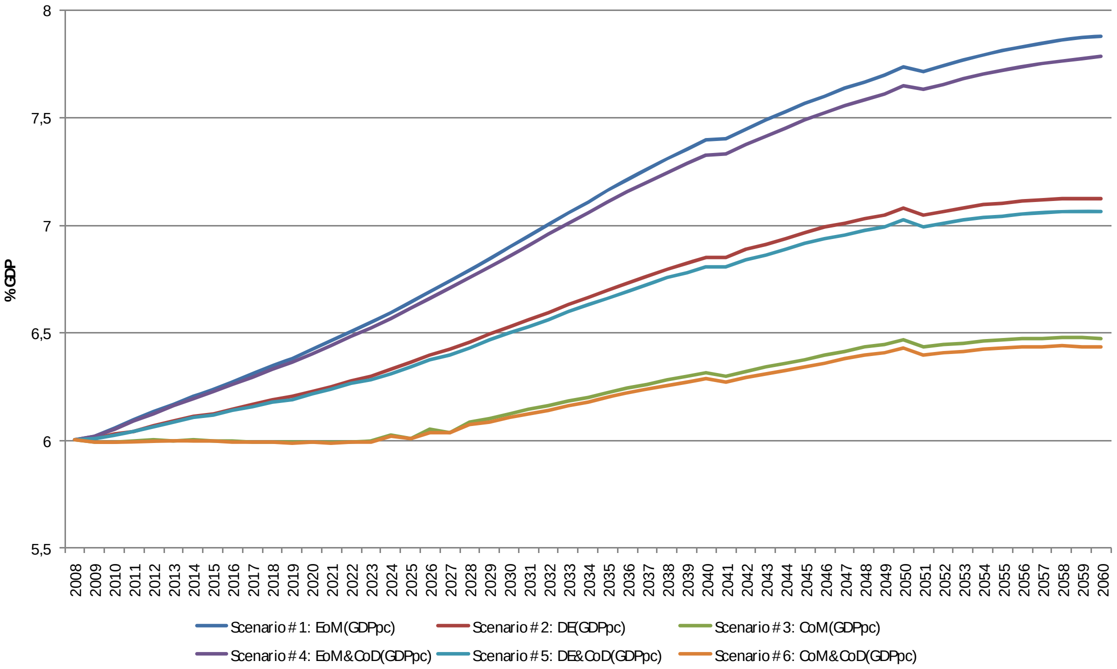
[30] DG Economic and Financial Affairs. Working Paper (2009). The 2009 Ageing Report: economic and budgetary projections for the EU-27 Member States (2008-2060).

Graph 21
SCENARIOS WHERE UNIT COST EVOLVE AS GDPpc
(health expenditure in Million Euros)



Source: own elaboration.

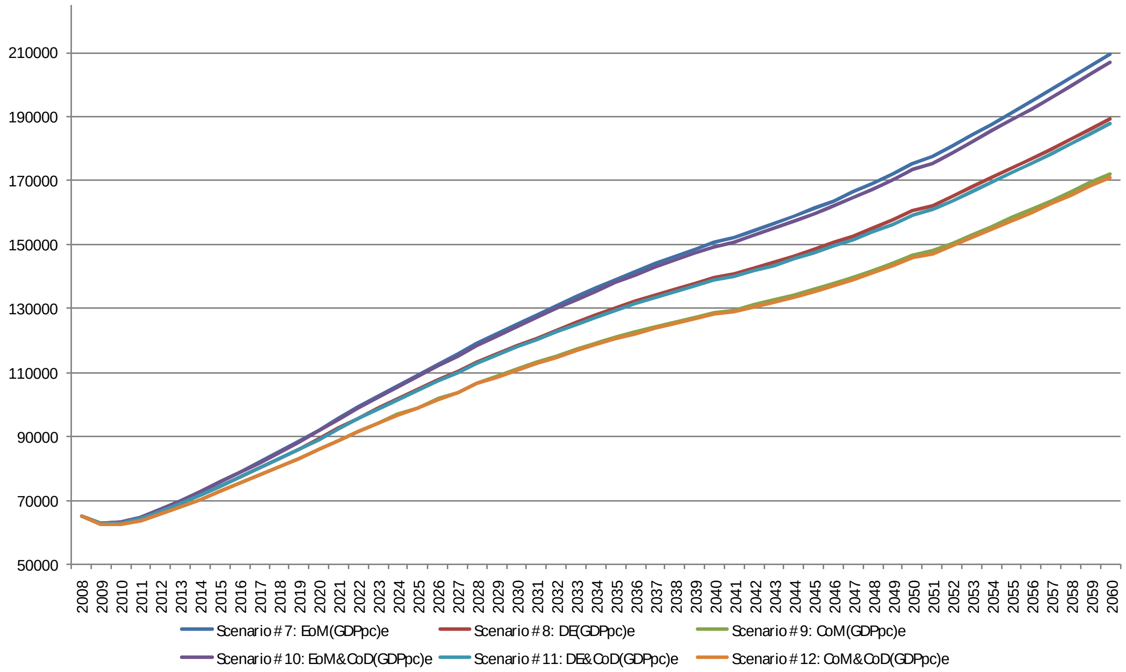
Graph 22
SCENARIOS WHERE UNIT COST EVOLVE AS GDPpc
(health expenditure in % GDP)



Source: own elaboration.

Graph 23

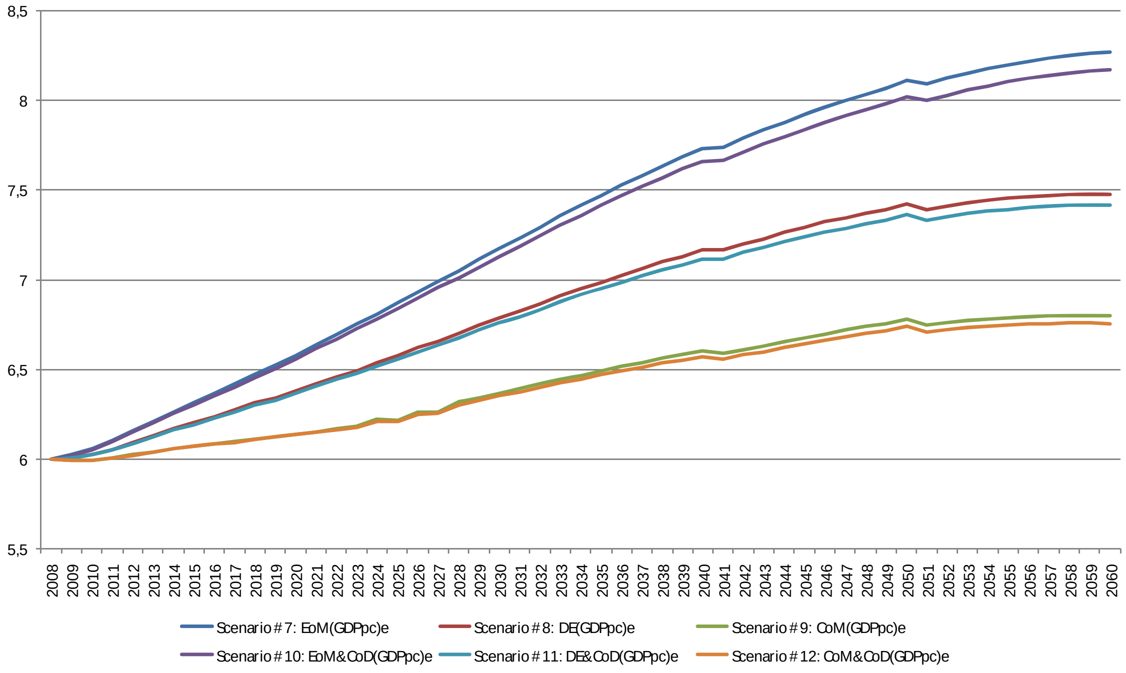
SCENARIOS WHERE UNIT COST EVOLVE AS GDPpc WITH ELASTICITY HYPOTHESIS (health expenditure in Million Euros)



Source: own elaboration.

Graph 24

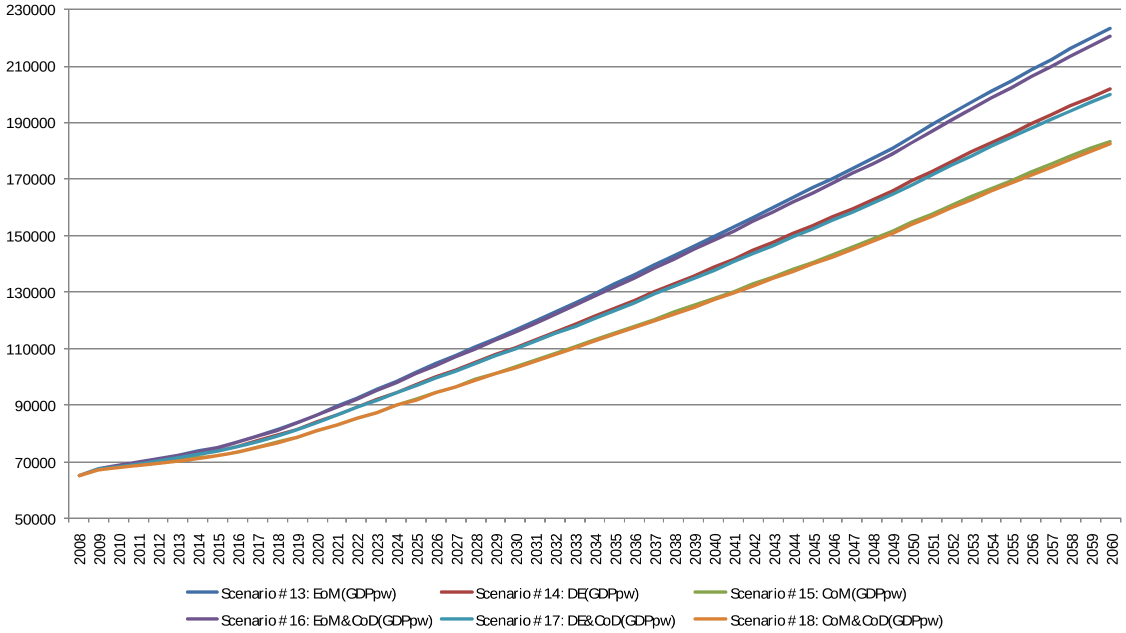
SCENARIOS WHERE UNIT COST EVOLVE AS GDPpc WITH ELASTICITY HYPOTHESIS (health expenditure in % GDP)



Source: own elaboration.

Graph 25

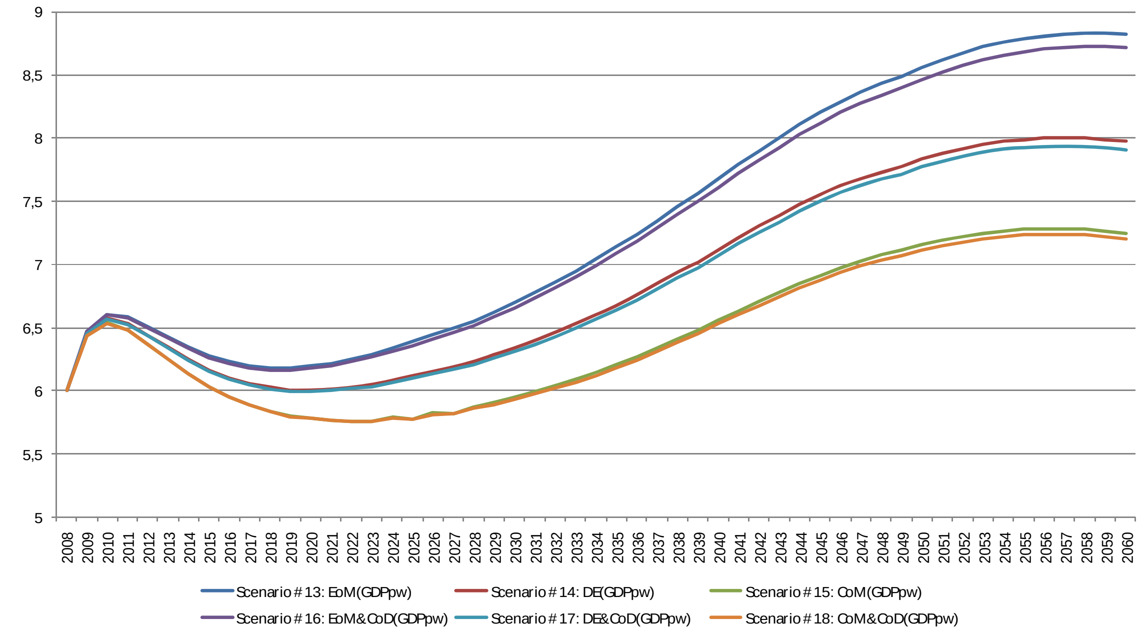
SCENARIOS WHERE UNIT COST EVOLVE AS GDPpw
(health expenditure in Million Euros)



Source: own elaboration.

Graph 26

SCENARIOS WHERE UNIT COST EVOLVE AS GDPpw
(health expenditure in % GDP)



Source: own elaboration.

5. FINAL REMARKS: MAIN IMPLICATIONS FOR POLICY MAKING

The foreseen evolution of public health expenditure may impose a significant pressure on public finances in the near future. In some of the projection scenarios used, the share of Spanish public expenditure on health over the GDP reaches almost 9% in 2060.

Our results further support the fact that the demographic effect is not the main driver of health expenditure, shifting the focus of concern to other factors: health status of the population, economic growth and development, new technologies and medical progress, and the organization and management of the healthcare system.

As it has been shown, changes in health status have a significant impact on healthcare expenditure, whose rate of growth could be slowed by reductions in morbidity. In order to achieve an improvement in health status, other factors besides the delivery of health care should be taken into account, including social determinants of health. Income, labour status, education levels and housing conditions have been proved to have an influence on population health, and also environmental conditions or lifestyles. A cost-effective and equitable health policy design involves tackling social determinants of health and becoming aware of the impact derived from non-healthcare policies, which can help to prevent illness and to reduce the rate of growth of healthcare expenditure.

The current economic depression offers a major chance of introducing the needed changes in health-oriented actions. At the present time, major reforms are being implemented in Spanish social policy (e.g., retirement benefits). A wave of reforms is also needed to promote cost-effectiveness of National Health Service, with the aim of ensuring financial sustainability of health care system in the near future.

Some drawbacks are present in this paper. To begin with, the impact of the economic crisis on the evolution of demography is uncertain. The significant flow of migrants arrived in Spain in the recent years may be affected by this phenomenon, and also the volume and structure of population in the near future. Moreover, we have assumed that changes in the use of healthcare services are homogenous across population groups. However, patterns of use of healthcare services may vary across age and sex groups over time. If this is the case, projections of healthcare expenditure will be biased. Further research is needed on this issue. Finally, further improvements of Spanish data sources should be promoted in order to get better estimations of future expenditure, including long-term care.

APPENDIX

TABLES

Table 1
INPATIENT EXPENDITURE (EUROS PER CAPITA, 2008)

	Men	Women	Total
0-4	431	365	399
5-9	108	80	95
10-14	107	85	96
15-19	142	139	140
20-24	139	201	169
25-29	137	265	199
30-34	150	337	240
35-39	190	291	239
40-44	255	244	250
45-49	340	274	307
50-54	451	319	385
55-59	629	383	503
60-64	853	494	667
65-69	1,070	618	831
70-74	1,428	851	1,111
75-79	1,784	1,102	1,392
80 and over	2,031	1,451	1,658
Total	465	419	441

Source: own elaboration on the basis of Administrative Records of the National Information System on Hospital Discharges and Diagnosis-Related Group (DRG) (2008), Eurostat and Spanish Statistics of Public Expenditure on Health (EGSP).

Table 2
EXPENDITURE ON SPECIALIZED OUTPATIENT SERVICES (EUROS PER CAPITA, 2008)

	Men	Women	Total
0-4	170	247	207
5-9	161	148	154
10-14	223	178	201
15-19	80	120	100
20-24	108	225	165
25-29	198	238	217
30-34	103	276	186
35-39	185	279	231
40-44	209	270	239
45-49	215	335	275
50-54	191	341	267
55-59	311	427	370
60-64	540	373	453
65-69	379	375	377
70-74	502	404	448
75-79	533	392	452
80 and over	390	363	373
Total	234	292	264

Source: own elaboration on the basis of Eurostat, EGSP and Spanish National Health Survey (2006).

Table 3

HEALTH EXPENDITURE ON PRIMARY HEALTHCARE (EUROS PER CAPITA, 2008)

	Men	Women	Total
0-4	411	360	386
5-9	169	194	181
10-14	126	142	134
15-19	113	168	140
20-24	103	176	138
25-29	112	182	146
30-34	123	175	148
35-39	126	200	162
40-44	154	195	174
45-49	168	260	214
50-54	144	293	219
55-59	258	306	282
60-64	301	355	329
65-69	311	396	356
70-74	329	417	377
75-79	378	407	394
80 and over	548	394	449
Total	200	261	231

Source: own elaboration on the basis of Eurostat, EGSP and Spanish National Health Survey (2006).

Table 4

EXPENDITURE ON PRESCRIPTION DRUGS (EUROS PER CAPITA, 2008)

	Men	Women	Total
0-4	310	280	296
5-9	178	194	186
10-14	120	159	139
15-19	121	167	144
20-24	113	202	157
25-29	130	189	159
30-34	110	201	154
35-39	144	225	183
40-44	173	259	215
45-49	194	350	272
50-54	164	393	280
55-59	329	476	404
60-64	405	698	557
65-69	515	739	634
70-74	514	850	698
75-79	623	1,006	843
80 and over	917	895	903
Total	246	398	323

Source: own elaboration on the basis of Eurostat, EGSP and Spanish National Health Survey (2006).

Table 5

PUBLIC EXPENDITURE ON HEALTH (EUROS PER CAPITA, 2008)

	Men	Women	Total
0-4	1,505	1,425	1,466
5-9	697	695	696
10-14	655	639	647
15-19	521	673	595
20-24	528	914	716
25-29	656	997	821
30-34	554	1,132	832
35-39	735	1,135	929
40-44	903	1,101	1,000
45-49	1,049	1,384	1,216
50-54	1,092	1,529	1,313
55-59	1,748	1,809	1,780
60-64	2,405	2,181	2,289
65-69	2,614	2,421	2,512
70-74	3,193	2,875	3,019
75-79	3,824	3,320	3,535
80 and over	4,471	3,561	3,885
Total	1,311	1,561	1,438

Source: own elaboration on the basis of Eurostat, EGSP and Tables 1-4.

Table 6

SPANISH POPULATION IN 2008 CLASSIFIED ACCORDING TO THEIR HEALTHCARE UTILIZATION AND THEIR SURVIVAL STATUS (TOTAL POPULATION)

Total population	Total inhabitants	Survivors			Decedents			Decedents at hospital		Decedents at home			
		Total	Inpatients (*)	Not inpatients	Total	Inpatients	Not inpatients	Total	Inpatients	Total	Palliative care	Other inpatients	Not inpatients
Total	45,283,259	44,961,801	2,817,345	42,144,455	321,458	192,211	129,247	152,946	152,946	168,512	12,406	26,859	129,247
0-4	2,364,938	2,362,870	218,426	2,144,444	2,068	1,655	413	1,612	1,612	456	0	43	413
5-9	2,170,521	2,170,303	52,529	2,117,774	218	154	64	152	152	66	0	2	64
10-14	2,084,077	2,083,816	42,025	2,041,791	261	139	123	136	136	125	0	3	123
15-19	2,285,278	2,284,502	64,599	2,219,903	776	299	477	286	286	490	0	13	477
20-24	2,785,246	2,784,120	112,269	2,671,852	1,126	366	760	343	343	783	0	23	760
25-29	3,649,554	3,648,010	185,384	3,462,626	1,544	518	1,026	481	481	1,063	0	37	1,026
30-34	4,038,981	4,036,706	250,990	3,785,715	2,275	799	1,476	734	734	1,541	0	65	1,476
35-39	3,826,264	3,822,686	191,884	3,630,802	3,578	1,448	2,131	1,360	1,360	2,218	0	88	2,131
40-44	3,609,867	3,604,463	137,196	3,467,267	5,404	2,435	2,969	2,322	2,322	3,082	0	113	2,969
45-49	3,281,994	3,274,452	131,342	3,143,110	7,542	4,131	3,411	3,674	3,674	3,868	308	149	3,411
50-54	2,824,951	2,815,164	133,753	2,681,411	9,787	5,462	4,325	4,826	4,826	4,961	399	237	4,325
55-59	2,523,032	2,510,282	148,818	2,361,464	12,750	7,238	5,512	6,316	6,316	6,434	520	402	5,512
60-64	2,318,248	2,301,264	172,919	2,128,345	16,984	10,333	6,651	9,003	9,003	7,981	693	637	6,651
65-69	1,898,150	1,877,286	168,930	1,708,356	20,864	12,161	8,703	10,278	10,278	10,586	851	1,032	8,703
70-74	1,878,485	1,844,176	217,847	1,626,329	34,309	20,759	13,550	17,116	17,116	17,193	1,399	2,243	13,550
75-79	1,661,718	1,611,608	237,433	1,374,175	50,110	31,136	18,974	24,904	24,904	25,206	2,044	4,188	18,974
80+	2,081,955	1,930,092	351,001	1,579,091	151,863	93,181	58,682	69,403	69,403	82,460	6,193	17,585	58,682

(*) Inpatients related to curative and rehabilitative care (long-term care excluded).

Sources:

Population by age and sex: AWG Demographic Scenarios.

Total decedents: AWG Demographic Scenarios.

Deaths in a public hospital: Institute of Health Information (MoHSP). Administrative Records of the National Information System on Hospital Discharges and Diagnosis-Related Group (DRG) (2008).

Alive discharges in a public hospital: Institute of Health Information (MoHSP). Administrative Records of the National Information System on Hospital Discharges and Diagnosis-Related Group (DRG) (2008).

Alive discharges in palliative care: Spanish Society of Palliative Care (SECPAL). Palliative Care Services in Spain, year 2000. SECPAL. Medicina Paliativa, Vol. 8, Núm. 2, págs. 85-99. *http://www.secpal.com/medicina_paliativa/index.php?acc=verart&idart=41*.

Age structure of patients in palliative care: own elaboration on the basis of meta-analysis.

Percentage of population in public hospitals: Institute of Health Information (MoHSP). Hospital Discharges Record.

Table 7

SPANISH POPULATION IN 2008 CLASSIFIED ACCORDING TO THEIR HEALTHCARE UTILIZATION AND THEIR SURVIVAL STATUS (MALES)

Males	Total inhabitants	Survivors			Decedents			Decedents at hospital		Decedents at home			
		Total	Inpatients	Not inpatients	Total	Inpatients	Not inpatients	Total	Inpatients	Total	Palliative care	Other inpatients	Not inpatients
Total	22,356,882	22,155,536	1,235,226	20,920,309	201,346	112,477	88,870	84,960	84,959	116,387	7,732	19,786	88,870
0-4	1,216,929	1,215,770	122,922	1,092,848	1,159	926	234	899	899	260	0	26	234
5-9	1,115,136	1,115,006	30,820	1,084,186	130	97	33	96	96	34	0	1	33
10-14	1,069,789	1,069,631	24,484	1,045,148	158	80	78	78	78	80	0	2	78
15-19	1,174,704	1,174,139	27,410	1,146,730	565	190	374	181	181	384	0	9	374
20-24	1,423,862	1,423,015	31,900	1,391,115	847	221	625	207	207	640	0	14	625
25-29	1,881,578	1,880,434	40,005	1,840,429	1,144	325	819	307	307	837	0	18	819
30-34	2,095,927	2,094,330	47,378	2,046,952	1,597	444	1,153	417	417	1,180	0	27	1,153
35-39	1,970,499	1,968,044	52,841	1,915,203	2,455	847	1,608	802	802	1,653	0	45	1,608
40-44	1,829,616	1,825,907	61,194	1,764,713	3,709	1,504	2,205	1,426	1,426	2,283	0	78	2,205
45-49	1,641,850	1,636,689	67,561	1,569,129	5,161	2,664	2,497	2,342	2,342	2,819	210	112	2,497
50-54	1,397,402	1,390,445	72,409	1,318,036	6,957	3,677	3,281	3,204	3,204	3,753	284	189	3,281
55-59	1,233,366	1,224,070	84,653	1,139,417	9,296	5,051	4,245	4,339	4,339	4,957	379	333	4,245
60-64	1,116,042	1,103,678	98,875	1,004,803	12,364	7,423	4,941	6,399	6,399	5,965	504	520	4,941
65-69	894,485	879,505	95,276	784,228	14,980	8,586	6,395	7,135	7,135	7,845	611	840	6,395
70-74	847,599	823,810	117,772	706,038	23,789	13,885	9,904	11,094	11,094	12,695	970	1,821	9,904
75-79	706,811	673,657	120,254	553,403	33,154	19,591	13,564	14,893	14,893	18,261	1,352	3,346	13,564
80+	741,287	657,404	139,472	517,932	83,883	46,967	36,916	31,141	31,141	52,742	3,421	12,404	36,916

Sources: see Table 6.

Table 8

SPANISH POPULATION IN 2008 CLASSIFIED ACCORDING TO THEIR HEALTHCARE UTILIZATION AND THEIR SURVIVAL STATUS (FEMALES)

Females	Total inhabitants	Survivors			Decedents			Decedents at hospital		Decedents at home			
		Total	Inpatients	Not inpatients	Total	Inpatients	Not inpatients	Total	Inpatients	Total	Palliative care	Other inpatients	Not inpatients
Total	22,926,377	22,806,265	1,582,119	21,224,146	120,112	79,734	40,378	67,987	67,987	52,125	4,675	7,073	40,378
0-4	1,148,009	1,147,100	95,504	1,051,596	909	729	180	713	713	196	0	16	180
5-9	1,055,385	1,055,297	21,709	1,033,588	88	57	31	56	56	32	0	1	31
10-14	1,014,288	1,014,184	17,541	996,643	104	59	45	58	58	46	0	1	45
15-19	1,110,574	1,110,363	37,190	1,073,173	211	109	103	105	105	106	0	4	103
20-24	1,361,384	1,361,105	80,368	1,280,736	279	144	135	136	136	143	0	8	135
25-29	1,767,976	1,767,576	145,379	1,622,197	400	193	207	174	174	226	0	19	207
30-34	1,943,054	1,942,376	203,612	1,738,763	678	355	323	317	317	361	0	38	323
35-39	1,855,765	1,854,641	139,043	1,715,599	1,124	601	523	558	558	566	0	43	523
40-44	1,780,251	1,778,557	76,002	1,702,554	1,694	931	764	896	896	798	0	35	764
45-49	1,640,144	1,637,763	63,781	1,573,982	2,381	1,467	914	1,332	1,332	1,049	97	38	914
50-54	1,427,549	1,424,719	61,344	1,363,375	2,830	1,786	1,044	1,622	1,622	1,208	115	48	1,044
55-59	1,289,666	1,286,211	64,165	1,222,047	3,455	2,187	1,268	1,977	1,977	1,477	141	69	1,268
60-64	1,202,206	1,197,586	74,044	1,123,542	4,620	2,909	1,710	2,604	2,604	2,016	188	117	1,710
65-69	1,003,665	997,782	73,654	924,127	5,883	3,575	2,308	3,143	3,143	2,740	240	192	2,308
70-74	1,030,886	1,020,366	100,075	920,291	10,520	6,873	3,647	6,022	6,022	4,498	429	422	3,647
75-79	954,907	937,951	117,179	820,773	16,956	11,545	5,410	10,011	10,011	6,945	691	843	5,410
80+	1,340,668	1,272,688	211,529	1,061,159	67,980	46,214	21,766	38,262	38,262	29,718	2,772	5,180	21,766

Sources: see Table 6.

Table 9

UNIT COST RATIO DECEDENT/SURVIVOR FOR HOSPITAL DISCHARGES BY AGE AND SEX (2008)

	Total	Males	Females
0-4	3.53	3.49	3.57
5-9	3.46	3.34	3.67
10-14	3.46	3.55	3.33
15-19	3.70	3.22	3.94
20-24	3.54	2.70	3.55
25-29	4.41	2.98	4.41
30-34	4.00	2.46	4.50
35-39	2.94	2.09	3.33
40-44	2.08	1.98	2.01
45-49	1.63	1.62	1.57
50-54	1.49	1.44	1.52
55-59	1.44	1.35	1.57
60-64	1.37	1.28	1.51
65-69	1.33	1.26	1.45
70-74	1.27	1.21	1.34
75-80	1.17	1.12	1.23
80+	0.96	0.94	0.97
Total	1.46	1.32	1.58

Source: own elaboration on the basis of Institute of Health Information (MoHSP). Administrative Records of the National Information System on Hospital Discharges and Diagnosis-Related Group (DRG) (2008).

Table 10

PUBLIC EXPENDITURE ON HEALTH ACCORDING TO HEALTHCARE UTILIZATION AND SURVIVAL STATUS (TOTAL POPULATION)

Total population	Total	Survivors			Decedents		
		Total	Inpatients	Not inpatients	Total	Inpatients	Not inpatients
Total	65,099,350,000	62,696,297,003	18,206,600,053	44,489,696,949	2,403,052,997	1,784,639,947	618,413,051
0-4	3,467,345,126	3,441,056,575	918,506,718	2,522,549,857	26,288,551	24,079,294	2,209,257
5-9	1,510,901,648	1,508,723,716	203,664,491	1,305,059,225	2,177,932	2,047,567	130,365
10-14	1,348,172,024	1,345,791,901	198,718,397	1,147,073,503	2,380,124	2,236,418	143,705
15-19	1,359,373,767	1,353,807,534	315,834,166	1,037,973,368	5,566,233	5,239,607	326,626
20-24	1,995,291,411	1,989,598,529	466,554,903	1,523,043,625	5,692,882	5,165,026	527,856
25-29	2,996,315,272	2,987,051,616	717,356,332	2,269,695,284	9,263,656	8,377,143	886,513
30-34	3,359,803,981	3,347,106,125	958,552,099	2,388,554,026	12,697,856	11,514,311	1,183,545
35-39	3,553,241,976	3,531,855,984	895,232,127	2,636,623,857	21,385,992	19,101,217	2,284,775
40-44	3,611,101,723	3,575,822,138	869,734,806	2,706,087,331	35,279,586	31,425,719	3,853,867
45-49	3,992,133,822	3,937,381,768	958,114,822	2,979,266,945	54,752,054	48,447,707	6,304,347
50-54	3,708,780,866	3,639,395,464	1,024,939,299	2,614,456,165	69,385,401	61,502,921	7,882,481
55-59	4,489,960,978	4,392,762,158	1,187,489,934	3,205,272,224	97,198,820	81,863,369	15,335,451
60-64	5,305,826,609	5,163,699,774	1,430,387,420	3,733,312,353	142,126,835	115,141,955	26,984,880
65-69	4,767,967,849	4,598,158,773	1,442,073,205	3,156,085,568	169,809,076	136,080,488	33,728,588
70-74	5,670,716,985	5,386,126,091	1,866,196,753	3,519,929,338	284,590,895	221,308,257	63,282,637
75-79	5,873,517,232	5,464,015,245	2,009,016,183	3,454,999,063	409,501,986	304,262,779	105,239,207
80+	8,088,898,731	7,033,943,613	2,744,228,397	4,289,715,217	1,054,955,118	706,846,168	348,108,949

Source: own elaboration on the basis of Tables 6 to 8, MoHSP. Spanish System of Health Accounts (2008), Institute of Health Information (MoHSP). Administrative Records of the National Information System on Hospital Discharges and Diagnosis-Related Group (DRG) (2008).

Table 11
PUBLIC EXPENDITURE ON HEALTH ACCORDING TO HEALTHCARE UTILIZATION AND SURVIVAL STATUS (MALES)

Males	Total	Survivors			Decedents		
		Total	Inpatients	Not inpatients	Total	Inpatients	Not inpatients
Total	29,316,917,423	27,849,371,514	9,303,373,565	18,545,997,950	1,467,545,909	1,085,529,997	382,015,911
0-4	1,831,507,833	1,817,123,369	510,988,734	1,306,134,636	14,384,464	13,139,098	1,245,366
5-9	777,264,072	775,937,996	119,650,565	656,287,431	1,326,076	1,249,772	76,303
10-14	700,427,517	699,048,492	113,450,460	585,598,032	1,379,025	1,292,795	86,229
15-19	611,867,868	608,122,629	163,708,644	444,413,985	3,745,239	3,531,573	213,666
20-24	751,287,188	747,453,054	194,820,221	552,632,833	3,834,134	3,505,388	328,746
25-29	1,233,991,181	1,227,538,980	251,262,315	976,276,665	6,452,201	5,858,458	593,744
30-34	1,160,464,368	1,152,986,145	307,740,150	845,245,995	7,478,223	6,833,727	644,496
35-39	1,447,784,776	1,434,617,724	362,959,935	1,071,657,789	13,167,052	11,830,369	1,336,683
40-44	1,651,696,527	1,628,137,201	445,389,986	1,182,747,215	23,559,326	21,156,684	2,402,642
45-49	1,722,114,308	1,685,483,876	524,641,602	1,160,842,273	36,630,432	32,970,095	3,660,338
50-54	1,526,459,691	1,479,626,714	588,295,704	891,331,009	46,832,977	42,373,106	4,459,871
55-59	2,156,365,858	2,088,898,246	718,404,875	1,370,493,371	67,467,612	57,060,165	10,407,448
60-64	2,683,979,372	2,582,460,669	869,312,774	1,713,147,895	101,518,703	82,326,332	19,192,371
65-69	2,338,150,240	2,219,077,658	861,474,485	1,357,603,172	119,072,582	95,948,729	23,123,853
70-74	2,706,453,838	2,516,184,927	1,062,391,466	1,453,793,461	190,268,910	148,288,211	41,980,699
75-79	2,702,841,535	2,443,522,542	1,069,554,885	1,373,967,657	259,318,992	191,698,960	67,620,032
80+	3,314,261,251	2,743,151,292	1,139,326,762	1,603,824,530	571,109,959	366,466,536	204,643,423

Source: own elaboration on the basis of Tables 6 to 8, MoHSP. Spanish System of Health Accounts (2008), Institute of Health Information (MoHSP). Administrative Records of the National Information System on Hospital Discharges and Diagnosis-Related Group (DRG) (2008).

Table 12

PUBLIC EXPENDITURE ON HEALTH ACCORDING TO HEALTHCARE UTILIZATION AND SURVIVAL STATUS (FEMALES)

Females	Total	Survivors			Decedents		
		Total	Inpatients	Not inpatients	Total	Inpatients	Not inpatients
Total	35,782,432,577	34,846,925,489	8,903,226,489	25,943,699,000	935,507,089	699,109,949	236,397,140
0-4	1,635,837,293	1,623,933,205	407,517,984	1,216,415,221	11,904,087	10,940,196	963,892
5-9	733,637,576	732,785,720	84,013,926	648,771,794	851,856	797,794	54,062
10-14	647,744,508	646,743,409	85,267,937	561,475,472	1,001,099	943,623	57,476
15-19	747,505,899	745,684,905	152,125,522	593,559,383	1,820,994	1,708,034	112,960
20-24	1,244,004,223	1,242,145,475	271,734,682	970,410,793	1,858,748	1,659,638	199,110
25-29	1,762,324,091	1,759,512,636	466,094,017	1,293,418,619	2,811,455	2,518,685	292,769
30-34	2,199,339,613	2,194,119,980	650,811,948	1,543,308,032	5,219,633	4,680,584	539,049
35-39	2,105,457,200	2,097,238,260	532,272,192	1,564,966,068	8,218,940	7,270,848	948,092
40-44	1,959,405,196	1,947,684,936	424,344,820	1,523,340,116	11,720,260	10,269,035	1,451,225
45-49	2,270,019,514	2,251,897,892	433,473,220	1,818,424,672	18,121,621	15,477,612	2,644,009
50-54	2,182,321,175	2,159,768,750	436,643,594	1,723,125,156	22,552,424	19,129,814	3,422,610
55-59	2,333,595,119	2,303,863,912	469,085,059	1,834,778,852	29,731,208	24,803,204	4,928,003
60-64	2,621,847,237	2,581,239,105	561,074,646	2,020,164,458	40,608,133	32,815,623	7,792,509
65-69	2,429,817,609	2,379,081,116	580,598,720	1,798,482,396	50,736,494	40,131,759	10,604,735
70-74	2,964,263,148	2,869,941,163	803,805,287	2,066,135,876	94,321,984	73,020,046	21,301,938
75-79	3,170,675,697	3,020,492,703	939,461,298	2,081,031,405	150,182,994	112,563,819	37,619,175
80+	4,774,637,480	4,290,792,321	1,604,901,635	2,685,890,687	483,845,159	340,379,633	143,465,526

Source: own elaboration on the basis of Tables 6 to 8, MoHSP. Spanish System of Health Accounts (2008), Institute of Health Information (MoHSP). Administrative Records of the National Information System on Hospital Discharges and Diagnosis-Related Group (DRG) (2008).

Table 13

***PER CAPITA* EXPENDITURE ON HEALTH IN 2008 ACCORDING TO THE SURVIVAL STATUS (TOTAL POPULATION)**

	All inhabitants	Survivors	Decedents
Total	1,438	1,394	7,475
0-4	1,466	1,456	12,711
5-9	696	695	10,010
10-14	647	646	9,108
15-19	595	593	7,175
20-24	716	715	5,057
25-29	821	819	6,001
30-34	832	829	5,581
35-39	929	924	5,977
40-44	1,000	992	6,529
45-49	1,216	1,202	7,260
50-54	1,313	1,293	7,089
55-59	1,780	1,750	7,623
60-64	2,289	2,244	8,368
65-69	2,512	2,449	8,139
70-74	3,019	2,921	8,295
75-79	3,535	3,390	8,172
80+	3,885	3,644	6,947

Source: own elaboration on the basis of Tables 6 and 9.

Table 14

***PER CAPITA* EXPENDITURE ON HEALTH IN 2008 ACCORDING TO THE SURVIVAL STATUS (MALES)**

	All inhabitants	Survivors	Decedents
Total	1,311	1,257	7,289
0-4	1,505	1,495	12,409
5-9	697	696	10,229
10-14	655	654	8,756
15-19	521	518	6,635
20-24	528	525	4,529
25-29	656	653	5,642
30-34	554	551	4,683
35-39	735	729	5,364
40-44	903	892	6,352
45-49	1,049	1,030	7,098
50-54	1,092	1,064	6,732
55-59	1,748	1,707	7,258
60-64	2,405	2,340	8,211
65-69	2,614	2,523	7,949
70-74	3,193	3,054	7,998
75-79	3,824	3,627	7,822
80+	4,471	4,173	6,808

Source: own elaboration on the basis of Tables 7 and 9.

Table 15

***PER CAPITA* EXPENDITURE ON HEALTH IN 2008 ACCORDING TO THE SURVIVAL STATUS (FEMALES)**

	All inhabitants	Survivors	Decedents
Total	1,561	1,528	7,789
0-4	1,425	1,416	13,096
5-9	695	694	9,687
10-14	639	638	9,643
15-19	673	672	8,618
20-24	914	913	6,656
25-29	997	995	7,027
30-34	1,132	1,130	7,694
35-39	1,135	1,131	7,315
40-44	1,101	1,095	6,917
45-49	1,384	1,375	7,610
50-54	1,529	1,516	7,969
55-59	1,809	1,791	8,606
60-64	2,181	2,155	8,791
65-69	2,421	2,384	8,624
70-74	2,875	2,813	8,966
75-79	3,320	3,220	8,857
80+	3,561	3,371	7,117

Source: own elaboration on the basis of Tables 8 and 9.

SCENARIOS

Table 16
DESCRIPTION OF SCENARIOS

Scenario # 1: EoM(GDPpc)
Expansion of morbidity with no cost of death hypothesis *Per capita* health expenditure evolving as GDP *per capita*.
Scenario # 2: DE(GDPpc)
Dynamic Equilibrium with no cost of death hypothesis *Per capita* health expenditure evolving as GDP *per capita*.
Scenario # 3: CoM(GDPpc)
Compression of morbidity with no cost of death hypothesis. *Per capita* health expenditure evolving as GDP *per capita*.
Scenario # 4: EoM&CoD(GDPpc)
Expansion of morbidity with cost of death hypothesis. *Per capita* health expenditure evolving as GDP *per capita*; cost ratio decedents/survivors constant over time.
Scenario # 5: DE&CoD(GDPpc)
Dynamic Equilibrium with cost of death hypothesis. *Per capita* health expenditure evolving as GDP *per capita*; cost ratio decedents/survivors constant over time.
Scenario # 6: CoM&CoD(GDPpc)
Compresion of morbidity with cost of death hypothesis. *Per capita* health expenditure evolving as GDP *per capita*; cost ratio decedents/survivors constant over time.
Scenario # 7: EoM(GDPpc)e
Expansion of morbidity with no cost of death hypothesis. *Per capita* health expenditure evolving as GDP *per capita* with changes in income elasticity for healthcare demand.
Scenario # 8: DE(GDPpc)e
Dynamic Equilibrium with no cost of death hypothesis. *Per capita* health expenditure evolving as GDP *per capita* with changes in income elasticity for healthcare demand.
Scenario # 9: CoM(GDPpc)e
Compression of morbidity with no cost of death hypothesis. *Per capita* health expenditure evolving as GDP *per capita* with changes in income elasticity for healthcare demand.
Scenario # 10: EoM&CoD(GDPpc)e
Expansion of morbidity with cost of death hypothesis. *Per capita* health expenditure evolving as GDP *per capita* with changes in income elasticity for healthcare demand; cost ratio decedents/survivors constant over time.
Scenario # 11: DE&CoD(GDPpc)e
Dynamic Equilibrium with cost of death hypothesis. *Per capita* health expenditure evolving as GDP *per capita* with changes in income elasticity for healthcare demand; cost ratio decedents/survivors constant over time.
Scenario # 12: CoM&CoD(GDPpc)e
Compression of morbidity with cost of death hypothesis. *Per capita* health expenditure evolving as GDP *per capita* with changes in income elasticity for healthcare demand; cost ratio decedents/survivors constant over time.
Scenario # 13: EoM(GDPpw)
Expansion of morbidity with no cost of death hypothesis. *Per capita* health expenditure evolving as GDP per worker.

(*Keep.*)

(*Continuation*.)

Scenario # 14: DE(GDPpw)
Dynamic Equilibrium with no cost of death hypothesis. *Per capita* health expenditure evolving as GDP per worker.
Scenario # 15: CoM(GDPpw)
Compression of morbidity with no cost of death hypothesis. *Per capita* health expenditure evolving as GDP per worker.
Scenario # 16: EoM&CoD(GDPpw)
Expansion of morbidity with cost of death hypothesis. *Per capita* health expenditure evolving as GDP per worker; cost ratio decedents/survivors constant over time.
Scenario # 17: DE&CoD(GDPpw)
Dynamic Equilibrium with cost of death hypothesis. *Per capita* health expenditure evolving as GDP per worker; cost ratio decedents/survivors constant over time.
Scenario # 18: CoM&CoD(GDPpw)
Compression of morbidity with cost of death hypothesis. *Per capita* health expenditure evolving as GDP per worker; cost ratio decedents/survivors constant over time.

EQUATIONS

Scenario # 1. EoM(GDPpc): $\tilde{c}_{igt} = c_{ig2008}$; unit cost evolves as GDP per capita (Ypc); cost of death is ignored. This scenario isolates the pure demographic or pure ageing effect: it measures the impact of changes in volume and structure of population, keeping the remaining factors constant.

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g c_{ig2008} \cdot \frac{Ypc_t}{Ypc_{2008}} \cdot P_{igt}$$

P_{igt} = population in each ig group in year t.

Scenario # 2. DE(GDPpc): healthy life expectancy grows at the same rate as total life expectancy; unit cost evolves as GDP per capita; cost of death is ignored.

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \tilde{c}_{igt} \cdot \frac{Ypc_t}{Ypc_{2008}} \cdot P_{igt}\text{, where:}$$

$$\tilde{c}_{igt} = c_{(i-\Delta e_{igt})g2008} \quad \text{for} \quad i \geq 35$$

$$\Delta e_{igt} = e_{igt} - e_{ig2008}$$

e_{igt} : life expectancy at age i for sex g in year t.

Scenario # 3. CoM(GDPpc): healthy life expectancy grows at a higher rate than total life expectancy; unit cost evolves as GDP per capita; cost of death is ignored.

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \tilde{c}_{igt} \cdot \frac{Ypc_t}{Ypc_{2008}} \cdot P_{igt}\text{, where:}$$

$$\tilde{c}_{igt} = c_{(i-2\Delta e_{igt})g2008} \quad \text{for} \quad i \geq 35$$

Scenario # 4. EoM&CoD(GDPpc): $\tilde{c}_{iglt} = c_{igl2008}$; unit cost evolves as GDP per capita; cost of death is included (the cost ratio decedents/survivors remains constant over time).

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \sum_l c_{igl2008} \cdot \frac{Ypc_t}{Ypc_{2008}} \cdot P_{iglt}$$

$$c_{igdt} = c_{igd2008}$$
$$c_{igst} = c_{igs2008}$$
where d=decedents; s=survivors.

Scenario # 5. DE&CoD(GDPpc): healthy life expectancy grows at the same rate as total life expectancy; unit cost evolves as GDP per capita; cost of death is included (the cost ratio decedents/survivors remains constant over time).

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \sum_l \tilde{c}_{iglt} \cdot \frac{Ypc_t}{Ypc_{2008}} \cdot P_{iglt}$$

$$\tilde{c}_{igst} = c_{(i-\Delta e_{igt})gs2008} \quad \text{for} \quad i \geq 35$$ where s=survivors.

$$\tilde{c}_{igdt} = \frac{c_{igd2008}}{c_{igs2008}} \cdot \tilde{c}_{igst}$$ where d=decedents.

Scenario # 6. CoM&CoD(GDPpc): healthy life expectancy grows at a higher rate than total life expectancy, unit cost evolves as GDP per capita; cost of death is included (the cost ratio decedents/survivors remains constant over time).

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \sum_l \tilde{c}_{iglt} \cdot \frac{Ypc_t}{Ypc_{2008}} \cdot P_{iglt}$$

$$\tilde{c}_{igst} = c_{(i-2\Delta e_{igt})gs2008} \quad \text{for} \quad i \geq 35$$ where s=survivors.

$$\tilde{c}_{igdt} = \frac{c_{igd2008}}{c_{igs2008}} \cdot \tilde{c}_{igst}$$ where d=decedents.

Scenario # 7. EoM(GDPpc)e: $\tilde{c}_{igt} = c_{ig2008}$; unit cost evolves according to GDPpc, but assuming that income elasticity for healthcare demand equals to 1.1 in the base year and converges in a linear manner to 1 by the end of projection horizon in 2060; cost of death is ignored.

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g c_{ig2008} \cdot \left[\frac{c_{t-1}}{c_{2008}} \left[1 + \varepsilon_t \left(\frac{Ypc_t}{Ypc_{t-1}} - 1 \right) \right] \right] \cdot P_{igt}, \ \forall t \geq 2009$$, where

$c_{2008} = 100$

c_t = average unit cost at 2008 prices

ε_t = income elasticity for healthcare demand in t

Scenario # 8. DE(GDPpc)e: healthy life expectancy grows at the same rate as total life expectancy; unit cost evolves according to GDPpc, but assuming that income elasticity for healthcare demand equals to 1.1 in the base year and converges in a linear manner to 1 by the end of projection horizon in 2060; cost of death is ignored.

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \tilde{c}_{igt} \cdot \left[\frac{c_{t-1}}{c_{2008}} \left[1 + \varepsilon_t \left(\frac{Ypc_t}{Ypc_{t-1}} - 1 \right) \right] \right] \cdot P_{igt}, \ \forall t \geq 2009$$

$$\tilde{c}_{igt} = c_{(i-\Delta e_{igt})g2008} \quad \text{for} \quad i \geq 35$$

Scenario # 9. CoM(GDPpc)e: healthy life expectancy grows at a higher rate than total life expectancy; unit cost evolves according to GDPpc, but assuming that income elasticity for healthcare demand equals to 1.1 in the base year and converges in a linear manner to 1 by the end of projection horizon in 2060; cost of death is ignored.

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \tilde{c}_{igt} \cdot \left[\frac{c_{t-1}}{c_{2008}} \left[1 + \varepsilon_t \left(\frac{Ypc_t}{Ypc_{t-1}} - 1 \right) \right] \right] \cdot P_{igt}, \ \forall t \geq 2009$$

$$\tilde{c}_{igt} = c_{(i-2\Delta e_{igt})g2008} \quad \text{for} \quad i \geq 35$$

Scenario # 10. EoM&CoD(GDPpc)e: $\tilde{c}_{iglt} = c_{igl2008}$; unit cost evolves according to GDPpc, but assuming that income elasticity for healthcare demand equals to 1.1 in the base year and converges in a linear manner to 1 by the end of projection horizon in 2060; cost of death is included (the cost ratio decedents/survivors remains constant over time).

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \sum_l c_{igl2008} \cdot \left[\frac{c_{t-1}}{c_{2008}} \left[1 + \varepsilon_t \left(\frac{Ypc_t}{Ypc_{t-1}} - 1 \right) \right] \right] \cdot P_{iglt}, \ \forall t \geq 2009$$

$$c_{igdt} = c_{igd2008}$$

$$c_{igst} = c_{igs2008}$$

Scenario # 11. DE&CoD(GDPpc)e: healthy life expectancy grows at the same rate as total life expectancy; unit cost evolves according to GDPpc, but assuming that income elasticity for healthcare demand equals to 1.1 in the base year and converges in a linear manner to 1 by the end of projection horizon in 2060; cost of death is included (the cost ratio decedents/survivors remains constant over time).

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \sum_l \tilde{c}_{iglt} \cdot \left[\frac{c_{t-1}}{c_{2008}} \left[1 + \varepsilon_t \left(\frac{Ypc_t}{Ypc_{t-1}} - 1 \right) \right] \right] \cdot P_{iglt}, \ \forall t \geq 2009$$

$$\tilde{c}_{igst} = c_{(i-\Delta e_{igt})gs2008} \quad \text{for} \quad i \geq 35$$

$$\tilde{c}_{igdt} = \frac{c_{igd2008}}{c_{igs2008}} \cdot \tilde{c}_{igst}$$

Scenario # 12. CoM&CoD(GDPpc)e: healthy life expectancy grows at a higher rate than total life expectancy; unit cost evolves according to GDPpc, but assuming that income elasticity for healthcare demand equals to 1.1 in the base year and converges in a linear manner to 1 by the end of projection horizon in 2060; cost of death is included (the cost ratio decedents/survivors remains constant over time).

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \sum_l \tilde{c}_{iglt} \cdot \left[\frac{c_{t-1}}{c_{2008}} \left[1 + \varepsilon_t \left(\frac{Ypc_t}{Ypc_{t-1}} - 1 \right) \right] \right] \cdot P_{iglt}, \ \forall t \geq 2009$$

$$\tilde{c}_{igst} = c_{(i-2\Delta e_{igt})gs2008} \quad \text{for} \quad i \geq 35$$

$$\tilde{c}_{igdt} = \frac{c_{igd2008}}{c_{igs2008}} \cdot \tilde{c}_{igst}$$

Scenario # 13. EoM(GDPpw): $\tilde{c}_{igt} = c_{ig2008}$; unit cost evolves as GDP per worker; cost of death is ignored.

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g c_{ig2008} \cdot \frac{Ypw_t}{Ypw_{2008}} \cdot P_{igt}$$

Scenario # 14. DE(GDPpw): healthy life expectancy grows at the same rate as total life expectancy; unit cost evolves as GDP per worker; cost of death is ignored.

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \tilde{c}_{igt} \cdot \frac{Ypw_t}{Ypw_{2008}} \cdot P_{igt} \text{, where:}$$

$$\tilde{c}_{igt} = c_{(i-\Delta e_{igt})g2008} \quad \text{for} \quad i \geq 35$$

Scenario # 15. CoM(GDPpw): healthy life expectancy grows at a higher rate than total life expectancy; unit cost evolves as GDP per worker; cost of death is ignored.

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \tilde{c}_{igt} \cdot \frac{Ypw_t}{Ypw_{2008}} \cdot P_{igt} \text{, where:}$$

$$\tilde{c}_{igt} = c_{(i-2\Delta e_{igt})g2008} \quad \text{for} \quad i \geq 35$$

Scenario # 16. EoM&CoD(GDPpw): $\tilde{c}_{iglt} = c_{igl2008}$; unit cost evolves as GDP per worker; cost of death is included (the cost ratio decedents/survivors remains constant over time).

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \sum_l c_{igl2008} \cdot \frac{Ypw_t}{Ypw_{2008}} \cdot P_{iglt}$$

$$c_{igdt} = c_{igd2008}$$

$$c_{igst} = c_{igs2008}$$

where d=decedents; s=survivors.

Scenario # 17. DE&CoD(GDPpw): healthy life expectancy grows at the same rate as total life expectancy; unit cost evolves as GDP per worker; cost of death is included (the cost ratio decedents/survivors remains constant over time).

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \sum_l \tilde{c}_{iglt} \cdot \frac{Ypw_t}{Ypw_{2008}} \cdot P_{iglt}$$

$$\tilde{c}_{igst} = c_{(i-\Delta e_{igt})gs2008} \quad \text{for} \quad i \geq 35$$ where s=survivors.

$$\tilde{c}_{igdt} = \frac{c_{igd2008}}{c_{igs2008}} \cdot \tilde{c}_{igst}$$ where d=decedents.

Scenario # 18. CoM&CoD(GDPpw): healthy life expectancy grows at a higher rate than total life expectancy; unit cost evolves as GDP per worker; cost of death is included (the cost ratio decedents/survivors remains constant over time).

Health expenditure projection formula:

$$HE_t = \sum_i \sum_g \sum_l \tilde{c}_{iglt} \cdot \frac{Ypw_t}{Ypw_{2008}} \cdot P_{iglt}$$

$$\tilde{c}_{igst} = c_{\left(i-2\Delta e_{igt}\right)gs2008} \quad \text{for} \quad i \geq 35 \qquad \text{where s=survivors.}$$

$$\tilde{c}_{igdt} = \frac{c_{igd2008}}{c_{igs2008}} \cdot \tilde{c}_{igst} \qquad \text{where d=decedents.}$$

DEMOGRAPHIC AND MACROECONOMIC SCENARIOS

The demographic and macroeconomic scenarios are taken from the AWG. They have been updated in 2010 for the period 2008-2060. The demographic projections correspond to those issued by the Spanish Office for National Statistics for 2009 to 2049, and have been extended to 2060 by the AWG. These projections provide the evolution of Spanish total population by sex and single ages. They also provide mortality projections; life expectancies have been calculated on the basis of mortality rates. Macroeconomic assumptions on GDP growth are aligned with the Stability Programme 2009-2013 for Spain. The AWG macroeconomic scenario only provides GDP at 2007 prices (in billion Euros). GDP at 2008 prices has been calculated by using a GDP price index of 1.024 for 2008, according to the Spanish National Accounts. We estimated GDP per capita and its rate of growth for the whole period. GDP per worker has been estimated by using the number of employees envisaged in the macroeconomic scenario.

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SUMMARY
MAIN IMPLICATION FOR POLICY MAKING

Our results further support the fact that the demographic effect is not the main driver of health expenditure, shifting the focus of concern to other factors. Changes in health status have a significant impact on healthcare expenditure, whose rate of growth could be slowed down by reductions in morbidity. In order to achieve an improvement in health status, other factors besides the delivery of health care should be taken into account, including social determinants of health. A cost-effective and equitable health policy design involves tackling social determinants of health and becoming aware of the impact derived from non-healthcare policies, which can help to prevent illness and to reduce the rate of growth of healthcare expenditure. At the present time, major reforms are being implemented in Spanish social policy. A wave of reforms is also needed to promote cost-effectiveness of National Health Service, with the aim of ensuring financial sustainability of health care system in the near future.

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