Social Science & Medicine 120 (2014) 110–117

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Variation in the costs of dying and the role of different health services, socio-demographic characteristics, and preceding health care expenses

Herbert J.A. Rolden [a, b, *], David van Bodegom [a, b], Rudi G.J. Westendorp [a, b]

[a] Leyden Academy on Vitality and Ageing, Rijnsburgerweg 10, 2333 AA Leiden, The Netherlands
[b] Leiden University Medical Center, P.O. Box 9600, 2300 RC Leiden, The Netherlands

ARTICLE INFO

Article history:
Received 21 March 2014
Received in revised form
20 August 2014
Accepted 9 September 2014
Available online 11 September 2014

Keywords:
Netherlands
Health care expenditure
Costs of dying
Proximity to death
Old age mortality
Population ageing
Hospital costs
Long-term care

ABSTRACT

The health care costs of population ageing are for an important part attributable to higher mortality rates in combination with high costs of dying. This paper answers three questions that remain unanswered regarding the costs of dying: (1) contributions of different health services to the costs of dying; (2) variation in the costs of dying; and (3) the influence of preceding health care expenses on the costs of dying. We retrieved data on 61,495 Dutch subjects aged 65 and older from July 2007 through 2010 from a regional health care insurer. We included all deceased subjects of whom health care expenses were known for 26 months prior to death ($n = 2833$). Costs of dying were defined as health care expenses made in the last six months before death. Lorenz curves, generalized linear models and a two-part model were used for our analyses. (1) The average costs of dying are €25,919. Medical care contributes to 57% of this total, and long-term care 43%. The costs of dying mainly relate to hospital care (40%). (2) In the costs of dying, 75% is attributable to the costliest half of the population. For medical care, this distribution figure is 86%, and for long-term care 92%. Age and preceding expenses are significant determinants of this variation in the costs of dying. (3) Overall, higher preceding health care expenses are associated with higher costs of dying, indicating that the costs of dying are higher for those with a longer patient history. To summarize, there is not a large variation in the costs of dying, but there are large differences in the nature of these costs. Before death, the oldest old utilize more long-term care while their younger counterparts visit hospitals more often. To curb the health care costs of population ageing, a further understanding of the costs of dying is crucial.

1. Introduction

Health care expenses in many ageing populations continue to rise (Christiansen et al., 2006). However, ageing itself is only a minor determinant of this rise. First, because the growing share of older people in many nations has only a marginal influence on the rise in health care expenses. Other factors – such as technological innovations – are found to be more important drivers of this rise (Barros, 1998; Reinhardt, 2003). Second, many studies show that, on an individual level, health care expenses increase manifold in the time close to death and overshadow rises in expenses due to advanced age alone (Zweifel et al., 1999; Seshamani and Gray, 2004a, 2004b; Stearns and Norton, 2004). Since health care expenses made at the end of life play a relatively large role in total health care cost levels, it is important to understand what factors influence these expenses. Many studies exist that discern the influence of different factors on health care expenses before death, but there are still gaps in literature that prevent social scientists, clinicians and policy-makers to gain a full understanding.

There is little insight into how the different health service types are affected by impending death. With some exceptions (McGrail et al., 2000; Spillman and Lubitz, 2000; Yang et al., 2003; Forma et al., 2009; Gielen et al., 2010), all studies investigating the effect of proximity to death on health care expenses focus on one sector or service type – often the hospital. Wong et al. (2011) and De Meijer (2011) have also focused on Dutch data, and analysed the costs of dying in hospital care and long-term care respectively. However, to our knowledge we the first to study the costs of dying for all health service types – including general practice, pharmacy, counselling, and hospices – using subjects from a single database.

* Corresponding author. Leyden Academy on Vitality and Ageing, Rijnsburgerweg 10, 2333 AA Leiden, The Netherlands.
E-mail address: rolden@leydenacademy.nl (H.J.A. Rolden).

http://dx.doi.org/10.1016/j.socscimed.2014.09.020
0277-9536/

Second, although authors have shown clear evidence that certain factors raise or lower the level of health care expenses before death, it remains unknown whether there are large differences in the costs of dying between individuals and what factors have the largest influence on this variation. Studies show that the expenses before death decrease with age in the medical care sector (Levinsky et al., 2001; Moorin and Holman, 2008; Wong et al., 2008; Shugarman, 2009), but increase in the long-term care sector (Forma et al., 2009). Also, it has been found that women have higher levels of health care expenses in general and close to death (Forma et al., 2009), but is unclear whether this a gender effect or a widowhood effect. Women have lower mortality rates than men, increasing their chance of being widowed, and it has also been found that subjects without a partner have higher levels of health care utilization and expenditure, also prior to death (Iwashyna, & Christakis, 2003; Gaugler et al., 2007; Weaver et al., 2009; Luppa et al., 2010). Besides socio-demographic characteristics, cause of death seems to play a role in the level of health care costs before death. It has been found that expenses before death are highest for cancer, and lowest for cardiovascular diseases, although other causes of death have no significant impact (Lubitz et al., 2003; Polder et al., 2006). Third, it is unknown whether individuals with a longer history of illness or disability have higher or lower costs of dying. It has been shown that health care expenses start rising as early as 31 months before death (Werblow et al., 2007), but it is unclear whether higher expenses at this time are associated with relatively higher or lower expense levels just before death. It is possible that death comes more unexpected for individuals who had an overall lower morbidity level, leading to more intensive and aggressive treatment at the end of life. Earlier health care expenditure levels form a decent indicator an individual's history of morbidity. It has been found that whites and females have higher health care expenses in general than others, but lower levels close to death (Hogan et al., 2001; Shugarman et al., 2009). This stands in contrast to the finding that higher expenses are incurred in the last year of life for people with a higher cardiovascular risk profile earlier in life (Daviglus et al., 2005). To summarize, it remains unclear how large the variation is in the costs of dying, and what socio-demographic factors are contributors to variation.

Therefore, we performed an analysis of the variation in the costs of dying, and the factors that have a possible influence on this variation. First, we calculate the costs of dying in the study population, and we further divide expenses by health service type, to see which types are affected most by impending death. Second, we portray the variation in the costs of dying in a Lorenz curve. Hereafter, we provide an oversight of what factors influence a potentially skewed distribution. Thirdly, we include preceding health care expenses in our analysis.

2. Methodology

2.1. Data

With the aim to perform multiple studies on the association between the life situation of older people and their health care costs, the *Leiden Health care Costs in Old Age* (LHCOA) study was started in 2011. For this study, data on health care costs for 61,495 people aged 65 and older in a period of 42 months were retrieved from a regional Dutch health insurer (Zorg & Zekerheid) and matched with data on socio-economic characteristics from the Central Bureau of Statistics (CBS).

Data were collected in the following steps:

1. After consulting the IRB (legal department) of the regional health insurer, data on medical care expenditure were retrieved from the health insurer's management information system. Data were collected for the period July 2007 through 2010 for all persons who lived in the regions where the health care insurer acted as the long-term care office, and who reached the age of 65 before 2011. Addresses were linked with data on socio-economic status by postal code, provided by the Netherlands Institute for Social Research.
2. Collecting data on medical care expenditure by service type proved to be highly time consuming. These data were only retrieved for a subpopulation, randomized for socio-economic status. Eight service types were identified: general practice, hospital, pharmacy, allied health care, psychology, instrumental aids, dental care, and other medical care.
3. In accordance with the IRB of the health insurer, data on long-term care utilization were collected from the EMEA Care Registration system (ECR), an information system which offers an oversight of all the coded messages that are sent between organizations active within the confounds of the EMEA. ECR messages designating the start and end of long-term care provision were linked with national average fees per volume unit, provided by the Health Insurance Board. The received volume of extramural treatment were unknown, and no costs could be calculated for this service type.
4. After consulting the IRB of the CBS a single transfer of data from the health insurer to the CBS was done over a secure line. CBS staff merged the data using citizen service numbers and dismissed any personal data afterwards. The authors could then only access the de-identified data in a secured room of the CBS. The authors had no access to identifying information. Any output destined for publication was first scrutinized by the IRB of the CBS, so no output could be traced back to individuals. No data is publicly available. Data collection and analysis was in full accordance with privacy legislation and protocol. Socio-demographic variables collected at the CBS were: age, gender, marital status, and time of death.
5. After these steps, the total study population comprises 61,495 subjects. Medical care costs by service type are known for 18,995 subjects.

The total study population of the LHCOA study ($n = 61{,}495$) was split up into two groups: subjects who died in the studied time period ($n = 9202$), and those that survived ($n = 52{,}293$). We defined the costs of dying as the expenses in the last six months before death. We selected average expenses made two years prior to death to represent preceding health care expenses. To retrieve a more robust estimate of these preceding health care expenses, and to be better able to compare these expenses with the costs of dying, we used the 26th through 21st month prior to death. From the group of subjects who died before 2012, we then selected only those for which health care expenses were known from the 26th month before death to the month of death (deceased population, $n = 2844$). Medical care expenses per service type were known for 926 subjects. In the population of surviving subjects, we selected those for whom health care expenses were known in 26 consecutive months in the same calendar time period as the deceased group. This group is referred to as the non-deceased group ($n = 42{,}204$). In the non-deceased group, medical care expenses per service type were known for 12,996 subjects.

2.2. Statistical analysis

Regression models were used to test the association between different determinants and health care expenditure. As the distribution of health care expenditure is skewed and the association with the determinants is subject to heteroskedasticity, we used a