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# Can your house keep you out of a nursing home?

Older people living in houses that are accessible for people with mobility problems have a lower probability to move to a nursing home than similar persons living in less accessible houses. This effect increases with age and is stronger for persons with physical limitations than for persons with cognitive limitations.

Policies focused on improving the accessibility of houses can contribute to ageing in place.

CPB Discussion Paper

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April 2019

# Can your house keep you out of a nursing home?[1]

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25 April 2019

**Abstract**

We examine the impact of the accessibility of an older individual's house on her use of nursing home care. We link administrative data on the accessibility of all houses in the Netherlands to data on long-term care use of all older persons from 2011-2014. We find that older people living in more accessible houses are less likely to use nursing home care. The effects increase with age and are largest for individuals aged 90 or older. The effects are stronger for people with physical limitations than for persons with cognitive problems. We also provide suggestive evidence that older people living in more accessible houses substitute nursing home care by home care.

[1] Results based on calculations by the authors using non-public microdata from Statistics Netherlands (CBS). The data used in this paper are available via remote access to the microdata services of CBS. We would like to thank Arne Jeninga, France Portrait and Henk Sijsling for providing useful comments. Moreover, we are grateful for comments received during presentations at CPB Netherlands Bureau for Economic Policy Analysis, Ministry of Health, Welfare and Sports, and the Netspar Pension Day.

## 1. Introduction

The housing environment is vital to the quality of life of older individuals (Harvard Joint Center for Housing Studies, 2014). Across the developed world, there is a tendency for older people to keep living in their own home, even at high ages and with severe limitations (Nederlandse Zorgautoriteit, 2018; OECD, 2017). This trend in "ageing in pace" seems to be driven by the preferences of older individuals themselves, who would like to keep living in their own home as long as possible (e.g. Binette and Vasold, 2018 Costa-Font et al., 2009; World Health Organization, 2011), and by a desire of policy makers to save expenditures by substituting nursing home care by hopefully lest costly home care (OECD, 2017).[2] In both cases, the question whether accessible housing can contribute to keeping individuals out of nursing homes is important.

Policy makers actively try to stimulate ageing in place through improvements in the house. Governments often provide subsidies within their (social) long-term care insurance system for home improvements (e.g. stair lifts). For instance, most states in the US offer Medicaid programs that cover home modifications, like Connecticut's Medicaid's waiver 'HCBS for elders'.[3] In the UK, adults are entitled to provisions for minor home adaptations under the Care Act 2014 and to provisions for major adaptations under the Housing Grants, Construction and Regeneration Act 1996 (Mandelstam, 2016). In the Netherlands, older people can directly receive a budget for home modifications, such as a stair lift, from the municipality financed out of the Law on Social Assistance introduced in 2015.

While housing improvements are thus perceived as contributing to ageing in place, it is the question whether the quality of the house really is an important factor for living longer at home and postponing nursing home care. There is a vast literature on the determinants of nursing home care. For example, the use of nursing home care is positively correlated with age, having a (chronic) disease, and the absence of a spouse, and negatively correlated with income and home ownership (De Meijer et al., 2011; Kim et al., 2013; Luppa et al., 2010a; Luppa et al., 2010b; Portrait et al., 2000; Rapp et al., 2015; Rouwendal & Thomese, 2013; Slobbe et al., 2017; Wong et al., 2010). However, large scale evidence on the role of the accessibility of the house on the use of nursing home care is scarce.[4] The aim of this study is to fill this gap in the literature and to provide empirical evidence on whether the accessibility of the house postpones, or prevents, older persons from using nursing home care.

[2] The evidence whether substitution from nursing homes to home care is indeed cost saving is mixed, and seems to be context depended (Bakx et al., 2018; Blackburn et al., 2014; Kok et al., 2015; Naomi et al., 2012; Young et al., 2017).
[3] See https://www.medicaid.gov/medicaid/section-1115-demo/demonstration-and-waiver-list/?entry=8681 and http://www.swcaa.org/wp-content/uploads/2013/12/HCBS-waivers-training.pdf
[4] Bockarjova et al. (2016) examine the link between the house and nursing home care on a smaller set of observations by using survey data.

There are two channels through which the accessibility of the house can affect the use of nursing home care. First, it can have a direct effect on the health of older individuals. Housing characteristics such as uneven floors, absence of hand rails, vinyl or linoleum flooring, and inconvenient doorsteps have been found to be related to falls (Aarsland et al., 2000; Isberner et al, 1998; Larsen et al., 2004). In turn, falls are an important reason for nursing home admission (American Geriatrics Society et al., 2001; Rubenstein, 2006; Tinetty and Williams, 1997; Wolinsky et al., 1992).

Second, older people who live in more accessible houses might be better able to cope with their limitations. Particular functional limitations might be less important for the daily functioning of someone living in an accessible than inaccessible house. Not being able to walk up the stairs, for instance, is less of a problem for someone who lives on the ground floor. Indeed, there is evidence that older people with access to assistance devices in their home, such as raised toilet seats, bath seats and bath rails, are better able to cope with limitations and need less hours of help (Agree et al., 2005; Freedman et al., 2006; Hoenig et al., 2003). Also, home care might be more easily provided in a house that is accessible (Aedes-Arcares, 2005), which might reduce the need for nursing home care. [5]

In this study, we investigate whether older people living in more accessible, or easily adaptable houses, use less nursing home care than older people in less accessible houses. We collected data on the accessibility of all houses in the Netherlands. Our accessibility indicator distinguishes between (1) houses that can be reached and used without climbing stairs, (2) houses where a stair lift can be placed at acceptable costs, and (3) houses that cannot be used without climbing stairs.

We link this accessibility indicator to administrative data on individual nursing home admissions from 2011-2014 for all older people in the Netherlands. We estimate linear probability models to investigate whether the probability of nursing home use is related to the accessibility of the house. As we expect the effects of the house to be stronger for the oldest individuals, who are frailer, we interact the accessibility indicator with age. To obtain plausible estimates, we control for a battery of other characteristics obtained from administrative sources. These include individual characteristics, such as past health care use, age, gender, income, wealth, having a partner or children, and housing characteristics such as house ownership. To correct for differences in the availability of formal care across neighborhoods, and possible clustering of older individuals within neighborhoods, we include neighborhood fixed effects.

[5] There is empirical evidence that home care can, for some patients, indeed substitute nursing home care (e.g. Bakx et al., 2018; Guo et al., 2015; Muramatsu et al., 2007).

We find that living in a more accessible house is associated with a lower probability to use nursing home care. The association increases with age. For example, an average 90-year-old person living in an inaccessible house has a two percentage points smaller probability of moving to a nursing home within the next year than a similar person living in an accessible house.

We confirm the plausibility of our estimates by performing additional analyses. First, we show that the effects are mainly determined by persons having physical problems when moving into a nursing home and to a lesser extent by persons with cognitive limitations. Second, we provide suggestive evidence of substitution: older people living in more accessible houses are more likely to use home care. Third, although we cannot fully exclude the possibility that our findings are driven by a third unobserved factor (individuals with better unobserved health live in more or less accessible houses), we can test for selective moving: Individuals might move to an accessible house *because* they have health problems. To test whether this may influence our results, we use the house an individual lived in 15 years ago as an instrument for the accessibility of the house an individual currently lives in. The results are similar to our main analysis.

## 2. The Dutch long-term care system

The Netherlands has one of the most extensive public long-term care (LTC) systems in the world (OECD, 2017). In our study period (before 2015), all inhabitants of the Netherlands were insured under a social insurance, called the Exceptional Medical Expenses Act (AWBZ). This insurance covered all chronic care and included a broad range of home care services and institutional care for older individuals.[6] Persons who used long-term care had to pay a co-payment which depended on their income and financial wealth. As a result, long-term care was accessible for all income groups.

Institutional care was provided in a nursing or residential care home (Bakx et al., 2018; Kok et al., 2015). The setting and intensity differ depending on the needs and health problems. Nursing homes provided intensive skilled care and medical treatment to older individuals with severe health and psychogeriatric problems. Autonomy was very limited. In residential care homes, the focus was on providing assistance to older people who cannot live independently. Generally, these homes had small apartments where people live on their own or with their partners. People still had substantial autonomy. Throughout this paper, we use the term nursing home care to refer to both nursing home care and residential home care. Home care is formal care, provided by professionals, at home. This included social support, personal care (assistance

[6] Daily housekeeping activities was not part of the AWBZ, as it was shifted to the Law on Social Assistance (WMO) in 2007.

with washing, dressing and eating), nursing, individual assistance and group assistance. The quantity and intensity of care could considerably: from one hour of personal care per week to around-the-clock nursing.

To decide whether someone was eligible for long-term care, the assessor took the health needs and circumstances of the applicant (e.g. living conditions and the social environment) into account.[7] As a result, the house played a role in whether an applicant would receive access to nursing home care or home care, although it is unclear what weight was given to this particular factor. At the same time, an older individual living in more accessible houses might be less likely to apply for an assessment herself. Persons eligible for nursing home care received an assessment on either physical (somatic, physical or sensory) or non-physical (psychogeriatric, psychiatric or mental) grounds. After the assessment was granted, the applicant could immediately go to a nursing home or, if her conditions allowed this, the patient could postpone it, or not go at all.[8]

The long-term care system has been reformed in 2015. Municipalities are now responsible for the provision of most home care, and nursing and personal care are covered by the Health Insurance Act (Zvw). Nursing home care is still covered by the social insurance, now called the Long-term Care Act (Wlz). Eligibility for nursing home care has been restricted to the more severe cases. The role of non-medical factors, such as the living environment, in the eligibility criteria for nursing home care has also been restricted.

## 3. Methods

### 3.1 The basic model

We model the effect of the accessibility of the house on the use of nursing home care. In our main analysis, we are interested in whether an individual *i* uses any nursing home care in year *t*, $y_{i,t} = \{0,1\}$. We think of the use of nursing home care in terms of an individual's latent health needs $y^*_{i,t}$. An individual will use nursing home care if her latent health needs are higher than some threshold: $y^*_{i,t} > \alpha$. Generally, individuals do not like to move to a nursing home; they will only apply for nursing home care when their needs are so severe that the health- and other gains from receiving nursing home care outweigh the utility of staying in their own house. The threshold also depends on the eligibility criteria used by the assessment agency: individuals,

[7] CIZ did not have financial incentives to grant assessments as its financial position was not affected by its decisions.
[8] Intramural care can be consumed in a nursing home or at home. During our study period, only few older persons consumed intramural care at home rather than in a nursing home.

who apply, can only use nursing home care when they are deemed eligible. As a result, the criteria of the assessment agency serve as a lower bound on the threshold.

We model latent health needs of an individual as a linear function of observed individual characteristics ( $X_{i,t}$ ), the accessibility of the house, and an unobserved component:

$$y^*_{i,t} = X'_{i,t}\beta + \gamma s_{i,t} + \varepsilon_{i,t}.$$

For now, it is easiest to think of the accessibility of the house $s_{i,t}$ as a dummy variable, which is 1 if the individual's house is well accessible and 0 if a house is poorly accessible. The parameter of interest is $\gamma$. The hypothesis that we will test throughout this paper is whether $\gamma$<0; the propensity to use nursing home care is lower for people in well accessible houses. The effect we estimate is a combined effect of the direct effect of the house on health and the effect of the house on the ability to cope with limitations.

In terms of observed nursing home care use $y_{i,t}$, we can write the model as:

$$\begin{aligned} y^*_{i,t} &= X'_{i,t}\beta + \gamma s_{i,t} + \varepsilon_{i,t} \le \alpha \Rightarrow y_{i,t} = 0 \\ y^*_{i,t} &= X'_{i,t}\beta + \gamma s_{i,t} + \varepsilon_{i,t} > \alpha \Rightarrow y_{i,t} = 1. \end{aligned} \qquad (1)$$

We assume that the unobserved part $\varepsilon_{i,t} \sim N(0,\sigma)$, so that we can estimate the following linear probability model:

$$y_{i,t} = \alpha + X'_{i,t}\beta + \gamma s_{i,t} + \varepsilon_{i,t}. \qquad (2)$$

We estimate the use of nursing home care in a particular year *t* as a function of an individual's characteristics, neighborhood and housing characteristics, and the accessibility of her house at the start of year *t.* We have an unbalanced panel, as most individuals appear every year in our dataset, i.e. individuals that do not use nursing home care and do not die. We exclude individuals who already live in a nursing home at the start of the year.[9] We cluster the standard errors at the individual level.

Above we described the housing indicator as a single dummy. In our analyses we distinguish 4 types of houses. This means that we have to include three dummies, and estimate three effects (relative to the reference category). We expect the strongest (most negative) effect for most accessible houses.

In the model in Equation (1), we have assumed that the accessibility of the house has a constant level effect on nursing home use. We expect, however, that the effect of the house

[9] For persons living in a nursing home at the start of year t, the accessibility of the home would measure the accessibility of the nursing home.

depends on health: the direct effect of the house on health will be stronger for frail individuals, who may experience more accidents in a poorly accessible house. Similarly, whether a house is suited to cope with certain limitations is only relevant for individuals actually have those limitations. We relax the assumption of a constant effect, by letting $s_{i,t}$ interact with age.[10] As most health problems correlate with age (De Meijer et al., 2013), we expect the effect of the house on nursing home use to increase with age as well.

In order to estimate the true effect of accessibility of the house on nursing home care use, the accessibility of the house an individual lives in should be uncorrelated with unobserved variables ($s_{i,t}$ should be uncorrelated with $\varepsilon_{i,t}$). Many characteristics play a role when explaining the use of nursing home care. Most studies include age, gender, race, marital status, living alone, education and health characteristics in the analyses (Aarsland et al., 2000; Bockarjova et al., 2016; Charles & Sevak, 2005; De Meijer et al., 2015; Guo et al., 2015; Kim et al., 2013; Luppa et al., 2010a; Marumatsu et al., 2007; Portrait et al., 2000; Rouwendal & Thomese, 2013; Slobbe et al., 2017; Wong et al., 2010). As in our study, most studies focus on a specific characteristic. For example, De Meijer et al. (2015) show that a severe disability increases the chance of nursing home use. Charles and Sevak (2005) show that receipt of informal care substantially reduces the risk of nursing home entry. Rouwendal and Thomese (2013) and Slobbe et al. (2017) find evidence that home ownership is negatively correlated with using nursing home care. Bockarjova et al. (2016) find that the wealth of persons is negatively correlated with using nursing home care. Others find that people live longer in their house when there is a spouse (Wong et al., 2010; Marumatsu et al., 2007), they obtain a subsidy (Kim et al. 2013), receive state level Home and Community Based Services expenditures (Marumatsu et al., 2007), or used home care services (Guo et al., 2015).

We control for a wide range of characteristics by including in $X_{i,t}$ dummies for age, gender, type of home care used in the previous year, being a medicine user, different types of medicines, the logarithms of various healthcare expenditures, being a home owner, having a partner, having children, having children living at home, gross income quintiles, and financial wealth quintiles. Moreover, we control for nationality and include the distance an individual lives to several services in the living environment, such as a supermarket or a general practitioner.

Even after controlling for these confounders, there is still a possible selection issue. The availability of nursing home care might differ across neighborhoods. Also, older people with poor (unobserved) health might be clustered in particular neighborhoods; Individuals with

[10] We use age as a proxy for health characteristics of older people that are not observable in our administrative data. For example, also healthy older people with no medical history will become frailer at older ages.

certain socioeconomic or cultural characteristics might live in neighborhoods with a relatively good or poor quality (and accessibility) of housing. When the variables in *X* do not fully capture these characteristics, and these are correlated with unobserved health, our estimate of $\gamma$ will be biased (the direction of the bias is unclear ex-ante). We solve these problems by including neighborhood fixed-effects ( $\delta$ ) in the regression model:

$$y_{i,t} = \alpha + \delta_j + X'_{i,t}\beta + \gamma s_{i,t} + \varepsilon_{i,t}. \qquad (3)$$

Subscript *j* denotes the neighborhood individual *i* lives in. We distinguish approximately 11,000 neighborhoods. The average number of older persons living in a neighborhood equals 79. We now identify the effect of $s_{i,t}$ solely on the variation in the accessibility of the houses *within* neighborhoods.

### 3.2 Additional analyses

To test the plausibility of our estimates and obtain more insight in the mechanisms that drive the effect of the accessibility of the house on nursing home use, we extend our analysis in three ways.

First, we investigate whether the effect of the accessibility of the house is related to the reason why people are eligible for nursing home care. As explained in Section 2, individuals need an assessment in order to use nursing home care. This assessment contains information on the nature of the health problem that makes someone eligible for nursing home use, which can be either physical (somatic, physical or sensory) or cognitive (psychogeriatric, psychiatric or mental). We hypothesize that the type of house matters more for persons with physical health problems than for persons with cognitive problems. In order to investigate this hypothesis, we run two separate linear regressions. One for $y_{i,t}^{phy}$, a dummy that is equal to 1 when individual *i* uses nursing home care in *t* on physical grounds, and 0 when the individual does not use nursing home care. And one for $y_{i,t}^{cog}$, that is 1 if an individual uses nursing home care in year *t* on cognitive grounds, and 0 if one does not use nursing home care. The two regressions then become:

$$\begin{aligned} y_{i,t}^{phy} &= \alpha_{phy} + \delta_j + X'_{i,t}\beta_{phy} + \gamma_{phy}\hat{s}_{i,t} + \varepsilon_{i,t}^{phy}, \\ y_{i,t}^{cog} &= \alpha_{cog} + \delta_j + X'_{i,t}\beta_{cog} + \gamma_{cog}\hat{s}_{i,t} + \varepsilon_{i,t}^{cog}. \end{aligned} \qquad (4)$$

The estimated coefficients $\gamma_{phy}$ and $\gamma_{cog}$ are the grounds-specific effects of $\hat{s}_{i,t}$ on the nursing home use threshold.

The second mechanism we explore is whether older people living in accessible houses use less nursing home care because they have more possibilities to use home care instead. Thus,

does the accessibility of the house stimulate substitution from nursing home care to home care? We estimate Equation (2), but now with the use of home care (yes/no) as the dependent variable. We exclude persons who used homecare in the prior year to focus on new cases.

Third, older people might selectively move to an accessible house *because* they have health problems. As a result, older people who live in an accessible house might have poorer unobserved health than older persons living in a poorly accessible house. This would bias our estimate of $\gamma$ upwards. To investigate whether selective moving it a play, we perform an instrumental variable analysis. We use the *current* accessibility of the house an individual lived in 15 years ago, as an instrument for the accessibility of the house an individual currently lives in.[11,12] The identifying assumption is that in making their housing decision at *t-15* individuals did not have or use information on their long term care needs at *t*. The two-stage model then becomes:

$$s_{i,t} = \kappa + \delta_j + X'_{i,t}\theta + \lambda s_{i,t-15} + \nu_{i,t} \quad (5)$$

$$y_{i,t} = \alpha + \delta_j + X'_{i,t}\beta + \gamma \hat{s}_{i,t} + \varepsilon_{i,t}, \quad (6)$$

where $\hat{s}_{i,t}$ in the second-stage equation (5) is the predicted probability of living in an accessible house at time *t,* based on the first-stage equation (4). We have four different types of houses and 4 age categories. This means that there are 12 endogenous variables: 3 house dummies and 9 interaction terms (3 house dummies * 3 age dummies). Hence we run 12 first stage regressions on the instruments, the interactions between the instruments and the age dummies, and all control variables. We combine the fixed effects and IV model using the estimator of Correia (2016), which is developed to estimate large linear probability models with many fixed effects.

## 4. Data

### 4.1 Data sources

We use a novel dataset on the accessibility of almost all buildings in the Netherlands (TNO).[13] The dataset is created in 2016 and shows to what extent a house is accessible, or can be made accessible by acceptable costs, for people with mobility problems.

All houses are classified with 0, 2 or 3-stars or 0/3-mix (see Figure 1). A 0-star house is a poorly accessible house: one has to climb stairs to reach the front door and hence it cannot be

[11] Because of data availability we focus on the house 15 years ago.
[12] We have 3 endogenous variables, and we also three instruments: we create dummies for each type of house which is equal to one if someone lived in such type of house 15 years ago.
[13] TNO, the Netherlands Organisation for applied scientific research, is an independent research organization. Information about the accessibility of individual buildings is publicly available. For details about the dataset, see http://www.zorgopdekaart.nl/bagwoningen/pdfs/toelichting/toelichting-woningvoorraad-woningaanpassingen-en-langer-zelfstandig-thuis-11.pdf

made accessible by acceptable costs. A 2-star house can be accessed without taking the stairs, consists of multiple floors, and it is possible to place a stair lift at acceptable costs (less than 10,000 euros). A 3-star house is the most accessible house: it can be accessed without walking the stairs and it has only one floor. For apartments in a building without an elevator, it is not always known whether the apartment is on the ground floor (3-star house) or above (0-star house). Therefore, all apartments in such building are placed in the category 0/3-mix.[14]

Figure 1: Examples of respectively a 0-star, 2-star, 3-star and 0/3-mix house. Images retrieved from Google 2019.

We link the dataset to individual-level administrative data for the years 2011-2014 from different sources. We have data on all positive eligibility decisions for nursing home care and home care data obtained from the Dutch assessment agency, CIZ), including the grounds for the assessment (physical or non-physical). We also have data on all care episodes for use of home care and nursing home care, including the date of admission (data obtained from the Central Administration Office, CAK). Furthermore, we link the data to data on prior health care use (type of home care in the previous year, medicine use[15] and costs of curative care used under the mandatory basic health care insurance[16]), personal characteristics (age, gender, ethnicity, partner status, household type, number of children, current and living address 15 years ago [17], neighborhood[18], income, net financial and housing wealth, house ownership[19], and facilities in

[14] In theory there are also 1, 4 and 5 star houses. 1 star houses are houses of which the front door is accessible without stairs, which has multiple levels and where it is not possible to place a stair lift. In practice, it is unknown whether the stairwell is large enough for a stair lift, but as this is the case for 95% of houses, it is assumed that it is always possible. Consequently, we do not observe 1 star houses in the data. 4 and 5 star houses are connected to a care institution but are not observed in the data.
[15] Data from Health Care Insurance Board (College voor Zorgverzekeringen in Dutch).
[16] Data from Vektis.
[17] Data from the Dutch population register.
[18] Data from TNO.
[19] Data from the tax authority.

the surroundings[20] (distance to nearest supermarket, general practice, general practice center, pharmacy and hospital).

### 4.2 Sample selection

We have data on 2011-2014. For all the time varying variables, we use lagged values. That is, we measure medicine use, use of home care, curative care expenditures and gross income during year *t-1*. We measure whether one has a partner and has children living at home at 31 December of year *t-1* and we measure age, financial wealth, the accessibility of the house and whether one owns the house at 1 January of year *t*. As we use lagged independent variables, our study period is 2012-2014.

We restrict the sample to persons of 75 and older. This leaves us with 4,187,202 observations. We exclude patients with a care package for restorative care as since 2013 a part of these patients received care out of the curative care insurance (Health Insurance Act) instead of the long term care insurance (Exceptional Medical Expenses Act) and hence we do not observe new cases. Besides, we exclude patients with a care package for palliative care. We retain 3,861,608 observations. Furthermore, we exclude individuals who used nursing home care in the past year leaving us with 3,465,436 observations. After excluding observations for which the accessibility of the home is unknown, we retain 2,793,545 observations. Because of missing values in other variables, we end with a dataset comprising of 2,599,069 observations.

### 4.3 Descriptive statistics

Table 1 displays descriptive statistics of the observations included in the main regression specification (column 1 in Table 2) by type of house for 2012-2014. 2 percent live in a 0-star house, 11 percent live in a 0/3-mix house, 49 percent live in a 2-star house, and 38 percent live in a 3-star house.

To explore whether people of a certain age cluster in particular types of houses, we show the percentage of people living in a particular type of house by age group in Figure 2. The majority of the persons in the oldest age groups live in a 3-star house, while the majority in the younger age groups lives in a 2-star house. The proportion of people living in a 0-star house is fairly constant across age groups.

Our dependent variable captures whether one moves to a nursing home in year *t*, and hence does not include individuals who already lived in a nursing home in the past year. Table 1 shows that 5% of the people living in a 0-star and 0/3-mix house live in a nursing home the next year, 3% of the persons living in a 2-star house, and 4% of the persons living in a 3-star house.

[20] Data from Statistics Netherlands.

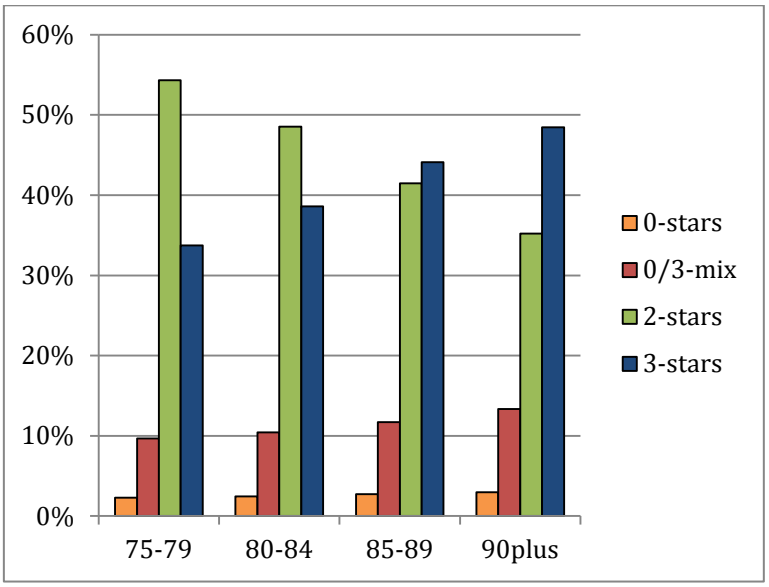
Table 1: Descriptive statistics by type of house

| | 0-star house | | 0/3-mix house | | 2-star house | | 3-star house | |
|---|---|---|---|---|---|---|---|---|
| | mean | sd | mean | sd | mean | sd | mean | sd |
| Total number of observations | 64,171 | | 274,752 | | 1,262,400 | | 997,746 | |
| Use of nursing home care | 0.04 | | 0.03 | | 0.02 | | 0.03 | |
| Assessment on physical ground | 0.02 | | 0.02 | | 0.01 | | 0.02 | |
| Assessment on cognitive ground | 0.01 | | 0.01 | | 0.01 | | 0.01 | |
| Use of home care | 0.35 | | 0.40 | | 0.29 | | 0.40 | |
| Age 75-79 | 0.37 | | 0.36 | | 0.44 | | 0.35 | |
| Age 80-84 | 0.35 | | 0.35 | | 0.35 | | 0.35 | |
| Age 85-89 | 0.20 | | 0.20 | | 0.15 | | 0.21 | |
| Age 90plus | 0.09 | | 0.09 | | 0.05 | | 0.09 | |
| Male | 0.37 | | 0.37 | | 0.46 | | 0.39 | |
| Dutch | 0.86 | | 0.89 | | 0.94 | | 0.94 | |
| Having a partner | 0.36 | | 0.36 | | 0.53 | | 0.43 | |
| Having children | 0.80 | | 0.84 | | 0.90 | | 0.86 | |
| Having children living at home | 0.05 | | 0.04 | | 0.07 | | 0.03 | |
| Gross income | 28,712 | 17,130 | 30096 | 24,100 | 37303 | 29,746 | 32971 | 24,191 |
| Financial wealth | 71,394 | 253,187 | 101357 | 456,071 | 130430 | 596,660 | 112141 | 474,617 |
| Medicine user | 0.95 | | 0.96 | | 0.95 | | 0.96 | |
| Cholestorol reducer | 0.39 | | 0.40 | | 0.40 | | 0.40 | |
| Diabetes | 0.18 | | 0.19 | | 0.16 | | 0.18 | |
| Astma | 0.17 | | 0.19 | | 0.17 | | 0.18 | |
| Antidepressants | 0.09 | | 0.10 | | 0.08 | | 0.10 | |
| Antipsychotics | 0.03 | | 0.03 | | 0.03 | | 0.03 | |
| Sleeping and tranquilizing tablets | 0.07 | | 0.07 | | 0.05 | | 0.06 | |
| ADHD and nootropics | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| Other medicines | 0.94 | | 0.95 | | 0.94 | | 0.96 | |
| Log of total ZVW expenditures (without | 7.58 | 1.34 | 7.67 | 1.33 | 7.59 | 1.32 | 7.71 | 1.28 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| mental health care costs) in euros | | | | | | | | |
| Log of GP care in euros | 5.36 | 0.56 | 5.42 | 0.59 | 5.37 | 0.56 | 5.43 | 0.57 |
| Log of pharmaceutical care in euros | 5.67 | 1.78 | 5.80 | 1.72 | 5.63 | 1.76 | 5.85 | 1.65 |
| Log of oral care in euros | 0.48 | 1.63 | 0.49 | 1.64 | 0.49 | 1.64 | 0.51 | 1.67 |
| Log of hospital care in euros | 5.89 | 2.79 | 6.03 | 2.70 | 5.97 | 2.69 | 6.13 | 2.60 |
| Log of paramedical care in euros | 0.44 | 1.59 | 0.52 | 1.73 | 0.47 | 1.66 | 0.54 | 1.76 |
| Log of technical aids in euros | 2.60 | 2.98 | 2.86 | 3.04 | 2.48 | 2.99 | 2.92 | 3.06 |
| Log of patient transport in euros | 0.87 | 2.23 | 0.91 | 2.29 | 0.75 | 2.12 | 0.89 | 2.26 |
| Log of care abroad in euros | 0.11 | 0.80 | 0.11 | 0.79 | 0.09 | 0.71 | 0.08 | 0.69 |
| Log of other care in euros | 1.75 | 2.40 | 1.91 | 2.46 | 1.84 | 2.49 | 1.92 | 2.48 |
| Domiciliary care in prior year | 0.23 | | 0.26 | | 0.16 | | 0.26 | |
| Personal care in prior year | 0.14 | | 0.19 | | 0.13 | | 0.20 | |
| Nursing in prior year | 0.06 | | 0.07 | | 0.05 | | 0.08 | |
| Individual assistance in prior year | 0.02 | | 0.02 | | 0.01 | | 0.02 | |
| Group assistance in prior year | 0.02 | | 0.03 | | 0.02 | | 0.03 | |
| Home owner | 0.20 | | 0.25 | | 0.58 | | 0.35 | |
| Living within 500 meter of supermarket | 0.59 | | 0.57 | | 0.37 | | 0.44 | |
| Living within 500 meter of general practice | 0.49 | | 0.50 | | 0.32 | | 0.38 | |
| Living within 500 meter of general practice center | 0.01 | | 0.01 | | 0.01 | | 0.01 | |
| Living within 500 meter of pharmacy | 0.44 | | 0.42 | | 0.23 | | 0.30 | |
| Living within median distance to hospital | 0.77 | | 0.63 | | 0.44 | | 0.55 | |

Descriptive statistics are based on the observations included in the main regression analysis (column 1 in Table 2) measured at time *t* for the years 2012-2014. The standard deviation is reported for continuous variables only.

Figure 2: Distribution of houses by age class




Distribution of houses by age class, expressed as the proportion of the total number of people of that age class. Sample: observations included in the main regression analysis (column 1 in Table 2).

2%-3% has an assessment on physical ground and 1% has an assessment on cognitive ground, irrespective of the type of house. Around 30% of all older people use home care, and most older people are between 75 and 84 years old. In each type of house, the majority is female, Dutch and has children who do not live at home. Persons living in the most accessible houses are more likely to have a partner than older people living a 0/3-mix or 0-star house. People living in a 2-star house are mostly likely to own the house and have a higher gross income and more financial wealth than others. Almost all persons use some kind of medicines, irrespective of the type of house. Of the 7 specified categories, cholesterol reducers are used most often. Diabetes and astma medicines are also common among the older people, in contrast to sleeping and tranquilizing tables. Average healthcare expenditures for GP care, pharmaceutical care and hospital care are higher than expenditures for the other curative care categories. Persons living a 2-star house are less likely to have used home care in the past year.

People living in the least accessible houses are most likely to live close to a supermarket, general practitioner, pharmacy and hospital than others. Only 1% of persons live within 500 meter of a practitioner center.

## 5. Results

### 5.1 Use of nursing home care

Table 2 shows the main regression coefficients to explain variation in the use of nursing home care. Appendix A contains the complete regression output including the coefficients of all control variables. The first column of Table 2 presents the result of an OLS regression with neighborhood fixed effects. This is our preferred specification.

Table 2: Use of nursing home care

| | 1<br>Use of nursing home care | 2<br>Use of nursing home care | 3<br>Use of nursing home care |
|---|---|---|---|
| 0/3 mix | 0.054 | -0.188** | 0.292* |
| | (0.085) | (0.078) | (0.149) |
| 2 stars | 0.126 | -0.177** | 0.399*** |
| | (0.079) | (0.072) | (0.136) |
| 3 stars | -0.009 | -0.280*** | 0.389*** |
| | (0.080) | (0.072) | (0.138) |
| 0/3 mix * Age 80-84 | -0.253 | -0.259* | -0.407 |
| | (0.156) | (0.155) | (0.261) |
| 0/3 mix * Age 85-89 | -0.777*** | -0.773*** | -0.717* |
| | (0.262) | (0.262) | (0.409) |
| 0/3 mix * Age 90 plus | -0.972* | -0.933* | -1.803** |
| | (0.521) | (0.520) | (0.780) |
| 2 stars * Age 80-84 | -0.474*** | -0.461*** | -0.766*** |
| | (0.143) | (0.142) | (0.233) |
| 2 stars * Age 85-89 | -1.242*** | -1.251*** | -1.494*** |
| | (0.243) | (0.243) | (0.368) |
| 2 stars * Age 90 plus | -2.230*** | -2.169*** | -3.680*** |
| | (0.488) | (0.488) | (0.719) |
| 3 stars * Age 80-84 | -0.352** | -0.351** | -0.515** |
| | (0.145) | (0.144) | (0.242) |
| 3 stars * Age 85-89 | -0.992*** | -1.038*** | -0.770** |
| | (0.244) | (0.244) | (0.382) |
| 3 stars * Age 90 plus | -1.596*** | -1.649*** | -2.438*** |
| | (0.485) | (0.485) | (0.737) |
| Observations | 2,599,069 | 2,599,069 | 2,466,684 |
| R-squared | 0.079 | 0.073 | 0.073 |
| Year dummies | YES | YES | YES |
| Neighborhood fixed effects | YES | NO | YES |
| Specification | OLS | OLS | IV |

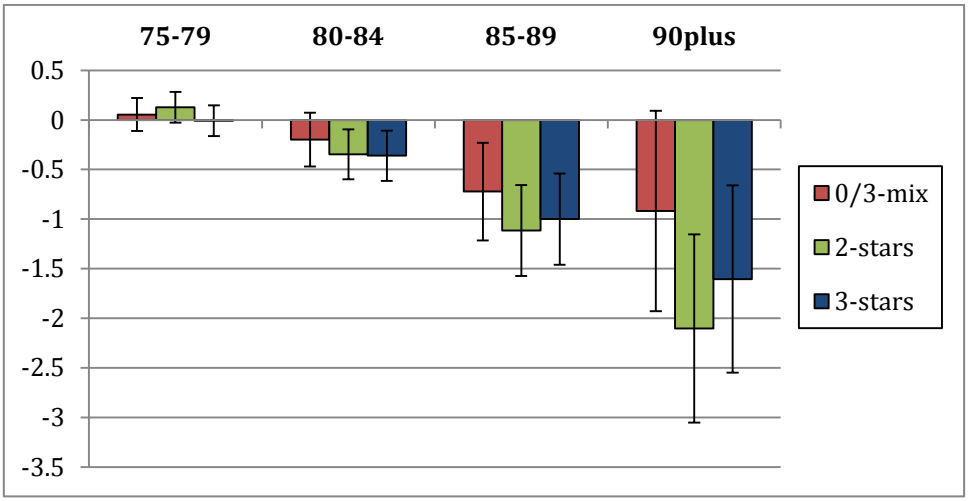
Regression results to explain the use of nursing home care. The coefficients are multiplied by 100 and hence express percentage points. All specifications include health controls, personal characteristics, and neighborhood characteristics.***p<0.01, **p<0.05, *p<0.1.

To examine whether the house plays a role in using nursing home care, we calculate the marginal effects, shown in Figure 3.[21] The figure shows the difference in the probability to use nursing home care between a person living in a certain type of house versus (2 star, 3 star, or 0/3-mix) and a person with similar characteristics and the same age living in a 0-star house (the reference category).

The main results are in line with our hypotheses. First, people living in well accessible houses use less nursing home care than people living in poorly accessible houses. This is the case across all ages. The effects of houses that *can be made* accessible (a 2-star house) are similar in size to house that *are* accessible (a 3-star house). The effect of a 0/3-mix house lies between the effects of a 0-star house and a 3-star house, which is intuitive as this category comprises of 0-star houses and 3-star houses.

Second, the effect of the house increases with age and is strongest for the oldest age groups. For example, consider persons living in a 2-star house. People between 75-79 year old have a 0.1 percentage points higher probability to use nursing home care than individuals of that age living in a 0-star house, but the effect is not statistically significant at 5%. In contrast, persons between 80-84 year old are 0.3 percentage points less likely to use nursing home care than persons of the same age living in a 0-star house, and persons of 85-89 year old and persons aged 90plus are respectively 1.1 percentage points and 2.1 percentage points less likely to use nursing home care (all significant at 5%). The results are more significant at higher ages: while the interaction coefficients and the marginal effects are not statistically different from 0 for persons between 75 and 79 years old, most of the results are significant for persons aged 80 and over.

Figure 3: The marginal effects of the accessibility of the house on the use of nursing home care




[21] A marginal effect is calculated as the sum of the coefficient of the house and the coefficient of the interaction term of the house and age. We use the non-rounded coefficients to construct the figure and hence the values may slightly deviate from the sum of the coefficients shown in Table 2.

Marginal effects and the 95% confidence intervals, by age class. Based on OLS with neighborhood fixed effects (column 1 in Table 2). It shows the difference in probability of using nursing home care for a person of the same age living in a certain type of house versus living in a 0-star house.

Excluding neighborhood fixed effects hardly affects the estimates (column 2 in Table 2): the coefficients of the interaction terms are comparable in size and significance levels. The negative marginal effects are slightly stronger, and the pattern remains unchanged for persons above 80: the effects increase with age, the effects for 2- and 3-star houses are comparable and the effect of a 0/3-mix lies between the effect of a 0-star house and a 3-star house.

So far, we have focused on the effect of the house. Appendix A outlines the complete regressions results and shows that the control variables are in line with the literature: Older people and people with worse health status are more likely to use nursing home care and, individuals who own their house, who have a higher gross income, and who have children are less likely to use nursing home care (Charles & Sevak, 2005; De Meijer et al., 2015; Kim et al., 2013; Luppa et al., 2010a; Portrait et al., 2000; Rouwendal & Thomese, 2013; Slobbe et al., 2017; Wong et al., 2010).

### 5.2 Additional analyses

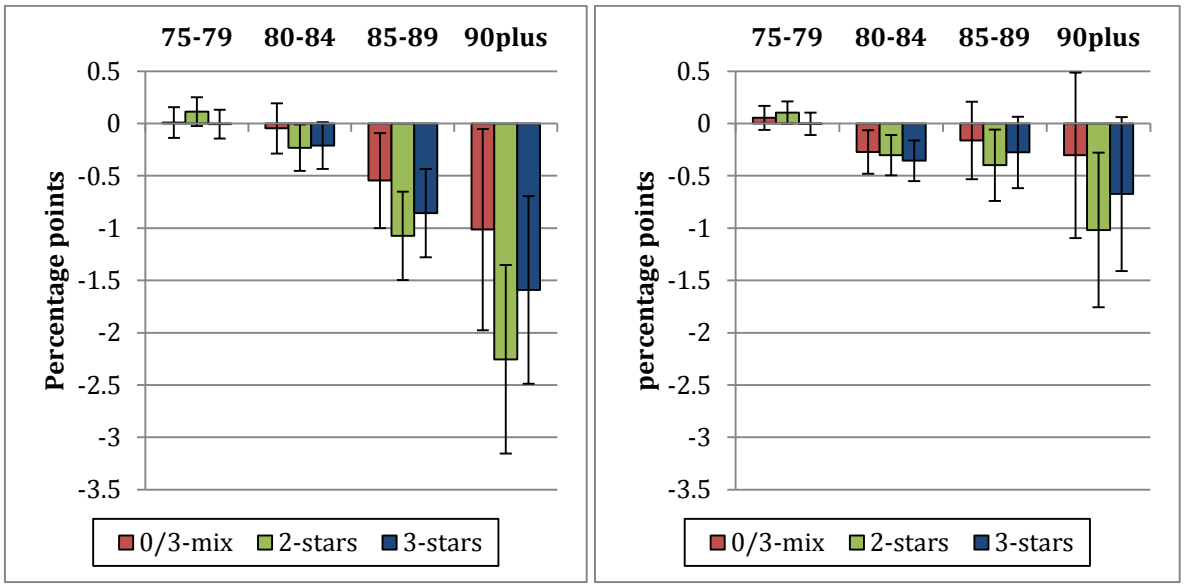
We perform three additional analyses to test the plausibility of our estimated effect. In this section, we discuss the most relevant outcomes. We refer to Appendix C for the regression coefficients. The complete estimation results are available on request.

We first investigate whether the effect of the accessibility of the house is related to different health problems when individuals are admitted to a nursing home. We expect that the accessibility of the house is more important for older people with physical problems, and to a lesser extent for older people with cognitive problems. Therefore, we construct two subsamples and rerun our regressions. First, we only include individuals who use nursing home care on a physical ground, and individuals who do not use nursing home care. Second, we only include individuals who use nursing home care on cognitive grounds, and individuals who use no nursing home care.

The left graph in Figure 4 presents the marginal effects of using nursing home care on a physical ground and the right graph in Figure 4 presents the marginal effects of using nursing home care on a cognitive ground. As in the main analysis, in both cases, the effect of the accessibility of the house increases with age. For example, for persons with physical problems, a 75-79 year old living in a 3-star house is equally likely to use nursing home care as a person of the same age living in a 0-star house. And a person aged 90plus living in a 3-star house is 1.6 (0.7) percentage points less likely to use nursing home care than a person of the same age living in a 0-star house.

The effects are more than twice as large for persons with physical problems as for people with cognitive limitations for individuals of 85 years and older. For instance, older

Figure 4: Marginal effects on the use of nursing home care on physical grounds (left) and the marginal effects on the use of nursing home care on cognitive grounds (right)




The left graphs shows the marginal effects of using nursing home care on physical ground, and the 95% confidence intervals, by age class. Sample: older people without assessment and older people with an assessment on physical ground. The right graph shows the marginal effects of using nursing home care on cognitive ground, and the 95% confidence intervals, by age class. Sample: older people without assessment and older people with an assessment on cognitive ground.

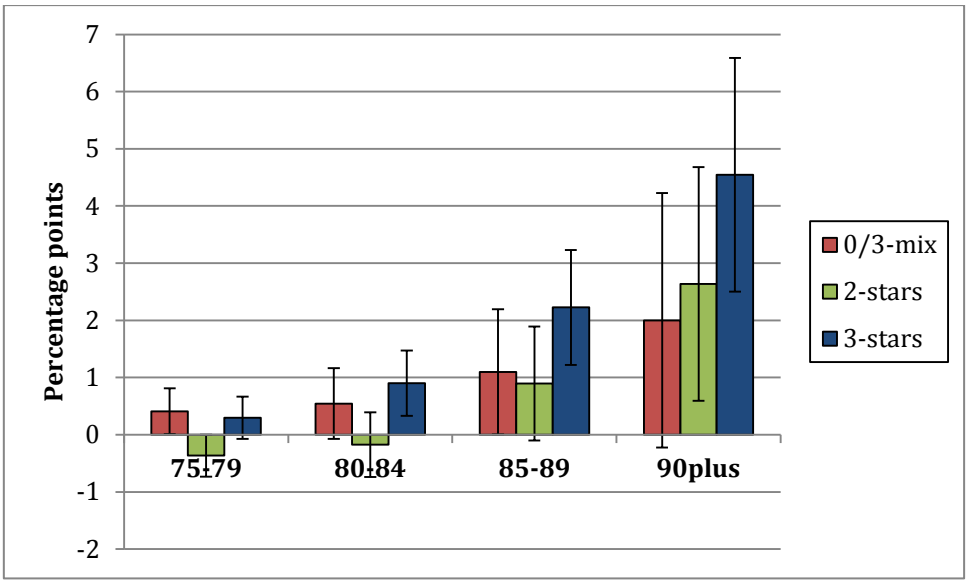
persons between 85-89 year old with physical limitations living in a 2-star house are 2.3 percentage points less likely to use nursing home care than a person of the same age living in a 0-star house, while this difference is only 1.0 percentage points for people with cognitive problems.

Second, we examine whether living in an accessible house leads to substitution of nursing home care by home care. We run similar regressions as before, but now with home care use as dependent variable. Figure 5 shows the marginal effects. As we hypothesized, persons living in more accessible houses are more likely to use home care. We find significant positive effects on the probability of home care use for 3-star houses in the age group 85-89, and 2-star and 3-star houses in the ages above 90. For example, a 75-79 year old living in 3 star house is 0.3 percentage points more likely to use home care than a person of that age living in a 0 star house, while a 90+ year old living in a 3 star house is 4.5 percentage points more likely to use home care.

Third, we perform an instrumental variable analysis, to test whether selective moving of

older individuals with health problems to accessible houses affects our results. We use the *current* accessibility of the house an older individual lived in *15 years ago* as an instrument for the accessibility of her *current* house. Table 3 shows that most people live in the same type of

Figure 5: Marginal effects on the use of home care




Marginal effects and the 95% confidence intervals, by age class. It shows the difference in probability of using home care for a person of the same age living in a certain type of house versus living in a 0-star house.

Table 3: Accessibility of the house 15 years ago and the current house

| | | Today | | | |
|---|---|---|---|---|---|
| | | 0 stars | 0/3 mix | 2 stars | 3 stars |
| 15 years ago | 0-stars | 56% | 6% | 5% | 32% |
| | 0/3-mix | 1% | 71% | 6% | 22% |
| | 2-stars | 1% | 5% | 74% | 20% |
| | 3-stars | 0% | 3% | 5% | 92% |

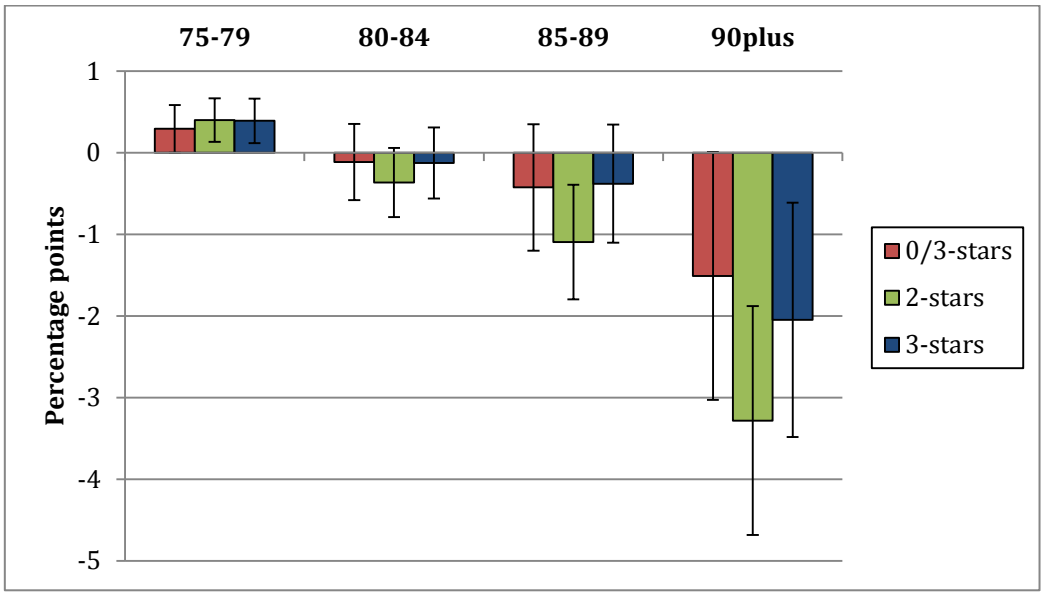
The number of persons (75+) living in type of house today expressed as proportion of the number of persons living in the type of house 15 years ago.

house as they did 15 years ago: respectively 56%, 71%, 74% and 92% of the people who lived in a 0, 0/3-mix, 2 and 3-star house 15 years ago, currently live in the same type of house. Individuals who lived in poorly accessible houses 15 years ago are more likely to have moved

than older people who lived in more accessible houses. Also, older people typically go from a poorly accessible house to a more accessible house.

Column 3 of table 2 shows the coefficients of interest of the instrumental variable specification including neighborhood fixed effects. Appendix B shows the complete regression results including the control variables, as well as the results from the first stage regressions. Figure 6 presents the marginal effects. The results are similar to our main specification, with

Figure 6: Marginal effects on the use of nursing home care (IV)




Marginal effects and the 95% confidence intervals, by age class. It shows the difference in probability of using nursing home care for a person of the same age living in a certain type of house versus living in a 0-star house based on the instrumental variable specification.

one exception: The marginal effect of living in a 0/3-mix house for a 90+ year old is now close to the marginal effect of living in a 2 or 3-star house for someone of that age.[22] Also, the standard deviations of the interaction terms have increased, which is often the case after using instruments (Baser, 2009).

The identifying assumption of the IV analysis is that in making their housing decision fifteen years ago, individuals did not have or used information on their *current* long term care needs. The time lag of 15 years is chosen because of data availability. Especially at higher ages, for instance individuals who 15 years ago were already 75, the assumption might be too strong.

[22] This difference in effect with our main model might indicate a selection effect, but it seems likely that it is due to the fact that the IV estimates the local average treatment effect for the compliers. The effect of the 0/3-mix is basically a weighted average of the effect of individuals living in a 3-star house and individuals living in a 0-star house. It might be that individuals in a 3-star house are overrepresented in the complier group (As shown in Table 3 for instance, persons who lived in a 0-star house 15 years ago are more likely to move than persons who lived in a 3-star house. The same might be the case within the 0/3-mix group).

As an additional robustness check, we therefore rerun the IV analysis excluding all individuals who use home care at *t-1*. The idea is that this only leaves cases who experience a new health shock in year *t* (In the Dutch system, both home care and nursing home care are publicly financed. This seems to justify the assumption that individuals, who moved to another house 15 years ago to receive care at home, will do so through the public system). The less strong identifying assumption is then that individuals did not take the probability of such a health shock into account when making their housing decision 15 years ago. We find similar results although the marginal effects of living in a 0/3 mix house and living in a 3 stars house are now almost the same size for persons aged 90 or older (results available upon request).

To conclude, our instrumental variable analysis suggests that our estimates are not strongly influenced by persons selectively moving to accessible houses in the past. However, there might be other reasons than selective moving why the accessibility of the house might be correlated with unobserved health factors (individual with certain unobserved characteristics might for instance prefer a particular type of house and invest more in their health). We therefore interpret the IV results as supportive evidence, but would refrain from claiming that the associations we have found are certainly causal.

## 5. Conclusion

So far, there has been no large scale study on the impact of the accessibility of the house an older person lives in on her use of nursing home care. This paper fills this gap. We have used unique population-wide data on the accessibility of the house and nursing home care use in the Netherlands to examine whether the accessibility of the house can postpone, or prevent, nursing home care use.

Our results provide some first evidence that the house should be added to the list of determinants of nursing home care use, such as age, having a chronic disease, income, absence of a spouse, and home ownership, that have been found in earlier empirical research. We find that living in an accessible house is associated with a lower probability to use nursing home care. The relation increases with age, and the results are stronger for people with physical problems than for people with cognitive limitations. We also provide some evidence of substitution: older people in accessible house are more likely to use home care.

Our findings imply that there is indeed scope for policies that try to stimulate ageing in place through improvements in the living conditions of the older population. Since the effect of the house is concentrated at the highest age groups policy makers should target the oldest old. They are most likely to benefit from improvements in the accessibility of the house. Large scale

interventions targeting the total older population might be too general and therefore less likely to be (cost-) effective.

We find that living in a house that cannot be made accessible leads to a higher likelihood of nursing home care use than living in a house that is or can be made accessible. In 2014, 27.000 persons aged 75plus lived in a 0-star house, 120.000 persons lived in a 0/3-mix house, of which a large part also lived in 0-star houses, and 1 million older people lived in an accessible house (2- and 3-star houses). As a result, the share of older people living in houses that cannot be made accessible is small, although there are neighborhoods with many of these houses. However, in countries with many poorly accessible houses, improvement policies might yield more substantial effects on nursing home use. A complication is that policy interventions targeted at older people living in inadaptable houses would require either moving very old people to a more suitable house when their health already has deteriorated or motivating relatively young people to move to a more suitable house while they are still healthy. Both options seem hard to do as many people like to remain living in their own house or neighborhood, or cannot afford to move.

However, we also find that living in a house that *can be made* accessible is equally beneficial, in terms of nursing home care use, as living in a house that actually *is* accessible. In 2014, 555.000 persons of 75 years and older lived in 2-star houses which can be made accessible. An important aspect of our study, also in terms of its policy implications, is that we cannot identify what aspects of, or adaptations to, the house exactly drive our results. If the equal effect is due to the fact that individuals living in adaptable house actually *do* adapt these houses, then our results also provide a motivation for (financially or otherwise) stimulating such adaptations. Unfortunately, we do not observe modifications people make to their house, so that we cannot further support this conclusion.

It is important to take the context of the Dutch long-term care system into account when generalizing our results to other institutional settings. First, the effects depend on the accessibility and funding for home care and nursing home care, which both are more generous in the Netherlands than in most other countries. The fact that the Dutch system is generous for both types of care is a good thing in terms of identification: our results are unlikely to be driven by differences in financial access to care. However, in other systems, where home care is less or more generously provided, the accessibility of the house might have a smaller or larger effect.

Second, during the time period of our analysis, housing conditions were officially taken into account in the assessment process to determine eligibility for nursing home care (although it is not clear to what extent they actually were in practice). We are not able to distinguish between the behavior of the older people themselves, who decide to apply for nursing home

care eligibility, and the behavior of the assessors, who decide to grant eligibility. This means that our results could be partly driven by the eligibility criteria that were in place.[23]

In 2015 a large reform has taken place in the Netherlands. Since then, municipalities are responsible for home care, eligibility criteria for nursing home care are stricter, and access to nursing homes for persons with relatively minor health problems is limited. This might impact our results, although, as not all changes are in the same direction of more or less home care provision, it is not clear to what extent.

A limitation of our study is that, with our data, we cannot disentangle the two channels behind the effect of the house on nursing home care use: the direct effect on health and the effect through coping. An area for future research would be to link our sample to data on hospital admissions and investigate whether living in an inaccessible house is related to more admissions for specific diagnoses related to a possible direct effect (e.g. falls, injuries).

[23] Prior literature shows that not all people move to a nursing home immediately after obtaining the assessment (Bakx et al., 2016). We performed a regression (not shown) with obtaining an assessment in year *t* as dependent variable. We find similar results as in our paper for moving to a nursing home in year *t*, hence our results are not likely to be driven by persons postponing the move to a nursing home after obtaining an assessment.

## References


Aarsland, D., Larsen, J.P., Tandberg, E., & Laake, K. (2000). Predictors of nursing home placement in Parkinson's disease: a population-based, prospective study. *Journal of the American Geriatrics Society, 48*(8), 938-942.

Aedes-Arcares (2005). Wie de woning houdt, passe haar aan: Gebruikersonderzoek naar het opplussen van eengezinswoningen voor ouderen. Retrieved from http://www.schellekensadvies.nl/Schellekens/media/Media/documenten/Zeeuwse-WG-12-Samenvatting-Eindrapport-def-120705.pdf

Agree, E.M., Freedman, V.A., Cornman, J.C., Wolf, D.A., & Marcotte, J.E. (2005). Reconsidering substitution in long-term care: When does assistive technology take the place of personal care? *Journal of Gerontology: Series B, 60*(5), S272-S280.

American Geriatrics Society, British Geriatrics Society, & American Academy of Orthopaedic Surgeons Panel on Falls Prevention (2001). Guideline for the prevention of falls in older persons. *Journal of the American Geriatrics Society, 49*, 664-672.

Bakx, P., Douven, R., Schut, F.T. (2016). *Does independent needs assessment limit supply-side moral hazard in long-term care?* (CPB Discussion Paper No. 327). Retrieved from https://www.cpb.nl/sites/default/files/publicaties/download/cpb-discussion-paper-327-does-independent-needs-assessment-limit-supply-side-moral-hazard-long-term-.pdf

Bakx, P., Wouterse, B., van Doorslaer, E.K.A., & Wong, A. (2018). *Better off at home? Effects of a nursing home admission on costs, hospitalizations and survival* (Tinbergen Institute Discussion Paper TI 2018-060.V). Retrieved from https://papers.tinbergen.nl/18060.pdf

Baser, O. (2009). Too much ado about instrumental variable approach: Is the curse worse than the disease? *Value in health, 12*(8), 1201-1209.

Blackburn, J., Locher, J. and Kilgore, M. (2014). Comparison of Long-term Care in Nursing Homes Versus Home Health: Costs and Outcomes in Alabama. *The Gerontologist, 56*(2), pp.215-221.

Binette, J., & Vasold, K. (2018). Home and Community Preferences: A National Survey of Adults Age 18-Plus. Retrieved from https://www.aarp.org/research/topics/community/info-2018/2018-home-community-preference.html

Bockarjova, M., Polder, J., & Rouwendal, J. (2016). *Long-term care, wealth and housing* (Netspar Academic Series DP 01/2014-099).

Charles, K.K., & Sevak, P. (2005). Can family caregiving substitute for nursing home care? *Journal of Health Economics, 24*, 1174-1190.

CIZ. (2014). CIZ Indicatiewijzer 7.1, The Dutch Assessment Office (CIZ).

Costa-Font, J., Elvira, D., & Mascarilla-Miró, O. (2009). 'Ageing in Place'? Exploring elderly people's housing preferences in Spain. *Urban Studies, 46*(2).

Correia, S. (2016). *A feasible estimator for linear models with multi-way fixed effects*. Retrieved from http://scorreia.com/research/hdfe.pdf

De Meijer, C., Bakx, P., Van Doorslaer, E., & Koopmanschap, M. (2015). Explaining declining rates of institutional LTC use in the Netherlands: a decomposition approach. *Health Economics, 24*(S1), 18-31.

De Meijer, C., Koopmanschap, M., Bago d'Uva T., & Van Doorslaer E. (2011). Determinants of long-term care spending: Age, time-to-death or disability? Journal of Health Economics. *3,* 425-438.

De Meijer, C., Wouterse, B., Polder, J., & Koopmanschap, M. (2013). The effect of population aging on health expenditure growth: a critical review. *European Journal of Ageing, 10*, 353-361.

Freedman, V.A., Agree, E.M., Martin, L.G., & Cornman, J.C. (2006). Trends in the use of assistive technology and personal care for late-life disability, 1992-2001. *The Gerontologist, 46*(1), 124-127.

Guo, J., Konetzka, R.T., Manning, W.G. (2015). The causal effects of home care use on institutional long-term care utilization and expenditures. *Health Economics, 24*(1), 4-17.

Harvard Joint Center for Housing Studies. (2014). *Housing America's older adults: Meeting the needs of an ageing population.* Retrieved from http://www.jchs.harvard.edu/sites/default/files/jchs-housing_americas_older_adults_2014_1.pdf

Hoenig, H.H., Taylor, D.H.., Sloan, F.A. (2003). Does assistive technology substitute for personal assistance among the disables elderly? *American Journal of Public Health, 93*(2), 330-337.

Isberner, F., Ritzel, D., Sarvela, P., Brown, K., Hu, P., & Newbolds, D. (1998). Falls of Elderly Rural Home Health Clients, *Home Health Care Services Quarterly, 17*(2), 41-51.

Kim, H., Kwon, S., Yoon, N., & Hyun, K. (2013). Utilization of long-term care services under the public long-term care insurance program in Korea: Implications of a subsidy policy. *Health Policy, 111*, 166-174.

Kok, L., Berden, C., Sadiraj, K. (2015). Costs and benefits of home care for the elderly versus residential care: a comparison using propensity scores. *European Journal of Health Economics, 16*, 119-131.

Ho, K.W., Matsubayashi, K., Wada, T., Kimura, M., Yano, S., Otsuka, K., Fujisawa, M., Kita, T., & Saijoh, K. (2003). What determines life satisfaction of the elderly? Comparative study of residential care home and community in Japan. *Geriatrics & Gerontology International, 3*(2), 79-85.

Larsen, E.R., Mosekilde, L., & Foldspang, A. (2004). Correlates of falling during 24h among elderly Danish community residents. *Preventive Medicine, 39*(2), 389-398.

Luppa, M., Luck, T., Matschinger, H., König, H., & Riedel-Heller, S.G. (2010a). Predictors of nursing home admission of individuals without a dementia diagnosis before admission – results from the Leipzig Longitudinal Study of the Aged (LEILA 75+), *BMC Health Services Research, 10*(186).

Luppa, M., Luck, T., Weyerer, S., König, H., Brähler, E., Riedel_heller, S.G. (2010b). Prediction of institutionalization in the elderly. A systematic review. *Age and Ageing, 39*(1), 31-38.

Mandelstam, M. (2016). *Home adaptations: The Care Act 2014 and related provision across the United Kingdom*. Retrieved from https://www.rcot.co.uk/sites/default/files/Home-adaptations-Care-Act2014.pdf

McKnight, R. (2006). Home care reimbursement, long-term care utilization, and health outcomes. *Journal of Public Economics, 90*(1-2), 293-323.

Ministerie van Home care reimbursement, long-term care utilization, and health outcomes Volksgezondheid, Welzijn en Sport. (2018). *Programma langer thuis.* Retrieved from https://www.rijksoverheid.nl/documenten/rapporten/2018/06/15/programma-langer-thuis

Muramatsu, N., Yin, H., Campbell, R.T., Hoyem, R.L., Jacob, M.A., & Ross, C.O. (2007). Risk of Nursing Home Admission Among Older Americans: Does States' Spending on Home- and Community-Based Services Matter? *The Journals of Gerontology: Series B, 62*(3), S169-S178.

Naomi, A., Shiroiwa, T., Fukuda, T., & Murashima, S. (2012). Institutional care versus home care for the elderly in a rural area: cost comparison in rural Japan. *Rural Remote Health*, 12(1817).

Nederlandse Zorgautoriteit. (2018). *Monitor Zorg voor ouderen 2018*. Retrieved from https://www.rijksoverheid.nl/documenten/rapporten/2018/04/19/monitor-zorg-voor-ouderen-2018

Organization for Economic Cooperation and Development (OECD). (2011). *Help Wanted? Providing and Paying for LTC.* OECD Health Policy Studies. OECD: Paris.

OECD. (2017). *Health at a glance 2017: OECD indicators*. OECD Publishing, Paris.

Portrait, F., Lindeboom, M., & Deeg, D. (2000). The use of long-term care services by the Dutch elderly. *Health Economics*. *9*(6). 513–31.

Rapp, K., Rothenbacher, D., Magaziner, J., Becker, C., Benzinger, P., König, H., Jaensch, A., & Büchele, G. (2015). Risk of nursing home admission after femoral fracture compared with stroke, myocardial infarction, and pneunomia. *JAMDA, 16*, 715.e7-715.e12

Rodriguez-Blazquez, C., Forjaz, M.J., Prieto-Flores, M.-E., Rojo-Perez, F., Fernandez-Mayoralas, G., & Martinez-Martin, P. (2012). Health status and well-being of older adults living in the community and in residential care settings: are differences influenced by age? *Ageing & Mental Health,* 16(7), 884-891.

Rouwendal, J. & Thomese, F. 2013. Homeownership and long-term care. *Housing Studies, 28*(5). 746–63.

Rubenstein, L.Z. (2006). Falls in older people: epidemiology, risk factors and strategies for preventions. *Age and ageing, 35*(S2), ii37-ii41.

Slobbe, L.C.J., Wong, A., Verheij, R.A., van Oers, H.A.M., & Polder, J.J. (2017). Determinants of first-time utilization of long-term care services in the Netherlands: an observational recode linkage study. *BMC Health Services Research, 17*.

Tinetti, M.E., & Williams, C.S. (1997). Falls, injuries due to falls, and the risk of admission to a nursing home. *The New England Journal of Medicines, 337*(18), 1279-1284.

World Health Organization (2011). *Global health and ageing*. Retrieved from https://www.who.int/ageing/publications/global_health/en/

Wolinsky, F.D., Johnson, R.T., & Fitzgerald, J.F. (1992). Falling, health status, and the use of health services by older adults: a prospective study. *Medical Care, 30*(7), 587-597.

Wong, A., Elderkamp-de Groot, R., Polder, J., & van Exel, J. (2010). Predictors of long-term care utilization by Dutch hospital patients aged 65+. *BMC Health Services Research, 10*.

Young, C,, Hall, A., Gonçalves-Bradley, D.C., Quinn, T.J, Hooft, L., van Munster, B.C., & Stott, D.J. (2017). Home or foster home care versus institutional long-term care for functionally dependent older people. *Cochrane Database of Systematic Reviews*, *4*.

**Appendix A: Regression results to explain the use of nursing home care**

| | 1<br>Use of nursing home care |
|---|---|
| 0/3 mix | 0.054 |
| | (0.085) |
| 2 stars | 0.126 |
| | (0.079) |
| 3 stars | -0.009 |
| | (0.080) |
| 0/3 mix * Age 80-84 | -0.253 |
| | (0.156) |
| 0/3 mix * Age 85-89 | -0.777*** |
| | (0.262) |
| 0/3 mix * Age 90 plus | -0.972* |
| | (0.521) |
| 2 stars * Age 80-84 | -0.474*** |
| | (0.143) |
| 2 stars * Age 85-89 | -1.242*** |
| | (0.243) |
| 2 stars * Age 90 plus | -2.230*** |
| | (0.488) |
| 3 stars * Age 80-84 | -0.352** |
| | (0.145) |
| 3 stars * Age 85-89 | -0.992*** |
| | (0.244) |
| 3 stars * Age 90 plus | -1.596*** |
| | (0.485) |
| 2013 | 0.010 |
| | (0.025) |
| 2014 | -0.258*** |
| | (0.024) |
| Cholestorol reducer | -0.396*** |
| | (0.023) |
| Diabetes | 0.201*** |
| | (0.036) |
| Astma | -0.591*** |
| | (0.030) |
| Antidepressants | 0.214*** |
| | (0.047) |
| Antipsychotics | 6.217*** |
| | (0.161) |
| Sleeping and tranquilizing tablets | -0.359*** |
| | (0.065) |
| ADHD and nootropics | -0.638* |
| | (0.370) |
| Other medicines | -1.397*** |
| | (0.058) |
| Log of GP care in euros | 0.761*** |
| | (0.033) |
| Log of pharmaceutical care in euros | 0.254*** |
| | (0.011) |
| Log of oral care in euros | -0.037*** |
| | (0.005) |
| Log of hospital care in euros | -0.106*** |
| | (0.005) |
| Log of paramedical care in euros | -0.047*** |
| | (0.007) |
| Log of technical aids in euros | 0.014*** |
| | (0.004) |

| | |
|---|---|
| Log of patient transport in euros | 0.017** |
| | (0.007) |
| Log of care abroad in euros | -0.100*** |
| | (0.010) |
| Log of other care in euros | -0.020*** |
| | (0.005) |
| Gross income quintile 2 | -0.079* |
| | (0.042) |
| Gross income quintile 3 | 0.021 |
| | (0.044) |
| Gross income quintile 4 | -0.062 |
| | (0.045) |
| Gross income quintile 5 | -0.118** |
| | (0.047) |
| Gross income quintile 6 | -0.160*** |
| | (0.049) |
| Gross income quintile 7 | -0.140*** |
| | (0.053) |
| Gross income quintile 8 | -0.197*** |
| | (0.058) |
| Gross income quintile 9 | -0.144** |
| | (0.066) |
| Gross income quintile 10 | -0.223*** |
| | (0.075) |
| Financial wealth quintile 2 | 0.037 |
| | (0.052) |
| Financial wealth quintile 3 | 0.061 |
| | (0.052) |
| Financial wealth quintile 4 | 0.169*** |
| | (0.052) |
| Financial wealth quintile 5 | 0.127** |
| | (0.051) |
| Financial wealth quintile 6 | 0.101** |
| | (0.051) |
| Financial wealth quintile 6 | 0.184*** |
| | (0.051) |
| Financial wealth quintile 8 | 0.166*** |
| | (0.052) |
| Financial wealth quintile 9 | 0.060 |
| | (0.052) |
| Financial wealth quintile 10 | -0.203*** |
| | (0.054) |
| Male | 0.034 |
| | (0.021) |
| Dutch | 0.525*** |
| | (0.039) |
| Having a partner | -0.004 |
| | (0.024) |
| Having children living at home | -0.261*** |
| | (0.046) |
| Age 80-84 | 1.227*** |
| | (0.141) |
| Age 85-89 | 3.469*** |
| | (0.237) |
| Age 90plus | 6.598*** |
| | (0.472) |
| Having children | -0.274*** |
| | (0.034) |
| Home owner | -0.155*** |

| | |
|---|---|
| | (0.024) |
| Living within 500 meter of supermarket | 0.028 |
| | (0.027) |
| Within 500 meter of general practice | 0.004 |
| | (0.030) |
| Living within 500 meter of general practic center | -0.220* |
| | (0.133) |
| Living within 500 meter of pharmacy | 0.020 |
| | (0.033) |
| Living within median distance to hospital | 0.052 |
| | (0.059) |
| Domiciliary care | 0.621*** |
| | (0.036) |
| Personal care | 4.143*** |
| | (0.052) |
| Nursing | 0.198*** |
| | (0.076) |
| Individual assistance | 7.718*** |
| | (0.192) |
| Group assistance | 15.444*** |
| | (0.173) |
| Constant | -3.028*** |
| | (0.192) |
| Observations | 2,599,069 |
| R-squared | 0.079 |
| Neighborhood fixed effects | YES |
| Specification | OLS |

The coefficients are multiplied by 100 and hence express percentage points.

**Appendix B: Results of the instrumental variable specification**

| | 1<br>2 stars | 2<br>3 stars | 3<br>0/3 mix | 4<br>3 stars * Age 80-85 | 5<br>3 stars * Age 85-90 |
|---|---|---|---|---|---|
| 0/3 mix | | | | | |
| 2 stars | | | | | |
| 3 stars | | | | | |
| 0/3 mix (15 years ago) | -2.135*** | -2.229*** | 54.708*** | 2.208*** | 1.161*** |
| | (0.263) | (0.381) | (0.295) | (0.077) | (0.050) |
| 2 stars (15 years ago) | 56.007*** | -3.847*** | -1.993*** | 2.644*** | 1.218*** |
| | (0.240) | (0.345) | (0.202) | (0.074) | (0.048) |
| 3 stars (15 years ago) | -9.719*** | 61.742*** | -1.819*** | 0.826*** | 0.466*** |
| | (0.242) | (0.353) | (0.205) | (0.073) | (0.047) |
| 0/3 mix * Age 80-84 | | | | | |
| 0/3 mix * Age 85-89 | | | | | |
| 0/3 mix * Age 90 plus | | | | | |
| 2 stars * Age 80-84 | | | | | |
| 2 stars * Age 85-89 | | | | | |
| 2 stars * Age 90 plus | | | | | |
| 3 stars * Age 80-84 | | | | | |
| 3 stars * Age 85-89 | | | | | |
| 3 stars * Age 90 plus | | | | | |
| 0/3 mix (15 years ago) * Age 80-84 | -0.189 | -2.377*** | 2.180*** | -11.687*** | 0.044 |
| | (0.323) | (0.534) | (0.389) | (0.469) | (0.054) |
| 0/3 mix (15 years ago) * Age 85-89 | -0.283 | -2.685*** | 3.456*** | -0.178 | -11.485*** |
| | (0.362) | (0.670) | (0.477) | (0.113) | (0.628) |
| 0/3 mix (15 years ago) * Age 90 plus | 0.120 | -2.745*** | 5.026*** | -0.670*** | -0.220** |
| | (0.460) | (0.952) | (0.659) | (0.164) | (0.111) |
| 2 stars (15 years ago) * Age 80-84 | -1.163*** | -0.362 | 0.939*** | -12.068*** | 0.084* |
| | (0.287) | (0.481) | (0.263) | (0.422) | (0.048) |
| 2 stars (15 years ago) * Age 85-89 | -2.454*** | 0.366 | 2.207*** | -0.248** | -10.583*** |

| | | | | | |
|---|---|---|---|---|---|
| | (0.332) | (0.604) | (0.318) | (0.101) | (0.566) |
| 2 stars (15 years ago) * Age 90 plus | -1.579*** | 0.584 | 2.751*** | -0.757*** | -0.353*** |
| | (0.452) | (0.871) | (0.451) | (0.149) | (0.101) |
| 3 stars (15 years ago) * Age 80-84 | 2.207*** | -3.051*** | 0.303 | 57.676*** | -0.278*** |
| | (0.294) | (0.492) | (0.268) | (0.424) | (0.050) |
| 3 stars (15 years ago) * Age 85-89 | 4.629*** | -5.515*** | 1.051*** | -1.514*** | 57.727*** |
| | (0.330) | (0.612) | (0.323) | (0.104) | (0.562) |
| 3 stars (15 years ago) * Age 90 plus | 6.949*** | -6.761*** | 1.587*** | -2.810*** | -1.771*** |
| | (0.425) | (0.871) | (0.452) | (0.153) | (0.103) |
| 2013 | 0.111*** | -0.132*** | 0.008 | -0.037* | -0.010 |
| | (0.024) | (0.024) | (0.016) | (0.019) | (0.014) |
| 2014 | 0.176*** | -0.211*** | 0.012 | -0.057** | 0.009 |
| | (0.032) | (0.032) | (0.021) | (0.025) | (0.018) |
| Cholestorol reducer | -0.343*** | 0.362*** | 0.009 | 0.103** | -0.002 |
| | (0.076) | (0.077) | (0.050) | (0.045) | (0.032) |
| Diabetes | 0.499*** | -0.377*** | -0.083 | -0.148** | -0.087* |
| | (0.111) | (0.114) | (0.075) | (0.067) | (0.045) |
| Astma | 0.367*** | -0.439*** | 0.027 | -0.176*** | -0.122*** |
| | (0.091) | (0.093) | (0.062) | (0.055) | (0.038) |
| Antidepressants | -0.857*** | 0.657*** | 0.145* | 0.284*** | 0.006 |
| | (0.118) | (0.121) | (0.080) | (0.072) | (0.050) |
| Antipsychotics | 0.813*** | -0.770*** | -0.085 | -0.313** | -0.274*** |
| | (0.222) | (0.229) | (0.153) | (0.137) | (0.104) |
| Sleeping and tranquilizing tablets | -0.094 | 0.138 | -0.014 | 0.156* | -0.043 |
| | (0.144) | (0.152) | (0.105) | (0.091) | (0.067) |
| ADHD and nootropics | -1.257 | -0.305 | 0.825 | -0.460 | -0.602 |
| | (0.957) | (0.972) | (0.667) | (0.550) | (0.445) |
| Other medicines | 0.353** | -0.012 | -0.274** | -0.182* | -0.056 |
| | (0.174) | (0.175) | (0.114) | (0.099) | (0.067) |
| Log of GP care in euros | -0.609*** | 0.517*** | 0.112** | 0.171*** | 0.119*** |
| | (0.068) | (0.069) | (0.046) | (0.041) | (0.031) |
| Log of pharmaceutical care in euros | -0.383*** | 0.299*** | 0.087*** | 0.106*** | 0.024* |
| | (0.032) | (0.032) | (0.021) | (0.019) | (0.013) |
| Log of oral care in euros | -0.095*** | 0.077*** | 0.021** | 0.028*** | 0.016*** |
| | (0.014) | (0.015) | (0.009) | (0.009) | (0.006) |
| Log of hospital care in euros | -0.062*** | 0.068*** | 0.003 | 0.013* | 0.006 |
| | (0.012) | (0.012) | (0.008) | (0.007) | (0.005) |
| Log of paramedical care in euros | -0.036** | 0.051*** | -0.001 | 0.008 | -0.018** |
| | (0.016) | (0.017) | (0.011) | (0.010) | (0.007) |
| Log of technical aids in euros | -0.142*** | 0.143*** | 0.009 | 0.066*** | 0.009* |
| | (0.011) | (0.011) | (0.007) | (0.007) | (0.005) |
| Log of patient transport in euros | 0.095*** | -0.103*** | 0.002 | -0.038*** | -0.036*** |

| | | | | | |
|---|---|---|---|---|---|
| | (0.013) | (0.014) | (0.009) | (0.008) | (0.006) |
| Log of care abroad in euros | -0.082** | -0.026 | 0.060** | -0.001 | -0.004 |
| | (0.036) | (0.037) | (0.026) | (0.020) | (0.011) |
| Log of other care in euros | -0.085*** | 0.057*** | 0.022** | 0.010 | 0.017** |
| | (0.016) | (0.017) | (0.011) | (0.010) | (0.007) |
| Gross income quintile 2 | -0.537*** | 1.905*** | -0.964*** | 0.640*** | 0.613*** |
| | (0.115) | (0.120) | (0.087) | (0.071) | (0.055) |
| Gross income quintile 3 | 0.483*** | 1.313*** | -1.334*** | 0.474*** | 0.368*** |
| | (0.129) | (0.132) | (0.093) | (0.077) | (0.058) |
| Gross income quintile 4 | 0.097 | 1.926*** | -1.439*** | 0.754*** | 0.440*** |
| | (0.139) | (0.142) | (0.098) | (0.082) | (0.061) |
| Gross income quintile 5 | 0.010 | 2.179*** | -1.552*** | 0.769*** | 0.517*** |
| | (0.148) | (0.152) | (0.102) | (0.087) | (0.064) |
| Gross income quintile 6 | -0.097 | 2.183*** | -1.482*** | 0.767*** | 0.628*** |
| | (0.162) | (0.164) | (0.108) | (0.093) | (0.068) |
| Gross income quintile 7 | 0.500*** | 2.049*** | -1.742*** | 0.803*** | 0.595*** |
| | (0.177) | (0.179) | (0.116) | (0.101) | (0.073) |
| Gross income quintile 8 | 1.249*** | 1.621*** | -1.928*** | 0.657*** | 0.652*** |
| | (0.200) | (0.200) | (0.128) | (0.112) | (0.081) |
| Gross income quintile 9 | 1.496*** | 1.622*** | -2.007*** | 0.721*** | 0.594*** |
| | (0.231) | (0.228) | (0.147) | (0.127) | (0.090) |
| Gross income quintile 10 | 2.871*** | 0.541** | -2.025*** | 0.494*** | 0.455*** |
| | (0.279) | (0.270) | (0.179) | (0.148) | (0.110) |
| Financial wealth quintile 2 | -0.307** | 1.294*** | -0.609*** | 0.318*** | 0.015 |
| | (0.147) | (0.152) | (0.111) | (0.085) | (0.056) |
| Financial wealth quintile 3 | -0.986*** | 1.782*** | -0.393*** | 0.652*** | 0.204*** |
| | (0.152) | (0.156) | (0.111) | (0.087) | (0.058) |
| Financial wealth quintile 4 | -1.138*** | 1.753*** | -0.189* | 0.635*** | 0.167*** |
| | (0.153) | (0.156) | (0.111) | (0.087) | (0.058) |
| Financial wealth quintile 5 | -1.165*** | 1.674*** | -0.133 | 0.594*** | 0.202*** |
| | (0.152) | (0.155) | (0.109) | (0.086) | (0.059) |
| Financial wealth quintile 6 | -1.806*** | 2.168*** | 0.021 | 0.779*** | 0.317*** |
| | (0.157) | (0.160) | (0.110) | (0.089) | (0.060) |
| Financial wealth quintile 6 | -2.797*** | 2.900*** | 0.133 | 0.988*** | 0.308*** |
| | (0.159) | (0.161) | (0.111) | (0.090) | (0.060) |
| Financial wealth quintile 8 | -4.687*** | 4.373*** | 0.550*** | 1.464*** | 0.520*** |
| | (0.167) | (0.169) | (0.115) | (0.095) | (0.064) |
| Financial wealth quintile 9 | -6.351*** | 5.515*** | 1.045*** | 1.805*** | 0.733*** |
| | (0.171) | (0.173) | (0.118) | (0.097) | (0.066) |
| Financial wealth quintile 10 | -5.811*** | 5.135*** | 0.856*** | 1.720*** | 0.751*** |
| | (0.185) | (0.185) | (0.124) | (0.103) | (0.071) |
| Male | 0.686*** | -0.705*** | -0.047 | -0.193*** | -0.001 |
| | (0.076) | (0.076) | (0.049) | (0.043) | (0.029) |
| Dutch | -2.750*** | 2.898*** | 0.295*** | 0.757*** | 0.282*** |
| | (0.135) | (0.141) | (0.099) | (0.078) | (0.057) |
| Having a partner | 0.417*** | 0.127 | -0.529*** | 0.005 | 0.227*** |

| | | | | | |
|---|---|---|---|---|---|
| | (0.086) | (0.087) | (0.056) | (0.050) | (0.034) |
| Having children living at home | 10.261*** | -9.129*** | -1.552*** | -2.921*** | -1.871*** |
| | (0.153) | (0.146) | (0.092) | (0.079) | (0.057) |
| Age 80-84 | -0.614** | 1.846*** | -0.650** | 33.164*** | -0.468*** |
| | (0.271) | (0.473) | (0.258) | (0.414) | (0.047) |
| Age 85-89 | -0.497 | 2.301*** | -1.831*** | -1.077*** | 34.464*** |
| | (0.304) | (0.591) | (0.311) | (0.100) | (0.552) |
| Age 90plus | -0.348 | 1.683** | -2.915*** | -0.817*** | -0.696*** |
| | (0.393) | (0.846) | (0.436) | (0.147) | (0.100) |
| Having children | -2.286*** | 2.093*** | 0.426*** | 0.836*** | 0.511*** |
| | (0.101) | (0.107) | (0.073) | (0.060) | (0.045) |
| Home owner | 13.183*** | -9.464*** | -3.543*** | -3.263*** | -1.863*** |
| | (0.090) | (0.088) | (0.056) | (0.049) | (0.033) |
| Living within 500 meter of supermarket | -2.939*** | 1.004*** | 1.610*** | 0.369*** | 0.096*** |
| | (0.091) | (0.092) | (0.061) | (0.052) | (0.036) |
| Within 500 meter of general practice | -1.606*** | 0.926*** | 0.626*** | 0.276*** | 0.256*** |
| | (0.100) | (0.102) | (0.068) | (0.058) | (0.040) |
| Living within 500 meter of general practic center | -1.168** | 0.896* | 0.248 | 0.203 | -0.229 |
| | (0.464) | (0.492) | (0.328) | (0.277) | (0.193) |
| Living within 500 meter of pharmacy | -2.437*** | 1.447*** | 0.854*** | 0.525*** | 0.171*** |
| | (0.108) | (0.111) | (0.076) | (0.064) | (0.044) |
| Living within median distance to hospital | 0.608*** | -1.119*** | 0.328*** | -0.444*** | -0.315*** |
| | (0.168) | (0.172) | (0.110) | (0.099) | (0.069) |
| Domiciliary care in prior year | -2.016*** | 2.353*** | -0.019 | 0.990*** | 0.465*** |
| | (0.094) | (0.098) | (0.066) | (0.060) | (0.047) |
| Personal care in prior year | -3.027*** | 2.920*** | 0.279*** | 1.105*** | 1.011*** |
| | (0.100) | (0.104) | (0.071) | (0.065) | (0.056) |
| Nursing in prior year | 0.845*** | -0.666*** | -0.207** | -0.361*** | -0.043 |
| | (0.120) | (0.125) | (0.084) | (0.078) | (0.069) |
| Individual assistance in prior year | 0.813*** | -0.338 | -0.302* | -0.278* | -0.102 |
| | (0.228) | (0.246) | (0.174) | (0.147) | (0.138) |
| Group assistance in prior year | -2.259*** | 2.154*** | 0.251 | 0.772*** | 0.426*** |
| | (0.211) | (0.222) | (0.155) | (0.137) | (0.121) |
| Observations | 2,466,684 | 2,466,684 | 2,466,684 | 2,466,684 | 2,466,684 |
| R-squared | 0.557 | 0.515 | 0.478 | 0.598 | 0.651 |
| Neighborhood fixed effects | YES | YES | YES | YES | YES |

| | 6<br>3 stars * Age 90 plus | 7<br>2 stars * Age 80-85 | 8<br>2 stars * Age 85-90 | 9<br>2 stars * Age 90 plus | 10<br>0/3 mix * Age 80-85 |
|---|---|---|---|---|---|
| 0/3 mix | | | | | |
| 2 stars | | | | | |
| 3 stars | | | | | |
| 0/3 mix (15 years ago) | 0.450*** | -0.863*** | -0.429*** | -0.156*** | -2.640*** |
| | (0.026) | (0.060) | (0.036) | (0.017) | (0.052) |
| 2 stars (15 years ago) | 0.384*** | -4.169*** | -1.825*** | -0.566*** | -0.112** |
| | (0.025) | (0.060) | (0.037) | (0.019) | (0.044) |
| 3 stars (15 years ago) | 0.159*** | -2.792*** | -1.327*** | -0.428*** | 0.292*** |
| | (0.025) | (0.061) | (0.037) | (0.018) | (0.043) |
| 0/3 mix * Age 80-84 | | | | | |
| 0/3 mix * Age 85-89 | | | | | |
| 0/3 mix * Age 90 plus | | | | | |
| 2 stars * Age 80-84 | | | | | |
| 2 stars * Age 85-89 | | | | | |
| 2 stars * Age 90 plus | | | | | |
| 3 stars * Age 80-84 | | | | | |
| 3 stars * Age 85-89 | | | | | |
| 3 stars * Age 90 plus | | | | | |
| 0/3 mix (15 years ago) * Age 80-84 | 0.012 | 0.565** | -0.051 | -0.030* | 65.512*** |
| | (0.024) | (0.220) | (0.038) | (0.016) | (0.322) |
| 0/3 mix (15 years ago) * Age 85-89 | 0.028 | 0.083 | 0.201 | 0.010 | -0.215*** |
| | (0.035) | (0.085) | (0.223) | (0.022) | (0.067) |
| 0/3 mix (15 years ago) * Age 90 plus | -10.393*** | 0.312** | 0.179** | -0.015 | -0.374*** |
| | (1.022) | (0.123) | (0.076) | (0.308) | (0.097) |
| 2 stars (15 years ago) * Age 80-84 | 0.038* | 68.100*** | -0.083** | -0.037*** | -0.967*** |
| | (0.021) | (0.204) | (0.034) | (0.014) | (0.212) |
| 2 stars (15 years ago) * Age 85-89 | 0.047 | 0.117 | 66.325*** | -0.044** | -0.137** |
| | (0.031) | (0.075) | (0.235) | (0.020) | (0.054) |

| | | | | | |
|---|---|---|---|---|---|
| 2 stars (15 years ago) * Age 90 plus | -9.093*** | 0.159 | -0.018 | 67.126*** | -0.091 |
| | (0.939) | (0.112) | (0.070) | (0.376) | (0.080) |
| 3 stars (15 years ago) * Age 80-84 | -0.075*** | 0.270 | 0.231*** | 0.055*** | -2.693*** |
| | (0.022) | (0.197) | (0.036) | (0.015) | (0.215) |
| 3 stars (15 years ago) * Age 85-89 | -0.237*** | 1.238*** | 0.602*** | 0.191*** | -0.013 |
| | (0.032) | (0.080) | (0.202) | (0.021) | (0.055) |
| 3 stars (15 years ago) * Age 90 plus | 60.445*** | 2.021*** | 1.209*** | 0.285 | 0.071 |
| | (0.921) | (0.116) | (0.072) | (0.287) | (0.081) |
| 2013 | -0.006 | 0.058*** | -0.003 | -0.004 | -0.030** |
| | (0.008) | (0.019) | (0.013) | (0.007) | (0.012) |
| 2014 | -0.011 | 0.082*** | -0.023 | -0.008 | -0.027* |
| | (0.010) | (0.025) | (0.017) | (0.009) | (0.016) |
| Cholestorol reducer | -0.028* | -0.074* | 0.003 | 0.034** | -0.016 |
| | (0.016) | (0.044) | (0.030) | (0.015) | (0.029) |
| Diabetes | -0.094*** | 0.212*** | 0.104** | 0.103*** | -0.035 |
| | (0.024) | (0.065) | (0.042) | (0.021) | (0.042) |
| Astma | -0.071*** | 0.143*** | 0.098*** | 0.066*** | 0.037 |
| | (0.022) | (0.053) | (0.036) | (0.020) | (0.035) |
| Antidepressants | -0.018 | -0.349*** | -0.062 | 0.055** | 0.048 |
| | (0.028) | (0.070) | (0.047) | (0.025) | (0.046) |
| Antipsychotics | -0.317*** | 0.347*** | 0.311*** | 0.341*** | -0.074 |
| | (0.070) | (0.131) | (0.099) | (0.064) | (0.087) |
| Sleeping and tranquilizing tablets | 0.007 | -0.109 | 0.054 | -0.002 | -0.000 |
| | (0.042) | (0.086) | (0.061) | (0.036) | (0.060) |
| ADHD and nootropics | 0.288 | -0.148 | 0.041 | -0.229 | 0.634 |
| | (0.292) | (0.534) | (0.418) | (0.268) | (0.390) |
| Other medicines | -0.106*** | 0.244** | 0.127** | 0.108*** | -0.035 |
| | (0.039) | (0.098) | (0.064) | (0.035) | (0.062) |
| Log of GP care in euros | -0.021 | -0.213*** | -0.133*** | -0.011 | 0.046* |
| | (0.021) | (0.040) | (0.030) | (0.019) | (0.027) |
| Log of pharmaceutical care in euros | 0.034*** | -0.125*** | -0.037*** | -0.040*** | 0.016 |
| | (0.008) | (0.018) | (0.012) | (0.007) | (0.012) |
| Log of oral care in euros | -0.001 | -0.035*** | -0.017*** | -0.001 | 0.005 |
| | (0.003) | (0.009) | (0.005) | (0.003) | (0.005) |
| Log of hospital care in euros | 0.008** | -0.007 | -0.005 | -0.004 | -0.005 |
| | (0.003) | (0.007) | (0.005) | (0.003) | (0.005) |
| Log of paramedical care in euros | -0.027*** | -0.004 | 0.025*** | 0.024*** | 0.002 |
| | (0.004) | (0.010) | (0.007) | (0.004) | (0.007) |
| Log of technical aids in euros | -0.009*** | -0.062*** | -0.010** | 0.010*** | 0.001 |
| | (0.003) | (0.006) | (0.004) | (0.002) | (0.004) |
| Log of patient transport in euros | -0.015*** | 0.031*** | 0.036*** | 0.018*** | 0.003 |
| | (0.004) | (0.008) | (0.006) | (0.003) | (0.005) |

| | | | | | |
|---|---|---|---|---|---|
| Log of care abroad in euros | 0.009 | -0.031 | -0.008 | -0.004 | 0.016 |
| | (0.006) | (0.020) | (0.011) | (0.006) | (0.014) |
| Log of other care in euros | 0.009** | -0.030*** | -0.016** | -0.009*** | 0.017*** |
| | (0.004) | (0.010) | (0.006) | (0.003) | (0.006) |
| Gross income quintile 2 | 0.311*** | -0.226*** | -0.320*** | -0.110*** | -0.327*** |
| | (0.036) | (0.067) | (0.051) | (0.031) | (0.049) |
| Gross income quintile 3 | 0.218*** | 0.044 | 0.006 | -0.009 | -0.392*** |
| | (0.036) | (0.075) | (0.054) | (0.032) | (0.052) |
| Gross income quintile 4 | 0.166*** | -0.144* | -0.103* | 0.003 | -0.478*** |
| | (0.038) | (0.080) | (0.057) | (0.034) | (0.055) |
| Gross income quintile 5 | 0.199*** | -0.094 | -0.142** | -0.032 | -0.524*** |
| | (0.039) | (0.085) | (0.060) | (0.036) | (0.057) |
| Gross income quintile 6 | 0.202*** | -0.187** | -0.231*** | -0.034 | -0.413*** |
| | (0.041) | (0.092) | (0.065) | (0.038) | (0.060) |
| Gross income quintile 7 | 0.220*** | -0.075 | -0.201*** | -0.023 | -0.527*** |
| | (0.044) | (0.100) | (0.070) | (0.041) | (0.064) |
| Gross income quintile 8 | 0.240*** | 0.183 | -0.202** | -0.025 | -0.560*** |
| | (0.049) | (0.112) | (0.078) | (0.047) | (0.070) |
| Gross income quintile 9 | 0.278*** | 0.189 | -0.065 | -0.061 | -0.637*** |
| | (0.055) | (0.129) | (0.090) | (0.053) | (0.081) |
| Gross income quintile 10 | 0.086 | 0.348** | 0.142 | 0.222*** | -0.465*** |
| | (0.067) | (0.155) | (0.112) | (0.070) | (0.097) |
| Financial wealth quintile 2 | 0.042 | -0.015 | 0.002 | -0.045 | -0.192*** |
| | (0.032) | (0.081) | (0.050) | (0.027) | (0.060) |
| Financial wealth quintile 3 | 0.049 | -0.481*** | -0.167*** | -0.061** | -0.091 |
| | (0.034) | (0.084) | (0.053) | (0.029) | (0.061) |
| Financial wealth quintile 4 | 0.087** | -0.430*** | -0.228*** | -0.119*** | -0.098 |
| | (0.034) | (0.084) | (0.053) | (0.030) | (0.060) |
| Financial wealth quintile 5 | 0.090*** | -0.394*** | -0.276*** | -0.154*** | -0.097 |
| | (0.035) | (0.084) | (0.054) | (0.031) | (0.059) |
| Financial wealth quintile 6 | 0.114*** | -0.658*** | -0.418*** | -0.162*** | -0.025 |
| | (0.034) | (0.087) | (0.056) | (0.031) | (0.060) |
| Financial wealth quintile 6 | 0.115*** | -0.909*** | -0.394*** | -0.175*** | -0.060 |
| | (0.035) | (0.088) | (0.057) | (0.031) | (0.060) |
| Financial wealth quintile 8 | 0.239*** | -1.521*** | -0.684*** | -0.304*** | 0.113* |
| | (0.037) | (0.093) | (0.060) | (0.033) | (0.063) |
| Financial wealth quintile 9 | 0.279*** | -2.022*** | -1.036*** | -0.394*** | 0.258*** |
| | (0.038) | (0.095) | (0.063) | (0.035) | (0.064) |
| Financial wealth quintile 10 | 0.206*** | -1.900*** | -0.958*** | -0.315*** | 0.240*** |
| | (0.043) | (0.102) | (0.068) | (0.040) | (0.068) |
| Male | 0.033** | 0.278*** | 0.023 | -0.039*** | -0.089*** |
| | (0.016) | (0.042) | (0.028) | (0.015) | (0.027) |
| Dutch | 0.131*** | -0.741*** | -0.384*** | -0.116*** | 0.081 |
| | (0.034) | (0.075) | (0.052) | (0.030) | (0.053) |
| Having a partner | 0.125*** | 0.103** | -0.263*** | -0.160*** | -0.111*** |
| | (0.018) | (0.050) | (0.033) | (0.017) | (0.031) |

| | | | | | |
|---|---|---|---|---|---|
| Having children living at home | -0.768*** | 3.395*** | 2.161*** | 0.868*** | -0.594*** |
| | (0.036) | (0.084) | (0.061) | (0.038) | (0.048) |
| Age 80-84 | -0.186*** | 5.264*** | 0.531*** | 0.200*** | 5.869*** |
| | (0.022) | (0.184) | (0.033) | (0.014) | (0.207) |
| Age 85-89 | -0.353*** | 1.585*** | 3.603*** | 0.372*** | -0.213*** |
| | (0.032) | (0.074) | (0.190) | (0.021) | (0.054) |
| Age 90plus | 33.485*** | 1.938*** | 1.210*** | 2.406*** | -0.403*** |
| | (0.908) | (0.109) | (0.069) | (0.273) | (0.080) |
| Having children | 0.180*** | -0.902*** | -0.603*** | -0.205*** | 0.144*** |
| | (0.028) | (0.056) | (0.041) | (0.024) | (0.040) |
| Home owner | -0.674*** | 4.443*** | 2.536*** | 0.905*** | -1.123*** |
| | (0.018) | (0.050) | (0.033) | (0.018) | (0.031) |
| Living within 500 meter of supermarket | -0.024 | -1.053*** | -0.388*** | -0.054*** | 0.584*** |
| | (0.020) | (0.051) | (0.034) | (0.019) | (0.033) |
| Within 500 meter of general practice | 0.110*** | -0.489*** | -0.330*** | -0.119*** | 0.193*** |
| | (0.023) | (0.057) | (0.038) | (0.021) | (0.038) |
| Living within 500 meter of general practic center | -0.054 | -0.099 | 0.195 | 0.078 | -0.035 |
| | (0.113) | (0.262) | (0.174) | (0.100) | (0.179) |
| Living within 500 meter of pharmacy | 0.018 | -0.874*** | -0.357*** | -0.049** | 0.310*** |
| | (0.026) | (0.062) | (0.042) | (0.023) | (0.042) |
| Living within median distance to hospital | -0.190*** | 0.260*** | 0.192*** | 0.101*** | 0.151** |
| | (0.039) | (0.095) | (0.064) | (0.035) | (0.062) |
| Domiciliary care in prior year | 0.161*** | -0.919*** | -0.426*** | -0.151*** | 0.042 |
| | (0.028) | (0.058) | (0.044) | (0.025) | (0.039) |
| Personal care in prior year | 0.470*** | -1.207*** | -1.002*** | -0.488*** | 0.190*** |
| | (0.036) | (0.062) | (0.052) | (0.033) | (0.042) |
| Nursing in prior year | -0.181*** | 0.406*** | 0.091 | 0.269*** | -0.051 |
| | (0.048) | (0.074) | (0.064) | (0.043) | (0.050) |
| Individual assistance in prior year | 0.302*** | 0.532*** | 0.073 | -0.258*** | -0.245** |
| | (0.114) | (0.136) | (0.125) | (0.100) | (0.097) |
| Group assistance in prior year | 0.231*** | -0.814*** | -0.530*** | -0.239*** | 0.035 |
| | (0.083) | (0.131) | (0.112) | (0.074) | (0.090) |
| Observations | 2,466,684 | 2,466,684 | 2,466,684 | 2,466,684 | 2,466,684 |
| R-squared | 0.705 | 0.677 | 0.669 | 0.678 | 0.457 |
| Neighborhood fixed effects | YES | YES | YES | YES | YES |

| | 11<br>0/3 mix * Age 85-90 | 12<br>0/3 mix * Age 90 plus | 13<br>Use of nursing home care |
|---|---|---|---|
| 0/3 mix | | | 0.292* |
| | | | (0.149) |
| 2 stars | | | 0.399*** |
| | | | (0.136) |
| 3 stars | | | 0.389*** |
| | | | (0.138) |
| 0/3 mix (15 years ago) | -1.318*** | -0.486*** | |
| | (0.034) | (0.019) | |
| 2 stars (15 years ago) | -0.150*** | -0.073*** | |
| | (0.029) | (0.016) | |
| 3 stars (15 years ago) | 0.083*** | 0.011 | |
| | (0.028) | (0.015) | |
| 0/3 mix * Age 80-84 | | | -0.407 |
| | | | (0.261) |
| 0/3 mix * Age 85-89 | | | -0.717* |
| | | | (0.409) |
| 0/3 mix * Age 90 plus | | | -1.803** |
| | | | (0.780) |
| 2 stars * Age 80-84 | | | -0.766*** |
| | | | (0.233) |
| 2 stars * Age 85-89 | | | -1.494*** |
| | | | (0.368) |
| 2 stars * Age 90 plus | | | -3.680*** |
| | | | (0.719) |
| 3 stars * Age 80-84 | | | -0.515** |
| | | | (0.242) |
| 3 stars * Age 85-89 | | | -0.770** |
| | | | (0.382) |
| 3 stars * Age 90 plus | | | -2.438*** |
| | | | (0.737) |
| 0/3 mix (15 years ago) * Age 80-84 | -0.089*** | -0.026* | |
| | (0.031) | (0.014) | |
| 0/3 mix (15 years ago) * Age 85-89 | 66.955*** | -0.102*** | |
| | (0.414) | (0.021) | |
| 0/3 mix (15 years ago) * Age 90 plus | -0.449*** | 69.066*** | |
| | (0.063) | (0.638) | |
| 2 stars (15 years ago) * Age 80-84 | -0.084*** | -0.038*** | |
| | (0.025) | (0.011) | |
| 2 stars (15 years ago) * Age 85-89 | 0.371 | -0.051*** | |
| | (0.267) | (0.017) | |

| | | | |
|---|---|---|---|
| 2 stars (15 years ago) * Age 90 plus | -0.097* | 0.764* | |
| | (0.052) | (0.425) | |
| 3 stars (15 years ago) * Age 80-84 | -0.046* | -0.023** | |
| | (0.026) | (0.012) | |
| 3 stars (15 years ago) * Age 85-89 | -2.008*** | -0.020 | |
| | (0.269) | (0.017) | |
| 3 stars (15 years ago) * Age 90 plus | 0.051 | -1.734*** | |
| | (0.053) | (0.421) | |
| 2013 | 0.010 | 0.012** | 0.013 |
| | (0.009) | (0.005) | (0.026) |
| 2014 | 0.007 | 0.019*** | -0.255*** |
| | (0.012) | (0.007) | (0.025) |
| Cholestorol reducer | -0.005 | -0.007 | -0.391*** |
| | (0.020) | (0.011) | (0.023) |
| Diabetes | -0.013 | 0.001 | 0.202*** |
| | (0.029) | (0.016) | (0.037) |
| Astma | 0.017 | -0.005 | -0.596*** |
| | (0.025) | (0.015) | (0.031) |
| Antidepressants | 0.036 | -0.036* | 0.213*** |
| | (0.033) | (0.019) | (0.048) |
| Antipsychotics | -0.044 | -0.039 | 6.253*** |
| | (0.068) | (0.045) | (0.166) |
| Sleeping and tranquilizing tablets | -0.036 | -0.001 | -0.360*** |
| | (0.045) | (0.028) | (0.067) |
| ADHD and nootropics | 0.181 | -0.118 | -0.645* |
| | (0.316) | (0.192) | (0.383) |
| Other medicines | -0.052 | -0.005 | -1.392*** |
| | (0.043) | (0.026) | (0.059) |
| Log of GP care in euros | 0.020 | 0.028** | 0.802*** |
| | (0.019) | (0.014) | (0.034) |
| Log of pharmaceutical care in euros | 0.012 | 0.007 | 0.255*** |
| | (0.008) | (0.005) | (0.011) |
| Log of oral care in euros | 0.002 | 0.001 | -0.037*** |
| | (0.004) | (0.002) | (0.006) |
| Log of hospital care in euros | -0.000 | -0.001 | -0.108*** |
| | (0.003) | (0.002) | (0.005) |
| Log of paramedical care in euros | -0.008* | 0.001 | -0.047*** |
| | (0.005) | (0.003) | (0.008) |
| Log of technical aids in euros | 0.002 | -0.001 | 0.012*** |
| | (0.003) | (0.002) | (0.004) |
| Log of patient transport in euros | -0.001 | -0.003 | 0.014* |
| | (0.004) | (0.002) | (0.007) |

| | | | |
|---|---|---|---|
| Log of care abroad in euros | 0.008 | -0.004 | -0.100*** |
| | (0.009) | (0.004) | (0.010) |
| Log of other care in euros | 0.002 | -0.002 | -0.020*** |
| | (0.004) | (0.003) | (0.006) |
| Gross income quintile 2 | -0.185*** | -0.164*** | -0.074* |
| | (0.039) | (0.025) | (0.044) |
| Gross income quintile 3 | -0.274*** | -0.168*** | 0.003 |
| | (0.039) | (0.025) | (0.045) |
| Gross income quintile 4 | -0.233*** | -0.143*** | -0.070 |
| | (0.041) | (0.026) | (0.047) |
| Gross income quintile 5 | -0.256*** | -0.137*** | -0.134*** |
| | (0.042) | (0.027) | (0.049) |
| Gross income quintile 6 | -0.279*** | -0.150*** | -0.179*** |
| | (0.044) | (0.027) | (0.051) |
| Gross income quintile 7 | -0.261*** | -0.170*** | -0.167*** |
| | (0.047) | (0.029) | (0.055) |
| Gross income quintile 8 | -0.304*** | -0.171*** | -0.246*** |
| | (0.050) | (0.032) | (0.060) |
| Gross income quintile 9 | -0.313*** | -0.154*** | -0.176*** |
| | (0.056) | (0.035) | (0.068) |
| Gross income quintile 10 | -0.354*** | -0.229*** | -0.271*** |
| | (0.067) | (0.041) | (0.078) |
| Financial wealth quintile 2 | 0.012 | 0.016 | 0.040 |
| | (0.040) | (0.024) | (0.054) |
| Financial wealth quintile 3 | 0.005 | 0.023 | 0.031 |
| | (0.040) | (0.024) | (0.054) |
| Financial wealth quintile 4 | 0.081** | 0.047* | 0.142*** |
| | (0.040) | (0.024) | (0.054) |
| Financial wealth quintile 5 | 0.083** | 0.067*** | 0.118** |
| | (0.040) | (0.024) | (0.053) |
| Financial wealth quintile 6 | 0.113*** | 0.057** | 0.080 |
| | (0.040) | (0.024) | (0.053) |
| Financial wealth quintile 6 | 0.095** | 0.060** | 0.174*** |
| | (0.040) | (0.024) | (0.053) |
| Financial wealth quintile 8 | 0.130*** | 0.054** | 0.168*** |
| | (0.042) | (0.025) | (0.054) |
| Financial wealth quintile 9 | 0.268*** | 0.105*** | 0.043 |
| | (0.043) | (0.026) | (0.054) |
| Financial wealth quintile 10 | 0.147*** | 0.074*** | -0.215*** |
| | (0.046) | (0.027) | (0.056) |
| Male | -0.023 | 0.007 | 0.028 |
| | (0.018) | (0.010) | (0.021) |
| Dutch | 0.123*** | -0.006 | 0.480*** |
| | (0.037) | (0.024) | (0.041) |
| Having a partner | 0.020 | 0.040*** | 0.016 |
| | (0.021) | (0.011) | (0.025) |

| | | | |
|---|---|---|---|
| Having children living at home | -0.340*** | -0.122*** | -0.205*** |
| | (0.033) | (0.021) | (0.048) |
| Age 80-84 | 0.017 | 0.020* | 1.451*** |
| | (0.025) | (0.011) | (0.230) |
| Age 85-89 | 5.189*** | 0.025 | 3.470*** |
| | (0.258) | (0.018) | (0.362) |
| Age 90plus | -0.068 | 4.730*** | 7.662*** |
| | (0.052) | (0.406) | (0.701) |
| Having children | 0.145*** | 0.035* | -0.282*** |
| | (0.030) | (0.019) | (0.035) |
| Home owner | -0.647*** | -0.235*** | -0.127*** |
| | (0.021) | (0.012) | (0.025) |
| Living within 500 meter of supermarket | 0.235*** | 0.059*** | 0.032 |
| | (0.023) | (0.014) | (0.027) |
| Within 500 meter of general practice | 0.100*** | 0.032** | 0.003 |
| | (0.027) | (0.016) | (0.030) |
| Living within 500 meter of general practic center | -0.011 | -0.061 | -0.173 |
| | (0.129) | (0.069) | (0.136) |
| Living within 500 meter of pharmacy | 0.151*** | 0.014 | 0.005 |
| | (0.030) | (0.018) | (0.034) |
| Living within median distance to hospital | 0.033 | 0.055** | 0.058 |
| | (0.043) | (0.024) | (0.060) |
| Domiciliary care | 0.023 | 0.018 | 0.611*** |
| | (0.031) | (0.019) | (0.037) |
| Personal care | 0.078** | 0.035 | 4.129*** |
| | (0.037) | (0.024) | (0.054) |
| Nursing | -0.052 | -0.096*** | 0.188** |
| | (0.045) | (0.032) | (0.078) |
| Individual assistance | 0.048 | -0.002 | 7.784*** |
| | (0.090) | (0.078) | (0.199) |
| Group assistance | 0.150* | 0.048 | 15.607*** |
| | (0.083) | (0.057) | (0.179) |
| Observations | 2,466,684 | 2,466,684 | 2,466,684 |
| R-squared | 0.484 | 0.545 | 0.073 |
| Neighborhood fixed effects | YES | YES | YES |

The coefficients of column 13 are multiplied by 100 and hence express percentage points.

## Appendix C: Regression results of the mechanisms

| | 1<br>Use of nursing home care on physical ground | 2<br>Use of nursing home care on cognitive ground | 3<br>Use of home care |
|---|---|---|---|
| 2013 | -0.054** | 0.128*** | -0.249*** |
| | (0.023) | (0.018) | (0.043) |
| 2014 | -0.433*** | 0.266*** | -0.768*** |
| | (0.021) | (0.018) | (0.046) |
| 0/3 mix | 0.009 | 0.054 | 0.696*** |
| | (0.075) | (0.059) | (0.218) |
| 2 stars | 0.113 | 0.103* | -0.745*** |
| | (0.070) | (0.055) | (0.201) |
| 3 stars | -0.006 | -0.002 | 0.453** |
| | (0.070) | (0.055) | (0.202) |
| 0/3 mix * Age 80-84 | -0.056 | -0.326*** | -0.250 |
| | (0.138) | (0.116) | (0.348) |
| 0/3 mix * Age 85-89 | -0.555** | -0.215 | -0.233 |
| | (0.241) | (0.195) | (0.461) |
| 0/3 mix * Age 90 plus | -1.023** | -0.358 | -1.416* |
| | (0.495) | (0.406) | (0.749) |
| 2 stars * Age 80-84 | -0.346*** | -0.405*** | 0.354 |
| | (0.126) | (0.106) | (0.320) |
| 2 stars * Age 85-89 | -1.189*** | -0.502*** | 2.149*** |
| | (0.223) | (0.179) | (0.426) |
| 2 stars * Age 90 plus | -2.368*** | -1.121*** | 3.276*** |
| | (0.464) | (0.379) | (0.708) |
| 3 stars * Age 80-84 | -0.204 | -0.354*** | 0.284 |
| | (0.127) | (0.107) | (0.322) |
| 3 stars * Age 85-89 | -0.851*** | -0.275 | 0.809* |
| | (0.224) | (0.180) | (0.426) |
| 3 stars * Age 90 plus | -1.585*** | -0.672* | -0.335 |
| | (0.462) | (0.378) | (0.700) |
| Observations | 2,567,430 | 2,553,844 | 2,539,311 |
| R-squared | 0.061 | 0.099 | 0.577 |
| Neighborhood fixed effects | YES | YES | YES |
| Specification | OLS | OLS | OLS |

All specifications include health controls, personal characteristics, and neighborhood characteristics. The coefficients are multiplied by 100 and hence express percentage points. ***p<0.01, **p<0.05, *p<0.1.