

# Spending on Health Care in the Netherlands

## Not Going So Dutch

Pieter Bakx, Owen O'Donnell and Eddy van Doorslaer

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## Abstract

The Netherlands is among the top spenders on health in the OECD. We document the life-cycle profile, concentration and persistence of this expenditure using claims data covering both curative and long-term care expenses for the full Dutch population. Spending on health care is strongly concentrated: the one per cent of individuals with the highest levels of expenditure account for one quarter of the aggregate in any one year. Averaged over three years, the top one per cent still accounts for more than a fifth of the total, indicating a very high degree of persistence in the largest expenses. Spending on long-term care, which amounts to one third of all expenditure on health care, is even more concentrated: the top one per cent accounts for more than half of total spending on this type of care. Average expenditure rises steeply with age and even more so with proximity to death. Spending on individuals in their last year of life absorbs one tenth of aggregate health care expenditure. In a given year, spending on health care is highly skewed toward individuals with lower incomes. Average expenditure on the poorest fifth is more than three times that on the richest fifth. Spending on long-term care is five times more concentrated on the poor.

## Policy Points

1. Spending on health care is highly concentrated on a small share of the population and is strongly persistent over time.
2. Public spending on long-term care is high and is even more concentrated and persistent.
3. In any given year, health spending is highly skewed towards poorer individuals.
4. The high concentration and persistence imply substantial interpersonal redistribution.
5. Steeply rising health expenditures with age and proximity to death imply substantial intrapersonal redistribution across the life cycle.

**JEL Codes: D12, I13, I14**

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## **I. Introduction**

The Netherlands is among the top spenders on health across the world and since 2008 health expenditure has risen more steeply than in almost any other high-income country (OECD 2015). There is universal coverage not only of medical care expenses but also of long-term care costs, with both financed from compulsory income-related contributions. Inconsistent with the fabled Dutch practice of each picking up his own tab, the bill for health care is largely split according to ability to pay. High and growing medical and long-term care expenditures may strain the solidarity that underpins this social insurance system (SER 2012). We document the extent to which spending on medical and long-term care is concentrated on the highest cost patients, and examine how spending is distributed in relation to income using claims data for the full population for the period 2009-2011. Further, we examine the persistence of individual expenditures from year to year in order to assess the extent to which public financing is insuring against fluctuating health expenses, as opposed to redistributing towards individuals with consistently high expenses.

There are three main reasons why the distribution of health care expenditures in the Netherlands may be of interest from an international perspective. First, the country combines universal compulsory coverage with competition between private providers of insurance, as well as private provision of medical and long-term care services. It is interesting to consider the distribution of publicly financed health care achieved under such a mixed system in the context of developments both in the US, where universal insurance offered through a regulated market is beginning to operate alongside private provision of care, and in tax financed National Health Systems, such as the UK, that are responding to funding pressures by experimenting with private provision.

Second, the Netherlands is peculiar in mandating very comprehensive universal coverage of long-term care costs. This may impact not only on the level of health expenditure (spending

on long-term care is particularly high), but also on its distribution. Long-term care expenditures are likely to be concentrated on the oldest old and to strongly affect the concentration of total health spending. While ageing electorates are likely to pressure for increased public financing of long-term care costs, ageing of the population raises concerns about the economic viability of doing so. In this context, we examine the contribution that long-term care expenditures make to the concentration and the persistence of total health spending.

Third, our analysis is based on data on personal health expenditures recorded in insurance claims for the full population. The comprehensiveness and accuracy of these data set them above what is available in most countries, facilitating analyses that would otherwise be infeasible. We can break the data down into different types of care, examine the correlation in expenditures for the same individuals over a number of years and link the data with tax records to obtain a highly accurate picture of how health spending is distributed in relation to income.

No previous study has documented the concentration and persistence of medical and long-term care expenditures for the whole Dutch population. The age profile of medical spending in a single year has been described (Vektis, 2011) and lifetime medical expenditures simulated from claims data for two-thirds of the population (Wong et al., 2016). The latter study claims that lifetime expenditures are much less concentrated than are those for any one year, implying that cross-sectional analysis grossly overstates the interpersonal redistribution effected by public health insurance. Inequality in the distribution of health expenditures is reduced — to a substantial degree according to the simulations — when the time horizon is stretched. We do not attempt to estimate lifetime expenditures but we do examine the persistence in expenditures over a three year period using data that are both more recent and

more comprehensive with respect to population coverage and health care expenses included.<sup>1</sup>

In addition, we examine the distribution of health spending by income.

Claims data for 13 per cent of the Dutch population in 1999 have been used to estimate that 10% of total health spending is concentrated in the last year of life (Polder, Barendregt and van Oers, 2006). We update this estimate using more recent and comprehensive data, and extend the analysis to expenses incurred in the last three years of life. Analyses of the distribution of health spending in the Netherlands by disease (RIVM, 2013) have revealed that mental disorders are the most expensive group, accounting for more than a fifth of total expenditures on health and welfare. There is evidence that the utilisation of health services in the Netherlands is higher among those with lower incomes (Van Doorslaer et al, 2000, 2006) but this seems to be entirely attributable to the income gradient in the burden of disease and disability (RIVM, 2007).

This paper contributes by documenting the concentration and persistence of not only medical expenses but also long-term care expenditures in the Netherlands. Only one study has previously used claims data to examine long-term care expenditures for the entire population and that study focused on the association of these expenditures with age and proximity to death (de Meijer et al, 2011). We are the first to examine the distribution of medical spending after a major reform in 2006 that radically altered health financing by bringing the richest third of the population, who could previously opt for private health insurance, into the social health insurance system that collects contributions in relation to income and delivers a regulated benefit package. This increased risk pooling and the potential for interpersonal redistribution. Establishing the effectiveness of social insurance in these respects requires good evidence on the distribution of medical spending by income and its persistence over time.

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<sup>1</sup> Wong et al. (2016) use data from 1997-2005 that excluded the one third of the population with the highest incomes and did not cover long-term care expenses.

We find that health expenditures are highly concentrated: one quarter of aggregate spending in a year is on the top percentile of the distribution. The degree of concentration falls only marginally when the data are averaged over three years – the top one per cent still accounts for more than a fifth of the total. This points to a very high degree of persistence. Indeed, 60 per cent of individuals in the top quintile of the spending distribution in one year are also at the top of the distribution the following year, and 56 per cent remain there after two years. Both concentration and persistence are even greater for expenditure on long-term care. Remarkably, the one per cent of individuals with the highest long-term care expenditures account for more than half of total spending on this type of care. The high concentration of health expenditure on relatively few individuals is partly driven by the strong increase in average expenditure with age. In the whole population, the top five per cent account for 60 per cent of aggregate spending but for the elderly (65+) this share is 35 per cent. One of the reasons for the difference is that many of those at the top of the distribution are elderly. But this is not the entire story. Restricting attention to individuals between the ages of 25 and 64, the top five per cent in the distribution still account for 60 per cent of total expenditure. Rapidly rising spending in the last months of life also contributes to the highly concentrated nature of health expenditure. Spending on individuals in their last year of life, who correspond to only 0.8 per cent of the population, absorbs one tenth of aggregate health care expenditure. There is a strong reverse income gradient in the distribution of health expenditure in a given year. On average, the poorest fifth of the population consumes health care resources that are three times more valuable than those expended on the richest fifth. This is not simply attributable to higher health spending and lower incomes among the elderly. The income gradient in spending is even more pronounced among individuals aged 25-64 than it is in the other age groups. It is likely that this reflects the impact of ill-health on both income and health care utilisation in this population of working-aged individuals.

The remainder of this article is organised as follows. Section II provides institutional background on health care financing and provision in the Netherlands, and documents trends in aggregate spending on health. Section III describes the data sources used. In section IV, we describe how medical and long-term care expenditures are concentrated – by level of spending, age, proximity to death and income – in the cross-section. In section V, we examine the persistence of expenditures over time. The final section concludes.

## **II. Health care and expenditure in the Netherlands**

### **1. Health care system**

#### *a. Health care financing*

Health and social care are mainly financed through two social insurance schemes that are mandatory for the entire population. One of these pays for curative care, including primary care and maternity care. It began in 1941 with coverage of the poor and has been extended to cover more groups until it became compulsory for the entire population in 2006. The other programme, which was introduced in 1968, finances long-term care for the elderly, care for the disabled and institutional mental health care. Both schemes operate on the pay-as-you-go principle.

Social health insurance for curative care is financed mainly by income-related contributions (47 percent of total revenue in 2015) and a community-rated premium (36 per cent) (table 1).<sup>2</sup> The remainder comes from deductibles (seven per cent) and from two tax-financed government subsidies that cover care for children and home care (10 per cent). There is a mandatory annual deductible of 385 euro with an option to raise this to 885 euro (2016) in

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<sup>2</sup> Contributions are levied on all income, including pensions and benefits. The rate is 6.95% of earnings up to 51,974 Euro, with no additional payments on earnings above that threshold. The retired and the self-employed pay a rate of 4.85% (Zorgcijfers, 2015). Community-rated premiums vary across health plans offered by private insurers. Within a health plan, everyone pays the same premium, although a discount of up to 10% may be given to members of a group, which is usually defined by a common employer. Premiums vary across health plans mainly in relation to the service level offered: the size of the provider network, how the insurance company may be contacted and how claims may be submitted (Van de Ven and Schut, 2008).

return for a premium discount<sup>3</sup> (Rijksoverheid, 2016). Expenditures on primary care, maternity care, home care, medical devices and the management of chronic conditions are excluded from the deductible.

Social health insurance is organised as managed competition. Citizens choose a health plan annually from those offered by competing private non-profit insurers. The government specifies the services and products to be covered by basic health plans. Insurers compete on the community-rated premium and the service level (see footnote 2). They select health care providers to be included in their network and negotiate with them on prices (for some procedures). Insurers may not refuse applicants. There are implicit cross-subsidies from low to high risks through the community rating, as well as explicit cross-subsidies through a risk adjustment scheme. The latter do not fully equalise the expected loss between groups and insurers are compensated for their losses on some types of care at the end of the year (Schut and Van de Ven, 2011; Zorginstituut Nederland, 2015).

Long-term care insurance is financed through income-related contributions (73.4 per cent), a subsidy financed from general government revenues (17.6 per cent) and co-payments (nine per cent) (Zorgcijfers, 2015) (table 1).<sup>4</sup> Co-payments are related to the type and amount of care used, the recipient's income and wealth (excluding housing), and household composition (CAK, 2015). Long-term care insurance covers expenditures on institutional care. It also covered expenditures on home care in the past, but the financing of this care has been reformed recently: domestic help (since 2007) as well as support with activities of daily living and some personal care (since 2015) are now tax funded, while nursing and most personal home care are covered from social health insurance since 2015.

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<sup>3</sup> The discount depends on the magnitude of the increase in the deductible and varies between insurers. The average discount for increasing the deductible by 500 euro was 240 euro (Van Winssen, Van Kleef, Van de Ven 2015).

<sup>4</sup> Contributions are 9.65% of income up to 33,589 euro with no additional payments on earnings above that threshold (Zorgcijfers, 2015a).



Table 1: Financing of social health and long-term care insurance, 2015 budgets

	Health insurance	Long-term care insurance
Earmarked contributions & premiums	83.5%	73.4%
Government subsidy	9.6%	17.6%
Cost sharing	7.1%	9.0%

Source: Zorgcijfers, 2015

In 2014, 85 per cent of the population opted to take supplementary insurance of expenses not covered by the social health insurance scheme, such as dental care, optometry and physical therapy (Vektis, 2015). This supplementary insurance rarely covers more expensive treatment substitutes or pays for deductibles. Out-of-pocket payments are made for care not covered through public health insurance, including certain branded off-patent prescription drugs and over-the-counter medicines. Private long-term care insurance is non-existent (OECD 2011) and private expenditures on long-term care other than co-payments are limited (Jonker et al., 2007).

*b. Health care provision*

Hospitals are private non-profit organisations. Market entry is regulated but there are only requirements concerning the profit status and the way in which the organisation is governed.<sup>5</sup> All health care professionals must be registered and are employed by private non-profit organisations or are self-employed. Three quarters of medical specialists are organised in partnerships, which are usually specific to a hospital and a specialty (Helderman et al., 2005). GPs receive an annual capitation. All other medics are paid on a fee-for-service basis<sup>6</sup>. Hospitals are paid an amount specific to a Diagnosis Treatment Combination (DTC). The DTC classification is similar to US Diagnosis Related Groups. DTC rates are negotiated

<sup>5</sup> Provision of a few procedures, including proton therapy and organ transplants, is limited to a small number of accredited hospitals (WTZI, 2015; Rijksoverheid, 2014).

<sup>6</sup> Integrated care for some groups of chronic patients that is organised by care groups has been financed through bundled payments since 2012. These bundled payments cover all care for these patients, except for inpatient care, drugs, durable medical equipment and diagnostics. Their level is negotiated between the care groups and health insurers (Tsiachristas et al., 2013).

between hospitals and insurers for some procedures, the share of which is rising over time.<sup>7</sup> The rates for other procedures are set by the government (Schut and Varkevisser, 2013). Medical specialists received a fixed payment per DTC, which is set by the government and was integrated in the DTC rate in 2015 (Oostenbrink and Rutten, 2006; Schut and Varkevisser, 2013).

Nursing homes and other institutional long-term care providers receive a per diem rate that is set by the government and that depends on the type and amount of care the patient is assessed to need. Home care providers are paid on a fee-for-service basis and either negotiate hourly prices with the regional single payer or bid for contracts with municipalities.<sup>8</sup> Rather than receive in-kind home care from a formal provider, the person in need of care can opt to receive cash that must be used to either compensate an informal carer (possibly a relative) or pay a professional caregiver (Bakx et al., 2015).

GPs act as gatekeepers for all secondary and tertiary care financed through social health insurance (Helderman et al., 2005). For care covered through social long-term care insurance, access is determined by independent assessors, with eligibility dependent upon the health status and disability of the applicant (Staatscourant, 2014).

## **2 Trends in aggregate health expenditure**

Aggregate health spending is documented in the National Health Accounts assembled by Statistics Netherlands (CBS, 2016). We concentrate here on expenditure on personal health care, which excludes spending on administration. From Figure 1 it can be observed that total expenditure on personal health increased from 7.6 per cent to 9.8 per cent of GDP between

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<sup>7</sup> The procedures for which DTC rates were negotiated accounted for 34 per cent of total hospital expenditures in 2009-2011, rising to 70 per cent from 2012. Total expenditure on these procedures was capped at the hospital (and aggregate) level until 2012 and since then has been capped at the aggregate level (Schut and Varkevisser, 2013).

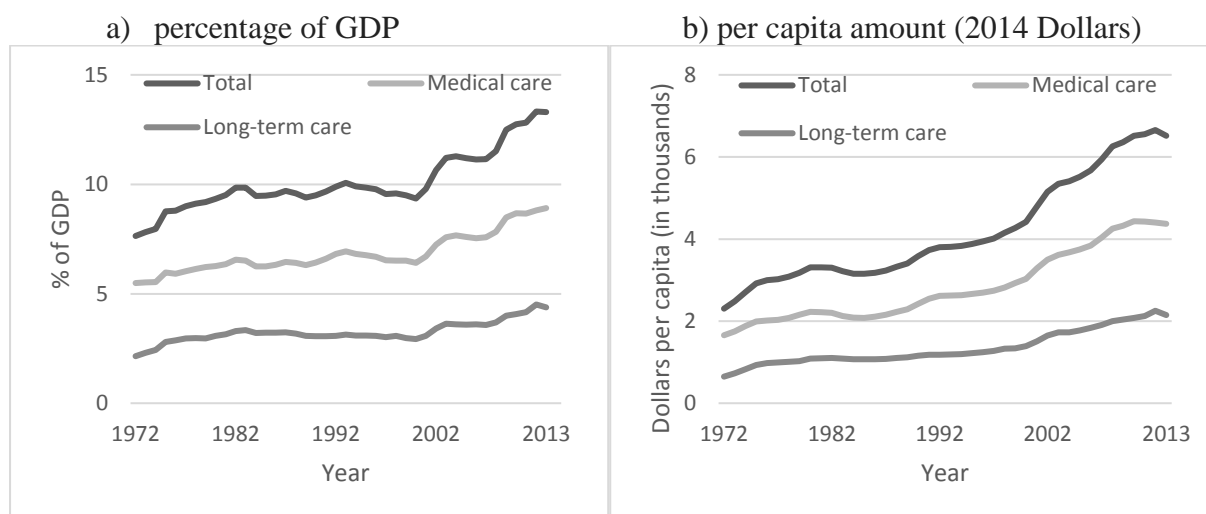
<sup>8</sup> Home care providers may be for-profit organisations even when revenue is solely from social long-term care insurance.

1972 and 1982, and then remained at around that proportion over the next two decades. After fiscal restraints were relaxed from 2001, the percentage of the GDP that is spent on personal health care increased by a third over the next 13 years to reach 13.3% by 2013. As a result, the Netherlands is now the country with the highest level of spending on health care in the world after the United States (OECD, 2015). Much of the increase in spending since 2001 was the result of a greater propensity to use hospital care, as well as the introduction of new technologies (De Meijer et al. 2013).

Expenditure on personal health care can be disaggregated into spending on medical care and spending on long-term care. The former includes spending on hospital care, primary care, professional services, medicines and medical devices, all of which are covered from social health insurance and are included in the claims data we analyse below. Also included in medical expenditure is spending on vocational rehabilitation, prevention, supporting organisations and other medical care. These are not financed from social insurance and are not included in the micro data analysed. Expenditure on long-term care (LTC) includes spending on institutional care and home care for the elderly and the disabled, which is covered by social long-term insurance and other schemes and is included in the micro claims data.

As a percentage of GDP, expenditures on medical care and on long-term care have moved in parallel since 1972. In 2013, spending on medical care reached 8.9% of GDP (\$4,368 per person) and long-term care expenditure amounted to a very substantial 4.4% of GDP (\$2,149 per person). Expenditure on long-term care for the elderly is the highest among the OECD countries and almost 2.5 times the OECD average (OECD 2011). Since 2001, per capita expenditure on both types of care has increased by around 40 per cent in real terms (Figure 1b). Due to the lower level of spending on long-term care, the difference in the absolute amounts of expenditure on the two categories has widened.

Figure 1: Personal health care expenditure



Note: Source: own calculations based on CBS (2015). Medical expenditure include spending on hospital care, professional services, medicine, medical devices, vocational rehabilitation, prevention, supporting organisations and other medical care. Long-term care expenditure includes spending on long-term care for the elderly and care for the disabled. The definition of expenditures changed in 1998, which decreased expenditures by 0.4%.

Table 2 shows the fractions of spending on personal health care by the type of expenditure and the source of finance. In 2014, around one-third of total personal health spending was on long-term care and this fraction has remained roughly constant since 1998. Another near third of spending is on hospital care, with this fraction having increased by two percentage points since 1998. This share is comparable to that in the US, France and Switzerland (OECD 2015). Spending on professional services – payments to GPs, dentists, paramedics and mental health professionals – accounts for 17.8 per cent of the total. The decrease in the share of spending on outpatient prescription drugs, which in 2014 is only six per cent of the total, is the result of generic substitution and financing some expensive outpatient drugs through hospital budgets. The mix of health financing has changed more markedly in the 1998-2014 period than has the distribution of spending across types of care (table 2). Between 1998 and 2006, the share of expenditure paid through public health insurance increased to reach four fifths of the total, pushing the contribution of private insurance to only one twentieth. This is the result of the 2006 reform that made public health insurance mandatory for the entire population, and not only for the two thirds with the lowest incomes. The share of government financing has

increased to reach 7.8 percent, partly as a result of transferring financial responsibility for domestic help from public long-term care insurance to municipalities. Reliance on out-of-pocket (OOP) payments has fallen markedly and contributed only one twentieth of total health financing in 2014. This is the lowest proportion among OECD countries (OECD 2015), although payments that are part of the social insurance deductible are not included. Private financing through OOP payments and insurance combined contributed less than one tenth of the total.

Table 2: Expenditure on personal health care by type and payer, 1998-2014

	1998	2006	2014
<i>Fraction by type of expenditure</i>			
Long-term care	33.0%	33.5%	34.2%
Hospital care	29.8%	29.9%	32.5%
Outpatient drugs	10.1%	9.2%	6.5%
Professional services	17.8%	18.3%	17.8%
Other health care	9.3%	9.1%	9.0%
<i>Fraction by payer</i>			
Social insurance	69.1%	80.1%	81.6%
Private insurance	14.5%	4.8%	4.3%
Government	6.3%	7.2%	7.8%
Out-of-pocket	7.5%	5.6%	4.6%
Other	2.5%	2.3%	1.7%
<i>Total personal health care</i>			
Expenditure in billions (2014 dollars)	62.1	90.0	106.2

Source: Own calculations based on CBS (2015). Note: Professional services include GP care, dental care, paramedical care, mental health care. Other health care includes medical devices, medical transportation, expenditures abroad and other medical and long-term care. ‘Social insurance’ refers to expenditures paid for by compulsory insurance. ‘Government’ refers to expenditures that the governments pays for directly. Out-of-pocket payments do not include payments that count toward the public health insurance deductible. ‘Other’ payer refers to payments made by corporations, international organisations and foreigners.

### III. Data

We analyse the concentration and persistence of personal health care expenditures using individual level data for the full population in the period 2009-2011. Data on medical care expenditures are obtained from claims that are approved and paid by insurers operating within the mandatory social health insurance system. These data, which are collated and

administered by a public agency (Vektis), cover the entire population of individuals who are required to hold public health insurance.<sup>9</sup> This excludes only the military, foreign students below the age of 30 and individuals who have a moral objection – usually founded on religious beliefs – to the purchase of health insurance. Expenses paid by the patient in the form of a deductible are recorded in the claims data. The data include expenditures on all services covered by public health insurance: GP care, maternity care, hospital treatment, specialist care, rehabilitation, pharmaceuticals, short-term mental health care, medical devices and medical transport. For children (<18 years), expenditures on physical therapy and dental care are also recorded.

Excluded are expenditures on services that are not covered by social insurance. Hence, the cost of any medical treatment financed from supplementary private insurance is not included. While 85% of the population has this cover (Vektis, 2015), it financed only four per cent of total personal health care expenditure in 2014 (Table 2). Supplementary private insurance mainly covers dental care and physical therapy, which are likely to be lower cost treatments. Consequently, it is likely that we are missing expenditures toward the bottom of the distribution and will slightly overestimate the extent to which expenditures are concentrated at the top. Also missing are OOP payments other than those that count toward the public insurance deductible. Again, it is likely that this results in some exaggeration of the degree to which individuals with particularly high levels of expenditures account for a large share of the total amount spent on medical care.

Data on long-term care are obtained from the Central Administration Office of the long-term care insurance scheme (CAK). The data include the use of – and expenditures on – institutional care and home care. Care provided to children (<18 years) is not recorded, and there is no reliable estimate of total spending on long-term care for minors. Cash benefits paid

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<sup>9</sup> 5% of the population is covered through a proxy holder and is excluded from the dataset. The data are weighted to allow for this omission and ensure population representativeness.

in compensation for informal care, which account for nine per cent of total social long-term care expenditures in 2013 (CBS, 2015), are not recorded in these data.

For institutional care, the data record the units (days) of utilisation received by an individual over a year. The corresponding tariff paid to the provider and set by the government depends only on the type and amount of care for which the person is eligible. For most episodes, this tariff can be determined from the information provided in the data.<sup>10</sup> We multiply units of utilisation by the tariffs to get annual expenditure on institutional care for each individual. The data record the number of hours of home care of a particular type, e.g. nursing, received by each individual each month but not the negotiated price. In the absence of individual specific price data, we multiply the hours of care received by each individual by an average price for that type of care<sup>11</sup>.

The two expenditure datasets are linked at the individual level by Statistics Netherlands using a unique identification number recorded on all administrative records. This number is issued to all citizens upon mandatory registration with the municipality of residence usually at birth or at the time of immigration. In order to describe the distribution of personal health care expenditures by income, we make use of the link of the two expenditure datasets to the tax records for the full population.<sup>12</sup> The measure of income adopted is gross household income equivalised to take account of household size and structure.<sup>13</sup> In order to calculate expenditures by age and proximity to death, the expenditure and income data are linked with

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<sup>10</sup> For individuals for whom the type and the amount of care had not been specified, we use the tariff from the previous or next episode of care. If there is a single episode for which no tariff is available, then we use the average tariff over the population using institutional care.

<sup>11</sup> For care covered through the social long-term care insurance scheme, utilisation is registered by type of care (nursing, personal care, and support) whereas prices are set per subtype of care (e.g. basic, extra and special for nursing care) (NZA 2009, 2010, 2011). We calculate a year-specific price per type of care as a (volume) weighted average of the respective subtypes (CBS, 2015a). For domestic care covered through the Social Support Act, prices differ between municipalities. We calculate the (population) weighted median price per year. Any bias from taking averages is likely to be small because the price differences are limited and the share of the population that uses long-term care is small.

<sup>12</sup> Income information is not available for five per cent of the population. These individuals are included in all analyses except, obviously, for that of expenditure by income.

<sup>13</sup> Equivalised household income = gross household income/(# of adults + 0.7\*# number of children)<sup>0.7</sup> (Citro and Michael, 1995).

data on gender, date of birth and date of death taken from the Municipal Registry. Statistics Netherlands provided one of us (Bakx) with remote fingerprint protected access to a secure server holding the individual level linked administrative data.

To facilitate comparison with analyses for other countries presented in this issue, all monetary amounts have been converted to 2014 prices using the Dutch Consumer Price Index for 2009-2014 (CBS, 2015) and to US dollars using the average exchange rate in 2014 (Eurostat, 2015).

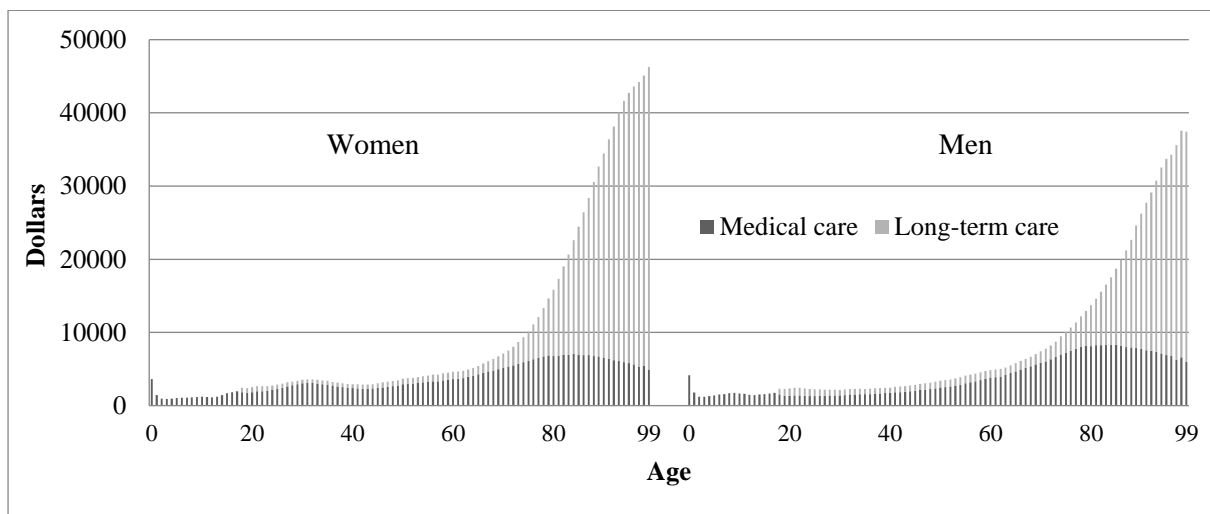
#### **IV. Health expenditure over the life cycle**

##### **1. Average expenditure by age**

Before examining the concentration of health expenditures – the extent to which relatively few high cost patients account for a large share of total spending – and the persistence of expenditures – the extent to which a high cost patient in one year also incurs high costs in the next – it is worth making clear how strongly expenditures are correlated with age. The concentration of spending is, to some extent, a concentration on the old and serial correlation will partly be driven by persistently high spending in old age. Figure 2 shows per capita annual expenditure on personal health care by age and gender. The increase in spending above the age of 70 is staggering. On average, \$42,729 is spent on the average woman aged 95. This is almost eight times the \$5439 spent on women aged 65. Spending on a 95 year old male is almost six times the average amount spent on a 65 year old male. The highest cost cases tend to be very old and so these individuals will account disproportionately for the concentration of total spending at the top of the distribution.



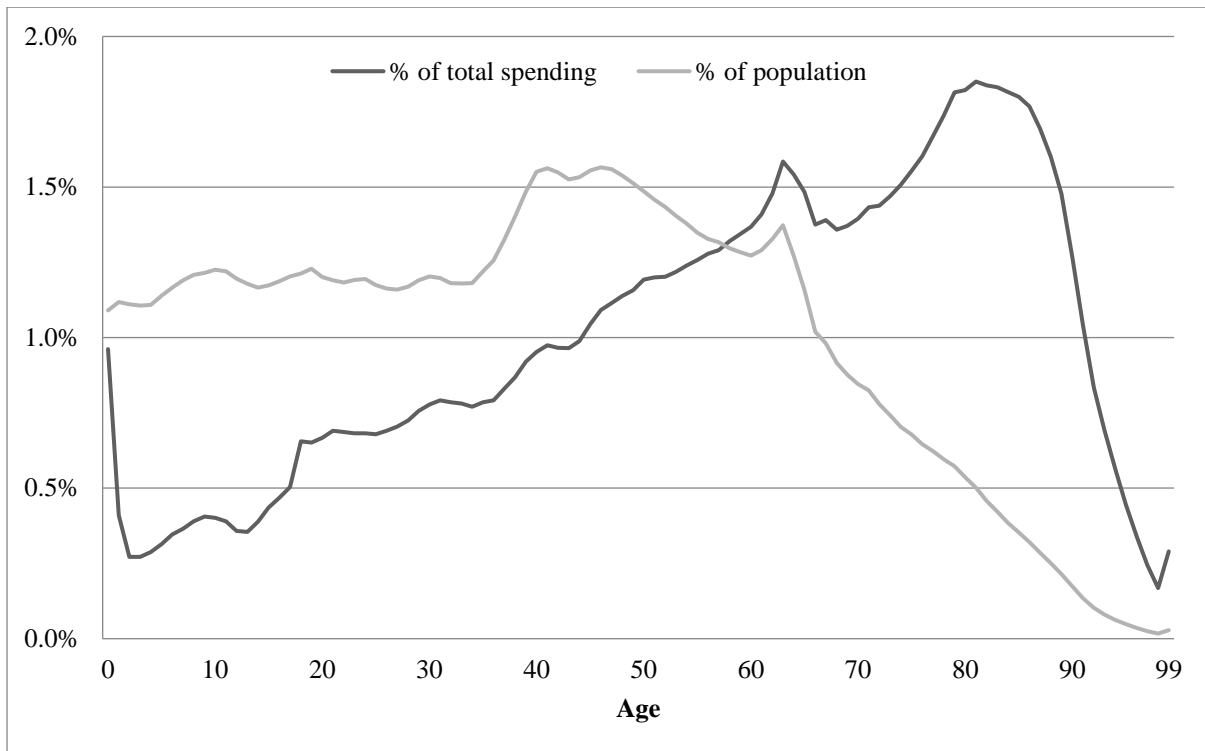
Figure 2: Average annual expenditures on personal health care per person by age, gender and type of expenditure, 2009-11 (US\$ 2014 prices)



Note: Calculated from Vektis and CAK data pooled across years 2009, 2010 and 2011. Number of observations is 47,309,246. Medical expenditure is all spending on personal health care excluding that on long-term care. Long-term care expenditures are not recorded for the ages 0-17.

Of course, the share of the population at very old ages is small and so spending on these groups does not necessarily account for a large fraction of total health expenditure. As is evident from Figure 3, after infancy, the share of total health expenditure spent on single-year age groups generally rises, and diverges from the respective population share, until the age of 82. The peak in the spending share at ages 63-66 is due to the increased population share of this post World War II baby boom cohort. Every single-year age group between the ages of 74 and 88 consumes at least 1.5 per cent of total health expenditure, and none has a population share of more than 0.7 per cent. From the age of 90, the share of spending falls rapidly despite the continued rise in spending per capita because of the very steep decline in the population share of the oldest old. Individuals aged 95 and above account for 1.5 per cent of total spending on personal health care, which is vastly disproportionate to the population share of this group – 0.2 per cent.

Figure 3: Percentage of total personal health care expenditure and population by age, 2009-11

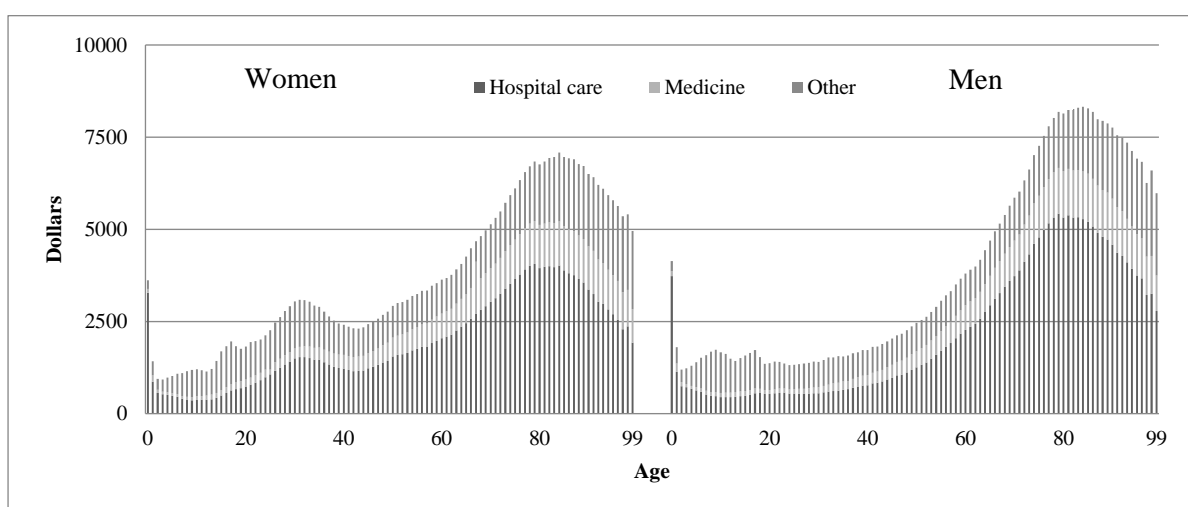


Note: Calculated from Vektis and CAK data pooled across years 2009, 2010 and 2011. Number of observations is 47,309,246. Health expenditure is all spending on medical care and long-term care for ages 18-99 and spending on medical care for age 0-17.

The steep rise in average expenditure in old age is primarily driven by spending on long-term care (Figure 2). From the age of 79 (84), average long-term care expenditures on women (men) exceed average medical care expenditures. For the oldest age group (95+), annual spending on long-term care reaches \$38,631 for the average woman and \$28,479 for the average man. These amounts are more than seven times and four times greater than the respective expenditures on medical care. By far the greatest part of the health care costs of the oldest old arises from long-term care needs. Long-term care expenditures are considerably higher for the oldest women than for the oldest men, possibly because women are more likely both to provide informal care while their spouse lives and to survive their spouse (De Meijer et al., 2011).

The very large long-term care expenses in old age make it difficult to observe the age profile of spending on medical care in Figure 2. In Figure 4 we show average spending on medical care by age and gender with a distinction between spending on hospital care and other types of care. The former includes both inpatient and outpatient care, as well as pharmaceuticals that are issued or prescribed from a hospital. The age profile of medical costs displays a pattern observed in many high-income countries. Costs are high in infancy before falling in childhood and adolescence. For females, there is a peak at 25-35 due to motherhood. For both genders, costs rise steadily through middle age and peak at 84. At this point, average medical spending reaches \$7086 for females and \$8321 for males, both of which are approximately twice the respective average over all age groups. More is spent on females than on males between the ages of 15 and 58. This is reversed in old age, possibly due to the higher mortality rate of males. The decline in mean medical spending at the oldest ages is likely to reflect both selective mortality – those surviving into very old age are healthier – and less intensive treatment of a given condition at very old ages (Mackenbach et al. 2011).

Figure 4: Average annual medical care expenditure per person by age, gender and type of expenditure, 2009-11 (US\$ 2014 prices)



Note: Calculated from Vektis data pooled across years 2009, 2010 and 2011. Number of observations is 47,309,246. Hospital care expenditure includes expenditures on inpatient and outpatient care and medicine that is prescribed and administered at the hospital. Medicine expenditure is for outpatient prescription medicine.

The fraction of medical expenditures that are incurred for hospital treatment is highest for newborns (90%). It rises again from middle age into old age and peaks at 59% at the age of 78 for females and at 66% at the age of 79 for males.

## **2. Health expenditure at the end of life**

Average health spending on the elderly is high partly because of the positive correlations between proximity to death and both age and health expenditure. Table 3 shows that average expenditure in the calendar year of death is \$30,659 – seven times average expenditure across the population (top panel, left). These end-of-life expenditures are split roughly evenly between spending on medical care and long-term care. The 0.82 per cent of individuals who die in a calendar year account for 5.6 per cent of total health expenditures in that year. Over the last three calendar years of life (i.e. 2009-2011 for those who die in 2011), health expenditure reaches \$99,730 on average, and long-term care accounts for more than half of that amount.

Using the method of Hoover et al. (2002)<sup>14</sup>, average expenditure in the last 12 months of life is estimated to be \$51,460 – almost 12 times average expenditure over a 12 month period (Table 3, bottom panel). Spending on individuals in their last full year of life is 9.4 per cent of aggregate health expenditure<sup>15</sup>. This is somewhat higher than the 6.7 per cent estimated by De Nardi et al. (2016) for the US. The comparison suggests that the often-heard claim that there is excessive spending on end-of-life care in the US may not be well founded. However, the estimates are not directly comparable since the US one is based on an assumption that average spending in the last year of life is the same below and above the age of 65. As is clear from

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<sup>14</sup> We restrict the sample to individuals who died in the current calendar year and regress health expenditures on: i) the number of months the individual was alive in the calendar year, ii) months alive in the calendar year squared, and iii) the square root of the number of months alive in the calendar year. The estimated coefficients are used to predict average expenditure with the number of months alive in the last calendar year set to 12.

<sup>15</sup> This is very close to the estimate of 10 per cent produced for the Netherlands in 1998-99 by Polder, Barendregt and van Oers (2006) using data on exact spending in the last year of life for a third of the population that are extrapolated to the remainder of the population.

comparison of the middle and right panel of table 3, this assumption does not hold in the Netherlands. Total expenditure in the last 12 months of life for those who die above the age of 65 is \$6,665 more than the equivalent spending on those dying below 65. Because of the much higher mortality rate in the elderly population, the proportion of aggregate expenditure on this population in a calendar year that is spent on the dying is six times the fraction of total expenditure spent on those dying in the younger population. Average spending on medical care in each of the three last years of life is considerably higher in the younger age group. This is more than offset, however, by much higher spending on long-term care for elderly individuals close to death.

If the difference by age in end-of-life total health expenditures was the same in the US as it is in the Netherlands, then the estimate of De Nardi et al. (2016) of the proportion of total health spending on individuals in their last year of life would be biased upward.<sup>16</sup> That would strengthen the finding that end-of-life health expenditure is not atypically high in the US, at least in comparison with a country that spends heavily on long-term care for the elderly.

Using the Hoover method, we estimate that average health spending on individuals aged 65+ in their final 12 months before death is \$52,508. This is almost 90% of the \$59,100 estimated by De Nardi et al. (2016) for the elderly population using the same method and also in 2014 prices. For both countries, health spending in the last 12 months of life is estimated to be around 17 per cent of total health expenditure on the 65+ population. If there is excessive spending on seniors in the last months of life in the US, then it would appear that the same criticism could be levelled at the Dutch health system. But there is an important difference in the type of care on which resources are expended in the last year of life in the two countries. In the Netherlands, no less than three fifths of expenditure is on long-term care. In the US,

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<sup>16</sup> Given the difference in the composition of end-of-life expenditures in the two countries (see next paragraph), one might expect that the age gradient in these expenditures is not similar. The Dutch figures show that end-of-life medical expenditures are consistently higher in the younger population. Since relatively more is spent on medical care at the end of life in the US, this may result in higher mean end-of-life total health expenditures in the younger population in that country.

only a quarter is on nursing home care. The Netherlands is spending much more than the US on long-term care of the elderly in their last year of life – average expenditure of \$30,850 compared with \$20,900 (De Nardi et al., 2016).<sup>17</sup> But spending on medical treatment of the elderly in the last 12 months of life in the Netherlands – \$21,658, on average – is substantially less than the respective expenditure in the US which is slightly less than \$38,200, on average. This discrepancy suggests, without the data being of sufficient detail to confirm, that in the US considerably more resources are expended on trying to keep the dying elderly alive. In the Netherlands, which has more comprehensive coverage of long-term care, there is much greater expenditure on caring for the needs of elderly nearing the end of life.

Figure 5 reconfirms the important contribution that spending on long-term care makes to the accumulation of health expenditure in the last year of life in the Netherlands.

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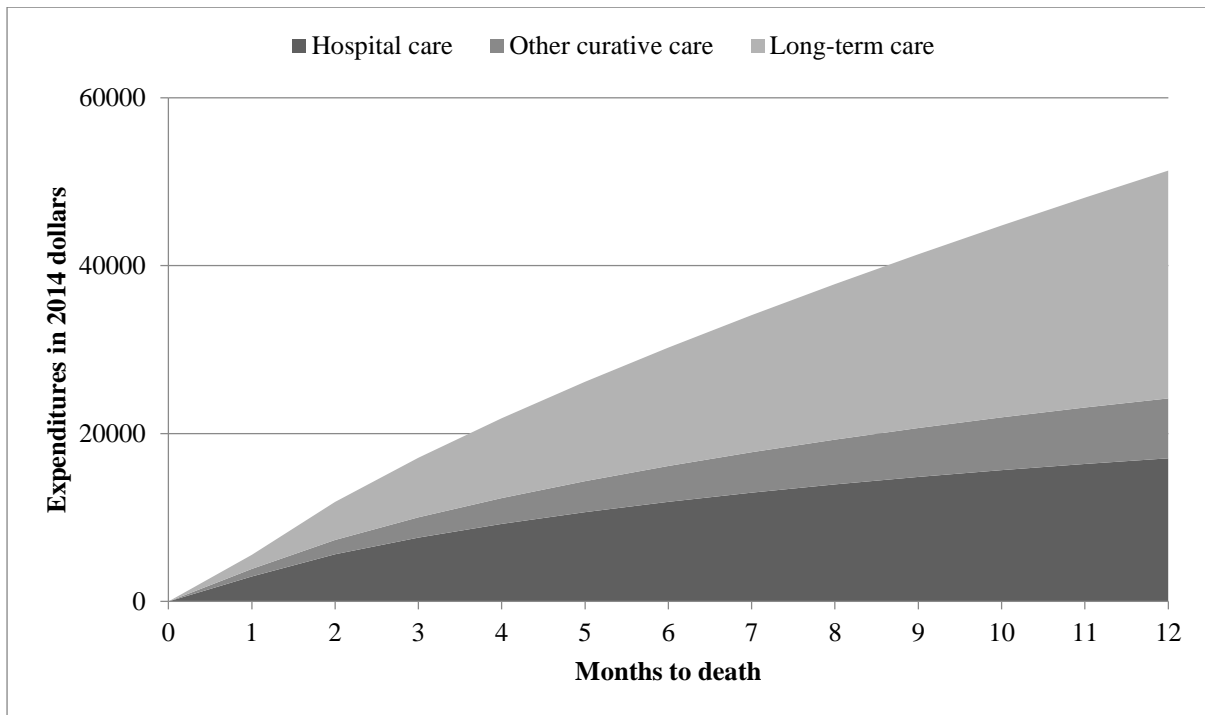
<sup>17</sup> The US estimate was kindly provided by Eric French in personal correspondence.

Table 3: Health expenditures in the last years of life

	All ages		Age < 65		Aged 65+	
	Mean (US\$)	% of aggregate annual expenditure	Mean (US\$)	% of aggregate annual expenditure	Mean (US\$)	% of aggregate annual expenditure
<i>Last years of life (from data)</i>						
<b>Calendar year of death</b>						
Total health expenditure	30,659	5.6%	28,662	1.7%	31,088	10.2%
Medical expenditure	15,802	4.4%	22,925	1.7%	14,271	9.3%
Long-term care expenditure	14,858	8.0%	5,737	1.7%	16,817	11.0%
<b>Next to last year</b>						
Total health expenditure	39,273	7.4%	30,950	1.9%	41,148	13.7%
Medical expenditure	15,721	4.5%	23,234	1.8%	14,029	9.3%
Long-term care expenditure	23,552	12.9%	7,715	2.2%	27,119	18.0%
<b>Second to last year</b>						
Total health expenditure	29,798	5.6%	20,736	1.2%	31,976	10.6%
Medical expenditure	11,035	10.4%	14,169	1.1%	10,282	6.8%
Long-term care expenditure	18,762	3.2%	6,567	1.9%	21,694	14.4%
<b>Sum of last three years</b>						
Total health expenditure	99,730	18.6%	80,348	4.8%	104,212	34.5%
Medical expenditure	42,558	12.0%	60,328	4.6%	38,582	25.5%
Long-term care expenditure	57,172	31.3%	20,020	5.8%	65,630	43.4%
<i>Hoover et al. (2002) method</i>						
<b>Final 12 months</b>						
Total health expenditure	51,321	9.4%	45,843	2.7%	52,508	17.2%
Medical expenditure	24,187	6.7%	35,926	2.7%	21,658	14.2%
Long-term care expenditure	27,134	14.6%	9,557	2.8%	30,850	20.2%

Note: Calculated from Vektis and CAK data pooled across years 2009, 2010 and 2011. For mean expenditure across all ages, the number of observations is 388,026, 397,602 and 401,715 for the analyses in the calendar year of death (all deaths in 2009-2011), the next to last year (all deaths in 2010-2012) and the second to last year (for all deaths in 2011-2013), respectively. In the panel 'Sum of last three years' percentage figures give average spending on individuals in the last three years of life as a percentage of aggregate annual expenditure. For mean expenditures on decedents aged 65+ (<65), the number of observations is 320,422 (67,604), 326,602 (72,000) and 325,011 (76,704) for calendar year, next to last year and second to last year of death respectively.

Figure 5: Cumulative health expenditures in the last year of life, by months to death



Note: Calculated from Vektis and CAK data pooled across years 2009, 2010 and 2011. Number of observations: 388,026

## V. Concentration of health expenditures

### 1. Cross-sectional distribution

In a given year, most expenditure on personal health care is spent on a small fraction of the population. In Table 4 we present the distribution of annual expenditure computed from all observations pooled over the years 2009, 2010 and 2011. On average, annual personal health expenditure is \$4,398 per capita. In the bottom half of the distribution, average spending is only \$255. The half of the population with the lowest levels of annual expenditure accounts for only 2.9 per cent of total expenditure. At the other extreme, average spending on the 5% most expensive cases is \$52,776 and these observations account for about 60 per cent of total expenditure.<sup>18</sup>

<sup>18</sup> Gender specific distributions are presented in Appendix Tables A1 and A2.



Table 4: Distribution of annual health expenditures (US\$ 2014 prices)

	Total health expenditure		Medical expenditure		Hospital expenditure	
	Average (\$)	% of total	Average (\$)	% of total	Average (\$)	% of total
All	4398	100%	2894	100%	1552	100%
96-100%	52766	60.0%	29002	50.1%	19126	61.6%
91-95%	12351	14.0%	8715	15.1%	4896	15.8%
71-90%	3961	18.0%	3360	23.2%	1448	18.7%
51-70%	1112	5.1%	1059	7.3%	285	3.7%
0-50%	255	2.9%	249	4.3%	8	0.2%

Notes: Data are annual expenditures of individuals pooled over 2009-11. Number of observations is 47,309,246. Total is sum of expenditure on medical care and long-term care. Medical care in turn includes hospital care, outpatient medicine and other medical care, including professional services. Hospital care includes expenditure on inpatient and outpatient care and medicine that is prescribed and administered at the hospital.

In the second two columns of Table 4 we exclude expenditure on long-term care and examine the cross-sectional distribution of medical care. Spending on long-term care is particularly top-heavy – only 4.3 per cent of the population makes use of long-term care. Omitting these heavily skewed expenditures results in a distribution of medical expenditures that is somewhat less concentrated at the top than that of total personal health expenditure. But the 5% most expensive medical cases still account for half of aggregate medical spending. In the right-most columns of Table 4 we restrict attention to spending on hospital treatment. Since 43 per cent of the population experiences no hospital treatment in a given year, the distribution of hospital expenses is more right-skewed than is the distribution of all medical spending. Average hospital expenditure on the top twentieth of the population is \$19,126 and they account for 61.6 per cent of the aggregate of this category of expenditure.

In Table 5 we show the distribution of personal health expenditure that is specific to three age groups. This again shows that average spending is much higher on the elderly. But it also reveals differences in the distribution of expenditure by age. Among the elderly, expenditures are much less concentrated at the top of the distribution. The most expensive 5% of cases in the elderly population accounts for 36.5 per cent of aggregate spending on this group. The

respective figure for the non-elderly adult population is 59.1 percent.<sup>19</sup> The lower degree of concentration of health expenditures in the elderly population is presumably due to a higher prevalence of (chronic) illness and disability that this more evenly spread across the population. Among the elderly, as for the full population, medical expenditures are more evenly distributed than total health expenditures as a result of the very unequal distribution of long-term care expenditures.<sup>20</sup>

Table 5: Distribution of annual total health expenditures by age (US\$ 2014 prices)

	0-24 years		25-64 years		65 and over	
	Average (\$)	% of total	Average (\$)	% of total	Average (\$)	% of total
All	1801	100%	3406	100%	12338	100%
96-100%	20594	57.2%	40229	59.1%	90028	36.5%
91-95%	4209	11.7%	8961	13.2%	50409	20.4%
71-90%	1628	18.1%	3249	19.1%	18343	29.7%
51-70%	622	6.9%	961	5.6%	5277	8.6%
0-50%	221	6.2%	210	3.1%	1184	4.8%

Notes: Data are annual expenditures of individuals pooled over 2009-11. Number of observations is 13,797,871, 25,624,847 and 7,886,528, for 0-24 years, 25-64 years and 65+ years respectively. Figures are for total personal health expenditures.

## 2. Distribution by income

Table 6 shows the distribution of annual personal health expenditures by quintiles of equivalised gross household income calculated from the cross-sectional data pooled across the years 2009-11. Expenditures on all personal health care are strongly negatively correlated with income. On average, the health spending on the poorest fifth of the population is \$7,563 per person per year. This is more than three times the average spending on the richest fifth. Average health spending on the poorest fifth is 43 per cent of the average income of this group. For the richest fifth, average health expenditure is only two per cent of average income. The poorest fifth receives 7.3 per cent of gross income but gets 36 per cent of all health spending.

<sup>19</sup> The percentage of total expenditure on the top 5% of the distribution is lower in each age group than it is across all age groups (compare Tables 5 and 4). This is due to the much higher level of spending on the elderly.

<sup>20</sup> See Appendix Table A3.

The columns toward the right of the table reveal that much of the income gradient in health expenditures is driven by the distribution of long-term care. Average expenditure on this type of care in the poorest income quintile is 17 times higher than the average in the richest quintile.<sup>21</sup> An income gradient in the distribution of medical expenditures is evident but much less marked.

Since contributions to public health and long-term care insurance increase with earnings (up to contribution ceilings), this strong negative correlation between care purchased from social insurance and income represents a substantial redistribution from the rich to the poor in any given year. However, given that health expenditures increase steeply with age, the cross-sectional relationship between expenditures and income provides a highly misleading impression of the redistribution achieved by social insurance from a lifetime perspective.

To get some impression of the extent to which the correlation between health expenditures and income is driven by age, we show the distribution of expenditures by income quintiles specific to three age groups in Table 7. Within each age group, health expenditure falls steeply as income rises. Even below the age of 25, the poorest fifth benefits from spending equal to \$2,651 on average, which is 88 per cent greater than that received by the richest fifth. Average health spending is 19 per cent of average income for the poorest in this age group, compared with 1.7 per cent for the richest. The income gradient in health expenditures is strongest for the working age population. It is likely that this is largely due to the large effect that a bad health has on income, through lost employment, before retirement (Van Kippersluis et al, 2010; Garcia Gomez et al, 2013). On average, the poorest 20% receive 3.2 times more spending than do the richest in this age group. Average health spending on the poorest fifth of the working aged population is a third of average income. For the poorest fifth of the elderly,

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<sup>21</sup> There may be two explanations for this strong income gradient. First, there may be differences in the prevalence and severity of disability by income. Second, the oldest old have accumulated much lower (pension) incomes than younger cohorts, even when compared to younger retirees, and use the bulk of the long-term care. Evidence based on Dutch survey data indicates that there is no income gradient in long-term care use after controlling for disability and age (De Meijer et al, 2011; Bakx et al, 2015).

health spending is 84 per cent of average income. It is 11 per cent even for the richest fifth of the elderly.

Table 6: Average income and health expenditures by income quintiles (US\$ 2014 prices)

	Income		Medical expenditure		Hospital expenditure		Total health expenditure	
	Average	% of total	Average	% of total	Average	% of total	Average	% of total
All	47705	100.0%	2797	100.0%	1476	100.0%	4199	100.0%
Poorest	17526	7.3%	3666	26.2%	1798	24.4%	7563	36.0%
2 <sup>nd</sup> poorest	29979	12.6%	3444	24.6%	1821	24.7%	5320	25.3%
Middle	41281	17.3%	2579	18.4%	1388	18.8%	3239	15.4%
2 <sup>nd</sup> richest	55190	23.1%	2253	16.1%	1231	16.7%	2605	12.4%
Richest	94550	39.6%	2043	14.6%	1142	15.5%	2268	10.8%
Poorest/Richest	0.19		1.79		1.57		3.33	

Notes: Income is equivalised gross household income. Health expenditure is the sum of annual expenditures on medical care and long-term care. Data pooled over 2009-11. Number of observations is 46,670,975.

Table 7: Average income and personal health expenditures by income quintile over age groups (US\$ 2014 prices)

	0-24 years		25-64 years		65 and over	
	Income	Health expenditure	Income	Health expenditure	Income	Health expenditure
All	43049	1794	53511	3355	36510	11556
Poorest	13801	2651	20002	6557	19454	16288
2 <sup>nd</sup> poorest	27887	1835	35215	3340	24208	12962
Middle	38546	1584	47255	2579	29265	11198
2 <sup>nd</sup> richest	50539	1495	61712	2263	38464	9247
Richest	84474	1408	103370	2035	71160	8086
Poorest/Richest	0.16	1.88	0.19	3.22	0.27	2.01

Notes: As Table 6. Number of observations is 13,707,173, 25,404,960 and 7,558,842 for the age groups 0-24, 25-64 and 65+ respectively.

## VI. The persistence of medical spending

In the cross-section, health expenditures are highly concentrated on the elderly, the poor and high cost cases. The concentration by age is consistent with social health and long-term care insurance in the Netherlands effecting substantial *intrapersonal* redistribution across the lifecycle. The concentration by income is consistent with substantial *interpersonal* redistribution. The concentration of expenditures at the top of the distribution is consistent with welfare gains from single-period insurance, but only if high expenditures are not predictable. If there is substantial persistence in medical expenses, then social insurance will play more of a redistributive role. The welfare gain it generates through an insurance function

will not be captured by a static single-period model but will require adoption of a lifetime perspective in which the gains from insuring the onset of chronic health conditions that persist once contracted can be evaluated (Kowalski, 2015). In this section, we examine the serial correlation in health expenditures with a view to assessing the extent to which the cross-section concentration is likely to dissipate when the analysis is stretched to a somewhat more distant horizon.

In Table 8 we show the linear correlation of individual health expenditures in levels and logs one and two years apart.<sup>22</sup> The correlation between spending in one year and the next is high at around 0.66 in both levels and logs. The correlation between expenditure one year and that two years later is predictably weaker but it is still substantial at 0.56 in levels and 0.61 in logs. Health spending in one year appears to be a rather good predictor of spending up to two years later. This suggests that the concentration of expenditure at the top of the distribution does not arise from single period risks that strike randomly in the population. To a substantial extent, it is the same individuals who are repeatedly receiving treatment that is most costly.

Table 8: Correlation of health expenditure in year t with expenditure in year t+1 and t+2

	Spending in levels		Spending in logs	
	t+1	t+2	t+1	t+2
Total health expenditures	0.66	0.56	0.67	0.61
Long-term care expenditures	0.82	0.70	0.88	0.79
Medical expenditures	0.43	0.33	0.60	0.53
Hospital expenditures	0.40	0.32	0.43	0.37
Number of observations	30,859,547	15,128,538	30,859,547	15,128,538

Note: Correlations between spending in year t and year t+1 are calculated using pairs from the years 2009-2010 and 2010-2011; correlations between year t and year t+2 are for the years 2009 and 2011. Expenditures below 10 per cent of the mean have been set to that value when calculating log expenditures.

<sup>22</sup> Attrition is not a major issue in the estimation of these correlations. Approximately 98 per cent of the 2009 observations are observed in 2010 and 97 per cent were observed also in 2011. Mortality and migration are the main sources of attrition. Individuals observed in 2009 but not in 2010 had higher than average health care expenditures.

Expenditures on long-term care display stronger serial correlation than do medical expenditures. This is to be expected given the chronic nature of the conditions that give rise to long-term care needs. The one-year and two-year correlations of hospital expenditures are only slightly weaker than those for all medical expenditures in levels, but substantially weaker in logs. The latter is what one would anticipate given that hospital expenses are more likely to be incurred for acute treatments that are not repeated, unlike the continued medication and primary care management of chronic conditions.

From the transition matrices presented in Table 9, it is apparent that the serial correlation is strongest toward the extremes of the distribution of health expenditure. Three fifths of the individuals located in the highest quintile of expenditure in one year remained in that quintile in the subsequent year. Of those who drop out of the top quintile, more than half move to the second top quintile. Only 18.3% fall out of the top two fifths of the distribution of health expenditures from one year to the next. Strikingly, more than half of those in the top fifth of the distribution were still there two years later. High levels of expenditure are rather persistent, at least over a three year period.

There is also a good deal of consistency at the bottom of the distribution. Half of those in the bottom quintile of the distribution in one year remain there in the next. Only four per cent of individuals in the lowest fifth of the distribution in one year move to the highest quintile in the next. Only six per cent move from the bottom to the top within two years. These figures provide an indication of the rarity of health shocks that shunt an individual from the bottom to the top of the distribution of health expenditures.

Table 9: Transition matrices for total personal health expenditures.

Quintile		year t+1 (n = 30,859,547)					years t+2 (n = 15,128,538)				
		lowest	2 <sup>nd</sup> lowest	middle	2 <sup>nd</sup> highest	highest	lowest	2 <sup>nd</sup> lowest	middle	2 <sup>nd</sup> highest	highest
year t	lowest	51.3	23.7	13.1	7.5	4.4	46.2	24.3	14.4	9.2	6.0
	2 <sup>nd</sup> lowest	22.5	36.3	23.0	12.1	6.1	22.4	33.5	22.8	13.5	7.8
	middle	12.1	23.5	33.2	20.9	10.3	12.9	23.8	30.3	21.2	11.8
	2 <sup>nd</sup> highest	6.6	11.7	22.1	38.8	20.8	7.5	13.2	22.0	35.1	22.2
	highest	3.5	5.5	9.3	21.5	60.2	4.6	6.9	10.5	21.9	56.2

Note: Cells indicates the percentage of individuals in row quintile i in year t who are in column quintile j in year t+1 (left panel) or t+2 (right panel). Total personal health expenditure is all expenditure on medical care and long-term care.

The less persistence there is in health expenditures, the greater will be the reduction in concentration in their distribution when expenditures are averaged over more years. The Lorenz curves for total health expenditures presented in Figure 6 show little evidence of this, once again confirming a high degree of persistence<sup>23</sup>. The curve for expenditures in one year is close to a reverse L shape reflecting the very high degree of concentration, or inequality, demonstrated in the previous section.

This is also evident from the measures of concentration presented in the top panel of Table 10. The 10 per cent most expensive cases account for three quarters of total expenditure in a year. The top one per cent accounts for a quarter. The corresponding Gini index is an astronomical 0.82.

The Lorenz curve for two- and three-year averaged expenditures move inward, indicating less inequality, but only marginally. Over three years, the fraction of total personal health expenditure spent on the top percentile of the population is still substantially more than one fifth and the Gini index falls only five hundredths to 0.77.

The Lorenz curves for medical expenditures, and particularly hospital expenditures, move inward to a greater extent than that for total health expenditures as the number of years of expenditure is increased. This indicates that these types of expenditure display less persistence

<sup>23</sup> Figure A1 in the appendix presents the distributions in the form of cumulative density functions.

than the remaining category, which is expenditure on long-term care. The very high degree of concentration and persistence of long-term care expenditures is evident from the second panel of Table 10. The top one per cent of the distribution accounts for more than half of these expenditures even over a three-year period. Of course, this is due to long-term care being used almost exclusively by the elderly and the steep increase in expenditure on this type of care at the most advanced ages. Over a period substantially longer than three years the degree of persistence in long-term care expenditures would fall dramatically.

In general, there is a good deal of persistence in all types of health expenditure. Even for hospital expenditures, which one expects to be most acute and least persistent, the Gini coefficient calculated from the 3-year averages is only eight hundredths less than that for the single year data. The one per cent of individuals with the highest 3-year average hospital expenses account for more than one fifth of spending over the three year period.

While we find that there is a high degree of persistence in health expenditures over a three year period, over a longer period there will inevitably be more intertemporal relative to interpersonal variability. Wong et al. (2016) use a nonparametric resampling method to simulate lifetime medical expenditures from Dutch public health insurance claims data for the period 1997-2005. They calculate a Gini index of 0.35 for lifetime expenditures. This is half of the value we estimate for 3-year averages for medical expenditures. The distribution of lifetime expenditures is substantially less concentrated than is the cross-sectional distribution. But a Gini of 0.35 is still indicative of a substantial degree of inequality.<sup>24</sup> Over a lifetime, the medical expenditures of some individuals are substantially greater than those of others.

We can get a partial picture of the contribution of age differences in spending to the persistence of health expenditures over a three-year period by repeating the analysis by age group. In Table 11 we show the serial correlation of total health expenditure for three age

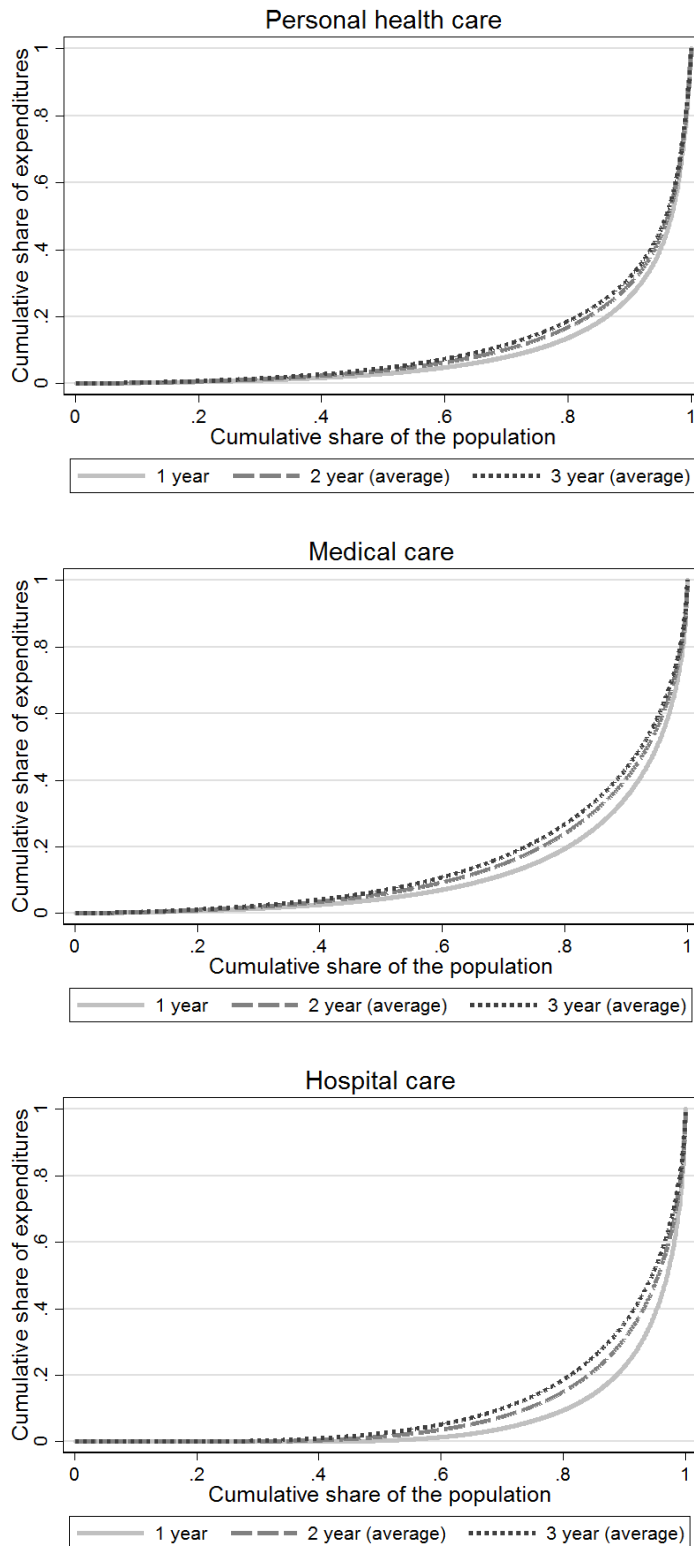
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<sup>24</sup> Compare, for example, with a Gini index of 0.25 for equalised disposable income in a single year in the Netherlands (Eurostat, 2015).



groups. Table 12 shows the equivalent of the top panel of Table 10 for each age group. Together, these tables show that health spending is somewhat more persistent among the elderly than among the young and the working-aged populations. The correlation between spending in year  $t$  and spending in years  $t+1$  and  $t+2$  is weakest for the youngest group. This suggests, as would be expected, that the degree of chronicity of illnesses and disabilities is higher at older ages. When moving from annual spending to multi-year averages, the shares spent on the top 1% and the top 10% of the distribution, and to some extent the Gini coefficient, decrease less for the 65+ population than they do for the younger age groups. But even at younger ages, there seems to be a good deal of persistence. For both of the younger groups, the percentage of total expenditure absorbed by the top 10 per cent falls by only around seven percentage points in moving from one year to three years of expenditure and for both the fraction remains 60 per cent over the three year period.

Figure 6: Lorenz curves for total personal health expenditures for one year (solid), two years (dash) and three years (dot) of expenditures.



Note: Number of observations is 47,309,246 (1 year), 30,859,547 (2 years), 15,107,038 (3 years). Personal health care is all medical care and long-term care. Medical care includes hospital care, outpatient medicine and other medical care, including professional services. Hospital care includes on inpatient and outpatient care and medicine that is prescribed and administered at the hospital.

Table 10: Measures of concentration of personal health expenditures over one, two and three years

	Expenditure average over		
	1 year	2 years	3 years
	Total personal health expenditure		
Gini index of expenditure	0.82	0.79	0.77
Percent on top 1% cases	24.6%	22.7%	22.0%
Percent on top 10% cases	74.0%	70.4%	68.3%
	Long-term care expenditures		
Gini index of expenditure	0.98	0.98	0.98
Percent on top 1% cases	56.4%	54.4%	53.5%
Percent on top 10% cases	100%	100%	100%
	Medical expenditures		
Gini index of expenditure	0.77	0.72	0.70
Percent on top 1% cases	23.8%	20.1%	18.3%
Percent on top 10% cases	65.2%	59.6%	56.5%
	Hospital expenditures		
Gini index of expenditure	0.86	0.81	0.78
Percent on top 1% cases	29.8%	24.0%	21.2%
Percent on top 10% cases	77.4%	69.1%	64.5%
N	47,309,246	30,859,547	15,107,038

Note: Data are expenditures of individuals pooled over 2009-11.

Table 11: Correlation of total personal health expenditure in year t with expenditure in year t+1 and t+2, by age

	Spending in levels		Spending in logs		N (t versus t+1)	N (t versus t+2)
	t+1	t+2	t+1	t+2		
All	0.66	0.56	0.67	0.61	30,859,547	15,128,538
Age: 0-24	0.47	0.36	0.48	0.38	8,707,666	4,123,040
Age: 25-64	0.65	0.57	0.60	0.53	16,840,457	8,303,905
Age: 65+	0.68	0.57	0.73	0.66	5,311,424	2,701,593

Note: Expenditures below 10 per cent of the mean have been set to that value when calculating log expenditures.

Table 12: Measures of concentration of total personal health expenditures over one, two and three years, by age

	Total personal health expenditure average over		
	1 year	2 years	3 years
	Age: 0-24		
Gini index of expenditure	0.77	0.72	0.70
Percent on top 1% cases	35.9%	33.0%	31.3%
Percent on top 10% cases	68.9%	63.7%	61.3%
N	13,797,871	8,707,666	4,115,876
	Age: 25-64		
Gini index of expenditure	0.81	0.78	0.76
Percent on top 1% cases	29.9%	27.9%	27.0%
Percent on top 10% cases	72.2%	67.6%	65.5%
N	25,624,847	16,840,457	8,290,358
	Age 65+		
Gini index of expenditure	0.72	0.70	0.68
Percent on top 1% cases	10.5%	9.6%	9.6%
Percent on top 10% cases	56.9%	54.3%	53.5%
N	7,886,528	5,311,424	2,700,804

## VII. Conclusion

In the Netherlands, as in other countries, the greater part of annual health expenditures is concentrated on a relatively small fraction of the population. Moreover, there is a very high degree of persistence in medical expenditures, especially among individuals with high expenditures, at least over a three-year period.

Expenditures are concentrated among the old and the dying. This needs to be borne in mind in interpreting the high degree of persistence in expenditures we find over a period of three years. If the horizon of the analysis could be stretched further, then there would be substantially less concentration and persistence. Therefore, one should not rush to conclude that the evidence presented here implies that social health insurance in the Netherlands mainly affects *interpersonal* redistribution from the rich and healthy to the poor and persistently unhealthy. It also facilitates *intrapersonal* reallocation from periods in good health to periods,

and indeed ages, in bad health. But the degree of persistence that we observe over a period of three years does point to a very large proportion of expenditure on conditions that are chronic. It is difficult to insure the risks associated with the onset of such conditions through unregulated private markets and a large part of the welfare gain from social insurance may arise from the provision of such insurance (Kowalski, 2015).

About a third of the aggregate health expenditures in the Netherlands are on long-term care. These expenditures are strongly concentrated on the elderly and the dying. Long-term care spending accounts for more than half of all expenditures incurred in caring for individuals in their last year of life. The comprehensive social long-term care insurance in the Netherlands has led to particularly high expenditures on long-term care (OECD, 2011). The Netherlands has a relatively high share of the elderly living in a nursing home (OECD, 2015) - the most expensive type of long-term care. High spending on long-term care contributes to a greater concentration of health expenditures on the very old and dying than in other countries and will also contribute to a high concentration on the very high cost cases. Universal long-term care insurance would also be expected to have implications for wealth accumulation by reducing the need to hold precautionary savings against the risk of care needs in old age. Indeed, many Dutch households hold only a very small amount of liquid assets (Van Ooijen et al, 2014).

Health expenditures are very strongly negatively correlated with income in the Netherlands. This is not simply an age effect. In part, it is a reflection of the interpersonal redistribution achieved by social health insurance. But one should not forget that health expenditures are made in response to illness, and ill-health also impacts on income through the loss of employment. The concentration of health expenditures on those with low incomes can therefore be consistent with the provision of insurance that covers the medical expenses of those losing earnings capacity due to disease and disability.

All in all, it seems that universal and very comprehensive social insurance coverage achieves a great deal of inter- and intra-personal redistribution. The high degree of interpersonal redistribution indicates that in the Netherlands the practice is not to ‘go Dutch’ when paying for health and long term care. The redistributive effect is strengthened by the high level of health spending – second only to the US in the OECD. It remains to be seen whether this level of spending and redistribution will prove to be sustainable in the coming decades as the share of the elderly in the population rises.

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## Appendix

Table A1: Distribution of health annual expenditures for men (US\$ 2014 prices)

	Personal health care		Medical care		Hospital	
	Average	% of total	Average	% of total	Average	% of total
All	3855	100%	2730	100%	1487	100%
96-100%	48885	63.4%	30068	55.1%	19996	67.2%
91-95%	10100	13.1%	7822	14.3%	4260	14.3%
71-90%	3137	16.3%	2830	20.7%	1181	15.9%
51-70%	887	4.6%	856	6.3%	190	2.6%
0-50%	201	2.6%	198	3.6%	1	0.0%

Notes: Data are annual expenditures of individuals pooled over 2009-11. Number of observations is 23,271,084. Total health expenditure is sum of medical expenditure and long-term care expenditure. Medical care in turn includes hospital care, outpatient medicine and other medical care, including professional services. Hospital care includes inpatient and outpatient care and medicine that is prescribed and administered at the hospital.

Table A2: Distribution of health annual expenditures for women (US\$ 2014 prices)

	Personal health care		Medical care		Hospital	
	Average	% of total	Average	% of total	Average	% of total
All	4928	100%	3054	100%	1614	100%
96-100%	56122	56.9%	27922	45.7%	18231	56.5%
91-95%	14420	14.6%	9407	15.4%	5449	16.9%
71-90%	4834	19.6%	3881	25.4%	1713	21.2%
51-70%	1361	5.5%	1273	8.3%	386	4.8%
0-50%	324	3.3%	314	5.2%	21	0.7%

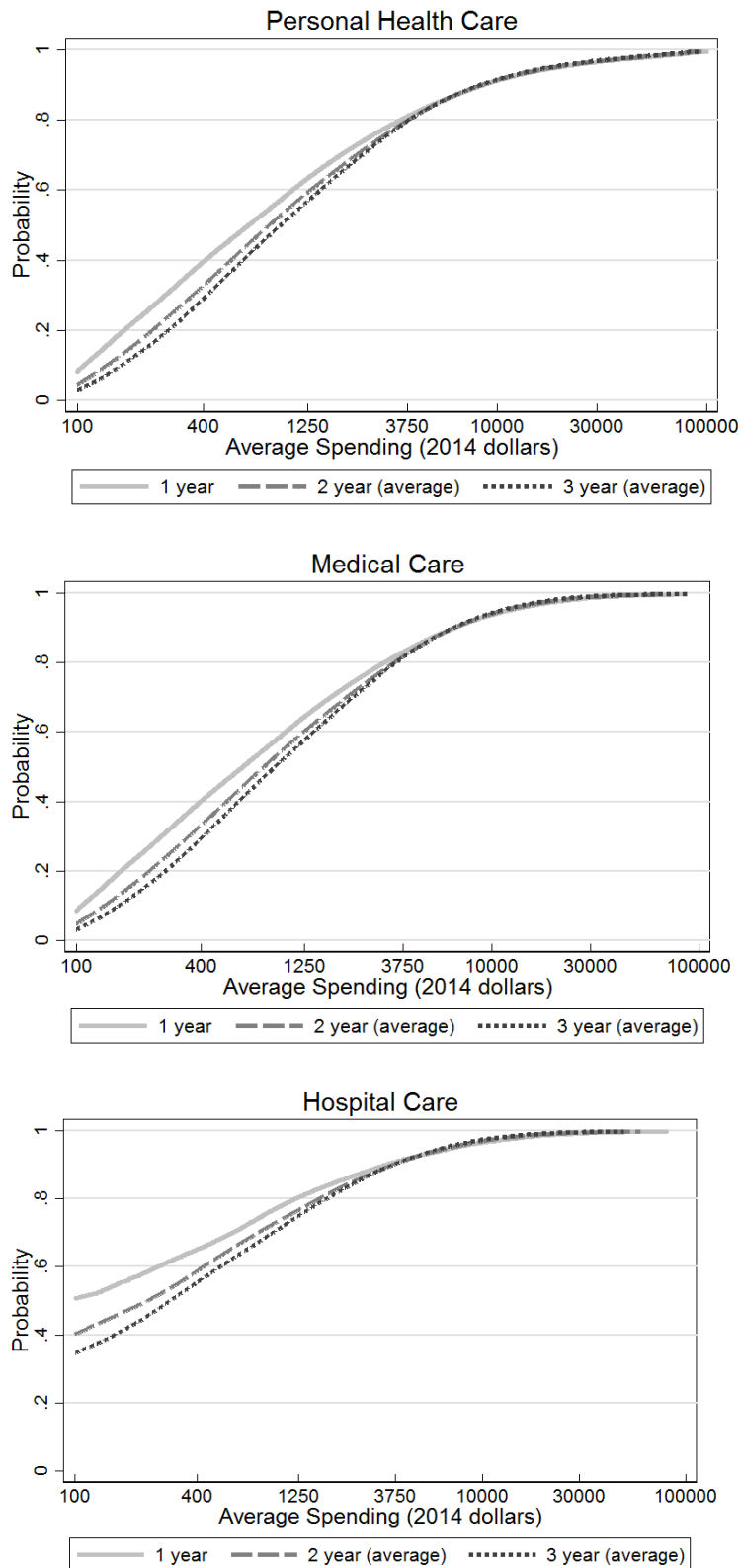
Notes: Data are annual expenditures of individuals pooled over 2009-11. Number of observations is 24,037,173. Total health expenditure is sum of medical expenditure and long-term care expenditure. Medical care in turn includes hospital care, outpatient medicine and other medical care, including professional services. Hospital care includes inpatient and outpatient care and medicine that is prescribed and administered at the hospital.

Table A3: Distribution of annual health expenditures (US\$ 2014 prices), 65+ population

	Total health expenditure		Medical expenditure		Hospital expenditure	
	Average	% of total	Average	% of total	Average	% of total
All	12338	100%	6163	100%	3741	100%
96-100%	90028	36.5%	45463	36.9%	35063	46.9%
91-95%	50409	20.4%	19431	15.8%	14051	18.8%
71-90%	18343	29.7%	8721	28.3%	4810	25.7%
51-70%	5277	8.6%	3469	11.3%	1197	6.4%
0-50%	1184	4.8%	960	7.8%	167	2.2%

Notes: Data are annual expenditures of individuals pooled over 2009-11. Number of observations is 7,886,528. Total health expenditure is sum of medical expenditure and long-term care expenditure. Medical care in turn includes hospital care, outpatient medicine and other medical care, including professional services. Hospital care includes inpatient and outpatient care and medicine that is prescribed and administered at the hospital.

Figure A1: Cumulative density functions for total personal health expenditures for one year (light grey), two years (grey) and three years (black) of expenditures.



Note: Number of observations is 47,309,246 (1 year), 30,859,547 (2 years), 15,107,038 (3 years). Personal health care is all medical care and long-term care. Medical care includes hospital care, outpatient medicine and other medical care, including professional services. Hospital care includes on inpatient and outpatient care and medicine that is prescribed and administered at the hospital.