Società italiana di economia pubblica
XVII CONFERENZA

FINANZIAMENTO DEL SETTORE PUBBLICO

Pavia, Università, 15 - 16 settembre 2005

DEMOGRAPHIC FACTORS AND HEALTH EXPENDITURE PROFILES BY AGE: THE CASE OF ITALY

S. GABRIELE, C. CISLAGHI, F.COSTANTINI, F. INNOCENTI, V. LEPORE, M. RAITANO, F. TEDIOSI, M. VALERIO, C. ZOCCHETTI

pubblicazione internet realizzata con contributo della

COMPAGNIA di San Paolo

Demographic factors and health expenditure profiles by age: the case of Italy [*] [□]

S. Gabriele[˝], C. Cislaghi[°], F.Costantini[´], F. Innocenti[°], V. Lepore[´], M. Raitano[˝], F. Tediosi[˝], M. Valerio[´], C. Zocchetti[•]

"Die, my dear doctor! That's
the last thing I shall do!"
Lord Palmerstone, 1784-1865

1. Age and time to death: introductory remarks

The demographic projections for the next half century have given rise to concerns that ageing may jeopardize the financial balances of European welfare systems. However the impact of ageing on welfare spending is not homogeneous in all sectors. While pension expenditure is likely to grow according to the number of recipients, the effects of ageing on health spending are rather uncertain. As known, the link between ageing and health expenditure increase derives from the observation that the health consumption pattern by age displays a J-shaped curve. Apart from the relatively large cost related to childhood, per capita consumption continuously increases with age. From this it is easy to infer that, if the elderly cost more than young people on average, a larger share of old people will imply an increase in health expenditure.

The literature contains two main objections against this view. First, consideration must be made of possible changes in the health status of the population: specifically, increased life expectancy may be accompanied either by a general improvement in the health status of the elderly, or, on the contrary, by a higher morbidity rate and incidence of disability. The consequences on expenditure will differ greatly according to the health status achieved.

The second objection is that the pattern of health expenditure by age is considerably influenced by the concentration of consumption (and expenditure) in the last months of life (Lubitz and Riley,

[*] This paper has been produced as a deliverable for the ENEPRI AHEAD (Ageing, Health Status and Determinants of Health Expenditure) project partly financed by the European Commission (Work Package 7).

[□] We are grateful to Mario Morlacco and Ambrogio Aquilino (Agenzia Regionale Sanitaria della Puglia) and Felice Vitullo (Regione Abruzzo) for having made regional data, respectively on Apulia and Abruzzi, available to us.
We also thank Massimo Arcà (ASL Roma E), for his useful discussions with us, and Nerina Dirindin (University of Turin), who began this project with us, before being appointed Assessore dell'Igiene e Sanità e dell'Assistenza Sociale (Health and Social Welfare Regional Minister) in Sardinia.
We wish to thank Antonio D'Ettorre for providing the record linkage software used for Abruzzi and Apulia.
We are grateful to Giuseppina Marasca for her assistance with the editorial layout of the graphs and tables.
We alone are responsible for any remaining errors or omissions.

[˝] ISAE
[•] Regione Lombardia
[°] ARS Toscana
[´] Mario Negri Sud

1993; Zweifel, Felder and Meier, 1999). In other words, the greater expenditure on the elderly – given the higher mortality rate in older cohorts – is a consequence of the heavy weight of so-called 'death-costs' (at least in part). If we overlook this aspect, we risk committing a 'composition' error so that we envisage a misleading scenario of health expenditure increase. In fact, it is unlikely that death costs are increased by ageing: rather, they are only postponed, with a change in the health expenditure profile by age. Moreover, there is some evidence that health costs prior to death even decrease with age[1] (in part for ethical reasons like lower therapeutic obstinacy as far as old people are concerned[2]).

The aim of this paper is to study the second of the above objections in depth.[3] Its purpose is to understand the extent to which health expenditure by age is due to distance from birth, and the extent to which it is due to proximity to death.

One might wonder why the risks for the health system sustainability associated with ageing have been so greatly emphasized before any definite conclusions about ageing effects on health expenditure have been reached. According to Evans et al. (2003), it may be for political reasons: the claim that health expenditure will grow dramatically to meet increasing needs is a way to obtain more resources with which to enhance the incomes of health care providers. At the same time, ageing may be used as justification for past increases in spending. This may distract attention from the actual causes of expenditure growth, from considerations concerning the appropriateness or effectiveness of care provision, and from evaluation and accountability. Finally, the prediction that universalistic public health care systems will collapse strengthens the argument for a shift to a more mixed financing system, with a greater level of private payment. These and similar observations have prompted some experts to wonder whether the risk of huge health expenditure increases due to ageing is not a "red herring" (see Zweifel, Felder and Meiers, 1999, and the reply by Seshamani and Gray, 2004).

Vineis and Dirindin (2004) observe that there are two different and partially opposing concerns in regard to the sustainability of health expenditure systems. There are worries about the level of public finances required to meet increasing demand, and expectations of health sector growth on the supply side. Then the dilemma arises between good management – and appropriateness – and employment and sales maximisation. It is difficult to reconcile these views. Hence the suggestion to

[1] Lubitz et al, 1995; Felder, Meier and Schmitt, 2000.
[2] Busse et al. (2002); Brockmann, 2000.
[3] The AHEAD project examines whether, and to what extent, ageing will produce pressure on health expenditure. It analyses both arguments against expenditure growth predictions grounded on a projection of a static health expenditure profile by age (based on demographic forecasts). As for the first , the working packages I, III and IV study some aspects of health status by age - specifically the rates of transition between good and poor health or vice versa.

change the public and private mix in financing and/or enlargement of the private insurances market.[4]

These various considerations highlight the complexity of health expenditure predictions and suggest the relevance of the political issues that lie behind certain technical aspects.

Thorough examination should be made of these matters in order to obtain better understanding of the actual impact of ageing on health expenditure growth. For the reasons just given, the study of health costs prior to death may also help policy making intended to curb expenditure and foster the efficiency of health systems.

As said, the primary objective of this paper is to provide estimates of health care expenditure by 'distance from birth' (i.e. age) and by 'distance from death' (i.e. the health expenditure incurred in the last period of life) in different parts of Italy. Specifically, we want to distinguish between 'old age costs' – health care expenditure due to the ageing of the population – and 'death costs' – health care expenditure due to the event of dying. Using the methodology proposed by Bartolacci et al. (2002), we estimate hospital costs prior to death in four Regions (Tuscany, Lombardy, Abruzzi and Apulia).

The results are then compared with previous estimates of health care expenditure by age and prior to death available for Italy: namely the above-cited study carried out in Tuscany, and a more recent survey of another Italian Region, Emilia Romagna (Taroni 2004). We compare the results with those of some other OECD countries as well.

The next section outlines the main features of the international literature on death costs. Section 3 describes the methods and data used. The following section sets out the results for the Regions analysed. The conclusions focus on the most interesting implications of this study and indicate the next steps in the research.

2. A survey of the empirical literature on death costs

In the present section we survey the empirical health economics literature, presenting the main results obtained by studies on the interaction among age, proximity to death, and health care expenditure. It should be pointed out that empirical studies have focused mainly on health care costs; only a few of them have examined long-term care as well. These studies have used different methodologies, and they can be classified into the following three groups :

1) descriptive studies, which evaluate the evolution of death costs by age of death, and the ratio, at each age, between the health care expenditures of decedents and survivors.

[4] However, also private insurance schemes must curb increasing costs. Moreover, most of them, stipulated within national or company-level agreements, mainly affect labour costs. We would add that enlargement of the private financing of health care – whether or not through private insurance schemes – may exacerbate inequalities.

2) econometric studies, which estimate whether age and distance from death are significant drivers of health care costs.

3) projection studies, which seek to calculate the difference between health care costs projections which include or otherwise the death costs assumption.

Descriptive studies

Numerous empirical studies have shown that the bulk of individual lifetime health care expenditure is concentrated in the last years - or months - of life quite independently of the age at which death occurs. Since the seminal paper by Lubitz and Riley (1993), all studies conducted in a variety of countries have confirmed this finding, and they have shown that the ratio between the costs incurred by decedents and survivors is very high and tends to decrease with age.

Descriptive studies usually analyze the per capita costs in the last period of life and their link with patient age, and they calculate the ratio between decedent and survivor costs by age (Box 1). All studies show a rapidly decreasing trend in the ratio by age. Most of the studies listed in Box 1 define individuals who do not survive in a given year as decedents (see Ahn et al., Cislaghi et al., Lubitz et al., Calfo et al., McGrail et al.), while others (Caisse National and Gray et al.) decompose the population by years of distance from death (suggesting that the impact of death on health costs is not restricted to the last year of life). In the latter case the ratio is between the costs of individuals with different numbers of years remaining.

Box 1: Decedent/survivor expenditure ratios for the elderly in some studies

Authors	Ahn et al. (2005)	Caisse National (2003)	Cislaghi et al. (2003)	Lubitz et al. (1995)	Calfo et al. (2003)	Gray et al. (2004 a)	McGrail et al. (2000)	McGrail et al. (2000)	Busse et al. (2002)
Country	Spain	France (1)	Italy	Usa	Usa	UK (2)	Canada (3)	Canada (4)	Germany
60-64	15.8	*45-54* 8.5	15.8		8.2				
65-69	11.9	*55-64* 3.3	10.0	10.6	12.1	14.6	*65* 17.9	*65* 11.9	*65-74* 2.2
70-74	9.4	*65-74* 2.6	7.2	8.6	9.2	17.9	*75* 10.4	*75* 6.0	
75-79	7.4	*75-84* 2.8	4.9	6.8	7.1	20.5	*85* 6.2	*85* 2.7	*75-84* 1.6
80-84	6.3		3.2	5.3	5.5	21.9	*93* 4.7	*93* 1.9	
>85	5.0	1.8	1.9	4.4	4.4	22			*>85* 1.3
All ages	24.1		11.5	*>65* 6.9	*>65* 6.8				

(1)Proportion of costs borne by a person dying in the same year to those of a person dying in four years' time. (2) Ratio between males 1 year from death and males 10 years from death. (3) Acute care costs. (4) Nursing care costs. (5) Quantity data.

Ratio observation shows clearly that both age and distance from death influence health care costs. The impact on spending of both variables can be analysed by observing the absolute values of costs in the last years of life and in years far from death. In other words, the intention is to determine

whether the age-decreasing profile is due more to a reduction in the numerator or to an increase in the denominator.

On observing studies which compare the costs incurred by individuals who die or do not die in a given year at different ages (see Cislaghi et al., 2002, and Riedel et al., 2002), one finds that death costs decrease by age more rapidly than survivor costs increase by age. This suggests that, because ageing postpones the onset of the more expensive terminal costs, it may reduce the pressure on health care spending.

Also studies which decompose populations by distance from death confirm that costs increase steadily in the last year of life, although the increase is substantial (independently of age) in the previous years as well (see Miller, 2001, Seshamani and Gray, 2004 a, Batljan and Lagergren, 2004). This finding suggests that death has a more profound impact on health care expenditure than that observed if only the last year of life is considered.

The age-decreasing pattern of terminal life costs may depend on various factors: different diseases afflicting young and old decedents, different hospitalisation rates by age group, more aggressiveness care given to the young compared to the old, 'care rationing' in regard to the elderly (the behaviour of doctors changes when they deal with patients of different ages), and substitution between health and long-term care for the oldest old. Descriptive analysis does not allow a causal inference to be drawn as to which factor most significantly influences this pattern.

However, it should be noted that long-term care costs in the last year of life seem to increase with age (see Hoover et al.et al., 2002, and McGrail et al.et al., 2000), so that the age-decreasing pattern of health care death costs may be partially offset by the age-increasing profile of long-term care death costs.

Econometric studies

The studies presented above are mainly descriptive; they do not infer a causal link between age, proximity to death, and health spending. This link can only be shown by econometric studies.

Zweifel, Felder, Meiers (1999) analyzed the importance of the death costs component using an econometric methodology. Since their seminal paper, other studies have applied econometric methodology to study the relationship among health care expenditure, age, and years of distance from death (see Box 2).

Zweifel et al. (1999) find that distance from death has an highly significant effect on hospital costs, while age is not significant at all. Zweifel et al. thus proved that, given the large difference in health care costs between survivors and decedents, the positive relationship between age and health care

spending depends on a spurious correlation between these two variables induced by the higher mortality rates (and then by the onset of death costs) in the old age groups.

Box 2: Econometric analysis of the interaction among age, proximity to death, and health care expenditure

Authors	Publication year	Country studied	Estimation method	Results
Zweifel, Felder, Werblow	2004	Switzerland	2 part model	Only proximity to death is significant.
Felder, Meiers, Schmitt	2000	Switzerland	2 part model	HCE increase with proximity to death. HCE in last months of life decrease with age
Zweifel, Felder, Meiers	1999	Switzerland	Heckman model	Only proximity to death is significant.
Gray, Seshamani	2004 a	England	2 part model with panel data	Age and proximity to death have significant effects.
Gray, Seshamani	2004 b	England	2 part model	Age and proximity to death have significant effects.
O' Neill et al.	2000	England	OLS	Only proximity to death is significant.
Brockmann	2000	Germany	OLS	Proximity to death is significant. Negative interactions between age and disease specific costs.

Intense debate ensued from this seminal paper:[5] some authors argued that issues of econometric methodology limited the robustness of Zweifel et al.'s results; others repeated their analysis with new datasets.

Mainly Seshamani and Gray (2004 a,b) criticised Zweifel et al.'s approach as not genuinely longitudinal, and used a panel data approach in truly longitudinal fashion in their own studies. They find that both variables (age and proximity to death) are significant, although their study confirms that the latter is the main driver of hospital costs. In particular distance from death is highly significant until 15 years from death. Then the results of Seshamani and Gray (2004a, b) clearly confirm the need to incorporate the death-costs component in projections of health care expenditure. However, in partial contradiction of Zweifel et al. (1999), they find that age is not neutral but has a significant impact on hospital costs.

Moreover, when focusing on the relationship between age and costs in the last period of life, Seshamani and Gray show that the link between age and death costs is not monotonic: death costs increase with age from 65 to 80 and then decrease, mainly because, after the age of 80, the likelihood of being hospitalized diminishes. Zweifel et al. (1999) instead show an age neutrality on costs also in the terminal phase of life, whereas most empirical studies suggest that such costs have an age-decreasing profile. It should be noted, however, that more robust econometric papers by

[5] See Gray, Seshamani (2004a and b), O' Neill et al.et al. (2004), Zweifel, Felder, Werblow (2004). For a technical analysis of the econometric problems raised by Zweifel et al.et al. (1999), see Salas, Raftery (2001).

Felder, Meiers, Schmitt (2000) and Zweifel, Felder, Werblow (2004) have confirmed that age is not a significant driver of survivors cost, instead showing an age-decreasing pattern of death costs.

Interesting results have been obtained by Brockmann (2000). Her study confirms that proximity to death is the main driver of the hospital component of health care costs, and also finds a negative relationship between last-year-of-life costs and age. This negative relationship may depend on various factors: different (and less expensive) diseases suffered by the oldest old; different hospitalization rates by age (because the elderly prefer long-term care to hospital care); and an 'age rationing' of hospital care (i.e. doctors prefer to devote scarce resources to the young, whose life value is higher, or apply less intensive medical treatments to the elderly). Brockmann (2000) confirms the hypothesis of age rationing by finding a negative relationship even in a multivariate econometric analysis which controls for the type of disease. In other terms, in their last year of life, oldest old patients receive less costly treatment than younger patients for the same illness.

Given this result, the consequences of ageing may be even less severe than is commonly assumed. If ageing postpones the onset of death-related costs at higher ages, and if such costs decrease with age, increased life expectancy may reduce the death costs component.

Projection studies

The standard methodology used to project the impact of ageing on health care spending combines a static age-related per capita expenditure profile (the so-called 'J curve', derived in one instant of time) with demographic projections of the future size of each age group. In that it is based on a constant age-related expenditure profile, this methodology does not take account of possible health status improvement, the impact of death-related costs, and the effects of non-demographic drivers of health care spending (i.e. technical progress, GDP growth rate and inflation in the health sector, especially for drugs).

A static link between age and individual health care costs implies that death costs do not matter and that, even if life expectancy increases, the care needs of each individual do not change. Here we focuse on the methodology used to project spending with account taken of the death costs effect, and on the results of the main projection studies which analyze that effect (summarized in Box 3).

Given that the bulk of individual lifetime health care costs are concentrated at the end of the life, and given that mortality is higher in the older age groups, excluding the relevance of death costs generates, owing to the decrease in mortality rates, an upward bias in the average per capita expenditure attributed to these groups. Consequently, when projections are run using a static age-related expenditure profile, and when life expectancy is supposed to increase, this bias leads to overestimation of future aggregate health care spending.

Box 3: Projections studies of the health care costs (HCE) including the impact of death costs.

Authors	Publication year	Country studied	Main results
Breyer, Felder	2004	Germany	Per capita HCE increases in the period 2005-2050 from 2,596 euro to 3,217 with a standard projection, to 2,959 with a death-costs-including projection.
Schulz, Leidl	2004	Germany	Projections for quantity. The number of hospital days increases from 172 million in 1998 to, in 2050, 231 million with a standard projection, and 212 million with a death-costs-including projection.
Miller	2001	USA (Medicare)	Standard projection results are 14% higher than those including the death costs assumption.
Stearns, Norton	2004	USA (Medicare)	Standard projection results are 15% higher than those including the death costs assumption.
Serup Hansen et al.	2001	Denmark	In the period 2005-2020 HCE will increase by 18.5% with a standard projection, and by 15.1% with a death- costs-including projection.
Riedel et al.	2002	Austria	Starting from 2.9% of GDP in 2000, in 2050 hospital costs will be 3.79% in the baseline scenario and 3.60% or 3.44% (depending on the assumptions made) if death costs are included.
Madsen	2004	Denmark	If death costs are included, projected spending will be 0.75 percentage points lower than shown by a standard projection.
Seshamani	2004	UK	Incorporating death costs halves the projected annual growth rate of national hospital expenditure (yearly from 0.85% to 0.42%).
Polder, Achterberg	2004	Netherlands	With a standard projection, the annual growth rate of HCE is 0.6% in 2002-2010 and 0.7% in 2010-2020, while it is respectively 0.02 and 0.04 percentage points lower on assuming the impact of death costs.
EPC	2001	Netherlands	Very significant overestimation with the baseline scenario with respect to the death costs scenario (in 2050 the increase will be 0.4 percentage points lower, i.e. from 4.7% in 2000 to 5.2% or 5.6% in 2050).
EPC	2001	Sweden	Significant overestimation with the baseline scenario with respect to the death costs scenario (in 2050 the increase will be 0.3 percentage points lower, i.e. from 6.0% in 2000 to 6.7% or 7.0% in 2050).
EPC	2001	Italy	Significant overestimation with the baseline scenario with respect to the death costs scenario (in 2050 the increase will be 0.3 percentage points lower, i.e. from 4.9% in 2000 to 6.2% or 6.5% in 2050).

N.B. These projections analyze only health care costs, not long-term care costs as well.

Projections which include the death-related costs component require micro-data which disentangle individual costs per age and years of remaining life, and these data (even if based on a sample) are not always available. Moreover, when such data are available, individuals are often not classified by number of remaining years, but only by their status in a given year, so that those who die in one year are defined as decedents, whereas those who survive in that year are defined as survivors. But econometric analyses (see Seshamani-Gray, 2004a) show that the impact of distance from death is significant for many years of remaining life. A distinction by survivor status based on only one year may therefore underestimate the projected impact of the death-costs component on health care expenditure (HCE).

The various projection methods applied and the data available may explain the different results obtained by the studies set out in Box 3, even though they all report that excluding death costs leads to overestimation of health care spending.

A limited expenditure savings is obtained when account is taken of death costs for Denmark, by Serup Hansen et al. (2001), for Netherlands by Polder, Achterberg (2004) and for USA by Miller (2001) and Stearns, Norton (2004).

However, limited health care expenditure savings in death-costs-including projections does not imply that these costs have scant effect. Rather, they can be explained by the huge increase in the share of survivors in old age groups. Although, at the individual level, proximity to death is the main driver of health spending (as proved by econometric analysis), in the aggregate, ageing may induce an increase in spending. If per capita survivor costs are age-increasing, given that the share of survivors in the population is much greater than the share of decedents, because longer life expectancy increases the share of old survivors, it may induce an aggregate expenditure growth that cannot be offset by including death costs in projections.

Nevertheless, other studies in Box 3 report that incorporating the death costs component into health care projections has a relatively significant effect (see also Riedel et al., 2002, Madsen, 2004, and Seshamani, 2004, EPC, 2001).

However, in EPC (2001) were used different methodologies Whereas forecasts for Italy and Netherlands were based on a splitting of costs between those surviving for a certain period (1 year) and those dying in that period (for each age class individuals were divided into two groups, survivors and decedents), the projections for Sweden were based on a more detailed breakdown of the population by years of remaining life.

Essentially, as said, there are two main methodologies with which to include death costs in health care projections and to extend the standard approach, where the population is decomposed only by age and gender and the derived age-profile is linked to demographic forecasts. The first is based on decomposition of the population in each cohort into only two groups – survivors or otherwise in a certain period (usually one year) – to which different costs profiles are applied. The second methodology, which requires more specific data, decomposes the population into numerous groups according to years of distance from death, without restricting the effect of death costs to an arbitrarily chosen number of years before death (i.e. one year). The first methodology has an arbitrary element because it is obliged to assume a specific period of time (i.e. one year) in order to classify individuals as decedents or survivors, while the second approach does not suffer from this limitation but requires much more detailed data.

Nevertheless also projection studies confirm that age alone is not a good basis for prediction of the effects of ageing on health care spending. In all the studies surveyed, projections which include time to death yield lower expenditure increases than standard ones, but this does not offset the impact of ageing.

3. Methods and data

As described above, the decentralization of the Italian NHS increased the historical differences among regional health systems, with Regions developing their own health care models. It also caused a split in the information set which is not easy to overcome. There is a lack of good quality data at national level, although at regional level they are of better quality – in a number of Regions at least for hospital care.

For the purpose of this study a network of research Institutes (ISAE and Mario Negri Sud) and Regions (ARS-Agenzia Regionale di Sanità Toscana, Regione Lombardia) was established in order to pool information and discuss the comparability of data. It was thus possible to gain information about four regions, one located in Northern Italy (Lombardy), one in Central Italy (Tuscany), and two in the South (Abruzzi and Apulia).[6] We can therefore check whether the regional differences between the Italian macro-areas (both the well-being and the health services gap) affect the results.

Methods

The analysis reported in this paper used a two-step method.

First, databases of information on health care consumption at individual level were assembled. These databases – which contained demographic information on patients – were used to compute health expenditure according to age[7] and gender, and health expenditure prior to death (i.e. in the last 12 months) by age and gender. For this purpose, the available administrative databases on health care consumption were linked – by means of a record linkage procedure using fiscal numbers as subject identifiers – to the death abstracts databases. In some cases (Abruzzi and Apulia) a clustering linkage procedure was adopted which used both the fiscal code and other variables (name, surname, data of birth and sex)[8].

To compute health care expenditure in the last year prior to death, the subjects were distinguished into 'cases' (deceased) and 'controls'(survivors), and some services were excluded from the analysis. See the following scheme (as regards hospital care costs):

'Cases': subjects deceased in year 2000.

Those subjects:

- ✓ deceased in 2000 and admitted to hospital in 2000;

[6] Note that the population of the four regions is just under 35% of the national total.

[7] Age was calculated as the difference in years between birth and first admission. This means that there is not full coherence with the age of people never admitted to hospital, which was calculated at death or at the end of the year.

[8] The cluster linkage procedure is due to Antonio D'Ettorre, Mario Negri Sud.

- ✓ deceased in 2000 and admitted to hospital in 1999 within 12 months of dying;
- ✓ deceased in 2000 and never admitted to hospital in the last 12 months of life.

'Controls': Subjects alive on 1.1.2001 and surviving for at least 12 months after hospital admission. These include subjects:

- ✓ admitted in 2000 and in 1999 - only admissions in 2000 are included;
- ✓ admitted between 1999 and 2000 or between 2000 and 2001 - only considered are days of stay in 2000;
- ✓ deceased in 2001 and admitted in 2000 only for the days of stay prior to the 12 months from death;
- ✓ never admitted and alive on 1.1.2001.

Hospital admissions in the last year of life of subjects deceased in 2001 were excluded. This meant the exclusion of subjects admitted in 2000 within 12 months before death and deceased in 2001.
The total number of survivors was calculated as the average number of survivors in 2000 (resident on 1 January 2000 plus residents on 1 January 2001 multiplied by 0.5) minus half the number of deceased in 2000 minus half the number of deceased in 2001.

Data

The administrative databases of health care consumption at individual level in Italy are available on hospital care and (only in some regions) on outpatient specialist care, re-habilitation services either in outpatient departments or at home, nursing homes, and pharmaceutical care. These databases contain information on patient characteristics, types of health services received (the procedures and therapies charged to the Regional Health Service), and health service tariffs.
Given the differing availability of data and their varying quality, it was possible to work with data of some Regions for hospital care and to carry out only rather preliminary case studies on pharmaceutical and specialist care in Tuscany**.** It should be borne in mind that, according to the Region, hospital care in Italy accounts for between 43% and 49% of the health care budget.
The data on hospital care were obtained from the regional Discharge Abstracts Database (years 1999, 2000 and 2001). People aged less then one year old were excluded from the analysis. We took account of so-called 'mobilità passiva' (passive health mobility) in the four Regions concerned. In other words, all admissions of residents **–** both in the residence Region and in other Regions **–** were considered. Account was not taken of 'mobilità attiva' (active health mobility), by which is meant admissions of non-residents in the Region considered.

The tariff lists for hospital care are established at national level, but each Region is allowed to modify them according to the incentives that they want to give providers so that they meet regional health policy objectives. Most of the Italian Regions now have their own tariff lists, which differ from each other to some extent. In order to make the data comparable, we applied the national tariff list provided by the Italian Ministry of Health (Ministry decree of 30 June 1997; http://www.salute.it), except for Lombardy, in which case the regional tariff list was used. Lombardy's tariffs are roughly 10% higher than national ones on average.

Tariffs are only a proxy for health care costs and expenditure, but they were the only available information that could be used at patient level. Per-day tariffs – useful for computing monthly costs - were calculated as the admission cost divided by the number of days in hospital, although the costs in fact vary during the stay.

The data on mortality were taken from the Regional Death Abstracts database of causes of deaths (Tuscany), the LHAs database (Lombardy) and a national database compiled by the national statistical institute (ISTAT, Mortalità per causa nelle regioni, 2000, 2001 and 2002). The demographic data, which were provided by ISTAT, included all residents in the Regions.

Data on mortality for the years 2000 and 2001 were used, while the Hospital discharge abstracts database related to the years 1999, 2000, and 2001.

4. Results

Using the method described above, we split hospital expenditure between survivors and deceased. Note that the percentage of success of the linkage procedure was about 95%.

Average spending per survivor was €406 in Lombardy, €419 in Tuscany, €568 in Abruzzi and €460 in Apulia. Graph 1 shows the survivors per capita expenditure profile by age for the four Regions. The curves, which are almost superimposed for the youngest ages, diverge widely thereafter, especially at the right end of the graph.

The curves are J-shaped, as we expected from the literature. Expenditure is lower for women than for men, at every age. The peak at 30-34 years in the women's graph is the consequence of the fertility age: which again was as expected. We also observe that per capita expenditure stops increasing at the oldest ages in three Regions out of four: in Lombardy it decreases after eighty years for men and after eighty-five for women; in Abruzzi it slightly diminishes from ninety years onwards; in Apulia it stabilizes from ninety onwards. Only in Tuscany does it continue to increase after the age of ninety, albeit at a lower rate. However, Tuscany is the Region with the lowest per capita expenditure, except for people aged over seventy-nine, who cost less in Lombardy. This lower figure for Lombardy is due to the wide availability in the region of RSAs (Residenze

Sanitarie Assistenziali, Nursing and Residential Care Facilities), institutions providing a mix of health and social services, that often take the place of hospitals in supplying care to old people. In other words, the demand for hospital services (as well as for other services) by the elderly is curtailed thanks to the presence of numerous RSAs.

Graph 2, which shows per capita spending on deceased, will be less familiar to health economists. Nevertheless, it confirms the findings of previous studies on costs near to death. These costs are massively higher then those for survivors, and they diminish after a certain age. Hospital expenditure reaches €5593, on average, in Lombardy, €5868 in Tuscany, €5770 in Abruzzi and €5481 in Apulia. There are wide fluctuations, which progressively diminish, until about the age of 55-59 (in some cases a little less for women). These fluctuations, and the variability among the Regions, can be explained by the small number of observations made on young ages (especially in the case of Abruzzi, the Region with the smallest population) and the large share of deaths due to accidents – with no health care costs – among young people. What happens after middle age is much more interesting: expenditure constantly diminishes, and the per capita amounts of the various Regions tend to coincide.

Graph 3 is perhaps clearer: it summarizes per capita expenditure trends on survivors and deceased for all Regions.[9] The deceased curve is constantly above the one for survivors. It shows the high per capita cost for very young people and a decrease until the age of about 20 years – which is once again likely to depend on the high frequency of accidental deaths at that age – followed by an increase. The cost falls rapidly after 55-59 years, reducing the distance from the survivors' curve (but women reach a peak at around 35 years of age). As Table 1 shows, expenditure on the deceased aged ninety or over is 26% that for 55-59-year-old men, 18% for women. This percentage tends to increase as age decreases: it is 51% at 80-84 years for men (42% for women), and 81% (men) at 70-74 years (70% for women).

Graph 4 sums up expenditure on deceased and survivors:[10] the shape more closely resembles the survivors curves (owing to the greater frequencies of survivors), but the maximums are higher and the decrease for the oldest age group is more pronounced.

Graph 5 shows the ratio between per capita expenditures on deceased and survivors by age; the data are set out in Table 2. For all ages, the ratio varies between 10 and 14 (12-16 for men and 8-12 for

[9] In this case the per capita value for every age band is calculated as the sum of all regions' survivors (deceased) expenditure for that age band divided by the sum of all regions' survivors (deceased) of the same age band.

[10] Note that the average per capita expenditure on survivors and deceased shown by graph 4 does not coincide with average per capita expenditure in 2000 because of the specific definition of survivors and deceased that we used (e.g. we excluded the subjects admitted to hospital in 2000 within 12 months before death and deceased in 2001).

women) among the regions.[11] Like the numerator (deceased expenditure), and for the same reasons, the ratio shows numerous fluctuations for young ages. Graph 6 focuses on over 40-year-olds, in which band we observe a downward trend. The ratio is one or two for over ninety-years-olds, whereas for the 35-39 age group it varies between 36 and 43 for men and between 21 and 40 for women.

Different methods, datasets and hypotheses notwithstanding, the size of the average ratio and of the ratio at old ages (see Table 1) is rather similar to that found for other countries, for instance the Netherlands[12] (11.5 for all ages), USA[13] (about 9 for 70-74 years, 7 for 75-79, 5 for 80-84, 4 for over 85), Spain[14] (about 9 for 70-74 years, 7 for 75-79, 6 for 80-84, 5 for over 85, but for all ages the ratio is 24)[15].

Graphs 7-10 show per capita hospital expenditure on the deceased in the last 12 months of their lives, by proximity to death, in the four Regions. For all ages, expenditure constantly increases from the twelfth to the last month before death, and the rise is exceptionally steep in the final month. The trend for all ages is strongly driven from the elderly one (65+), lying just over the latter. At the youngest ages (1-44), expenditure is much higher for deceased women than for men. Yet inspection on all ages shows greater expenditure for men then for women.

In Abruzzi and Apulia, expenditure seems to become substantial only eleven months prior to death. In Lombardy and Tuscany, by contrast, the deceased are treated in hospital for longer periods of time: the twelfth month expenditure for all ages is 498 euro for men and 396 euro for women in Lombardy, 161 for men and 124 for women in Tuscany.

In the last month before death, per capita expenditure for all ages is just over €2000 for men and €1500 for women in Apulia, between €2000 and €2500 for men and between €1500 and €2000 for women in Abruzzi and Tuscany, and between €3000 and €3500 for men and between €2000 and €2500 for women in Lombardy.

Although we chose four Regions situated in the North, Centre and South of Italy, we may conclude that there are no significant differences among them in respect to health costs near death, in spite of the wide regional gap and the different Regional Health Service models. The main result of this study is that both the specific profile of per capita health expenditure for deceased and the characteristic trend of the deceased/survived ratio, found for Tuscany and for other countries, can be

[11] Using data from Taroni and Nobilio (Taroni and Nobilio, 2004) we also calculated the Emilia-Romagna ratio, which is about 14 (women and men).
[12] Polder and Achterberg (2004).
[13] Lubitz and Riley (1993), and Calfo, Smith and Zezza (2003).
[14] Ahn and Herce (2003).
[15] See Raitano (2005) for a survey on available empirical studies on health cost near to death.

roughly confirmed for Italy. And the value of that ratio calculated for all ages is similar, for the four Italian Regions, to those of some other countries.

We have seen that the concentration of the bulk of hospital costs in the last months before death is an important element in explanation of the expenditure profile by age. However, the phenomenon may be less important for the other items of health expenditure: in fact, hospital costs are generally greater. Moreover, all health expenditure on deceased in-patients is charged to the hospital, whereas territorial costs are zero. At any rate, it remains to be seen whether the distinction between survivors and deceased matters with regard to the profile of out-patient per capita expenditure by age.

In order to get a rough idea, we carried out a very preliminary survey on prescription drugs and outpatient specialist care in Tuscany, adopting for the purpose the same linkage method as used for the hospital database. Graph 11 shows per capita expenditure on deceased by age in regard to outpatient specialist care, laboratory tests and prescription drugs. As in the case of hospital expenditure, the graph shows wide fluctuations until around fifty-five years, after which age the expenditure constantly declines. The per capita cost of outpatient specialist care for 85+ year-old people is only 17% of that for 60-64 years; and for those aged 80-84 it is 43%. The same ratios for laboratory tests are 35% and 56%, while for prescription drugs they are 9% and 20%.

Graph 12, which displays per capita expenditure per month during the last year before death, shows an upward trend for the three expenditure items when death is approached. In the last month the slope increases, but the curves do not become as steep as they are in the case of hospital expenditure. Per capita expenditure in the twelfth month before death is only 55% of that in the last month for surgery, 43% for medical tests, and 16% for prescription drugs.

The preliminary results on specialist and pharmaceutical expenditure confirm the death costs trend found for hospital expenditure.

5. Conclusions and next steps

We have already stressed that our study confirms the results of recent research on heath care costs prior to death carried out in other OECD countries. It also suggests that Italian institutional and socio-economic regional differences are not particularly significant with regard to the issue in discussion: although the four Regions examined are situated in three different macro-areas, they have similar patterns of prior to death per capita expenditure profiles by age. The ratio between deceased and survivor expenditure per age also displays a similar trend in the four Regions, falling after 40 years and equalling one or two for over ninety-years-olds (the regional range is 10-14 for all ages).

Nevertheless, our analysis has mainly concerned hospital expenditure. Hence, to deepen knowledge of the question, we must extend our analysis to other items of heath expenditure. The first results on Tuscany must be checked and compared with those for the other Regions. We expect confirmation for specialist and pharmaceutical care. By contrast, long term care is not likely to show a characteristic pattern of costs near to death, since the concentration of the bulk of expenditure in the last months (years) is due to the onset of acute diseases.

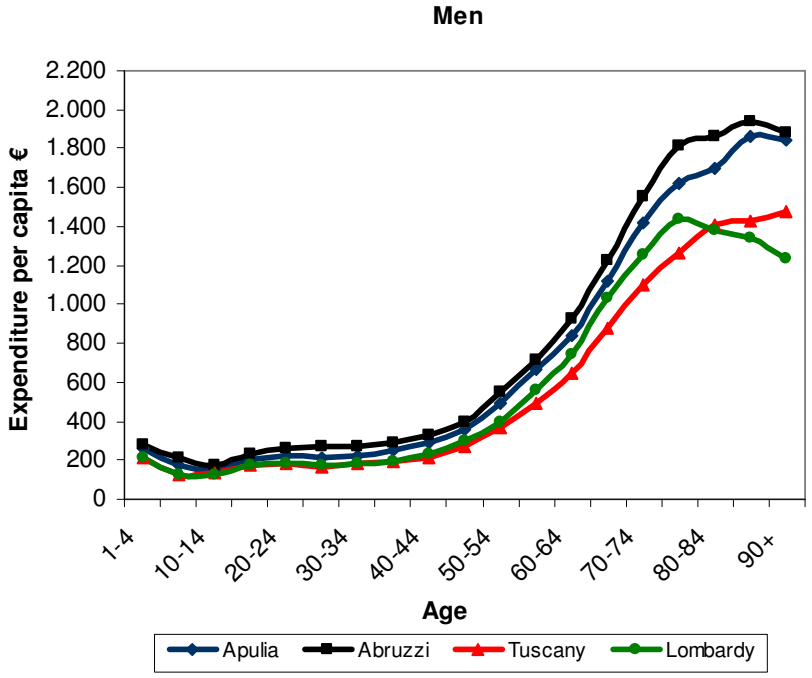
A second step to gaining better understanding of the profile of health expenditure per age would be to examine the split between survivors and deceased over several years. However, it is not possible to perform this analysis with regard to Italy because the data are lacking. In fact, administrative databases of health care consumption at individual level are not available for many years in the past, and the less recent ones are generally not as complete and reliable as the most recent ones.

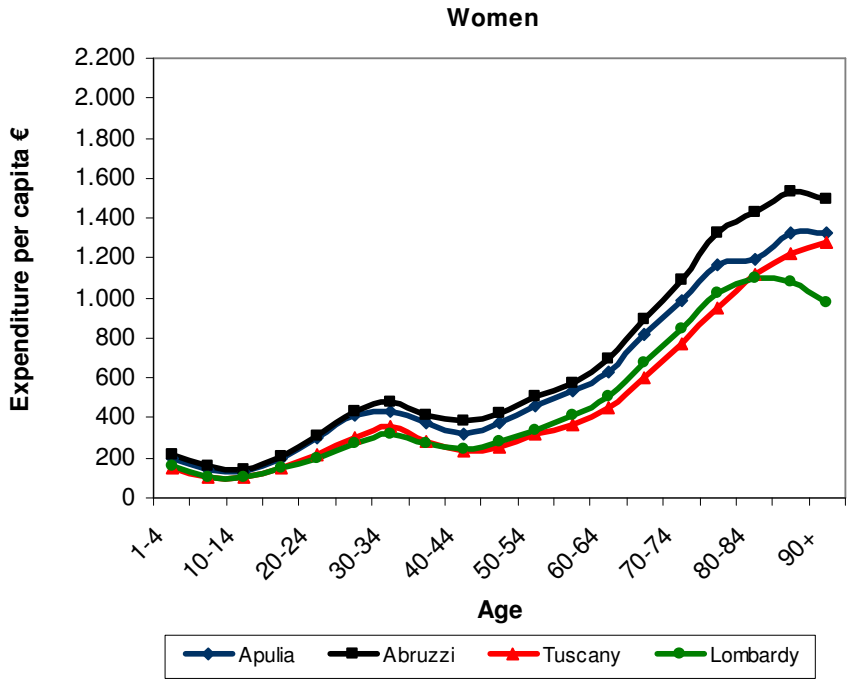
From the macro-economic point of view, the distinction between 'old age costs' (health care expenditure due to the ageing of the population) and 'death costs' (health care expenditure due to the event of dying) can be used as the basis for long-term health care expenditure projections. This is what the Ragioneria Generale dello Stato (RGS, 2001) did for Italy with data on Tuscany, and the results were taken up by Economic Policy Committee (2001). In the light of our new multiregional data we can confirm that health spending is likely to grow to a lesser extent than expected when account is taken of costs near to death. The size of the cut in the expenditure foreseen by the Ragioneria Generale[16] could be roughly maintained on the basis of our information on the four Regions situated in different zones of Italy.

From a micro-economic point of view as well, distance to death is an important factor in explaining the concentration of health expenditure on certain groups of people. In this regard, it would be useful to analyse the health care treatments and costs due to certain chronic conditions and terminal pathologies, and to identify and promote cost-effective practices.

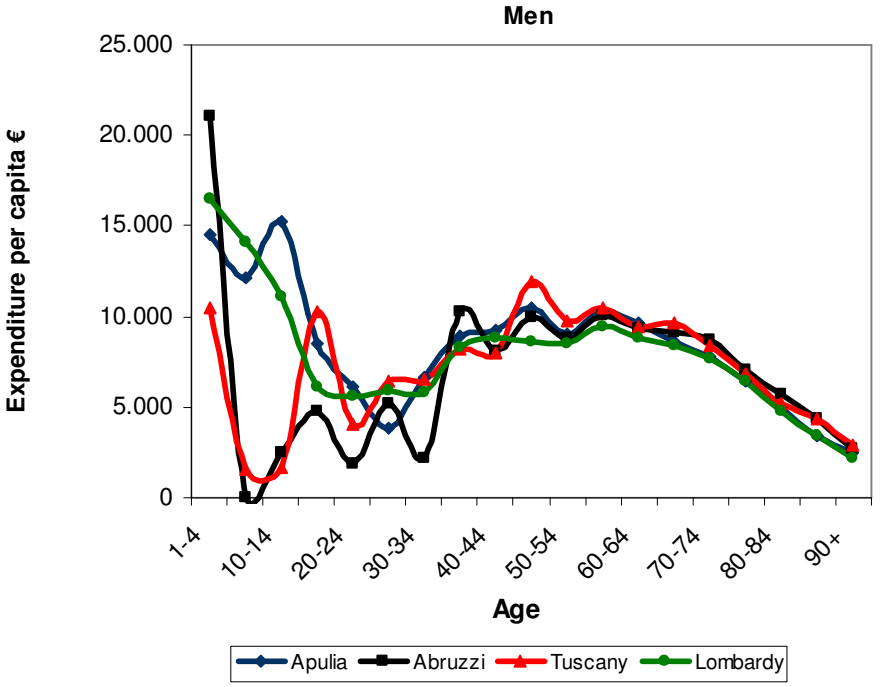
[16] For the latest projections see Ragioneria Generale Dello Stato, 2004; see also Aprile and Palombi, 2005, mimeo, for methodological aspects relative to the inclusion of death costs as an input to heath care expenditure projections.

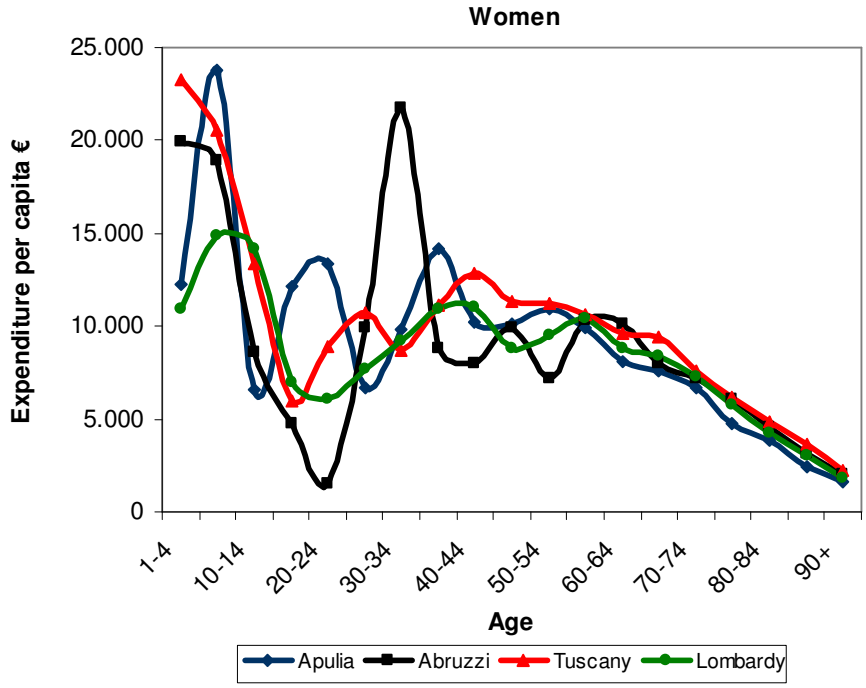
Graph.1 - Hospital expenditure by age and gender of survivors



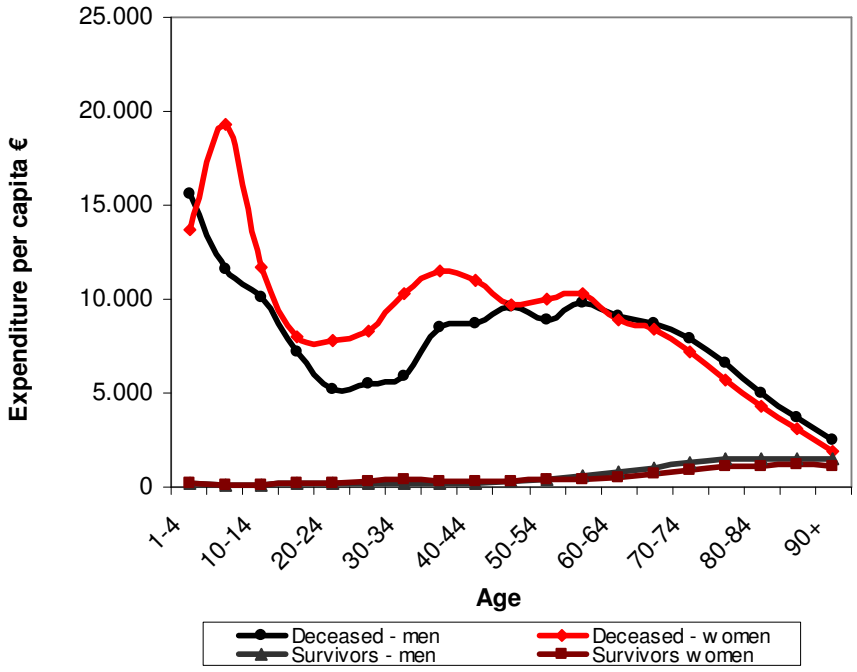


Graph. 2 - Hospital expenditure by age and gender of deceased

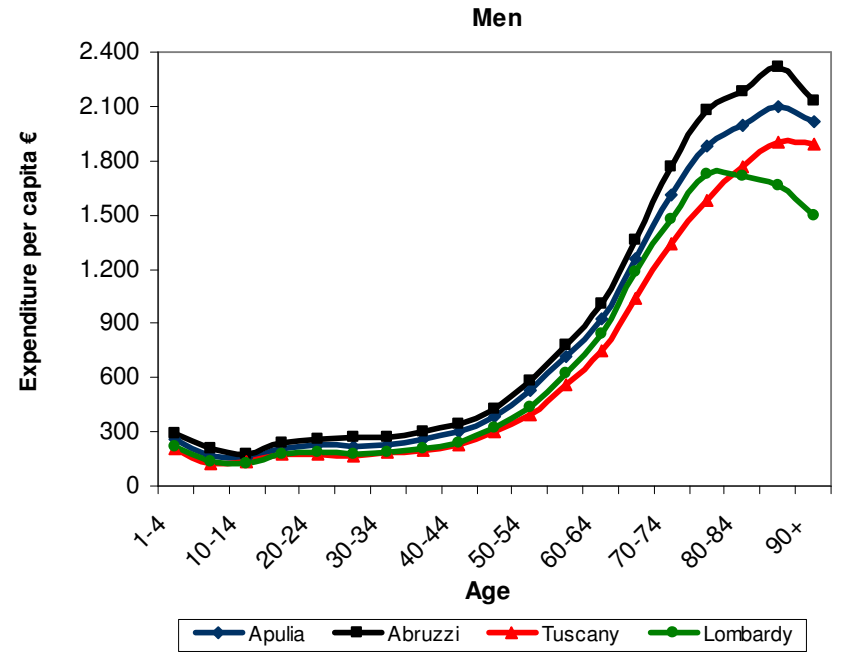


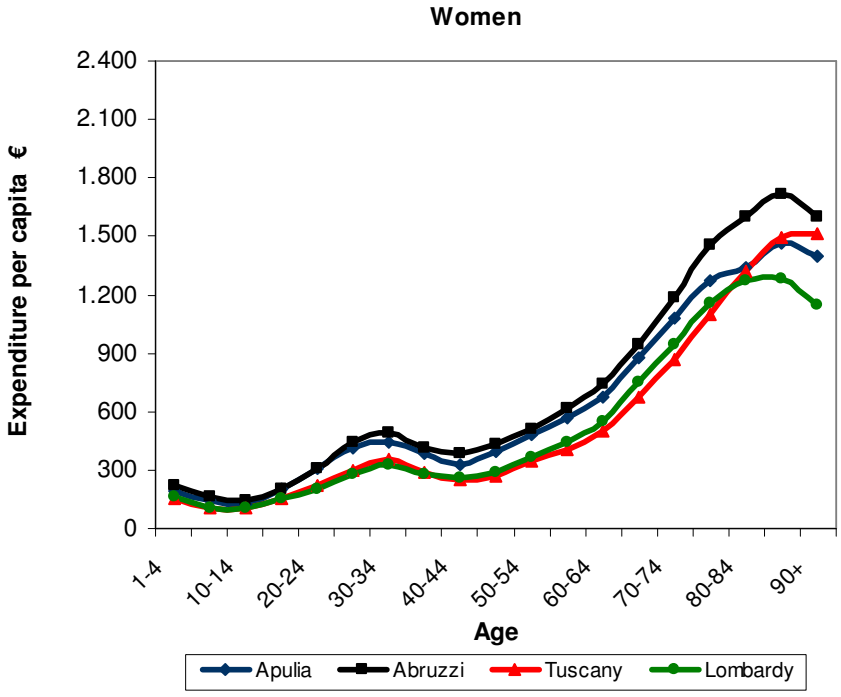


Graph. 3 - Hospital expenditure by age and gender of survivors and of deceased, all regions

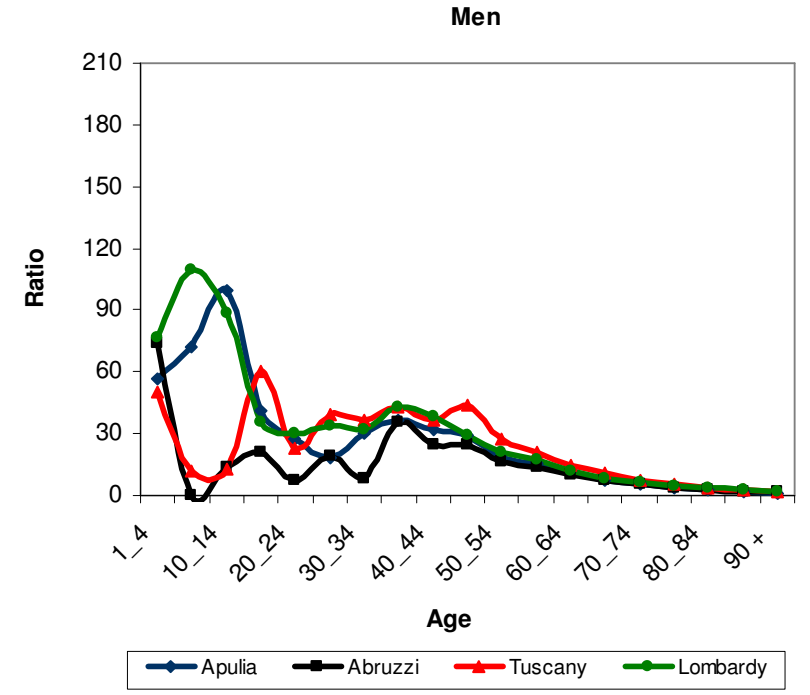


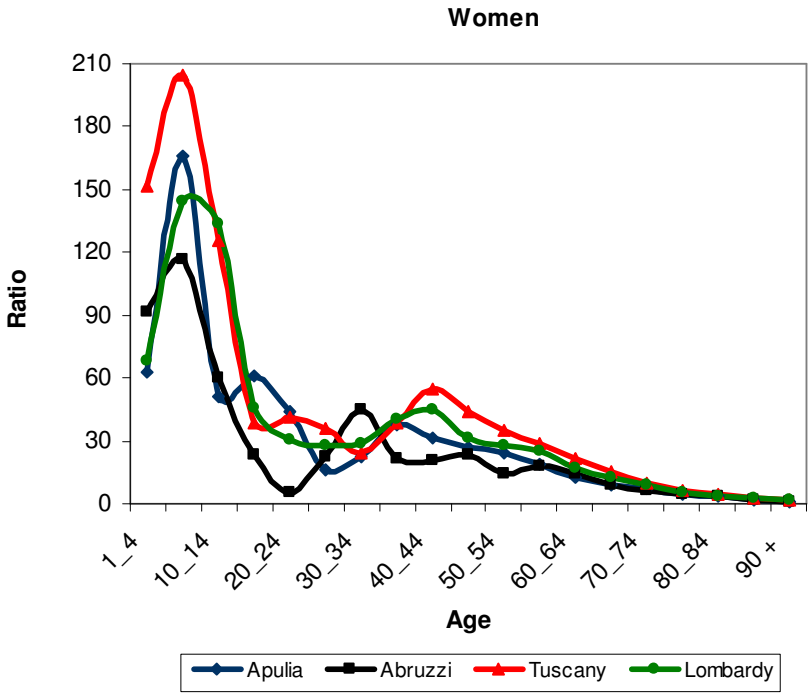
Graph. 4 - Hospital expenditure by age and gender of survivors and deceased (sum).



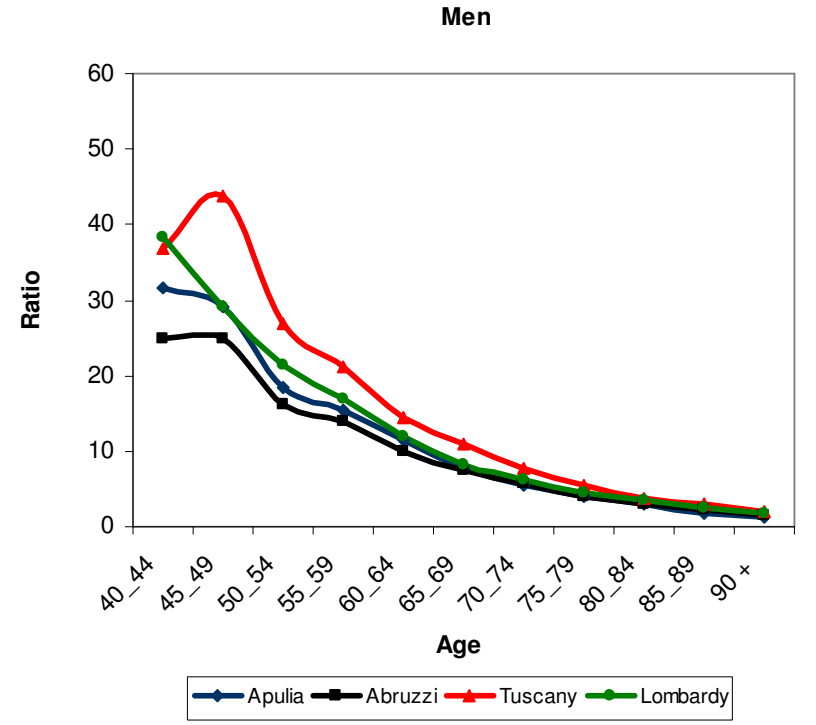


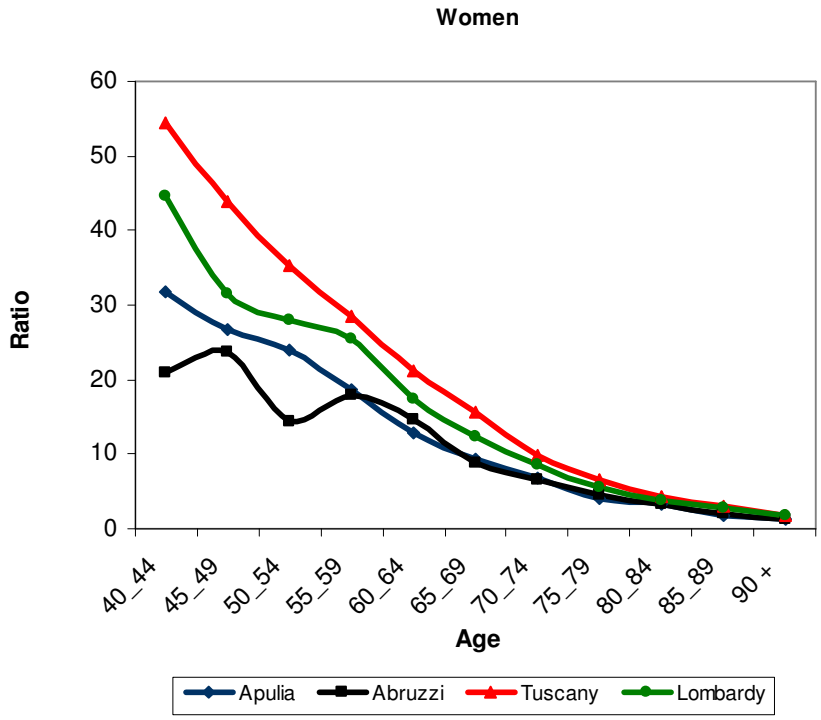
Graph. 5 - Per capita hospital expenditure ratio deceased/survivors by age and gender.



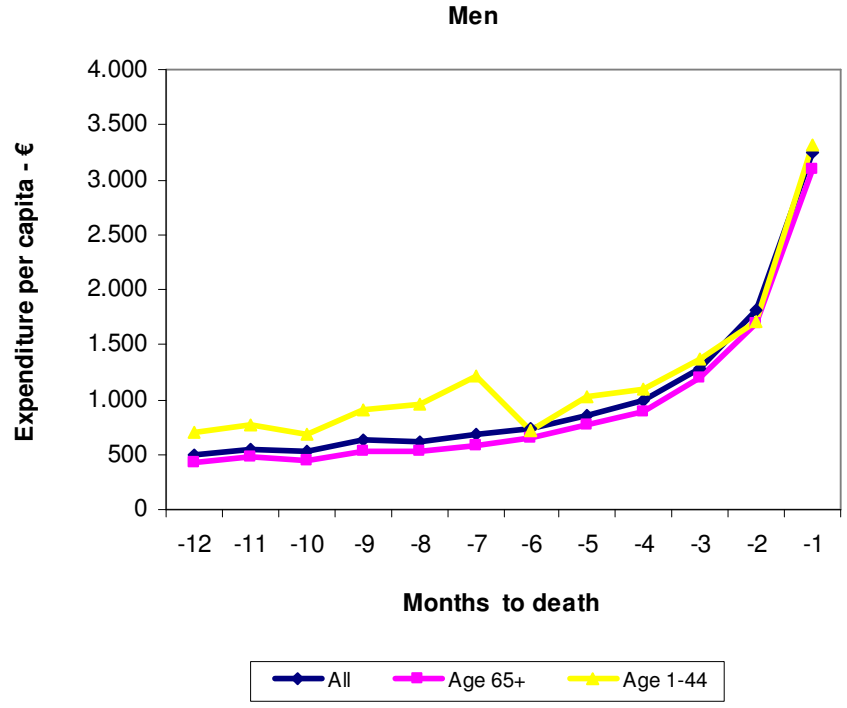


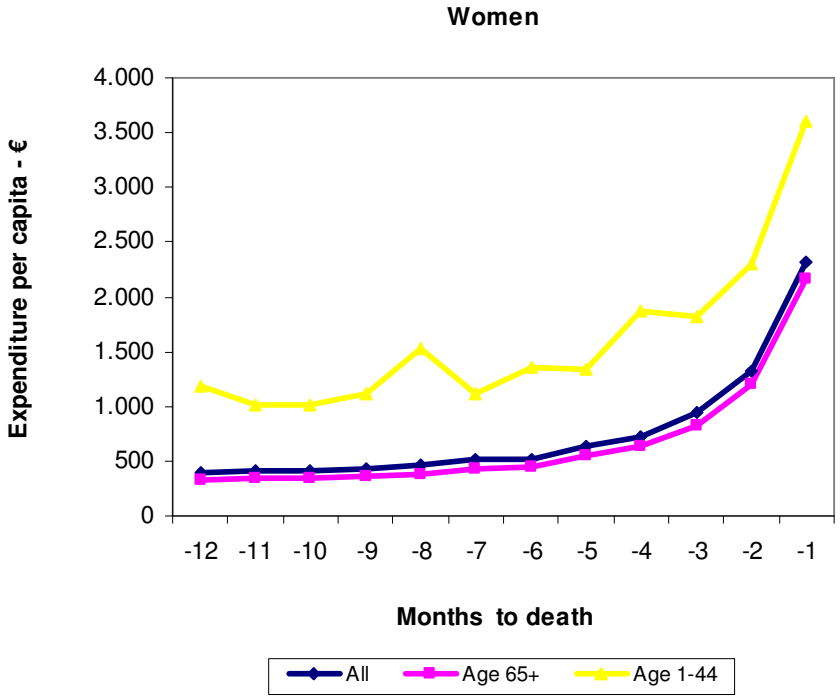
Graph. 6 - Per capita hospital expenditure ratio deceased/survivors by age and gender (40 +).



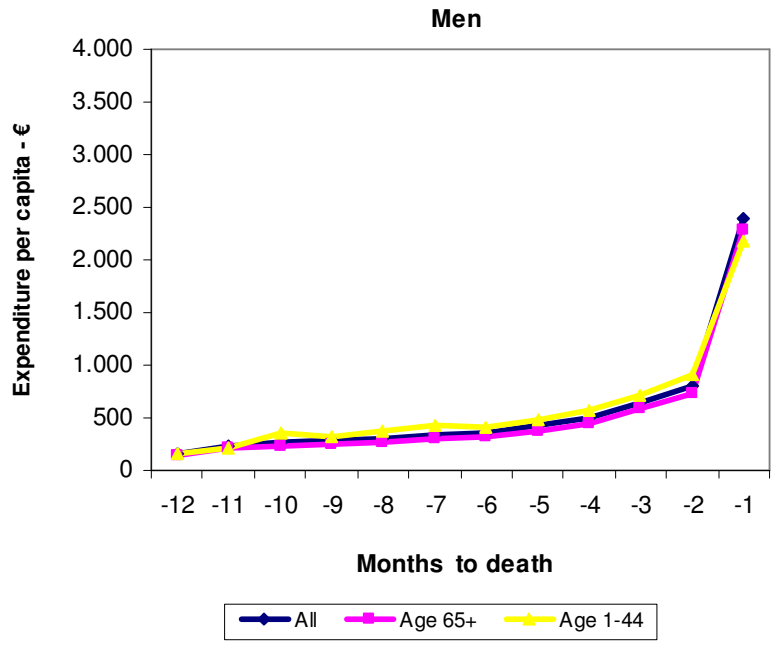


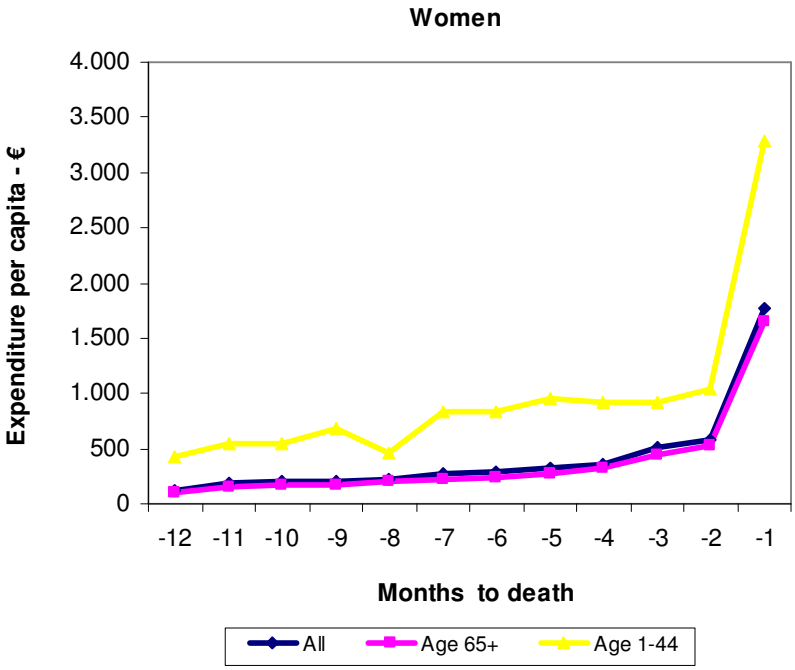
Graph. 7 - Hospital expenditure of deceased in the last 12 months by proximity to death - Lombardy



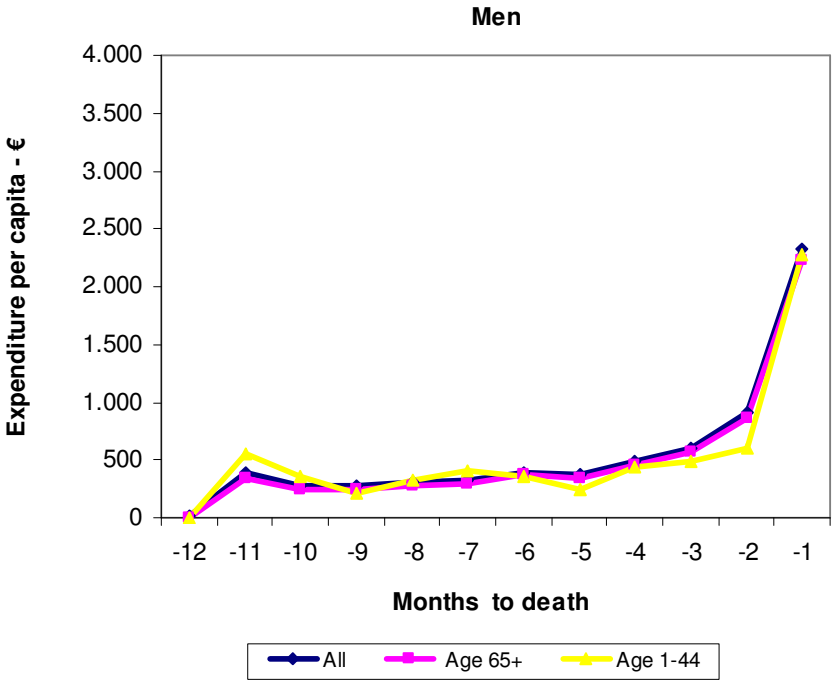


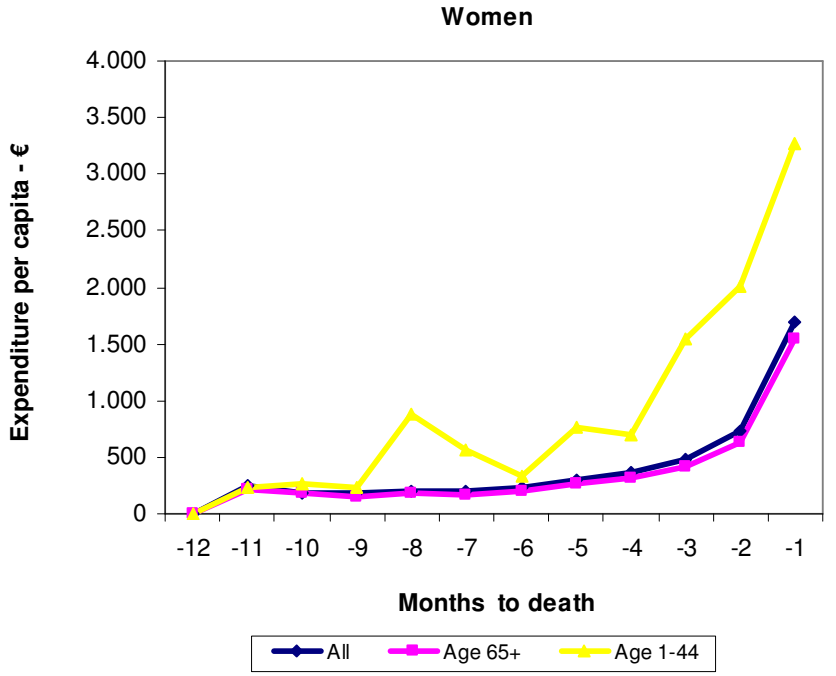
Graph. 8 - Hospital expenditure of deceased in the last 12 months by proximity to death - Tuscany



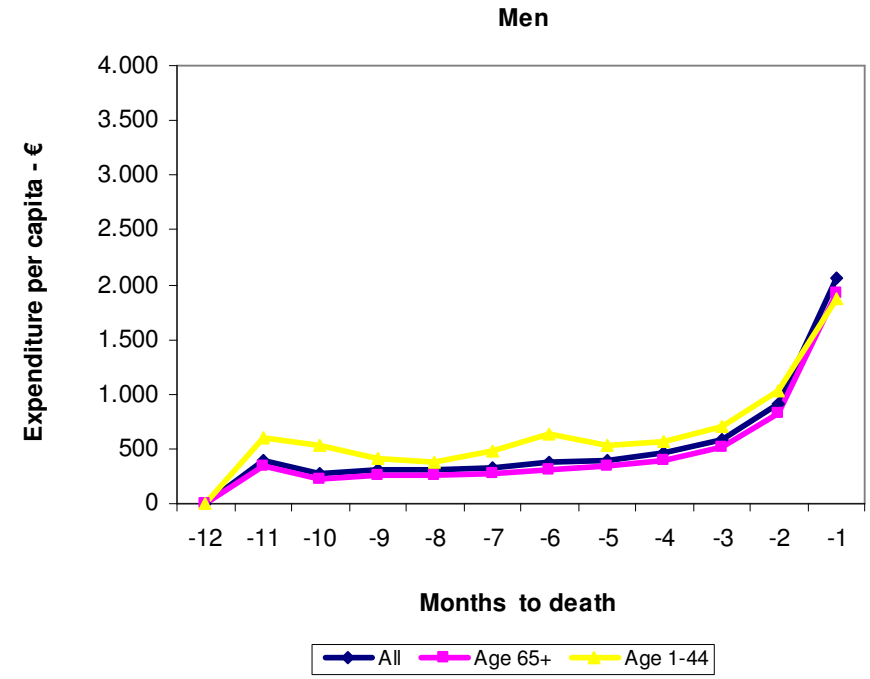


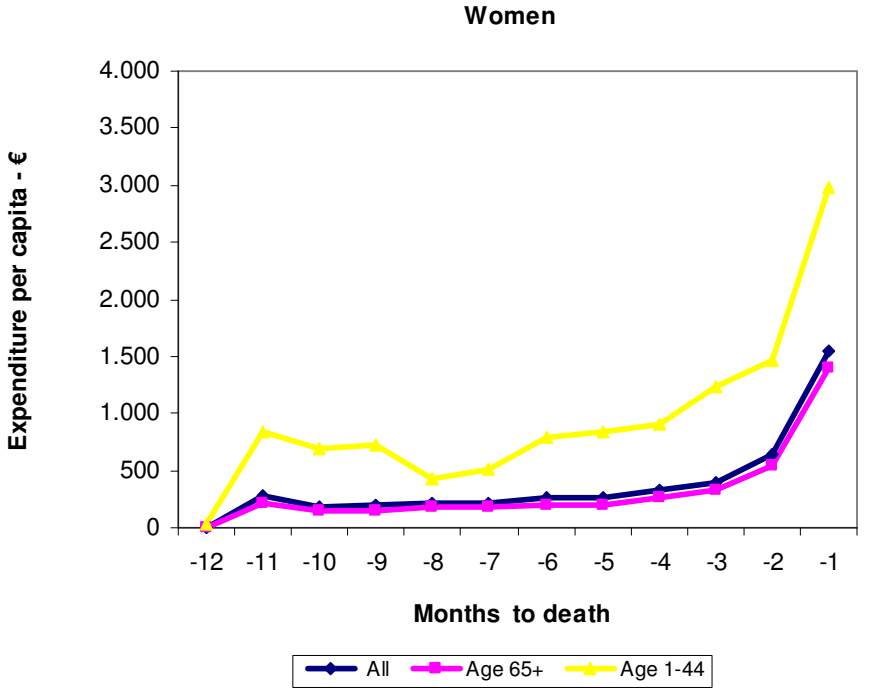
Graph. 9 - Hospital expenditure of deceased in the last 12 months by proximity to death - Abruzzi



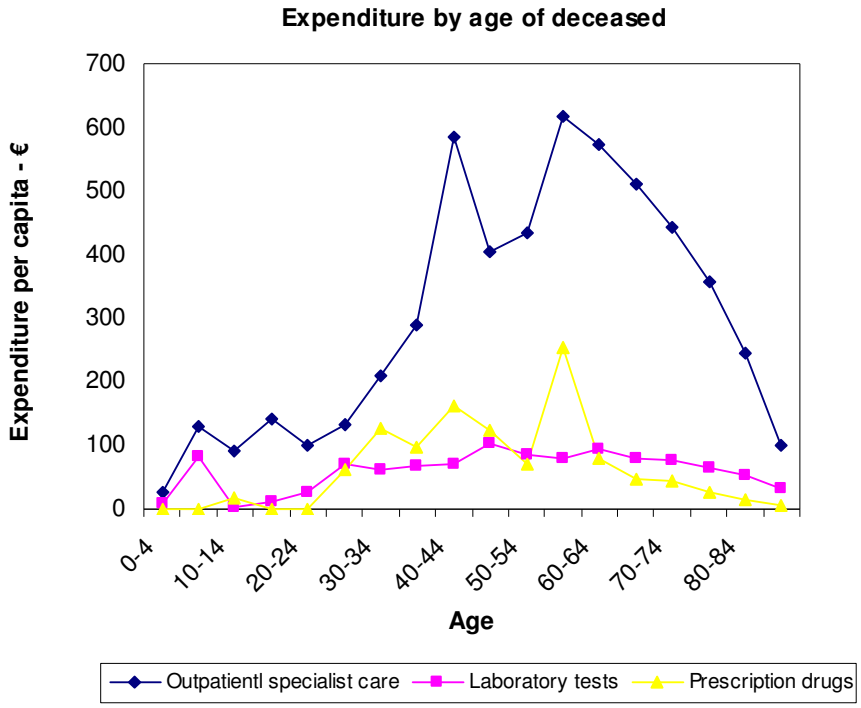


Graph. 10 - Hospital expenditure of deceased in the last 12 months by proximity to death - Apulia

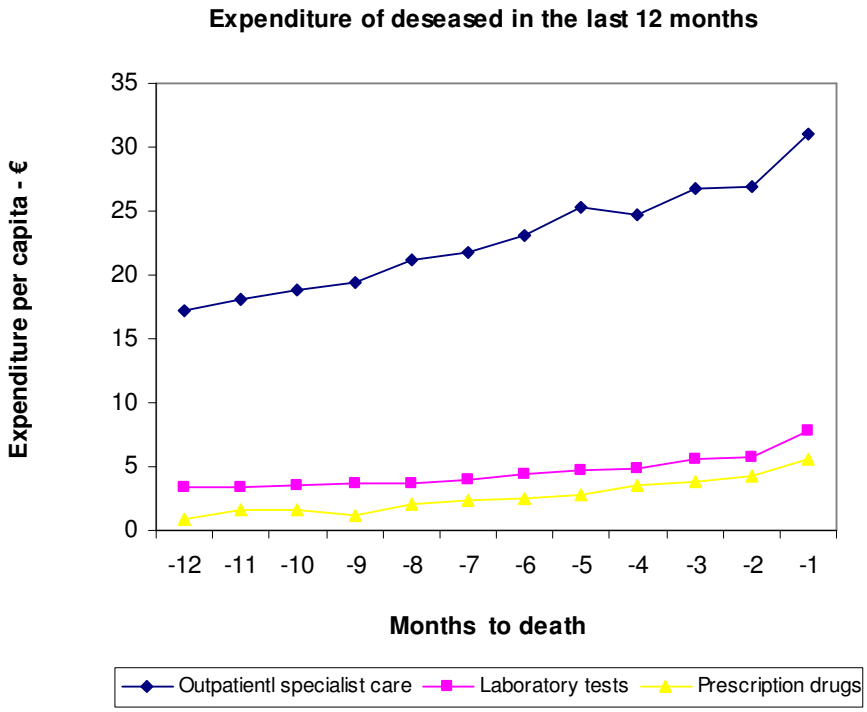




Graph. 11


Expenditure by age of deceased
Expenditure per capita - €
700
600
500
400
300
200
100
0
0-4
10-14
20-24
30-34
40-44
50-54
60-64
70-74
80-84
Age
Outpatientl specialist care
Laboratory tests
Prescription drugs

Graph. 12


Expenditure of deseased in the last 12 months
Expenditure per capita - €
35
30
25
20
15
10
5
0
-12
-11
-10
-9
-8
-7
-6
-5
-4
-3
-2
-1
Months to death
Outpatientl specialist care
Laboratory tests
Prescription drugs

Tab. 1 - Per capita hospital expenditure of deceased in % of 55-59 years old per capita expenditure

	Lombardy		Tuscany		Apulia		Abruzzi		All regions		
Age	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	All
60-64	94%	85%	90%	91%	94%	82%	92%	98%	93%	86%	91%
65-69	89%	81%	92%	89%	84%	76%	90%	77%	89%	81%	86%
70-74	81%	70%	80%	72%	76%	68%	87%	69%	81%	70%	77%
75-79	68%	55%	66%	58%	62%	48%	70%	58%	67%	55%	62%
80-84	51%	41%	50%	46%	49%	39%	56%	44%	51%	42%	46%
85-89	36%	29%	41%	34%	33%	25%	43%	31%	38%	30%	33%
90+	24%	17%	27%	21%	24%	16%	27%	19%	26%	18%	21%
All ages	69%	45%	64%	48%	63%	45%	66%	47%	67%	46%	57%

Tab. 2 - Per capita hospital expenditure ratio deceased/survivors by age and gender

	Lombardy			Tuscany			Apulia			Abruzzi		
Age	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women	All
1-4	77,1	67,8	71,8	50,1	151,6	101,3	56,6	63,0	58,8	74,0	91,9	81,8
5-9	109,9	144,4	124,1	12,1	204,4	102,5	71,8	165,9	113,5	0,0	116,5	60,5
10-14	88,7	134,1	109,0	12,5	125,4	73,2	99,5	51,0	81,5	14,0	60,0	32,8
15-19	35,3	46,1	39,4	60,0	38,7	54,6	41,4	60,6	47,3	20,8	23,4	22,0
20-24	30,0	30,3	29,6	22,7	41,4	27,4	27,6	44,0	28,8	7,1	5,0	6,3
25-29	33,4	27,9	28,1	39,0	36,2	32,8	18,0	16,1	14,5	19,3	22,8	17,8
30-34	32,3	28,6	26,8	36,8	24,6	27,3	29,9	22,5	23,0	8,1	45,0	25,0
35-39	42,9	40,0	38,8	42,5	38,8	38,7	36,3	37,5	33,9	35,8	21,4	28,1
40-44	38,4	44,6	40,3	36,9	54,5	43,9	31,7	31,6	31,2	25,0	21,0	22,9
45-49	29,1	31,4	30,1	43,8	44,0	44,2	29,1	26,7	28,0	24,9	23,8	24,3
50-54	21,4	28,0	24,0	27,0	35,2	30,3	18,4	23,9	20,5	16,1	14,4	15,8
55-59	16,9	25,5	20,2	21,2	28,5	24,4	15,5	18,6	17,0	14,1	18,0	15,8
60-64	11,9	17,4	14,3	14,5	21,2	17,4	11,5	12,9	12,5	10,0	14,6	11,9
65-69	8,1	12,4	10,0	10,9	15,5	13,0	7,7	9,3	8,6	7,4	8,9	8,3
70-74	6,1	8,6	7,4	7,6	9,9	8,9	5,5	6,8	6,3	5,6	6,6	6,3
75-79	4,5	5,6	5,2	5,4	6,5	6,1	3,9	4,1	4,2	3,9	4,6	4,4
80-84	3,4	3,8	3,8	3,7	4,3	4,1	2,9	3,2	3,2	3,0	3,2	3,2
85-89	2,5	2,8	2,7	3,0	2,9	3,0	1,8	1,9	1,9	2,2	2,1	2,2
90+	1,8	1,8	1,8	1,9	1,8	1,8	1,3	1,2	1,3	1,5	1,3	1,4
All ages	15,9	11,7	13,8	16,1	12,0	14,0	14,2	9,7	11,9	11,7	8,5	10,2

References

Ahn N., García JR and Herce JA, 2003, *Health Care Expenditure and Demographic Uncertainty*, Demwel, WP2.

Aprile R. and Palombi M., 2005, *How to take account of death related costs in projecting health care expenditure*, mimeo.

Bartolacci S., Berni. R., Forni S., Tediosi F., Cislaghi C. *Il valore economico dell'ospedalizzazione in funzione del tempo dalla nascita e dalla morte.* Politiche Sanitarie 2001; 4-6: 193-203.

Batljan I., Lagergren M., 2004, *Inpatient/Outpatient Health Care Costs and remaining Years of Life: Effect of Decreasing Mortality on Future Acute Health Care Demand*, mimeo.

Breyer F., Felder S., 2004, *Life Expectancy and Health Care Expenditures in the 21st Century: A New Calculation for Germany Using the Costs of Dying*, DIW Berlin, German Institute for Economic Research Discussion Papers, n. 452.

Brockmann H., 2002, *Why is Less Money Spent on Health Care for the Elderly than for the Rest of the Population? Health Care Rationing in German Hospitals*, Social Science & Mecicine, n. 55.

Busse R., Krauth C., Schwartz F.W., 2002, *Use of acute Hospital Beds Does not Increase as the Population Ages: Results for a Seven Year Cohort Study in Germany*, Journal of Epidemiology and Community Health, vol. 56.

Caisse National de l'Assurance Maladie des Travailleurs Salaries, 2003, *Le Viellissement de la Popolation et Son Incidence sur l'Evolution des Depenses de Santè*, mimeo.

Calfo, Smith, Zezza, 2003, *Last Year of Life*, CMS (Center for Medicare and Medicaid Services) *mimeo*.

Cislaghi S., Bertolacci S., Berni R., Forni S., Tediosi F., 2003, *Il valore economico dell'ospedalizzazione in funzione del tempo dalla nascita e dalla morte*, Agenzia Regionale di Sanità Toscana, Firenze.

Economic Policy Committee (EPC), 2001, *Budgetary Challanges 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*, Bruxelles.

Evans R.G., McGrail K.M., Morgan S.G., Barer M.L. and Hertzman C. (2001), *Apocalypse NO: Population Aging and the Future of Health Care Systems*, SEDAP research Paper No. 59.

Evans G. (2004), *Political Wolves and Economic Sheep: The Sustainability of Public Health Insurance in Canada*, W.P. CHSPR (Centre for Health Services and Policy Research) 03: 16W., University of British Columbia, in *The Public-Private Mix for Health*, edited by A. Maynard, Nuffield Trust, London, due to be published 2005.

Felder S, Meier M., Schmitt H., 2000, *Health Care Expenditure in the Last Months of Life*, Journal of Health Economics, vol. 19.

Hoover D., Crystal S., Kumar R., Sambamoorthi U., Cantor J., 2002, *Medical expenditures During the Last Year of Life: Findings from the 1992-1996 Medicare Current Beneficiary Survey*, mimeo.

Lubitz J., Riley G., 1993, *Trends in Medicare Payments in the Last Year of Life*, New England Journal of Medicine, vol. 328.

Lubitz J., Beebe J., Baker C., 1995, *Longevity and Medicare Expenditure*, New England Journal of Medicine, vol. 332.

Madsen M., 2004, *Methodologies to Incorporate Death Related Costs in Projections of Health and Long-Term Care Based on Danish Data*, mimeo.

Mc Grail K., Green B., Barer M., Evans R., Hertzmann C., Normand C., 2000, *Age, Costs of Acute and Long-Term Care and Proximity to Death: Evidence for 1987-88 and 1994-95 in British Columbia*, Age and Ageing, vol. 29.

Miller T., 2001, *Increasing Longevity and Medicare Expenditures*, Demography, vol. 38.

Nobili L., Taroni F., 2004, *Concentrazione e persistenza della spesa sanitaria: evidenze empiriche e implicazioni per le politiche sanitarie*, in *I sevizi sanitari in Italia*, 2004, G. Fiorentini (edited by), Il Mulino, Bologna.

O' Neill C., Groom L., Avery A., Boot D., Thornill K., 2000, *Age and Proximity to Death as Predictors of GP Care Costs: Results from a Study of Nursing Home Patients*, Health Economics, vol. 9.

Polder J.J. and Achterberg P.W. (2004), *Cost of illness in the Netherlands*, published by The National Institute for Public Health and the Environment.

RGS, 2001, Dipartimento della Ragioneria Generale dello Stato, Ispettorato Generale per la Spesa Sociale, *Le tendenze di medio-lungo periodo del sistema pensionistico e sanitario*, Temi di finanza pubblica e protezione sociale, Quaderno N. 3.

Raitano M. (2005), *The impact of death related cost on health care expenditure: a survey*, *mimeo*.

Riedel, M., Hofmarcher M., Buchegger R., Brunner J., 2002, *Nachfragemodell Gesundheitswesen*, Institute for Advanced Studies, IHS Research Report, Ed: BMGF (Federal Ministry of Health and Women) Sektion IV, Vienna.

Salas C., Raftery J., 2001, *Econometric Issues in Testing the Age Neutrality of Health Care Expenditure*, Health Economics, vol. 10.

Sbilanciamoci, 2004, *Come si vive in Italia?* Edited by Martino Mazzonis, Sbilanciamoci!, Rome.

Schulz E., Leidl R., Konig H., 2004, *The Impact of Ageing on Hospital Care and Long-Term Care: The Example of Germany*, Health Policy, vol. 67.

Serup-Hansen N., Wickstrom J., Sonbo Kristiansen I., 2002, *Future Health Care Costs: Do Health Care Costs During the Last Year of Life Matter?*, Health Policy, vol. 62.

Seshamani M., 2004, *The Impact of Ageing on Health Care Expenditures: Impending Crisis, or Misguided Concern?*, Office of Health Economics.

Seshamani M., Gray A., 2004a, *Ageing and Health care Expenditure: The Red Herring Argument Revisited*, Health Economics, vol. 13.

Seshamani M., Gray A., 2004b, *A Longitudinal Study of the Effects of Age and Time to Death on Hospital Costs*, Journal of Health Economics, vol. 23.

Stearns S., Norton E., 2004, *Time to include Time to Death? The Future of Health Care Expenditure Predictions*, Health Economics, vol. 13.

Vineis P., Dirindin N., 2004, *In buona salute*, Einaudi, Torino.

Zweifel P., Felder S, Meier M., 1999, *Ageing of Population and Health Care Expenditure: A Red Herring?*, Health Economics, vol. 8.

Zweifel P., Felder S. Werblow A., 2004, *Population Ageing and Health Care Expenditure: New Evidence on the "Red Herring"*, Geneva Papers on Risk and Insurance, vol. 29.