European Network of Economic Policy
Research Institutes

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

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

ENEPRI RESEARCH REPORT NO. 18

AHEAD WP7

MAY 2006

ENEPRI Research Reports consist of papers presenting the findings and conclusions of research undertaken in the context of ENEPRI research projects. This paper was prepared as part of the **AHEAD project – *Ageing, Health Status and the Determinants of Health Expenditure*** – which has received financing from the European Commission under the 6th Research Framework Programme (contract no. SP21-CT-2003-502641). Its findings and conclusions are attributable only to the authors and not to ENEPRI or any of its member institutions.

ISBN 92-9079-618-9

AVAILABLE FOR FREE DOWNLOADING FROM THE ENEPRI WEBSITE (HTTP://WWW.ENEPRI.ORG) OR THE CEPS WEBSITE (WWW.CEPS.BE)

Demographic Factors and Health Expenditure Profiles by Age: The Case of Italy

ENEPRI Research Report No. 18/May 2006

S. Gabriele*, C. Cislaghi†, F.Costantini‡, F. Innocenti†, V. Lepore‡, F. Tediosi*, M. Valerio‡ and C. Zocchetti§

Abstract

This paper analyses the health expenditure profile by age and gender of survivors and deceased in four Italian regions. Per capita spending on the deceased constantly diminishes after middle age. The ratio between per capita expenditures on deceased and survivors by age shows a downward trend after about 40 years. 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 with respect to health costs near death, in spite of the wide regional gap and the different Regional Health Service models. Health spending projections for Italy – as well as for other countries – are less pessimistic when account is taken of costs near death. The main result of this study is that both the specific profile of per capita health expenditure for the deceased and the characteristic trend of the deceased/survived ratio, found for Tuscany and for other countries, can be roughly confirmed for Italy.

---

* ISAE (Istituto di Studi e Analisi Economica – Institute for Studies and Economic Analyses) in Rome.

† ARS Toscana.

‡ Consorzio Mario Negri Sud (CMNS) in Abruzzo.

§Regione Lombardia.

Acknowledgements: 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.

Contents

List of Figures

List of Tables

Demographic Factors and Health Expenditure Profiles by Age: The Case of Italy

ENEPRI Research Report No. 18/May 2006

S. Gabriele, C. Cislaghi, F.Costantini, F. Innocenti, V. Lepore, F. Tediosi, M. Valerio and 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 jeopardise 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 increases in health expenditure 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 & Riley, 1993; Zweifel et al., 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, such as the lower therapeutic obstinacy on the part of doctors when they treat old people[2]).

[1] Lubitz et al. (1995); Felder et al. (2000).

[2] Busse et al. (2002); Brockmann (2002).

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's sustainability associated with ageing have been so greatly emphasised before any definite conclusions about ageing effects on health expenditure have been reached. According to Evans et al. (2004), 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 increase 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 universal 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 et al., 1999, and the reply by Seshamani & Gray, 2004).

Vineis & 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 change the public and private mix in financing and/or enlargement of the private insurance 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 the growth of health expenditure. 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. (2001), we estimate hospital costs prior to death in four regions (Tuscany, Lombardy, Abruzzi and Apulia).

---

[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.

[4] However, private insurance schemes must also 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.

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 & Nobilio, 2004). We compare the results with those of some other OECD countries as well.

The next section outlines the institutional situation, with special reference to health system decentralisation in Italy and to the main differences among the four regional health services examined. 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. The institutional picture

In Italy, during the last decade, the National Health Service (NHS) has undergone major reforms and profound institutional changes, which eventually resulted in the devolution of organisational, political and fiscal powers to the regions.

A law has also been enacted (2001) to amend the Constitution and, as a consequence, the regions now have legislative power, except in regard to fundamental principles, while the government fixes the entitlement.

In the past, the Italian NHS was characterised by central funding and decentralised spending. Although the level of total expenditure as a percentage of GDP was not high[5] and indeed below the European average, the management of financial balances lacked consistency and transparency. The resources necessary to meet requirements were underestimated and the consequent deficits were funded by the government on an *ex-post* basis. The first attempts to transfer some fiscal responsibility to the regions were unsuccessful.[6] The strict budget policy undertaken by the Italian government to keep the public accounts under control meant that regional public expenditure needed to be reined in. So, 'fiscal federalism' was seen as a way to ensure the financial accountability of the decentralised level of government, besides being a political answer to the increasing distrust coming from some groups of the better-off regions, which were asking for more autonomy and challenging the policy of inter-regional solidarity and redistribution.

The regional gap between the North and the South of the country has hindered the implementation of devolution, however, and there are still substantial differences between the two areas in both the availability of health care facilities and fiscal capacity.

At the beginning of this century, the introduction of fiscal decentralisation (by legislative decree 56/2000) formally abolished central transfers to the regions (National Health Fund), replaced by shares of centrally-collected taxes, especially VAT (value-added tax).[7] A National Solidarity Fund financed out of VAT was set up in order to reduce the differences between the per capita

[5] After decreasing to just over 5% in the first half of the 1990s, it rose to 6.5% in 2002, compared with 7.5% on average for EU15, according to Eurostat data.

[6] The regions were given the opportunity to increase payroll taxes, local taxes and co-payments to face the deficits, but they never took it up. A few years later, the payroll taxes were replaced by a regional tax on productive activities (IRAP). At the same time a portion of IRPEF (the national income tax) was transferred to the regions, which were empowered to impose additional rates on these taxes. However, this provision was then suspended by the central government.

[7] Moreover, the shares of IRPEF and of the excise duty on petrol were increased.

revenues of the regions and the average. After the first year of implementation of the reform, it was intended that the inflows to the regions would be calculated according to population, fiscal capacity, health requirements and geographical size. These new allocation criteria would have progressively replaced the previous ones.

However, enforcement of fiscal federalism was suspended, mainly because the central government and all the regions failed to agree on the cost of health requirements[8] and on the allocation of resources among the regions. The contradiction between achieving fiscal autonomy and accountability on the one hand, and the need to ensure the national standards in a basic service like health on the other, makes the process of fiscal federalism difficult to accomplish. A new funding system is currently being discussed, as well as further reform of the constitutional provisions on health care (a recent constitutional law on devolution will be submitted to a referendum).

As regards health service management, since the 1992-93 reform the regions have been responsible for the regulation of the internal market within their territory. As a consequence, regional health services have developed differently among the various regions, with a wide variability in the organisation of health care provision, which ranges between the complete separation of purchasing and providing functions to their complete integration within the public sector. This further decentralisation of the Italian NHS has increased the historical differences among regional health services. However, it is very difficult to evaluate the performance of regional health services since good quality activity data are not available for all regions.

Nevertheless, the quality of administrative data has improved dramatically over the past five years, in particular in some regions, and this makes it possible to carry out studies like the present one.

A few details on the features of the four regions analysed by this study may aid understanding of the issues involved.

2.1 Tuscany

Tuscany has a population of 3.5[9] million people, a density of 153 inhabitants per km^2; and 78% of Tuscan residents live in urban areas. It is one of the most developed and affluent of the Italian regions, with a GDP per capita of over €24,200 (119.6 as a percentage of the EU25 average in Purchasing Power Standard),[10] an unemployment rate of around 4.7%, and an adjusted Human Development Index[11]of 0.8201, compared to 0.7653 for Italy as a whole.

---

[8] The government stipulated Essential Levels of Assistance (LEA): that is, the benefit package that the health service must provide to all citizens. However, at present, only some qualitative standards have been fixed. Nevertheless, the third 'experimental' survey of services supplied and LEA costs has been concluded (Monitor, Year III, n. 10, see http://www.assr.it/monitor/monitor_2004/Monitor_10_04.pdf - year 2002).

[9] The data for the four regions are from ISTAT and refer to 2003 unless otherwise specified (www.istat.it).

[10] The data on GDP per capita are from EUROSTAT and refer to 2002.

[11] The UNDP Human Development Index combines indicators of life expectancy at birth, the adult literacy rate, gross enrolment ratio and per capita GDP. The adjusted regional Human Development Index quoted here, calculated by Sbilanciamoci (2004), takes account of the secondary enrolment ratio.

Almost 23% of the population is aged over 64 and 11.1% over 74. The old age index (65+/0-14) is 1.9 and is predicted to increase to 2.0 by 2010.

The infant mortality rate (2001) is 3.3 per 1,000 (3.7 for men, 2.8 for women) and life expectancy at birth is 83.4 for women and 77.8 for men.

The regional health care system is organised around 12 Local Health Authorities (LHAs) and 4 independent Hospital Trusts. Local Health Authorities organise all health services – hospital care included – while Hospital Trusts provide tertiary and highly specialised care. Central planning plays a fundamental role in governance of the health care system, with great emphasis placed on the importance of a comprehensive approach to the promotion of good health in which planning, integrated health plans and primary care are the key features.

The number of hospital beds[12] (including day hospitals) per 1,000 inhabitants is 4.8, 4.1 in public hospitals (85%) and 0.7 in private 'accreditati' (accredited)[13] ones. The gross hospitalisation rate (including day hospitals) is 195.11 per 1,000 and the average length of stay is 7.5 days.[14] Almost 94% of hospital admissions are to public hospitals.[15]

The number of ambulatory care services (internally to and outside hospitals, public and private 'accredited' institutes) is 29 per 100,000 residents, and 62% of them are public. The number of beds in residential and semi-residential care institutions is 319 per 100,000 residents.

Total per capita health care expenditure in 2002 was €1,449: 52.01% on outpatient services (including 12.87% on drugs and 8.94% on residential and semi-residential care[16]), 43.33% on hospital care and 4.66% on prevention.

2.2 Lombardy

Lombardy is one of the largest and most affluent of the Italian regions, with a population of over nine million, a GDP per capita of around €28,680 (141.8 as a percentage of the EU25 average in Purchasing Power Standard), a 3.6% unemployment rate and an adjusted Human Development Index of 0.7948. It has a density of 378 inhabitants per km^2, and 91% of its residents live in urban areas.

Around 18.6% of the population are aged over 64 and 8.1% over 74; the old age index (65+/0-14) is 1.4 and is predicted to increase to 1.6 by 2010.

The infant mortality rate (2001) is 3.9 per 1,000 (4.8 for men, 3.0 for women), and life expectancy at birth is 83.2 for women and 76.9 for men.

In Lombardy the organisation of the health system is characterised by separation between purchasers and providers. In fact there are now 15 LHAs and 27 Hospital Trusts, the former

[12] The structural data on Local Health Authorities and Hospital Trusts are taken from Ministero della Salute, Attività gestionali ed economiche delle ASL e Aziende ospedaliere (www.ministerosalute.it).

[13] 'Accreditati' bodies are private corporations which supply services on behalf of, and charged to, the National Heath Service (NHS).

[14] These data, and those that follow on per capita expenditure, are taken from Monitor, Year III, n. 10 (http://www.assr.it/monitor/monitor_2004/Monitor_10_04.pdf - year 2002).

[15] Ministero della Salute, Rapporti annuali sui ricoveri ospedalieri (www.ministerosalute.it).

[16] In Italy, the level of public long-term care costs is relatively low.

being responsible for purchasing and the latter for providing. As a result of the recent reform of the health sector, Lombardy has increased the role of the private sector.

The total number of hospital beds[17] (including day hospitals) per 1,000 inhabitants is 5.2: 4.2 in public hospitals (81%) and 1 in private 'accredited' ones. The gross hospitalisation rate (including day hospitals) is 219.11 per 1,000 and the average length of stay is 7.36 days.[18] Around 79% of hospital admissions are to public hospitals.[19]

The number of ambulatory care services (internally to and outside hospitals, public and private 'accredited' hospitals) is 16 per 100,000 residents; 49% of them are public. The number of beds in residential and semi-residential care institutions is 700 per 100,000 residents.

Total per capita health care expenditure in 2002 was € 1,373, 50.98% on outpatient services (including 13.83% on drugs and 9.38% on residential and semi-residential care), 44.96% on hospital care, 4.06% on prevention.

2.3 Abruzzi

Abruzzi has a population of 1.27 million people and a density of 119 inhabitants per km^2. About 29.4% of Abruzzi inhabitants live in the mountains: in fact, the region is mainly mountainous (54.4%). It has a GDP per capita of around €18,570 (91.8% of the EU25 average in Purchasing Power Standard), an unemployment rate of 5.4% and an adjusted Human Development Index of 0.7868.

Almost 21% of the population are aged over 64 and 9.8% over 74; the old age index (65+/0-14) is 1.5 and is predicted to increase to 1.55 by 2010.

The infant mortality rate (2001) is 5 per 1,000 (5.4 for men, 4.5 for women), and life expectancy at birth is 83.3 for women and 77.9 for men.

The regional health care system is organised around 6 LHAs, which manage all health services – hospital care included – while Hospital Trusts provide tertiary and highly specialised care. There is no separation between purchasers and providers: LHAs provide health services in accordance with the general national law regulating the NHS.

The total number of hospital beds[20] (including day hospitals) per 1,000 inhabitants is 5.1: 4.3 in public hospitals (84%) and 0.8 in private 'accredited' ones. The gross hospitalisation rate

---

[17] The structural data on Local Health Authorities and Hospital Trusts are taken from Ministero della Salute, Attività gestionali ed economiche delle ASL e Aziende ospedaliere (www.ministerosalute.it).

The following data are from Ministero della Salute, Attività gestionali ed economiche delle ASL e Aziende ospedaliere (www.ministerosalute.it).

[18] These data, and those that follow on per capita expenditure, are taken from Monitor, Year III, n. 10 (http://www.assr.it/monitor/monitor_2004/Monitor_10_04.pdf - year 2002).

[19] Ministero della Salute, Rapporti annuali sui ricoveri ospedalieri (www.ministerosalute.it).

[20] The structural data on Local Health Authorities and Hospital Trusts are from Ministero della Salute, Attività gestionali ed economiche delle ASL e Aziende ospedaliere (www.ministerosalute.it).

(including day hospitals) is 278.25 per 1,000, and the average length of stay is 6.6 days.[21] About 80.6%[22] of hospital admissions are to public hospitals.

The number of ambulatory care services (internally to and outside hospitals, public and private 'accredited' hospitals) is 23 per 100,000 residents; 55% of them are public. The number of beds in residential and semi-residential care institutions is 131 per 100,000 residents.

Total health care expenditure per capita in the year 2002[23] was €1,456, of which 46.45% went to outpatient services (including 16.03% on drugs and 7.32% on residential and semi-residential care), 48.96% to hospital care and 4.59% to prevention.

2.4 Apulia

Apulia is the fifth-largest Italian region, with a population of over four million people and a density of 209 inhabitants per km^2. The GDP per capita is about €14,660 (72.4 as a percentage of the EU25 average in Purchasing Power Standard). The unemployment rate is 13.8%, and the adjusted Human Development Index is 0.7010.

Around 16% of the population are aged over 64, 7% over 74. The old age index (65+/0-14) is 9.7, and it is predicted to increase to 1.12 by 2010.

The infant mortality rate (2001) is 5.6 per 1,000 (6.3 for men, 4.9 for women) and life expectancy at birth is 82.7 for women and 77.3 for men.

The regional health care system is organised around 12 Local LHAs and 2 Hospital Trusts. LHAs manage all health services – hospital care included – while Hospital Trusts provide tertiary and highly specialised care. There is no separation between purchasers and providers. LHAs provide health services in accordance with the general national law which regulates the National Health Service.

The total number of hospital beds[24] (including day hospitals) per 1,000 inhabitants is 4.4: 3.9 in public hospitals (89%) and 0.5 in private 'accredited' ones. The gross hospitalisation rate (including day hospitals) is 221.76 per 1,000 and the average length of stay is 6.0 days.[25] Around 90% of hospital admissions are to public hospitals.[26]

The number of ambulatory care services (internally and outside hospitals, public and private 'accredited' hospitals) is 21 per 100,000 residents; 53% of them are public. The number of beds in residential and semi-residential care institutions is 70 per 100,000 residents.

Total per capita health care expenditure in 2002 was €1,282: 47.85% on outpatient services (including 17.3% on drugs and 5.15% on residential and semi-residential care), 48.54% on hospital care, 3.61% on prevention.

---

[21] These data are taken from Relazione sanitaria 2004, Osservatorio Epidemiologico Regionale, Regione Abruzzo (http://sanitapo.regione.Abruzzi.it/news/relazione+sanitaria+.htm).

[22] Ministero della Salute, Rapporti annuali sui ricoveri ospedalieri (www.ministerosalute.it).

[23] Monitor, Year III, n. 10 (http://www.assr.it/monitor/monitor_2004/Monitor_10_04.pdf - year 2002).

[24] The structural data on Local Health Authorities and Hospital Trusts are from Ministero della Salute, Attività gestionali ed economiche delle ASL e Aziende ospedaliere (www.ministerosalute.it).

[25] These data, and those that follow on per capita expenditure, are from Monitor, Year III, n. 10 (http://www.assr.it/monitor/monitor_2004/Monitor_10_04.pdf - year 2002).

[26] Ministero della Salute, Rapporti annuali sui ricoveri ospedalieri (www.ministerosalute.it).

3. Methods and data

As described above, the decentralisation 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 that 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 – at least for hospital care in a number of regions.

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).[27] 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.

3.1 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. In the second step, these databases – which contained demographic information on patients – were used to compute health expenditure according to age[28] 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) (for more details, see Appendix A).

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;
- ✓ 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;

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

[28] 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.

- ✓ admitted between 1999 and 2000 or between 2000 and 2001 - only days of stay in 2000 are considered;
- ✓ 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 (residents 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.

3.2 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, rehabilitation services either in outpatient departments or at home, nursing homes and pharmaceutical care. These databases contain information on patient characteristics, type 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 than 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 tariffs 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 (see Appendix B). Figure 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 figure.

The curves are J-shaped, as we expected from the literature. Expenditure is lower for women than for men, at every age, except the peak around 30-34 years in the women's figure. This peak, which again is as expected, is the consequence of the age of fertility. We also observe that per capita expenditure stops increasing at the oldest ages in three regions out of four: in Lombardy it decreases after 80 years for men and after 85 for women; in Abruzzi it slightly diminishes from 90 years onwards; in Apulia it stabilises from 90 onwards. Only in Tuscany does it continue to increase after the age of 90, albeit at a lower rate. However, Tuscany is the region with the lowest per capita expenditure, except for people aged over 79, 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.[29] 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. This means that the smaller hospital expenditure is balanced by a larger long term-care expenditure (which is likely to increase with ageing).

Figure 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 death. These costs are massively higher than those for survivors and they diminish after a certain age. Hospital expenditure reaches €5,593, on average, in Lombardy, €5,868 in Tuscany, €5,770 in Abruzzi and €5,481 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.

Figure 3 is perhaps clearer: it summarises per capita expenditure trends on survivors and deceased for all regions.[30] 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

[29] Confirming the marked differences in the provision of long-term care, we have to stress that in Lombardy there are 79.9 dependent old users per 10,000 inhabitants, in Tuscany 30.7, in Abruzzi 17.1 and in Apulia 0.9.

[30] 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.

shows, expenditure on the deceased aged 90 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).

Figure 4 sums up expenditure on deceased and survivors:[31] 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.

Figure 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 women) among the regions.[32] Like the numerator (deceased expenditure), and for the same reasons, the ratio shows numerous fluctuations for young ages. Figure 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[33] (11.5 for all ages), USA[34] (about 9 for 70-74 years, 7 for 75-79, 5 for 80-84, 4 for over 85), Spain[35] (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).[36]

Figures 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 by the trend for the elderly (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 than for women.

In Abruzzi and Apulia, expenditure seems to become substantial only 11 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 for men and €396 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 €2,000 for men and €1,500 for women in Apulia, between €2,000 and €2,500 for men and between €1,500 and €2,000 for women in Abruzzi and Tuscany, and between €3,000 and €3,500 for men and between €2,000 and €2,500 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 with respect to health costs near

---

[31] Note that the average per capita expenditure on survivors and deceased shown by Figure 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).

[32] Using data from Taroni & Nobilio (2004), we also calculated the Emilia-Romagna ratio, which is about 14 (women and men).

[33] Polder & Achterberg (2004).

[34] Lubitz & Riley (1993), and Calfo et al. (2003).

[35] Ahn et al. (2003).

[36] See Raitano (2006) for a survey on available empirical studies on health costs near death.

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 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 explaining 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 (pharmaceutical, specialist care and laboratory tests included) 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 prescriptive drugs and outpatient specialist care in Tuscany, adopting for the purpose the same linkage method as used for the hospital database. Figure 11 shows per capita expenditure on deceased by age with regard to outpatient specialist care, laboratory tests and prescriptive drugs. As in the case of hospital expenditure, the figure shows wide fluctuations until around 55 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 prescriptive drugs they are 9% and 20%.

Figure 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 prescriptive 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 90 years olds (the regional range is 10-14 for all ages).

Nevertheless, our analysis has mainly concerned hospital expenditure. Hence, to deepen our 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 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 older ones are generally not as complete and reliable as the more recent ones.

From the macroeconomic 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 (State General Accounting Department, 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 multi-regional data, we can confirm that health spending is likely to grow to a lesser extent than expected when account is taken of costs near death[37].

From a microeconomic 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.

[37] The results on Italy worked out for this paper were taken into account by the Ragioneria Generale dello Stato (RGS, 2005) and by the Economic Policy Committee to outline the health expenditure projection scenario for the 25 member states including death costs (EPC and EC, 2006); see also Aprile & Palombi 2006, for methodological aspects relative to the inclusion of death costs as an input to heath care expenditure projections.

Figure 1. Hospital expenditure by age and gender of survivors

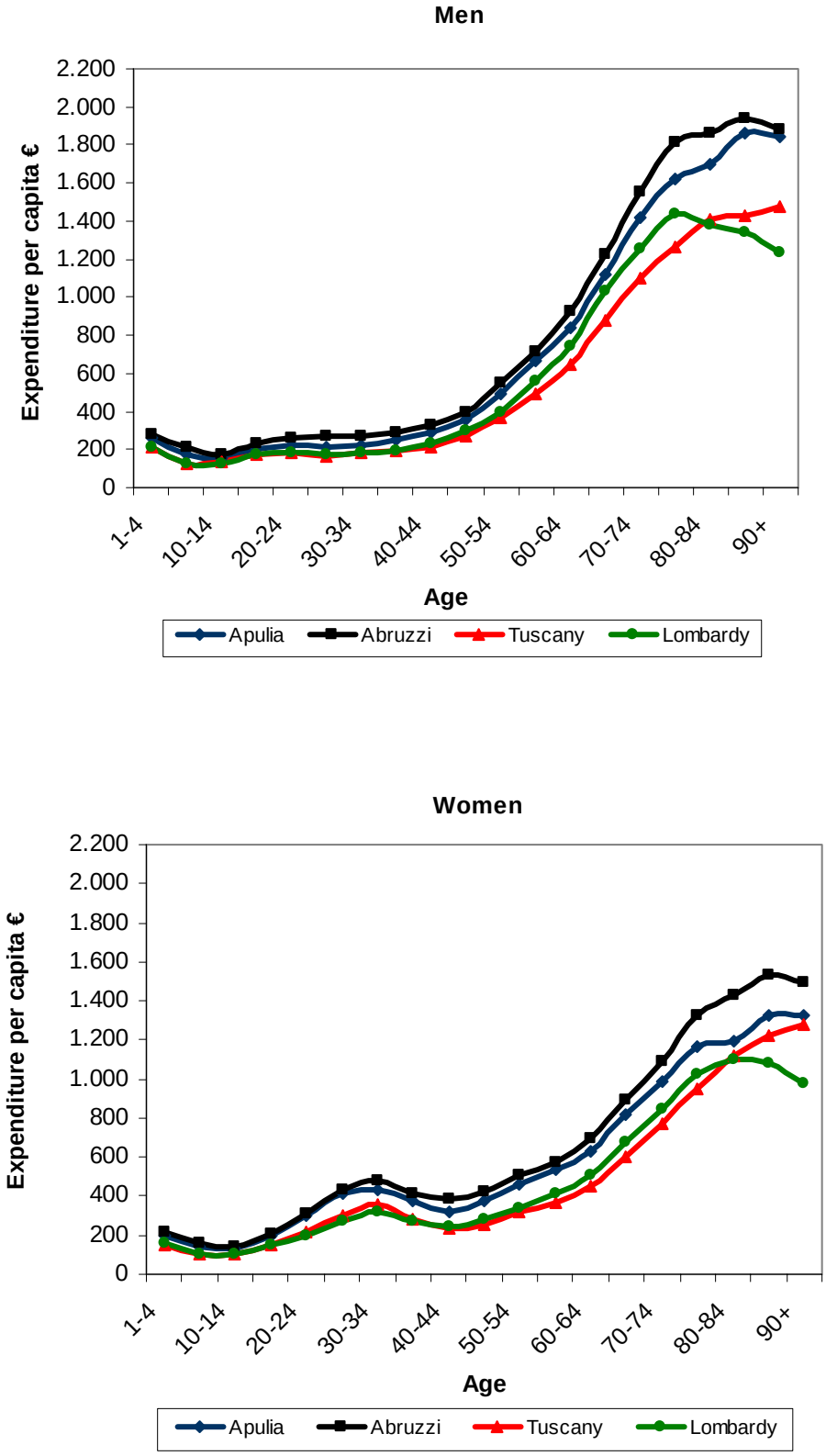


Figure 2. Hospital expenditure by age and gender of deceased

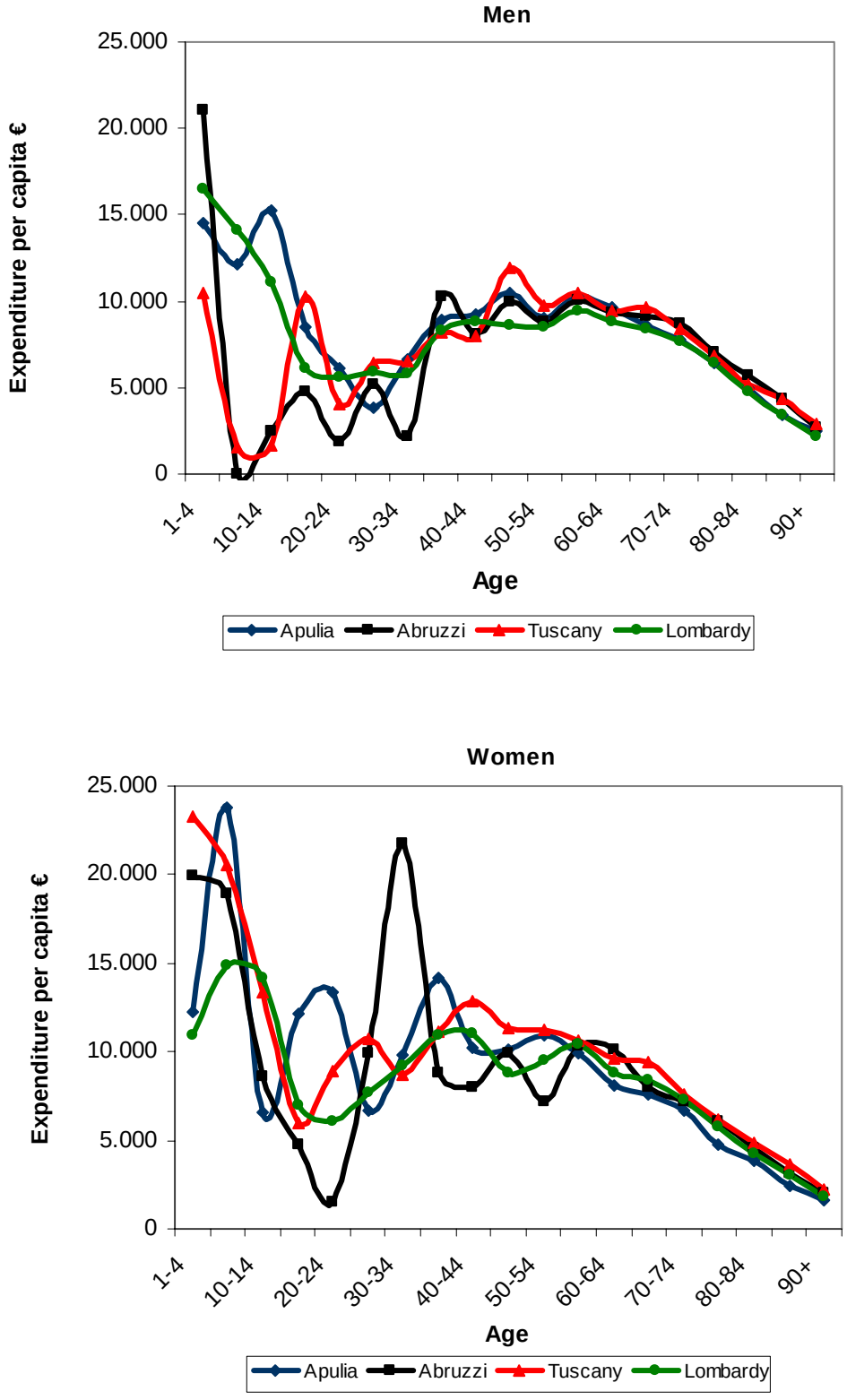


Figure 3. Hospital expenditure by age and gender of survivors and of deceased, all regions

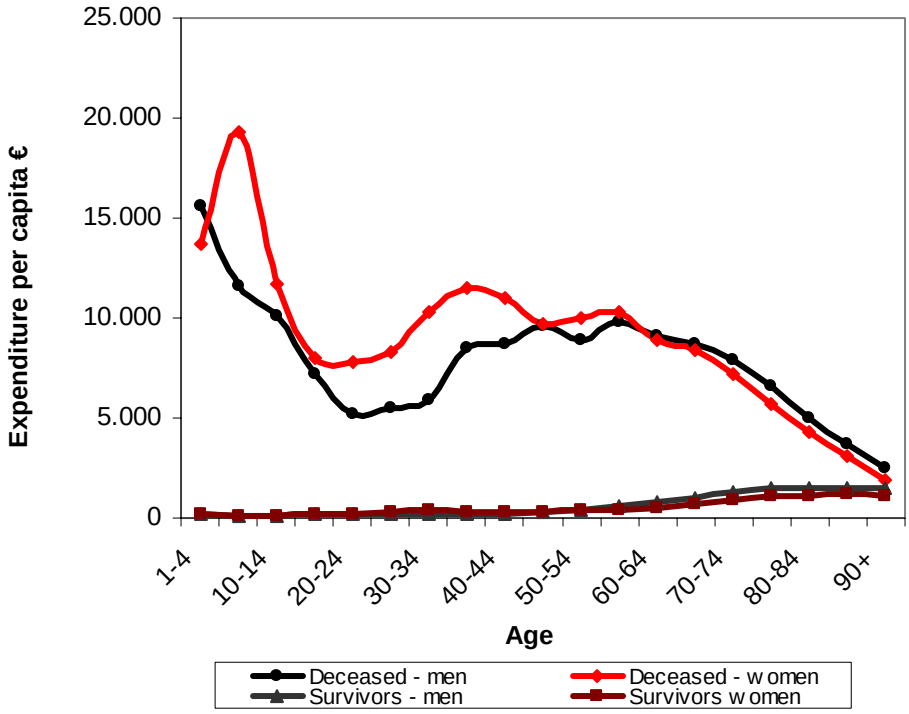


Figure 4. Hospital expenditure by age and gender: sum of survivors and deceased

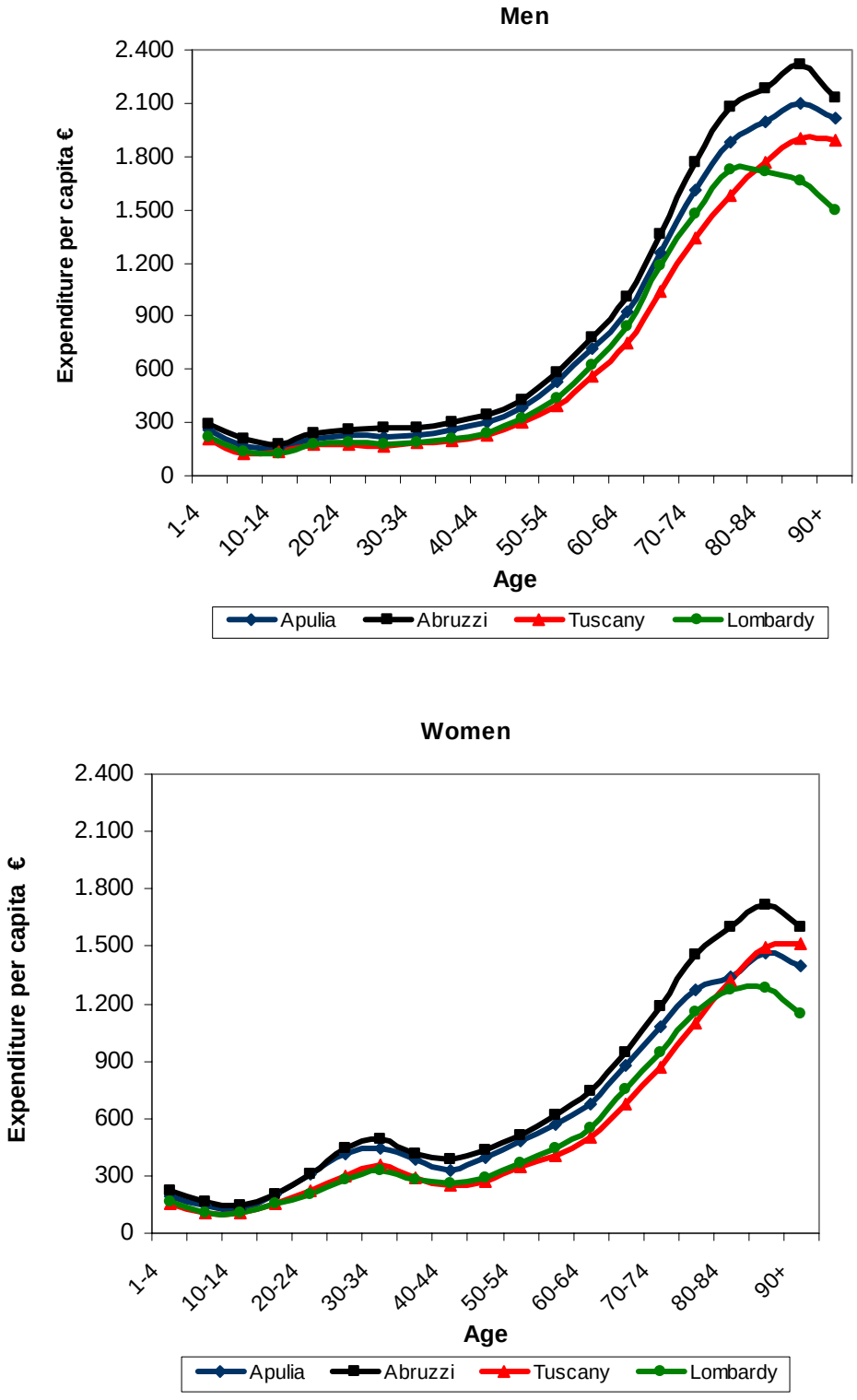


Figure 5. Per capita hospital expenditure ratio deceased/survivors by age and gender

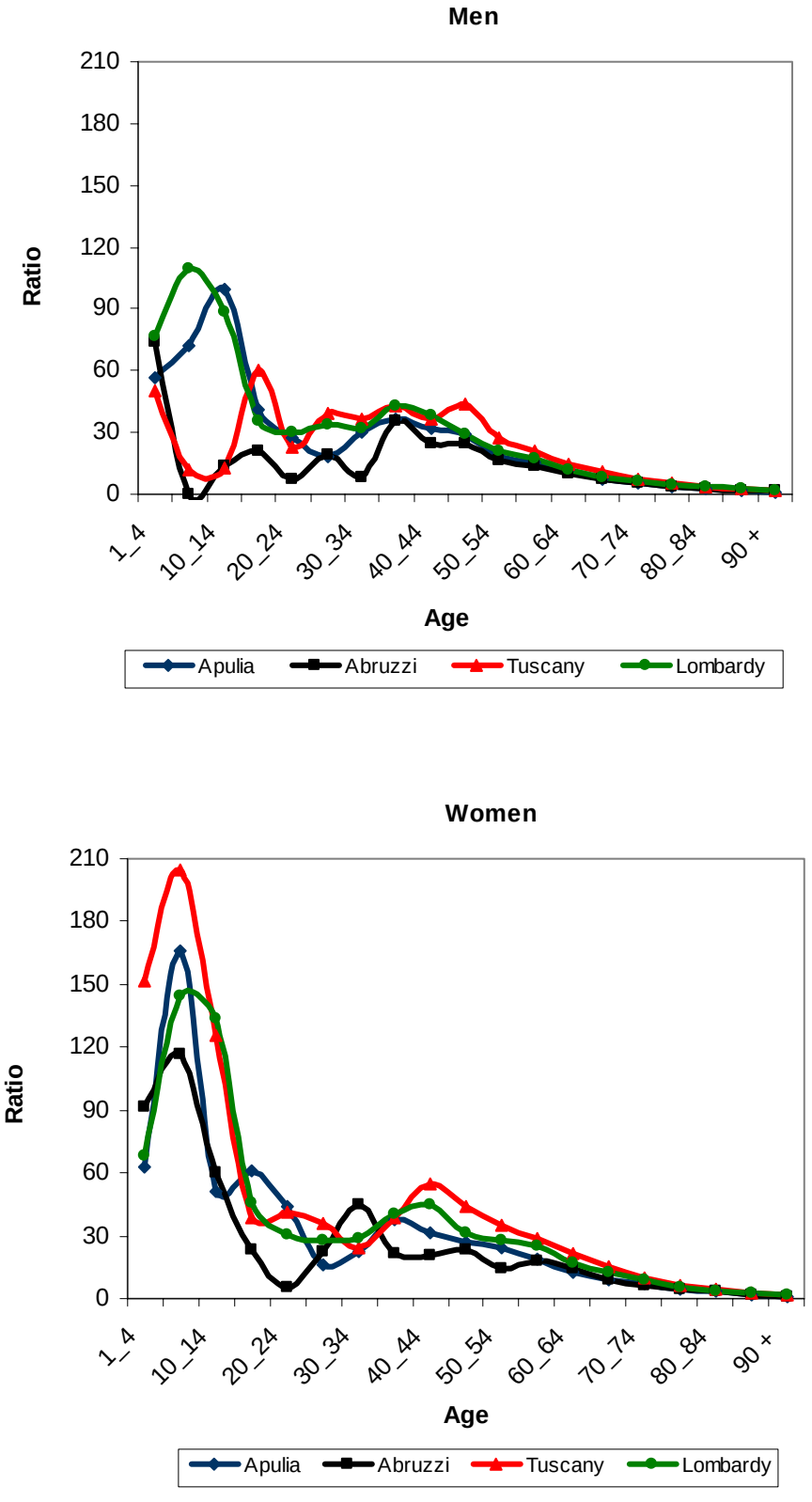


Figure 6. Per capita hospital expenditure ratio deceased/survivors by age and gender (40 +)

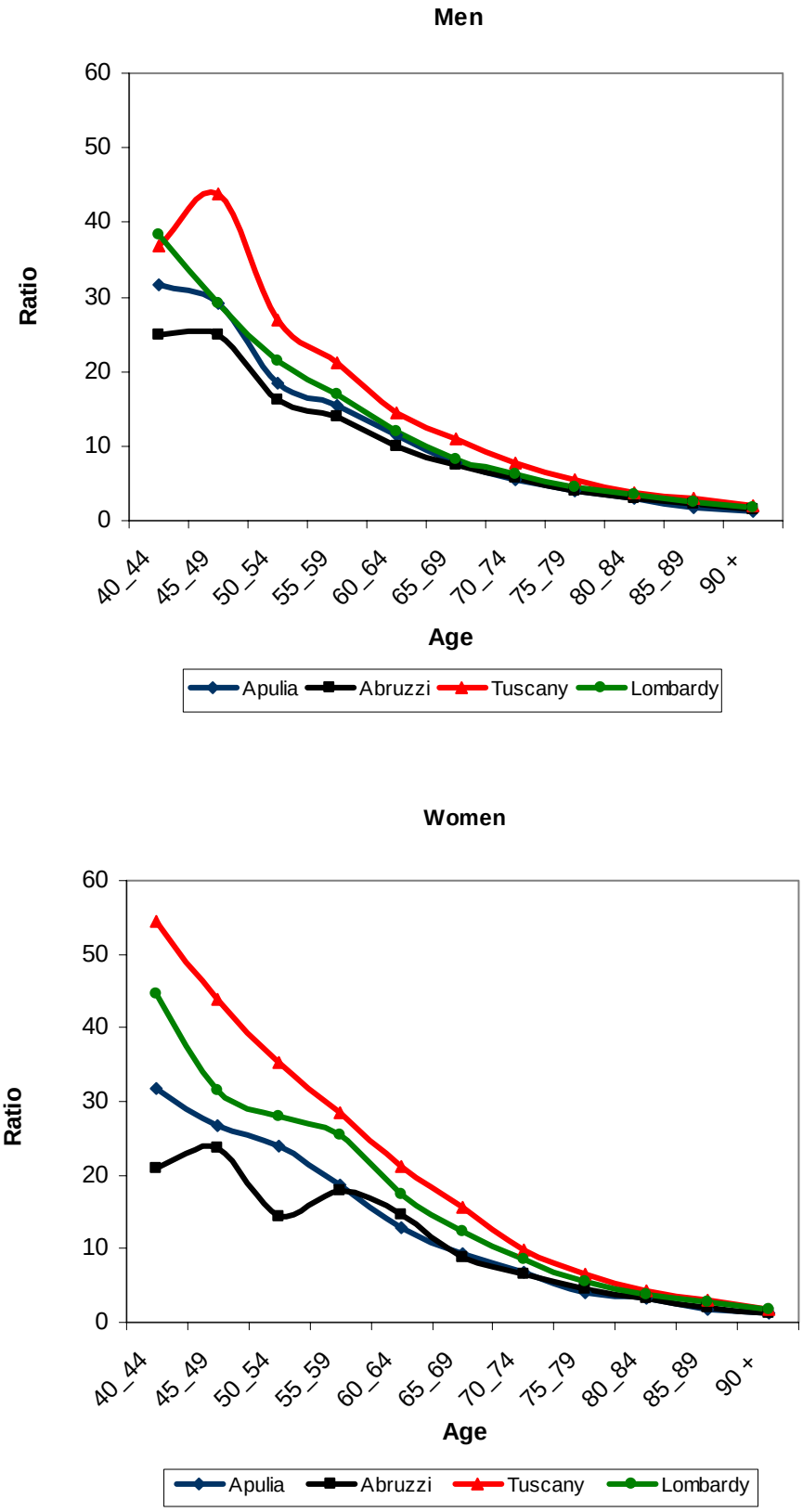


Figure 7. Hospital expenditure of deceased in the last 12 months by proximity to death – Lombardy

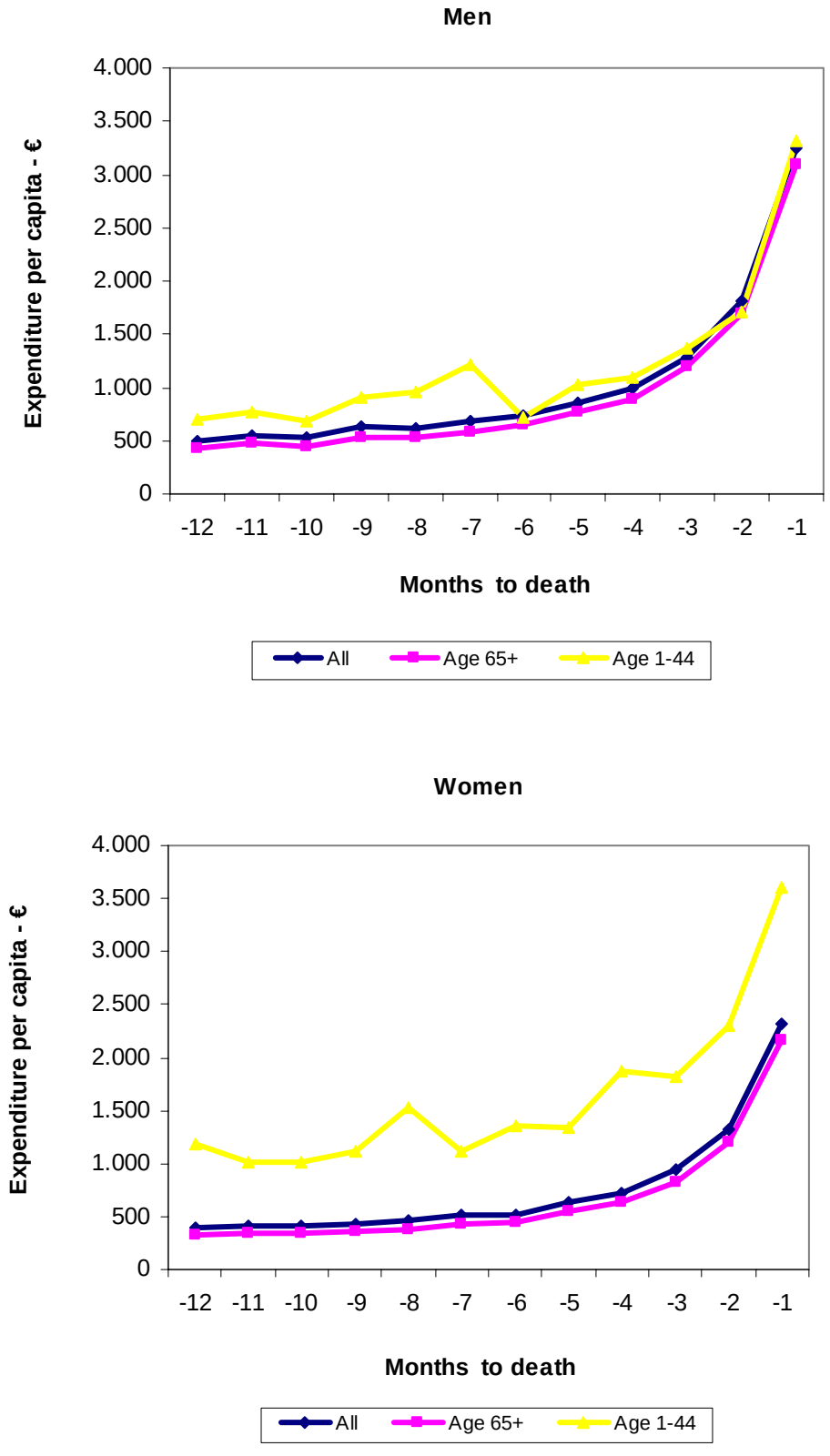
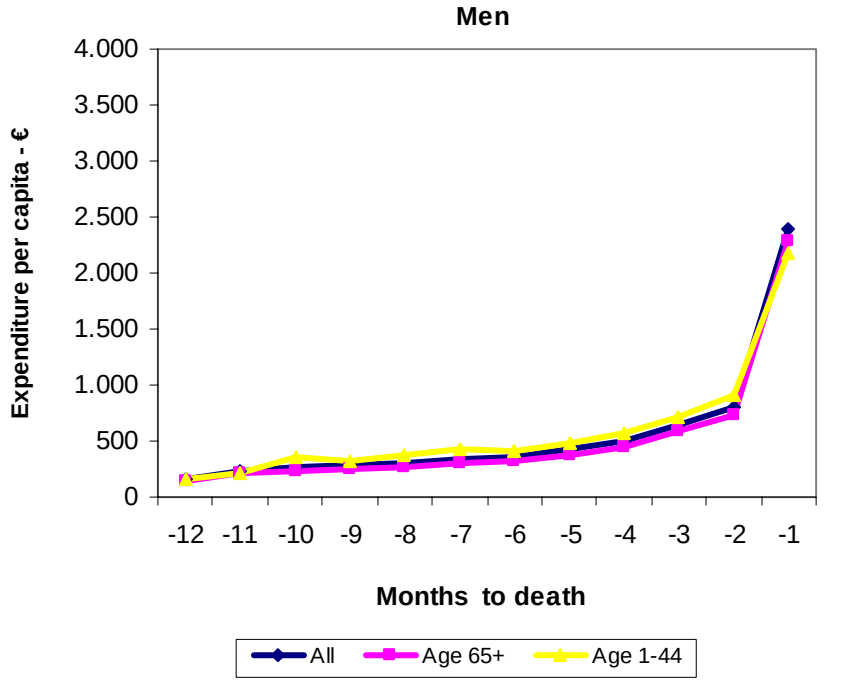


Figure 8. Hospital expenditure of deceased in the last 12 months by proximity to death – Tuscany



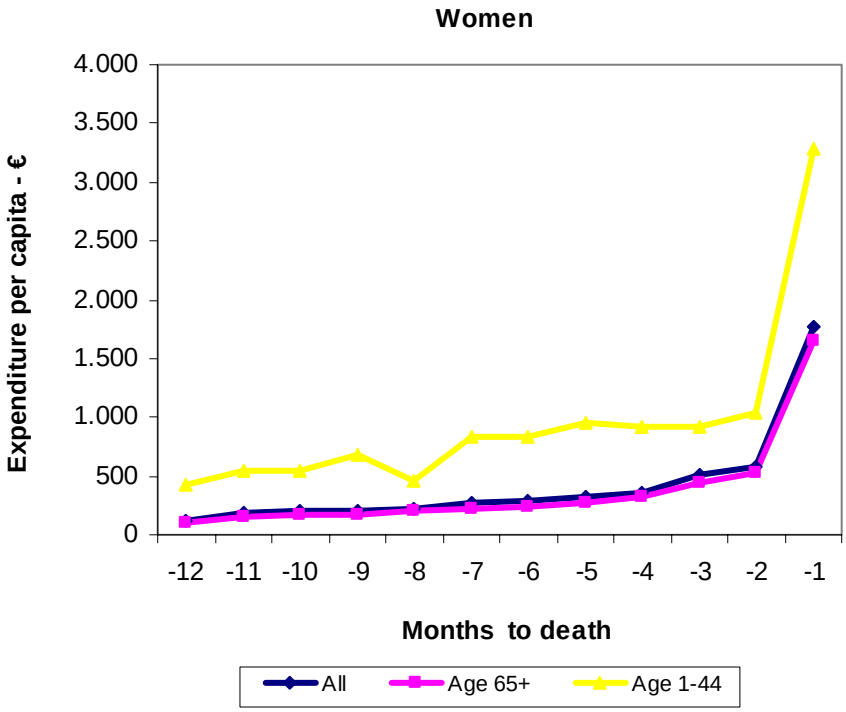
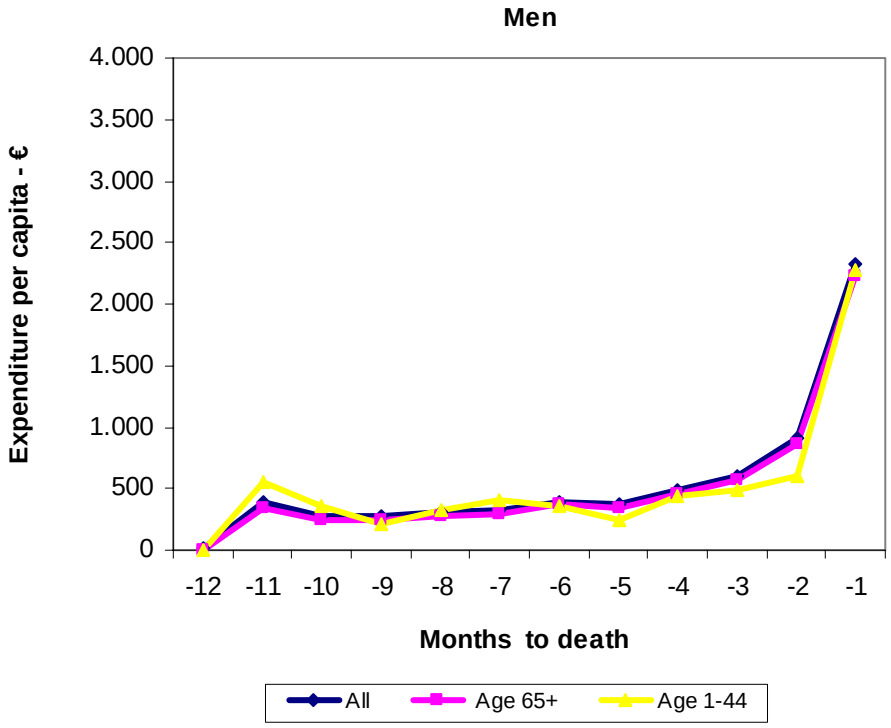


Figure 9. Hospital expenditure of deceased in the last 12 months by proximity to death – Abruzzi



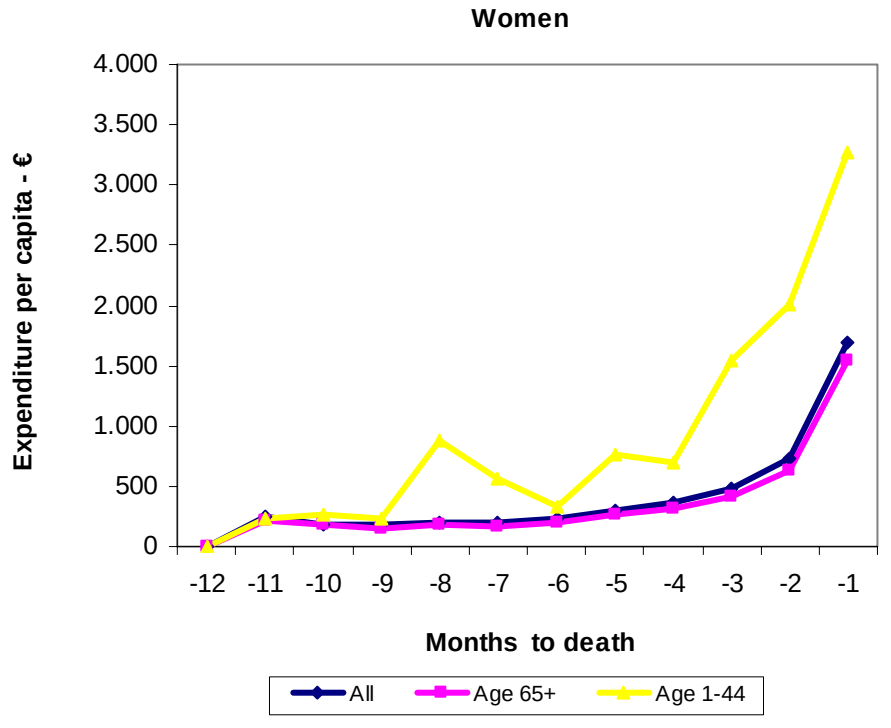


Figure 10. Hospital expenditure of deceased in the last 12 months by proximity to death – Apulia

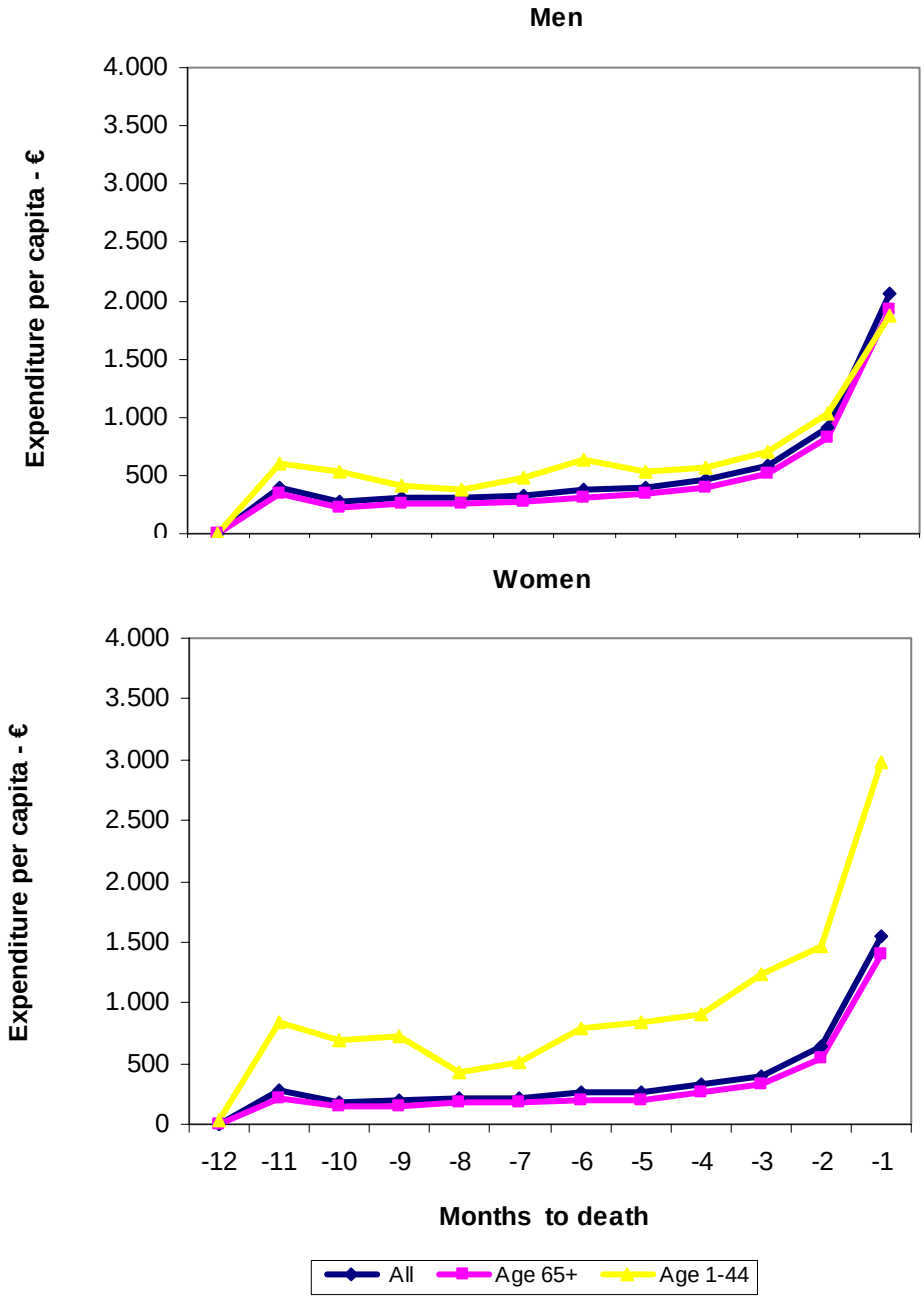


Figure 11. Expenditure by age of deceased

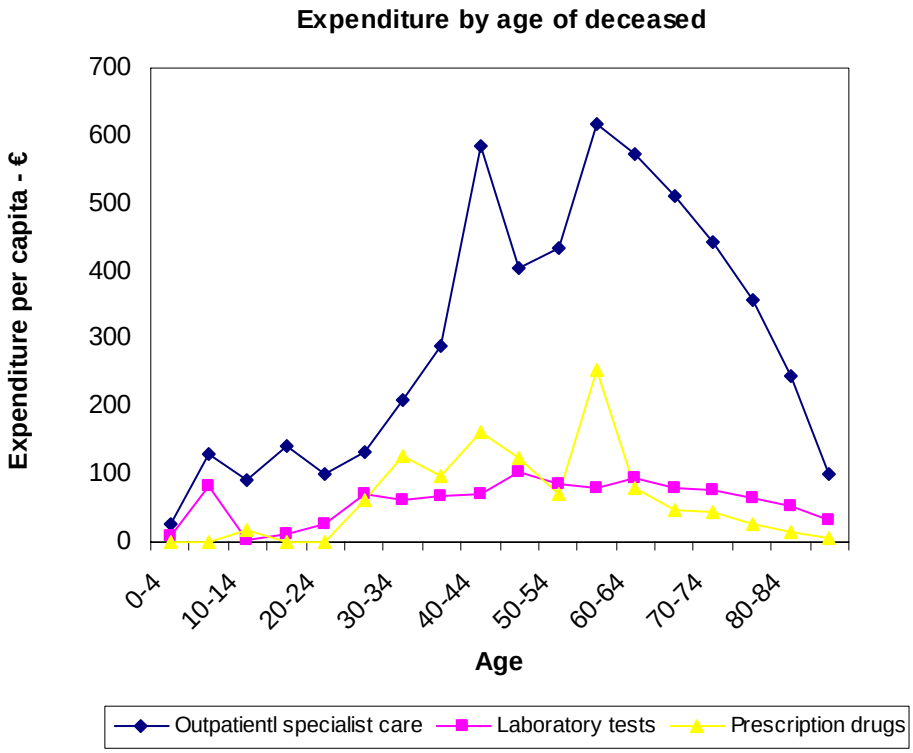
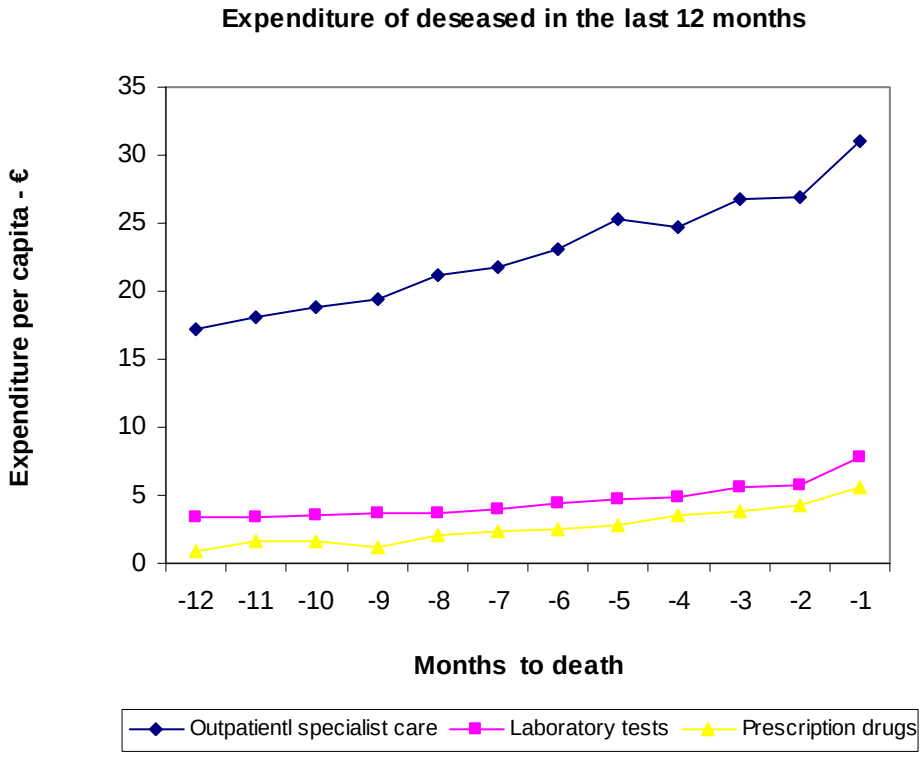


Figure 12. Expenditure of deceased in the last 12 months



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., J.R. García and J.A. Herce (2003), *Health Care Expenditure and Demographic Uncertainty*, Demwel project (Demographic Uncertainty and the Sustainability of Social Welfare Systems), WP2.

Aprile, R. and M. Palombi (2006), *How to take into account death related costs in projecting health care expenditure*, in Genus, LXII (No.1), XX-XX.

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

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 & Medicine*, No. 55.

Busse, R., C. Krauth and F.W. Schwartz (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.

Calfo, S., J. Smith and M. Zezza (2003), "Last Year of Life", CMS (Center for Medicare and Medicaid Services), mimeo (http://www.cms.hhs.gov/statistics/lyol).

Economic Policy Committee (EPC) (2001), "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", Brussels.

Economic Policy Committee and European Commission (EPC and EC) (2006), "The impact of ageing on public expenditure: projections for the EU25 Member States on pensions, health care, long-term care, education and unemployment transfers (2004-2050)", in European Economy, Special Report n° 1, Brussels.

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; also in A. Maynard (ed.), *The Public-Private Mix for Health*, Nuffield Trust, London, 2005.

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

Felder, S, M. Meier and H. Schmitt (2000), "Health Care Expenditure in the Last Months of Life", *Journal of Health Economics*, Vol. 19.

Lubitz, J. and G. Riley (1993), "Trends in Medicare Payments in the Last Year of Life", *New England Journal of Medicine*, Vol. 328.

Lubitz, J., J. Beebe and C. Baker (1995), "Longevity and Medicare Expenditure", *New England Journal of Medicine*, Vol. 332.

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

Raitano, M. (2006), *The Impact of Death-Related Costs on Health Care Expenditure: A Survey*, ENEPRI Research Report No. 17, ISAE-ENEPRI, December 2005 (available for free downloading from www.enepri.org or http://shop.ceps.be).

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.

RGS (2005), Dipartimento della Ragioneria Generale dello Stato, Ispettorato Generale per la Spesa Sociale, Le tendenze di medio-lungo periodo del sistema pensionistico e sanitario, Rapporto N. 7.

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

Seshamani, M. and A. Gray (2004), "Ageing and Health Care Expenditure: The Red Herring Argument Revisited", *Health Economics*, Vol. 13.

Taroni, F. and L. Nobilio (2004), "Concentrazione e persistenza della spesa sanitaria: Evidenze empiriche e implicazioni per le politiche sanitarie", in G. Fiorentini (ed.) (2004), *I sevizi sanitari in Italia*, Bologna: Il Mulino.

Vineis, P. and N. Dirindin (2004), *In buona salute*, Torino: Einaudi.

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

Zweifel, P., S. Felder and A. Werblow (2004), *Population Ageing and Health Care Expenditure: New Evidence on the "Red Herring"*, Geneva Papers on Risk Insurance, 29(4): 652-667.

Appendix A

RECLUST linkage procedure*

Record linkage is a procedure allowing the integration of information from two (or more) independent sources. Record linkage techniques can help to identify the same patient in various types of files – hospital discharge abstracts, insurance claims, administrative registries, death abstract databases – that contain similar identifiers. Record linkage facilitates cross-checks between separately maintained datasets to highlight data quality problems and assist in the use of administrative records for research purposes.

When the requirement is to link records at different times and in different places, in principle it would be possible to link such records using a unique personal identification number. In practice, a unique number (such as the national health system code) is not generally available on records.

The clustering procedure (RECLUST) is a probabilistic linkage based on a computed calculation of the probability that a record is related to the same person, by using a clustering algorithm performed with SAS language and an interactive method which consists of 5 steps.

1st step: Definition of cluster keys

The most common data elements used for identification purposes are: name (or part thereof), address (or a location descriptor), date of birth, sex, fiscal code or National Health Service code.

These elements will be joined in order to create a unique key composed by n-dimension, as the number of the elements used for the identification must be present in all databases (so it is necessary to exclude someone if s/he is not present in every database).

The choice of the number of dimensions depends on the quality of the element and its informational value. In this step it is important to make sure that the variables to be used as linkage keys are formatted in the same way in each file. Differences in capitalisation, justification, leading zeroes can all make the same value look different to a linkage programme. Names present a special problem as the same name can be represented in many different ways. Alternate spellings, initials, abbreviations, shortened forms of names, changes in last name due to marriage, and people going by their middle name instead of their 'real' first name can all make linkage difficult.

Some simple strategies for standardising name fields that proved useful in this project include:

- Convert all names to uppercase.
- Remove period after St. for names starting with 'St.'
- Take first space-delimited value in each name field. If the name is compound (de Braun, van Dyck, van den Bergh, etc.) take all components and remove spaces. van den Bergh becomes VANDENBERGH.

2nd step: Assignment of a weight to the variables

RECLUST procedure allows for the assignment of different levels of priority, giving more importance to those keys that are more reliable for the identification of the patient.

* The cluster linkage procedure was developed by Antonio D'Ettorre, Mario Negri Sud.

3rd step: Application to the Soundex procedure

RECLUST algorithm includes the Soundex procedure, applied only to string variables (as name and surname) allowing the equality of two or more variables to be verified.

Specifically, the Soundex function is an indexing system that translates a name into a 4-digit code consisting of one letter and three numbers. The advantage of Soundex is its ability to locate names by the way they sound, rather than by exact spelling. For example, consider the name *Maris*. This name has a Soundex code of M620. Other variations on this name (such as *Mares, Marriss, Mariss* and *Mairis*) all have the same Soundex code.

4th step: Key code assignment

After selecting the keys, the algorithm RECLUST assigns to the records some numerical codes that are the results of the clustering operation made by each key. The algorithm will assign the same code not only to records with the same informational response, but also to those records that are phonetically similar, according to Soundex algorithm. Then the RECLUST will operate only by using the assigned codes and ignoring the original information (name, age, etc).

5th step: Finally the RECLUST procedure creates a final cluster, by grouping the records with the assigned codes and by establishing a value that increases when a new class is identified.

Appendix B

Per capita hospital expenditure of deceased and survivors by age and gender - Lombardy

	a			b			a/b		
	Per capita expenditure deceased			Per capita expenditure survivors					
Age	Men	Women	All	Men	Women	All	Men	Women	All
1-4	16494,61	10967,66	13546,91	213,93	161,72	188,59	77,10	67,82	71,83
5-9	14090,18	14829,43	14376,83	128,23	102,69	115,83	109,88	144,40	124,12
10-14	11079,26	14215,30	12615,28	124,85	105,98	115,70	88,74	134,13	109,03
15-19	6096,94	7010,64	6401,50	172,52	152,13	162,60	35,34	46,08	39,37
20-24	5601,91	6099,85	5725,52	186,45	201,03	193,58	30,04	30,34	29,58
25-29	5861,27	7731,15	6319,10	175,59	277,27	225,03	33,38	27,88	28,08
30-34	5812,97	9200,82	6669,97	180,10	321,97	248,80	32,28	28,58	26,81
35-39	8260,08	10939,54	8997,02	192,75	273,38	231,97	42,85	40,02	38,79
40-44	8800,30	11051,65	9606,10	229,06	247,76	238,28	38,42	44,61	40,31
45-49	8605,00	8815,56	8677,74	295,39	280,63	288,01	29,13	31,41	30,13
50-54	8492,04	9505,64	8853,58	397,07	340,01	368,32	21,39	27,96	24,04
55-59	9423,45	10419,41	9744,03	558,43	409,16	482,06	16,87	25,47	20,21
60-64	8847,37	8826,77	8840,60	742,05	507,26	619,72	11,92	17,40	14,27
65-69	8372,07	8401,74	8382,06	1027,69	677,81	836,54	8,15	12,40	10,02
70-74	7628,53	7260,59	7488,28	1256,11	845,84	1015,93	6,07	8,58	7,37
75-79	6431,99	5774,54	6126,73	1436,97	1022,98	1171,93	4,48	5,64	5,23
80-84	4769,77	4221,79	4462,99	1384,45	1099,79	1186,01	3,45	3,84	3,76
85-89	3396,54	2995,47	3134,36	1339,85	1083,71	1147,76	2,54	2,76	2,73
90+	2226,18	1773,92	1881,37	1236,12	982,40	1029,23	1,80	1,81	1,83
All ages	6482,93	4736,43	5593,42	407,12	404,17	405,60	15,92	11,72	13,79

Per capita hospital expenditure of deceased and survivors by age and gender - Tuscany

	a			b			a/b		
	Per capita expenditure deceased			Per capita expenditure survivors					
Age	Men	Women	All	Men	Women	All	Men	Women	All
1-4	10509,17	23232,70	18461,38	209,62	153,23	182,24	50,13	151,62	101,30
5-9	1554,33	20583,14	11800,62	128,75	100,70	115,11	12,07	204,40	102,51
10-14	1671,29	13409,36	8844,56	133,92	106,95	120,79	12,48	125,38	73,23
15-19	10308,58	5956,24	8912,55	171,93	153,89	163,16	59,96	38,70	54,62
20-24	4057,26	8924,28	5394,35	179,08	215,44	196,87	22,66	41,42	27,40
25-29	6435,76	10764,64	7546,46	165,22	297,37	230,17	38,95	36,20	32,79
30-34	6585,51	8667,79	7209,02	179,11	352,72	264,30	36,77	24,57	27,28
35-39	8215,32	11098,99	9247,22	193,47	286,03	239,14	42,46	38,80	38,67
40-44	7980,39	12839,70	9927,82	216,55	235,64	226,06	36,85	54,49	43,92
45-49	11878,97	11308,60	11656,42	270,95	257,09	263,97	43,84	43,99	44,16
50-54	9774,54	11218,35	10307,80	362,14	318,78	340,04	26,99	35,19	30,31
55-59	10440,40	10577,70	10488,70	491,36	371,36	429,28	21,25	28,48	24,43
60-64	9401,13	9597,30	9471,71	648,88	452,17	545,76	14,49	21,23	17,35
65-69	9610,74	9398,20	9537,93	878,39	604,43	731,11	10,94	15,55	13,05
70-74	8392,00	7599,63	8106,77	1102,93	768,27	913,37	7,61	9,89	8,88
75-79	6878,64	6179,15	6578,73	1267,34	954,04	1077,41	5,43	6,48	6,11
80-84	5213,10	4840,69	5019,94	1412,71	1114,52	1219,73	3,69	4,34	4,12
85-89	4325,85	3603,44	3893,95	1425,39	1224,61	1285,33	3,03	2,94	3,03
90+	2859,14	2271,38	2440,22	1475,54	1277,95	1322,41	1,94	1,78	1,85
All ages	6698,37	5049,48	5867,89	417,28	419,98	418,68	16,05	12,02	14,02

Per capita hospital expenditure of deceased and survivors by age and gender - Abruzzi

	a			b			a/b		
	Per capita expenditure deceased			Per capita expenditure survivors					
Age	Men	Women	All	Men	Women	All	Men	Women	All
1-4	21025,27	19902,53	20544,10	284,09	216,57	251,11	74,0	91,9	81,8
5-9	0,00	18973,60	11384,16	212,07	162,91	188,21	0,0	116,5	60,5
10-14	2471,16	8563,99	5240,63	176,38	142,64	160,00	14,0	60,0	32,8
15-19	4810,00	4771,02	4802,46	231,17	204,04	217,92	20,8	23,4	22,0
20-24	1881,05	1557,76	1800,23	263,28	310,51	286,28	7,1	5,0	6,3
25-29	5182,05	9947,92	6275,86	268,06	437,01	352,05	19,3	22,8	17,8
30-34	2199,62	21726,43	9443,43	272,51	482,37	376,99	8,1	45,0	25,0
35-39	10288,34	8830,76	9835,98	287,20	412,68	349,61	35,8	21,4	28,1
40-44	8138,83	7987,66	8093,93	325,48	381,09	353,33	25,0	21,0	22,9
45-49	9925,97	9958,73	9938,48	399,35	419,13	409,30	24,9	23,8	24,3
50-54	8789,57	7220,16	8288,41	546,53	503,12	524,78	16,1	14,4	15,8
55-59	10106,57	10361,02	10201,53	718,85	576,01	646,44	14,1	18,0	15,8
60-64	9293,46	10142,35	9592,63	925,93	694,30	806,36	10,0	14,6	11,9
65-69	9096,09	7959,72	8715,20	1221,15	893,13	1044,68	7,4	8,9	8,3
70-74	8750,40	7160,92	8143,33	1550,80	1090,91	1292,72	5,6	6,6	6,3
75-79	7069,89	6048,14	6619,07	1812,35	1325,46	1519,06	3,9	4,6	4,4
80-84	5676,49	4601,99	5123,28	1865,77	1430,88	1590,96	3,0	3,2	3,2
85-89	4356,49	3170,02	3673,66	1937,29	1531,67	1665,94	2,2	2,1	2,2
90+	2733,50	1977,11	2239,18	1881,04	1491,10	1596,48	1,5	1,3	1,4
All ages	6661,684	4823,81	5770,2501	567,7571	568,3736	568,0738	11,7	8,5	10,2

Per capita hospital expenditure of deceased and survivors by age and gender - Apulia

	a			b			a/b		
	Per capita expenditure deceased			Per capita expenditure survivors					
Age	Men	Women	All	Men	Women	All	Men	Women	All
1-4	14539,16	12222,44	13308,40	256,68	194,01	226,28	56,6	63,0	58,8
5-9	12178,37	23789,86	17818,24	169,62	143,44	156,97	71,8	165,9	113,5
10-14	15253,81	6565,50	11530,25	153,35	128,67	141,39	99,5	51,0	81,5
15-19	8474,98	12128,91	9579,65	204,91	200,12	202,57	41,4	60,6	47,3
20-24	6169,27	13329,52	7555,13	223,50	303,16	262,56	27,6	44,0	28,8
25-29	3875,56	6632,68	4564,84	215,91	412,77	314,31	18,0	16,1	14,5
30-34	6644,38	9823,59	7590,39	222,41	437,12	330,56	29,9	22,5	23,0
35-39	8961,89	14191,80	10619,10	246,59	378,25	313,53	36,3	37,5	33,9
40-44	9211,20	10175,52	9569,54	290,35	321,57	306,35	31,7	31,6	31,2
45-49	10473,38	10138,83	10344,65	359,35	379,27	369,56	29,1	26,7	28,0
50-54	9049,90	10936,89	9730,57	492,82	457,74	474,87	18,4	23,9	20,5
55-59	10257,30	9929,00	10131,68	661,33	535,11	596,34	15,5	18,6	17,0
60-64	9609,33	8123,13	9072,15	837,13	631,33	728,38	11,5	12,9	12,5
65-69	8618,99	7588,61	8238,92	1116,53	818,27	954,23	7,7	9,3	8,6
70-74	7786,67	6720,45	7341,73	1413,60	986,61	1172,54	5,5	6,8	6,3
75-79	6394,91	4802,83	5673,89	1620,41	1162,30	1346,82	3,9	4,1	4,2
80-84	4992,20	3866,68	4416,50	1696,86	1191,57	1376,09	2,9	3,2	3,2
85-89	3406,06	2452,18	2839,55	1860,52	1323,28	1505,12	1,8	1,9	1,9
90+	2451,08	1621,65	1894,91	1845,53	1329,74	1473,97	1,3	1,2	1,3
All ages	6419,337	4506,585	5481,313	452,6557	466,2353	459,6305	14,2	9,7	11,9

About ENEPRI

The European Network of Economic Policy Research Institutes (**ENEPRI**) is composed of leading socio-economic research institutes in practically all EU member states and candidate countries that are committed to working together to develop and consolidate a European agenda of research. **ENEPRI** was launched in 2000 by the Brussels-based Centre for European Policy Studies (CEPS), which provides overall coordination for the initiative.

While the European construction has made gigantic steps forward in the recent past, the European dimension of research seems to have been overlooked. The provision of economic analysis at the European level, however, is a fundamental prerequisite to the successful understanding of the achievements and challenges that lie ahead. **ENEPRI** aims to fill this gap by pooling the research efforts of its different member institutes in their respective areas of specialisation and to encourage an explicit European-wide approach.

ENEPRI is composed of the following member institutes:

CASE	Center for Social and Economic Research, Warsaw, Poland
CEE	Center for Economics and Econometrics, Bogazici University, Istanbul, Turkey
CEPII	Centre d'Études Prospectives et d'Informations Internationales, Paris, France
CEPS	Centre for European Policy Studies, Brussels, Belgium
CERGE-EI	Centre for Economic Research and Graduated Education, Charles University, Prague, Czech Republic
CPB	Netherlands Bureau for Economic Policy Analysis, The Hague, The Netherlands
DIW	Deutsches Institut für Wirtschaftsforschung, Berlin, Germany
ESRI	Economic and Social Research Institute, Dublin, Ireland
ETLA	Research Institute for the Finnish Economy, Helsinki, Finland
FEDEA	Fundación de Estudios de Economía Aplicada, Madrid, Spain
FPB	Federal Planning Bureau, Brussels, Belgium
IE-BAS	Institute of Economics, Bulgarian Academy of Sciences, Sofia, Bulgaria
IER	Institute for Economic Research, Bratislava, Slovakia
IER	Institute for Economic Research, Ljubljana, Slovenia
IHS	Institute for Advanced Studies, Vienna, Austria
ISAE	Istituto di Studi e Analisi Economica, Rome, Italy
NIER	National Institute of Economic Research, Stockholm, Sweden
NIESR	National Institute of Economic and Social Research, London, UK
NOBE	Niezalezny Osrodek Bana Ekonomicznych, Lodz, Poland
PRAXIS	Center for Policy Studies, Tallinn, Estonia
RCEP	Romanian Centre for Economic Policies, Bucharest, Romania
SSB	Research Department, Statistics Norway, Oslo, Norway
SFI	Danish National Institute of Social Research, Copenhagen, Denmark
TÁRKI	Social Research Centre Inc., Budapest, Hungary

ENEPRI publications include three series: Research Reports, which consist of papers presenting the findings and conclusions of research undertaken in the context of ENEPRI research projects; Working Papers, which constitute dissemination to a wider public of research undertaken and already published by ENEPRI partner institutes on their own account; and thirdly, Occasional Papers (closed series) containing a synthesis of the research presented at workshops organised during the first years of the network's existence.

European Network of Economic Policy Research Institutes
c/o Centre for European Policy Studies
Place du Congrès 1 ▪ 1000 Brussels ▪ Tel: 32(0) 229.39.11 ▪ Fax: 32(0) 219.41.51
Website: http//:www.enepri.org ▪ E-mail: info@enepri.org