



# The effect of age and time to death on primary care costs: The Italian experience



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## ABSTRACT

A large body of literature shows that time to death (TTD) is by far a better predictor of health spending than age. In this paper, we investigate if this finding holds true also in presence of *primary care costs* (pharmaceuticals, diagnostic tests and specialist visits) in Italy, where they represent an important share (about 30%) of the total health care expenditure (HCE). Our analysis is based on a large sample of the Italian population (about 750,000 individuals), obtained from the Health Search-SiSSI database, which contains patient-level data collected routinely by General Practitioners in Italy since 2002. We study individuals aged 19 and older, over the period 2006–2009. By means of a two-part model which accounts for the presence of zero expenditure, our findings show that age represents the most important driver of *primary care costs* in Italy, although TTD remains a good predictor. These results suggest that age and TTD can have a different role in shaping health care costs according to the component of health expenditure examined. Therefore, our advice to policy makers is to use disaggregated models to better disentangle these contributions and to produce more reliable health spending forecasts.

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## 1. Introduction

The continued growth in health care spending observed over the last decades has put pressure on many government budgets, household finances and, inevitably, health services provision. Concerns about health care expenditure (hereafter HCE) growth and its long-term sustainability have risen to the top of the policy agenda in several countries. As a consequence, policy makers have started requesting expenditure forecasts to support policy planning. The building of reliable econometric models has then become an important research objective, with the main aim of supporting policy makers' decision processes.

An existing large body of literature has investigated the main determinants of health care expenditures, trying to understand whether an increase in HCE (especially at older ages) occurs as a function of proximity to death or simply as a function of age. If aging is the main responsible factor for the surge in health care costs, then demography tells us that we should expect a constant growth in HCE until 2040, with serious effects on the financial sustainability of the

systems (OECD, 2005). On the contrary, if time-to-death (hereafter TTD) is what really drives the expenditure, then, independent of decedent age, the bulk of per capita health-care costs is concentrated in the last years of life. In this last case, improvements in life expectancy should let us observe decreases in age-specific mortality rates and, consequently, a fall in age-specific costs (because declining mortality rates reduce the proportion of high-cost users, i.e. those close to death). Moreover, many studies on closeness to death confirm the need to incorporate the death-cost component in projections of health-care expenditures (for a review, see Gray, 2005; Raitano, 2006). In fact, as pointed out by Stearns et al. (2004), models that do not take into account time to death predict a 9% higher health expenditure than models which control for it.

A milestone study in the debate of age *versus* time to death was carried out by Zweifel et al. (1999) who used a Swiss panel data to provide empirical evidence that time to death, and not age, matters for health care expenditure, thus reverting the evidence obtained until then (Mendelson et al., 1993; Gerdtam, 1993). The authors propose the 'red herring' argument according to which traditional projection methods tend to overestimate the influence of aging since improvements in life expectancy will postpone, rather than raise, health expenditure (Zweifel et al., 1999, 2004). In line with this view, Seshamani and Gray, 2004a use UK panel data and find that both time to death and age matter for hospital costs, but the

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impact of closeness to death is higher. In a further paper, [Seshamani and Gray, 2004b](#) show that time to death affects health costs up to 15 years prior to death. However, some authors have raised methodological concerns about the approach of [Zweifel et al. \(1999\)](#), since it may suffer from collinearity as well as from reverse causality ([Dow and Norton, 2002](#); [Salas et al., 2001](#); [Seshamani et al., 2004a](#)). In a later work, [Felder et al. \(2010\)](#) address the problem of reverse causation using an instrumental variable approach, confirming that closeness to death matters and that a surge in HCE is more likely to occur due to technological changes in the health system, rather than to aging. Other recent studies by [Gray \(2005\)](#), [Yang et al. \(2003\)](#), [Lubitz et al. \(2003\)](#) and [Polder et al. \(2006\)](#) have confirmed that health care expenditure is mostly driven by proximity of an individual to death rather than by age *per se*.

Despite this large body of evidence, there exist a strand of the literature, which is against the 'red-herring' hypothesis. [Westerhout \(2006\)](#) argues that closeness to death effect is over-estimated and that population aging is still the most important health cost-driver. [OECD \(2005\)](#) and [Breyer and Felder \(2006\)](#) have also confirmed this result using longitudinal data for OECD countries and Germany, respectively. More recently, [Wong et al. \(2011\)](#) split up total hospital expenditure by primary hospital diagnosis and model separately 94 disease-specific categories. The authors claim the existence of a 'carpaccio of red-herring', due to the high variation in the extent to which age and proximity to death matter according to the disease examined. They find that, although time to death is a good predictor of HCE for most diseases, age plays a major role for diseases which are nonlethal and prevalent among elderly.

Some authors have studied the relationship between age and time to death by analyzing long-term care (LTC) ([Meijer et al., 2011](#); [Yang et al., 2003](#); [Karlsson and Klohn, 2011](#); [Colombier and Weber, 2011](#)) and primary care costs ([Dormont and Huber, 2006](#); [Werblow et al., 2007](#)). [Yang et al. \(2003\)](#) conduct a descriptive analysis and highlight that time to death is the main reason for higher inpatient health care expenditure, whereas age is the main reason for higher LTC. They conclude that the increase in HCE due to an increase in life expectancy is less than expected, since costs referred to the last year of life are higher than in extra years of relatively healthy life. Using a large Swiss dataset, [Werblow et al. \(2007\)](#) analyze seven components of health costs, such as ambulatory care, prescription drugs, hospitals' inpatient and primary care and LTC. Although the authors confirm that HCE is mainly driven by closeness to death, they claim that one exception is represented by LTC - the only component of health expenditure for which both age and time to death have an important role. Similar results on LTC have also been found by [Karlsson and Klohn, 2011](#), who use administrative Swedish data and find that the age structure of a municipality remains a strong predictor of LTC costs, after they account for mortality. [Colombier and Weber \(2011\)](#) analyze Swiss data and find that population aging remains the most influential driver of LTC costs. In addition, they also claim that the impact of population aging may be underestimated because the resulting increase in demand may put wages of health care workers and health care goods' prices under pressure. [Meijer et al. \(2011\)](#) use a Dutch dataset on LTC expenditure and find that time to death does not have any effect on health costs after controlling for morbidity and disability, whereas age remains a significant determinant. Thus, they conclude that closeness to death is simply a proxy for morbidity and disability. Outside the LTC costs, [Dormont and Huber \(2006\)](#) analyze pharmaceuticals, ambulatory and hospital expenditures and find that aging explains only part of the surge in HCE. The authors argue that the change in medical practices is indeed the main driver of higher health costs since increasing medical treatments are addressed to the elderly in order to prevent pathologies and to achieve a better

well-being for them. In a study conducted for US, [Shang and Goldman \(2008\)](#) find that age has a limited predictive power, once remaining individual life expectancy is introduced into the model.

Based on this literature, it is clear that the 'red herring' hypothesis still remains a controversial hypothesis in the explanation of HCE. This may be due to several reasons and, in particular, to differences in the structure of the populations examined, to methodological issues as well as to different components of health expenditure under analysis.

In this paper we provide more evidence on this hypothesis, focusing the analysis on primary care costs in Italy, which represent more than 30% of total health expenditure. The reminder of the paper is organized as follows. In Section 2 we present data and methods used to carry out the analysis. In Section 3 we introduce our empirical results and present the descriptive and econometric analyses. Finally, in Section 4 we discuss our results and draw some conclusions.

## 2. Data and methods

### 2.1. Data

Our analysis is based on data obtained from the Health Search-SiSSI database, a longitudinal observational dataset, which contains patient-level data on adults (aged 15 and older) from computer-based patient records collected routinely by General Practitioners (GPs) in Italy since 2002. Health Search was established in 1998 as a research unit of the Italian Society of General Practitioners (SIMG), with the goal of training general practitioners (GPs) on the utilization of a particular software called Millewin©. Through this software, GPs can obtain clinical records of their patients, thus creating a large database which is useful to improve patient management and health outcomes. Currently, the database collects data on the daily activity of about 1000 GPs. Although the project was born to study GPs's behavior, it has then become a rich source of data on health costs and health outcomes in Italy and it is also used to forecast the health expenditure and to measure the efficiency and effectiveness of some health policies.

The general practitioners' participation is on a voluntary basis, but their selection can be regarded as representative of the National Health Service (NHS), including a number of patients proportional to the size of the Italian adult population. The database contains detailed information on patients' treatments for all Italian regions with the exception of Molise (which, however, represents less than 1% of the Italian population). Patient data are linked through a unique anonymous identifier to prescriptions, clinical events and diagnoses.

The dataset allows us to study three components of primary care costs that, overall, represent 33% of the annual Italian health care budget: pharmaceuticals, diagnostic tests and specialist visits, which we refer to as "primary care" services provided by primary care physicians (PCPs). LTC, hospital inpatient and outpatient visits are excluded from this definition. Moreover, we do not include GP visits and ambulatory physicians visits in the definition of primary care services, since these are free of charge in Italy. Primary care is by far one of the most important components of public health care expenditure in Italy. In fact, according to the financial accounts of the Ministry of Health, the primary care sector represents about 51% of the total annual Italian budget. In our dataset we record only 33.5% of the public health care spending, due to the presence of services in the primary care sector which are not mediated by PCPs (see [Table 1](#)).<sup>1</sup>

<sup>1</sup> In financing health care at regional level, the Ministry of Health has established a criterion according to which 51% of the annual budget is allocated to the primary care sector, 44% to hospital services and 5% to prevention activities. Unfortunately, in our dataset we do not have reliable information on hospitalization and prevention but we have extremely detailed data on primary care services.

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