Better off at home? Effects of nursing home eligibility on costs, hospitalizations and survival

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ABSTRACT

Encouraging and helping elderly to postpone a nursing home admission appears to be a win-win that keeps long-term care spending in check and is in line with the target population's preferences, but there is little evidence about its effects. We study the causal impact of nursing home admission eligibility using Dutch administrative data and exploiting variation between randomly assigned assessors in their tendency to grant eligibility for a nursing home admission. We find a drop in medical care use when eligibility is granted, especially in hospital admissions, while total healthcare spending is unaffected. This suggests that postponing an admission may not always be a win-win after all.

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1. Introduction

The rising costs of long-term care (LTC) are a major public policy concern. Policies aimed at postponing nursing home admissions are popular and seen as an effective way to contain LTC costs (Konetzka, 2014; Guo et al., 2015; Norton, 2016). Since the 1980s, a shift from nursing home care towards home care has taken place in the United States (US) (Bishop, 1999; McKnight, 2006) and other developed countries. Among those countries, the average share of elderly LTC recipients receiving care at home increased from 59 percent in 2000 to 65 percent in 2013

(Organization for Economic Cooperation and Development (OECD, 2015). Postponing nursing home admissions is often argued to keep costs down by substituting cheaper home care for more expensive nursing home care, and to be in line with preferences of the elderly, whose satisfaction and quality of life are believed to be higher at home than in a nursing home (Konetzka, 2014; Guo et al., 2015; Norton, 2016).

Admitting a frail, old person to a nursing home may affect his or her health in multiple, possibly offsetting, ways. On the one hand, nursing homes provide a protective environment with round-the-clock care and are thus expected to have a positive influence on their residents' health. On the other hand, a nursing home admission may also be detrimental to health, because the transition to a nursing home is a major, often irreversible and disruptive, life event and because nursing homes probably provide a lower-quality life environment. Finally, nursing homes are

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"total institutions" (Goffman, 2009) that take over many aspects of the everyday life of residents. This may lead to passivity and dependence, and a (perceived) partial loss of control and of one's identity.

Healthcare spending may also rise or fall following a nursing home admission: a nursing home admission is expensive because of facility costs, living costs[1] and the intensity of care provided. Yet, a nursing home admission may be cheaper if keeping patients at home requires intensive care that can be provided more efficiently in nursing homes, due to economies of scale. Moreover, a nursing home admission may reduce spending on medical care, because the nursing home staff takes over tasks from other providers, or the care that is provided and the facilities may prevent accidents warranting a doctor visit or hospitalization.

Whether providing *the same level of care* is more costly at home or in a nursing home likely depends on the level of need: the severity of the functional limitations and health problems. For relatively low levels of need, care provision at home may be cheaper than in a nursing home, while we expect the opposite for patients with a higher level of need. Hence, whether the costs of care for the marginal nursing home user are higher at home or in a nursing home depends on how strict the eligibility criteria are, i.e. at what level of need the cut-off between home care and nursing home care is set. Finding out about the costs of care for the marginal nursing home user helps to understand the consequences of changing this cut-off, which is done (or proposed) regularly in the Netherlands and other countries that seek to re-structure the provision of LTC.

We study the effects of nursing home admission eligibility on survival and health care use. To address the problem of selection, we exploit two institutional features of LTC organization in The Netherlands. First, virtually all LTC is financed through the public LTC insurance scheme (94 percent of total public LTC expenditures, including all spending on nursing home care) or the Social Support Act (6 percent) (Centraal Bureau voor de Statistiek (CBS, 2016). This means that financial incentives play a very limited role for elderly in their decision to opt for home care or nursing home care. Second, to become eligible for publicly funded LTC, patients need to request an assessment from an independent government agency. While the eligibility criteria are set by the Minister of Health and documented in policy guidelines, the assessors working for this agency have considerable discretionary power when deciding on an applicant's eligibility, which we exploit as a source of random variation in the probability of becoming eligible for a nursing home admission. This is the first study that uses this source of random variation in long-term care.

We find that eligibility for a nursing home admission has no effect on total health care spending. It does decrease the probability of a hospital admission. We also find, on average, no evidence of an effect on mortality, although there seems to be considerable underlying effect heterogeneity. These results pertain to applicants who are sufficiently

close to the eligibility threshold for the leniency of the assessor to play a crucial role. As this is the prime target group of policies encouraging and assisting elderly to live at home longer, such policies may not be saving healthcare expenditures, as generally hypothesized (cf. Organization for Economic Cooperation and Development (OECD, 2011; De Meijer et al., 2015; Guo et al., 2015; Kim and Lim, 2015; Norton, 2016).

This article is one of the first studies providing evidence on the effects of a nursing home admission on health and healthcare spending. A major reason for the lack of studies is that individuals self-select – patients who receive institutional care are usually in worse health than those who continue to live at home – and therefore these groups cannot be compared directly. A Cochrane review by Young et al. (2017) finds no conclusive evidence of the effects of nursing home care versus home care on different health outcomes or quality of life. Observational studies, relying mostly on matching on observables, find similarly mixed results on costs, medical care use, and happiness (e.g. Chappell et al., 2004; Kok et al., 2015[2]; Wysocki et al., 2014; Blackburn et al., 2014).

Kim and Lim (2015) use cut-offs in the eligibility criteria for public LTC in South Korea to employ a regression discontinuity design. These cut-offs lead to differences in the level of subsidies for home care and/or nursing home care that elderly with a disability score just below or above particular thresholds receive. For a cut-off at a relatively low level of disability, they find that substitution of home care by nursing home care leads to an increase in total LTC spending, but not to a significant decrease in medical spending. For a cut-off at a more severe level of disability, they find that substitution from nursing home care to home care leads to no difference in total LTC spending, but, surprisingly, does lead to a small decrease in medical spending.

Werner et al. (2019) study the effects of the choice for a nursing home or home care for the subgroup of LTC users who are discharged after a hospitalization in the US using the difference in the distance to the nearest suppliers of both types of care as the instrument. They find that nursing homes reduce the readmission probability and lower the Medicare hospital care expenditures but increase total Medicare expenditures.

A different strand of studies evaluates changes in home care subsidies in the US (see e.g. Pezzin et al. 1996; McKnight, 2006; Orsini 2010; Marek et al., 2012; Weissert and Frederick, 2013; Guo et al., 2015), Canada (Stabile et al., 2006) and Spain (Costa-Font et al., 2018). Such subsidies are often introduced to eliminate the difference in out-of-pocket payments that elderly face when choosing between privately financed home care and publicly financed nursing home care. Home care subsidies can then eliminate the misallocation of care due to the fact that the difference in payments makes even elderly with relatively light health

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[1] In the Netherlands, the rent and cost of living in a nursing home are also covered by public LTC insurance.

[2] Kok et al. (2015) performed a study for the Netherlands, which relied on propensity score matching for identification using a limited set of matching variables. They found that nursing home care is more expensive than home care, and that nursing home residents are happier than elderly living at home.

problems opt for nursing home care. An important finding is that it is challenging to target home care, as subsidies also induce elderly who would otherwise use no formal care at all to use home care, resulting in an increase in overall spending.

We make three contributions to the literature. First, we study the effects of substitution in the context of a very comprehensive and accessible social insurance system for both home care and nursing home care. This means that, in contrast to the existing studies, differences between the public financing of home care and nursing home care or substitution with private care play no role. We can therefore investigate a different group of elderly, i.e. those who on the basis of their health needs are just at the margin between home care and nursing home care. Second, other studies focus on financial incentives in the form of subsidies; this is the first study analyzing the effect of differences in direct access to care. Dutch elderly cannot move to a nursing home if they are not eligible. Although relevant, home care subsidies are far from the only policy lever. In many countries, there is more equal financial access to both types of care than in the US (cf. Organization for Economic Cooperation and Development (OECD, 2011; Bakx et al., 2015; Kim and Lim, 2015). In these countries, access to care is often restricted through eligibility criteria, and policy makers use these criteria to actively stimulate substitution towards home care. Third, we extend the use of assessor leniency as a source of exogenous variation to the field of LTC. Assessments of eligibility for government programs (or penalties) by individual assessors play an important role in many policy domains, from criminal justice to foster care or disability insurance. Variation in these judgements across assessors has been demonstrated to matter for important outcomes such as employment, income and delinquency (e.g. Doyle, 2007; Maestas et al., 2013; French and Song, 2014; Dahl et al., 2014; Dobbie et al., 2018). We show that similar mechanisms are at play late in life: for an important subgroup of the Dutch elderly, whether they receive home care or nursing home care depends to some extent on the assessor that happens to evaluate their application. And even though total health care expenditures appear to be similar irrespective of whether they are eligible for a nursing home admission, this does affect hospital use, and potentially quality of life.

2. Long-term care in the Netherlands

2.1. Long-term care

LTC helps individuals to cope with functional limitations. The focus here is on LTC for the elderly – about two-thirds of all LTC recipients[3] – who may need help because of limitations caused by physical deterioration often related to chronic conditions or psychogeriatric problems (e.g. dementia). There are two types of LTC: formal care, provided by paid professionals; and informal care, provided by family members, friends or neighbors. We concentrate on formal care, which is provided at home or in an institution.[4]

With 2.6 percent of gross domestic product (GDP) spent on public LTC provision (Organization for Economic Cooperation and Development (OECD, 2017), The Netherlands has one of the most extensive public LTC systems in the world.[5] While in most countries out-of-pocket expenditures on formal care are substantial (Organization for Economic Cooperation and Development (OECD, 2011), in The Netherlands virtually all formal care, delivered at home or in institutions, is paid for by mandatory social insurance[6] . Co-payments are relatively low: only 8 percent of public expenditure on LTC was financed from co-payments in 2014 (Centraal Bureau voor de Statistiek (CBS, 2016). Public LTC insurance covers the costs of the care, the facilities, room and board.

Institutional care is provided in an environment that is adapted to the needs of frail, elderly residents. The setting and intensity differ depending on the needs and health problems.[7] For elderly with severe health and psychogeriatric problems, nursing homes provide intensive care and medical treatment. Those patients generally stay in one-person bedrooms. Autonomy, especially for patients with dementia, is very limited. Nursing home residents receive care ranging from 3 to 32.5 h per week (Bureau HHM, 2010). For older individuals who cannot live independently, but who do not need intensive care and treatment, the care is focused on assistance in daily living.[8] Generally, these individuals have small apartments where they live on their own or with their partner (Kok et al., 2015). Care, meals and day activities are provided, but the elderly still have substantial autonomy. In the remainder of the paper, we refer to all of these as nursing home care admissions, which also include a (small share of) residential care admissions.

Home care is formal care, provided by professionals, at home. As covered by Dutch social insurance, this includes social support, personal care (assistance with washing, dressing and eating) and nursing. The quantity and intensity of care may vary considerably according to the (assessed) needs of the elderly: from one hour of personal care per week to around-the-clock nursing.

An independent government agency (Centrum Indicatiestelling Zorg (CIZ), 2011) decides on the level and

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[3] The other groups receiving LTC are the mentally handicapped, the physically disabled and patients with chronic mental illnesses. Together, these groups account for about a third of all LTC users (CBS, 2016).

[4] Most elderly who need help use a mix of formal care and informal care. Specifically, De Klerk et al. (2017) show descriptive evidence from a survey of informal caregivers that more than half of informal caregivers do so alongside care provided by a professional (in the community or in a nursing home).

[5] Private spending on long-term care (including home care) was 17 million euro in 2015, which is equal to 0.1% of total spending (18 billion) in that year (Statistics Netherlands, 2017).

[6] In addition, public provision of domestic help is funded from general taxation.

[7] Historically, institutions would either be residential care homes (focused on assistance) or nursing homes (focused on intensive care and treatment). Although institutions can still focus on different types of patients, this strict division has gradually disappeared. The type of care individuals receive and the setting they live in depend on the intensity of care they eligible for (see Section 2.2).

[8] Public financing for residential care home stays was terminated in 2014.

types of care for which elderly who apply are eligible (see Section II.B). Once an individual is eligible for public LTC, he or she can choose to either receive this care in-kind or to receive a cash transfer amounting to about 75 percent of the value of the care if it were provided in-kind at home.[9] In-kind care is provided by private not-for-profit or for-profit (home care only) providers that are contracted by regional single payers. These single payers operate under a budget constraint based on past spending in the region. While this constraint is often binding, waiting lists are virtually non-existent (College Voor Zorgverzekeringen, 2013; Bakx et al., 2016a). Nursing homes are paid an all-in per-diem rate that varies by how much care the patient needs.

The government has implemented various measures since 2000 to incentivize and facilitate the postponement of nursing home admissions. It has increased the supply of home care (from 2000); has introduced the option of receiving home care for those eligible for institutional care (2007); has increased co-payments for institutional care (2013); and, has tightened the eligibility criteria for institutional care (2014) (Alders et al., 2015; De Meijer et al., 2015).

2.2. The assessment procedure[10]

Individuals who may need LTC have to apply for an assessment to the regional CIZ office, or a healthcare provider or family member has to do so on their behalf (about 70 percent has such a proxy applicant). Assessors handle one of three types of applications – for elderly care, care for the disabled or long-term mental health care – but there is no further specialization. Applications are assigned to assessors by a planner taking into account only the priority status of the application[11] and assessor workload – but not any information about patient's health or care needs.

The assessor has access to: i) information filled out on the application form; ii) information about prior LTC use; and, iii) any information collected in previous applications. He/she decides which information needs to be verified or updated. The assessor may contact the patient, household and family members, the health insurer, and the healthcare providers (e.g. the general practitioner [GP] or an LTC provider). The assessment framework requires the assessor to take into account the health, health-related limitations, living conditions, social environment, psychiatric and social functioning of the applicant, and any other professional services and informal care the patient is receiving. The assessor is a street-level bureaucrat (Lipsky, 2010) who applies general rules to specific cases. To do this, he/she has

– and needs to have – considerable discretionary power. Assessors have the freedom to determine which of the abovementioned aspects are relevant, and to determine which information is verified or collected and how this will be done.

The assessor then decides whether the applicant is eligible for nursing home care or home care and, if applicable, the type and amount of home care – nursing, personal care or assistance. If the applicant does not agree with the decision, he/she may appeal, and the decision is reconsidered. The applicant appeals in less than 1 percent of all cases and 25 percent of these appeals are approved (Centrum Indicatiestelling Zorg (CIZ, 2014). Appeals must be made within 6 weeks after the decision and are dealt with in 6 weeks. The initial decision is usually only reversed because new or additional information is made available. People may submit a new application at any time, but usually only do so when their situation has substantially changed.

3. Data

3.1. Study population and available information

The data set consists of all eligibility applications handled by CIZ in the years 2009–2013[12] and for which full information on all covariates was available. To create a homogenous study population for which the leniency of the assessor is relevant, the population was restricted to applicants of at least 65 years of age, who applied for a permanent nursing home admission[13] (or had someone who did this on their behalf) indicating a psychogeriatric or somatic condition (thus excluding the sensory and mentally handicapped) and who were not already eligible for a nursing home admission when they applied. Individuals who are denied eligibility for a nursing home admission are virtually always entitled to home care.

Applications made by medical specialists or hospitals on behalf of a patient were removed because in these cases the type of care requested is virtually always granted. Excluding these applications means that the results do not apply to patients experiencing major health shocks requiring hospitalization and subsequent post-acute nursing home admission. Finally, applications were removed from the sample when the assessor handling the application was unknown or handled fewer than 50 of these applications in all years combined. Excluding these applications does not have an effect on the generalizability of the results, as the allocation of cases to assessors is arbitrary within a region.

The eligibility data contain the eligibility decision and information on who filed the application, the type of application and whether it was part of the random 5 percent of applications that receive a full review (see Appendix B for details). These data were linked at the individual level

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[9] 97% of all *users* (i.e. a subset of all the eligible) of institutional care opt for care provided in kind, 3% choose a cash benefit in 2015 (Hussem et al., 2020). Numbers from earlier years are not available

[10] The description of the assessment procedure is based on the rules described in CIZ (2013) and face-to-face interviews with a team coach (and former assessor) and a data manager at CIZ. This is an abridged version, the full version is in Appendix B.

[11] All applications must be handled within six weeks. However, applications for admissions that solve a dangerous situation requiring immediate action need to be handled within 24 or 48 hours.

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[12] Thus excluding assessments done by mandated providers.

[13] Including residential care facilities but excluding post-acute care and hospice care. Applicants who request eligibility for a permanent admission, may also indicate the specific level of care they request – there were 6–8 levels of nursing home care eligibility during the study period. However, not all applicants do this so we ignore this information.

to data on the use of LTC provided in kind (2008–2014)[14]; vital statistics, including death records (2009–2015), household composition (2009–2013), family composition (2009–2013); household income and household wealth (2009–2013); hospital discharge data (2008–2012); and to annual claims data from mandatory public health insurance covering roughly two-third of spending on medical care (2009–2014).[15] Expenditures and household income are not adjusted for inflation, which was very low during the study period (Statistics Netherlands, 2020).

The number of observations in the study population is 51,047 for 49,187 individuals; 3.7 percent applied twice or more, and the maximum number of applications for a nursing home admission by an individual is four.

3.2. Descriptive statistics

The applicants in the study population were mostly women, who were old and close to death (Table 1, Column 1). They also used a lot of health care: medical care expenditures in the next calendar year are close to 6000 Euro, almost three times the population average (Bakx et al., 2016b). Their prescription drug use suggests a high rate of multimorbidity, e.g. cardiovascular problems (52 percent used antithrombotics in Anatomical Therapeutic Chemical Classification System (ATC) category B01), infections (antibiotics in ATC category J01: 41 percent) and diabetes (medication in ATC category A10: 18 percent). Of the applicants 30.4 percent died within two years of the application. Finally, the majority were already eligible for home care at the time of the application and used on average about 5.4 h of home care per week in the year prior to the application[16].

Initial (non-)eligibility does not automatically result in (non-)admission. Not all of the applicants eligible for a nursing home admission move there: after one year, only 64 percent of those eligible had done so, after two years 76 percent (Column 2). By contrast, 27.1 percent of rejected applications were admitted within a year and 44.9 percent within two years (Column 3). Eligible applicants showed higher mortality rates and lower healthcare spending (conditional on surviving until the start of the next calendar year) than non-eligible applicants. This may be due to three reasons: i) it may reflect that nursing homes are capable of keeping their residents healthier and thus their demand for health care low; ii) nursing homes provide some of the care that would otherwise be provided by general practition-

ers and hospitals and pay for prescription drugs; and, iii) selective mortality, i.e. the highest spending nursing home residents have the lowest probability of surviving to the end of the calendar year.

4. Empirical strategy

4.1. Instrumental variable (IV) analysis

We estimate the effect of eligibility for a nursing home admission (ENHA) on an applicant's outcome y (i.e. survival, healthcare use or healthcare expenditures). For a given applicant i, suppose that the relationship between eligibility for a nursing home admission and y follows the model:

$$y_i = x_i^T \times \beta + \gamma \times EHNA_i + v_i, \tag{1}$$

Where x_i^T is the transposed vector containing observed characteristics, and v_i is the error term. It is likely that assessors have more information on the applicant's health than can be gathered from the data, and that they use this in their decision. If so, $ENHA_i$ is likely to be correlated with unobserved health, and direct estimation of Eq. (1) using an Ordinary Least Squares regression (OLS) provides a biased estimate of the effect γ of $ENHA_i$ on the outcome y_i. Since applicants in poorer unobserved health are more likely to be deemed eligible for a nursing home admission than individuals in better health, we expect an upward bias in the OLS estimates of γ in the analyses explaining mortality and nursing home admissions. Whether the bias for the effect on healthcare expenditures is also positive is not clear, as it depends on two additional factors: i) the degree to which a nursing home admission substitutes for other types of care; and, ii) how differences in unobserved health affect the use of these types of care.

To deal with this selection, we employ an instrumental variable analysis, in which we exploit the fact that $ENHA_i$ is partly random. The source of this randomness is that, as described above, i) an applicant's eligibility status is determined by an employee of the needs-assessment agency; ii) the allocation of cases to assessors is arbitrary within a region; and, iii) that assessors have some discretionary power, with some more likely to judge the same applicants as eligible than others, i.e. to be more lenient. Hence, whether the applicant is assessed by a more lenient assessor may be used as an instrument for $ENHA_i$ in the instrumental variable analysis.

We summarize the leniency of evaluators in one measure to create a strong instrument[17]. Following Maestas et al. (2013), we define leniency for application i handled by assessor j by taking the share of the other cases for which the assessor considered a nursing home admission appro-

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[14] Information on the use of support (*begeleiding*) is only available from 2011 onwards.

[15] All these data are available for all applicants, with two exceptions. First, healthcare expenditure data are not available for individuals who are insured through a proxy holder (about 10 percent in this subpopulation); probability weights are used to correct for this. Second, discharge information is lacking for approximately 10 percent of all hospital admissions. There is regional variation in the coverage of the registration of hospital admissions and hence missing values on these variables are not random but are nonetheless not expected to affect the results because we control for the region of residence.

[16] This figure comes from a back-of-the-envelope calculation in which we round the cost of one hour of home care to 40 Euro and use 11,297 Euro of home-care spending in the year prior to the application.

[17] The most straightforward way to exploit the differences between assessors would be to generate an indicator variable for each assessor and use this set of indicator variables as instruments. But this strategy would yield a large number of instruments for just one endogenous regressor. Furthermore, each of these assessor dummies separately would have a small impact on the overall probability of a nursing home admission. As a result, this approach is expected to yield biased estimates (Wooldridge, 2010; French and Song, 2014; Maestas et al., 2013).

Table 1
Descriptive statistics: group means.

	Study population	Eligible for nursing home admission (nursing home admission)		Difference between subgroups
	mean	No	Yes	
Endogenous variable				
Eligibility for a nursing home admission	0.835	0	1	–
Instrument				
Leniency of the evaluator	0	−0.028	0.006	−0.034***
Outcomes				
Mortality				
3-month	0.042	0.020	0.047	−0.027***
6-month	0.085	0.046	0.092	−0.046***
1-year	0.161	0.104	0.172	−0.068***
1.5-year	0.232	0.160	0.247	−0.086***
2-year	0.304	0.217	0.321	−0.104***
Admitted to a nursing home within:				
3 months	0.289	0.055	0.335	−0.279***
6 months	0.425	0.137	0.482	−0.344***
1 year	0.581	0.271	0.642	−0.371***
1.5 years	0.657	0.373	0.712	−0.339***
2 years	0.712	0.449	0.763	−0.314***
Long-term care expenditures				
Nursing home care in the next year	14142.83	4302.03	16087.21	−11785.18***
Nursing home care in the next 2 years	34882.67	16254.36	38504.68	−22250.32***
Home care in the next year	15107.34	14104.28	15305.52	−1201.24***
Home care in the next 2 years	23023.45	26013.00	22442.18	3570.82***
Medical care expenditures				
Next calendar year	5951.92	7582.64	5620.00	1962.64***
Next 2 calendar years	11225.97	13973.57	10640.69	3332.88***
Total healthcare expenditures				
Next calendar year	39786.97	31113.03	41552.46	−10439.43***
Next 2 calendar years	84074.89	68206.05	87455.20	−19249.15***
Hospital care use				
≥ 1 hospital admission in the next year	0.32	0.358	0.312	0.046***
Charlson score in the next year	0.258	0.266	0.257	0.009
Covariates[a]				
Eligible for home care in the past 30 days	0.723	0.677	0.732	−0.054***
Applicant				
Patient	0.296	0.48	0.259	0.221***
GP	0.027	0.028	0.026	0.002***
LTC provider	0.294	0.176	0.317	−0.141***
Other[b]	0.383	0.316	0.398	−0.082***
Application type				
Regular	0.962	0.962	0.962	0.000
After emergency LTC	0.013	0.011	0.013	−0.003**
Other	0.025	0.027	0.025	0.002**
Random sample getting full assessment	0.035	0.029	0.036	−0.007***
Sociodemographics				
Age	82.73	82.13	82.85	−0.72***
Female	0.66	0.663	0.659	0.004
Household size	1.47	1.47	1.46	0.01
Number of children	2.42	2.44	2.42	0.02
Number of children in household	0.044	0.046	0.043	0.003
Widowed in last year	0.016	0.019	0.016	0.003**
Widowed in last three months	0.008	0.01	0.008	0.001
Standardized household income[d]	19954	19338	20075	−737***
Wealth	189676	169172	193727	−24555***
Home owner	0.335	0.314	0.339	−0.025***
Value of the home	99983	92885	101385	−8500***

Table 1 (Continued)

	Study population	Eligible for nursing home admission (nursing home admission)		Difference between subgroups
	mean	No	Yes	
Past long-term care spending				
Home care last year	11298	6108	12323	−6215***
Home care past two years	15606	9244	16864	−7620***
Nursing home care past two years	138.49	141.46	137.90	3.563
Prescription drug use[e]				
ATC category B01	0.515	0.571	0.503	0.068***
ATC category J01	0.405	0.453	0.395	0.057***
ATC category A10	0.188	0.227	0.181	0.046***
Number of observations	51047	8406	42641	

Source: Authors' calculations

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. All expenditures are in euros. [a] Descriptive statistics for period in which application was filed, the region of residence and other categories of prescription drug use in Table A1 in Appendix A. [b] Includes family members and client representatives; [c] Descent following Statistics Netherlands definition: applicants classified as of foreign descent if they or one of their parents born abroad; [d] Household income divided by square root of number of household members; [e] ATC stands for Anatomical Therapeutic Chemical Classification System.

priate:

$$Leniency_i = \left(Number\ of\ approvals_j - I_i(approved) \right) / \left(Number\ of\ cases_j - 1 \right) \quad (2)$$

We exclude case i itself to ensure that the instrument is exogenous. Assessors with greater approval shares are taken to be more lenient.

Subsequently, we regress the leniency measure on region, half-year dummies and the type of application and take the residual. Thus, we create a leniency measure conditional on region and half-year fixed effects, reflecting that randomization occurs within these cells[18]. Using this standardized estimate of $Leniency_i$ as an instrument, $\sim Leniency_i$, we can obtain an unbiased estimate of γ using the following Two-Stage Least Squares regression (2SLS):

$$ENHA_i = x_i^T \times \theta + \lambda \times \sim Leniency_i + \eta_i \quad (3)$$

$$y_i = x_i^T \times \beta + \gamma \times E\hat{N}HA_i + \varepsilon_i \quad (4)$$

Where $E\hat{N}HA_i$ in Eq. (4) is the predicted probability of $ENHA_i$ from Eq. (3).

4.2. Interpretation

The interpretation of the results is affected by two aspects. First, we estimate the causal effect of *eligibility* for a nursing home admission, not the effect of an admission itself. Applicants who are eligible for a nursing home

admission may choose to postpone the admission or to not use any nursing home care at all and stay at home using home care instead[19], while applicants who are currently ineligible for a nursing home admission may apply again, become eligible and be admitted later: about half of the control group is admitted at some point in the future (Table 1, Column 2). These dynamics imply that we cannot use the current setup to study the effects of a nursing home admission on the outcomes: even if the assignment of the eligibility decision is completely random, the uptake and timing of nursing home care may still be correlated with unobserved (changes in) health (cf. Abbring and Van den Berg, 2005; Eberwein et al., 1997; Cellini et al., 2010).[20]

The simplest interpretation of the results is that the eligibility decision is the treatment. However, we expect differences between eligible and non-eligible applicants to be solely caused by differences in the timing and quantity of use of nursing home care[21]. Therefore, another interpretation is that we are estimating an intention-to-treat effect[22] for nursing home care: the effect of offering indi-

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[18] More specifically, we use an OLS regression to correct for information about the applications, i.e. the region and the period in which the application was submitted; whether the application was filed by a) the patient, b) his family doctor, c) his LTC provider, or d) someone else (e.g. a family member); whether it was a) a regular application, b) an application that followed a temporarily valid emergency application, or c) another type of application. Adjusting the leniency measure might improve the efficiency of the estimates, while including a subset of covariates ensures that the risk of overfitting is limited. A robustness check in which the leniency score is not adjusted (Table 5) and a robustness check in which we corrected the leniency estimates for all approximately 170 covariates (appendix) confirm that the instrument is strong and give similar results.

[19] There may be many reasons for this, e.g. the applicant may prefer to wait until a room becomes available in the nursing home of their preference, or may be hospitalized or may die before the admission takes place.

[20] Two approaches would enable using a nursing home admission as the endogenous variable. First, following Abbring and Van den Berg (2005) a joint-duration model of admission and outcome may be estimated (see Eberwein et al. [1997]). This approach, however, requires restrictive assumptions about the distribution of the unobserved effects and preliminary analyses showed the model could not be properly identified using our data. The second approach considers admission within an arbitrary time period t after the eligibility decision as the endogenous variable and measures outcomes over a subsequent period (t, $t+x$). Autor et al. (2015) show that, under additional monotonicity assumptions, the estimate can be interpreted as a LATE. Nonetheless, the results from this approach (available upon request) do not have straightforward interpretation because the treatment differs within the treatment group: some treated individuals are admitted right away, while others only at the end of the period t. Hence, it is not clear what effect is being estimated.

[21] It is unlikely that eligibility has a direct effect on the outcomes.

[22] Our approach differs from a design in which the intention to treat is used as an instrument for the treatment; this would mean using eligibility as an instrument for actual admission. Instead, we use leniency as an

viduals access to the actual treatment, i.e. a nursing home admission.

Second, the IV analysis provides an estimate of the local average treatment effect (LATE): the average effect of eligibility for compliers, i.e. those applicants who are at the margin of eligibility and for whom the eligibility decision is affected by the assessor's leniency. Some applicants are never eligible for nursing home care, regardless of the assessor's leniency: the never takers. Others – the always takers – are always eligible for nursing home care (e.g. because of severe health limitations) even if assessed by the strictest assessor. As the compliers might have different characteristics than the always- and never-takers, and the effects of eligibility for a nursing home admission might be heterogeneous, the LATE identifies the average effects for the compliers only.

We cannot identify the compliers individually, but we can examine their group characteristics by looking at the relative likelihood of a marginal applicant having a particular characteristic relative to the full population of applicants. We do this by dividing subgroup-specific first-stage coefficients for the leniency measure by the first-stage coefficient for leniency for the full population (Angrist and Pischke, 2009).

Therefore, we estimate the effect of access to nursing home care for individuals who are at the margin of eligibility. This seems to be one of the most policy-relevant effects. First, the way that policy makers in The Netherlands and a number of other countries often try to influence the use of nursing home care is through the eligibility decision (Organization for Economic Cooperation and Development (OECD, 2011; Bakx et al., 2015). Second, such policy changes are likely to mainly affect the compliers. As policy changes often entail marginal shifts in the rate at which the elderly move to a nursing home. These changes will most likely affect the access to nursing home care for applicants at the margin of eligibility, and not for applicants with very severe health problems.

4.3. Outcomes and selection of covariates

We consider six outcomes. First and second, we estimate the effect of eligibility on nursing home admissions and on LTC expenditures, which consist of spending on home care and nursing home care. Third and fourth, we look at spending on medical care and the probability of having at least one hospital admission. A nursing home admission may affect use and costs of medical care by affecting the health and survival of the admitted and through substitution: nursing homes pay for some of the medical care that would otherwise have been covered by health insurance and a nursing home might substitute for hospital care. Fifth and sixth, we estimate the impact on all-cause mortality and on morbidity, as measured by the hospital discharge diagnoses-based Charlson index (Sundararajan et al., 2004).
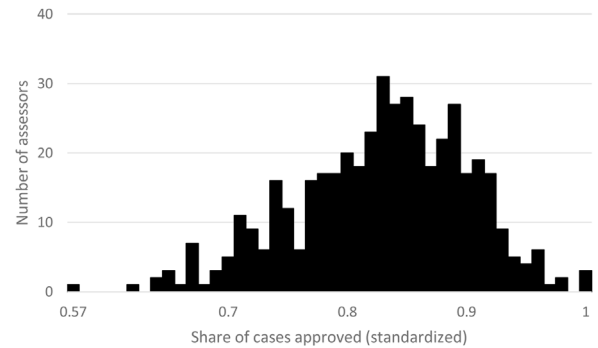

Fig. 1. Distribution of the leniency measure.
Note: the leniency measure is standardized for the type of the application, the period and the region of residence of the applicant.
Source: Authors' calculations

We control for all information available to CIZ when the application was assigned to an assessor and added information from the sources described in section 3.[23] We include information on: i) the type and timing of the application; ii) prior use of LTC and health care, including detailed information on medicine use; and, iii) socio-economic and demographic characteristics, including the age, gender, region of residence, household wealth, income and household and family composition of the applicants (Table A1 in Appendix A contains a full list of covariates).

4.4. Appraisal of assessor leniency as instrumental variable

To be a good instrument, the measure of the assessors' leniency needs to fulfill three requirements: it needs to be relevant, valid, and it needs to affect the probability of an admission monotonically.

4.4.1. Assumption 1: relevance

The variation in the leniency of assessors that handle more than 50 cases (n = 455) in the total time frame is considerable: the share of patients that are rated as eligible for nursing home care ranges from 0.53 to 0.99 (standard deviation = 0.08) across assessors.[24] After adjusting for differences in types of applications handled and regions, the variation is reduced (standard deviation = 0.07) but between-assessor differences remain substantial (Fig. 1).

The first-stage estimates presented in Table 2 confirm the relevance of the leniency instrument: the significance

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instrument for eligibility to obtain an unbiased estimate of the effect of eligibility not of nursing home admission.

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[23] We do not include the information on health status and functional limitations collected by the assessor. Assessors decide themselves which (additional) information they gather and may interpret situations differently. Analyses (available upon request) using detailed information on functional limitations from the Health Care Monitor survey of 2 percent of the population in 2012 show that more lenient assessors are more likely to overreport limitations and disabilities. Hence, including the information reported by the assessor would lead to an underestimation of the effect of assessor leniency on the probability of being eligible for a nursing home admission and hence to overestimation of the health effects of an admission.

[24] Figs. A.1 and A.2 in Appendix A contain histograms detailing the distribution of the caseload across the assessors and the share of applications that they approve.

Table 2
First-stage estimation results by subgroup.

	Effect of leniency (λ)	Relative likelihood	Observations
Full population	0.973 (0.018)***	1	51047
Man	0.894 (0.038)***	0.96	17372
Women	1.012 (0.025)***	1.04	33675
Healthcare spending last year			
1 st quartile (lowest)	0.782 (0.042)***	0.80	12414
2nd quartile	1.014 (0.046)***	1.04	12452
3rd quartile	1.058 (0.052)***	1.09	12447
4th quartile (highest)	1.054 (0.054)***	1.08	12446
Age			
65−69	0.776 (0.118)***	0.80	1746
70−79	0.920 (0.044)***	0.95	13916
80−89	1.038 (0.031)***	1.07	27748
90 and over	0.851 (0.062)***	0.87	7637
Home care user			
Yes	0.901 (0.028)***	0.93	14158
No	1.140 (0.055)***	1.17	36889
Prior nursing home admission			
Yes	0.968 (0.019)***	0.99	2947
No	1.080 (0.100)***	1.11	48100
Applicant			
Patient	1.446 (0.051)***	1.49	15097
LTC provider	0.724 (0.039)***	0.74	14989
Other	0.774 (0.034)***	0.80	20961
Standardized household income			
1 st quartile (lowest)	1.040 (0.050)***	1.07	12761
2nd quartile	0.959 (0.048)***	0.99	12761
3rd quartile	1.051 (0.044)***	1.08	12763
4th quartile (highest)	0.839 (0.045)***	0.86	12762

Source: Authors' calculations
Note: Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. All regressions control for period, region, type of application, demographics and household characteristics and medication use and healthcare spending in the previous calendar year.

of the coefficient for leniency, the F-statistic and the partial R^2-statistic show that assessor leniency has a strong effect on the probability of being labeled eligible for a nursing home admission. Being assigned to a one standard deviation more lenient assessor increases the probability of being eligible for nursing home care by 6.9 percentage points.

4.4.2. Assumption 2: validity

As explained in Section C, assessors are assigned to applications by a planner whose main goals are: i) to ensure that every application is reviewed on time; and, ii) that assessors have an even workload. Applicants cannot pick an assessor and assessors cannot select which types of applications they would like to review. This means that the validity of the instrument is plausible: the assignment procedure makes it unlikely that the instrument is correlated with any (unobservable) characteristics of the applicant.[25]

While this claim cannot be verified empirically, we further examine its plausibility by testing whether the instrument is correlated with *observed* characteristics. It is more likely that none of the subgroups based on *unobserved* characteristics is being assessed by more lenient assessors, if none of the observed subgroups of applicants on average

is assessed by a more lenient assessor[26] . To this end, we inspect which characteristics are correlated with assessor leniency by regressing it on the observed characteristics of the applicant (cf. French and Song, 2014).[27] Any difference between observable subgroups of applicants in the average leniency of their assessors might be a sign of non-random assignment, in particular when the difference is in a characteristic that is likely to be connected to the applicant's unobserved health. This regression reveals that when correcting for all other characteristics (and correcting for multiple testing using the method developed by Benjamini and Hochberg (1995)), there are no between-group differences in assessor leniency (Table A4 in Appendix A).

To further assess the exclusion restriction, we use results from a Least Absolute Shrinkage and Selection Operator (Lasso) analysis (see Section V.D). We use this as a robustness check to see whether our main results change when we use automated variable selection based on all available information in our data set. As suggested by Belloni et al. (2014), we let the Lasso select the covariates

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[25] In addition, the arbitrary assignment of applications to assessors means that Stable Unit Treatment Value Assumption (SUTVA) holds, as it rules out serial correlation in the leniency of assessors reviewing applications made by the same applicant (or the same group or household).

[26] The crucial assumption is that the observed and unobserved characteristics are correlated, which is highly likely in this case because of the availability of information on all aspects influencing the health of the applicant and the probability of a nursing home admission, including past health status, socio-economic status, informal care availability and demographic background characteristics.

[27] A close alternative to this test is to split the population in quartiles using the leniency of the assessor, and to test for differences in other characteristics between these quartiles. The results from this test reconfirmed the results reported here (full results available upon request).

for three equations: the first-stage and second-stage equations of the 2SLS estimation, and an equation explaining the leniency score. The estimation results for the leniency score equation also provide further insight into the validity of the IV: if the Lasso does not select any (health-related) variables in the leniency score equation, this means that none of the observable variables have strong predictive power for leniency. None of the 170 variables were selected for the leniency equation by the Lasso, which further confirms that the observed characteristics are uncorrelated with the instrument.

4.4.3. Assumption 3: monotonicity

The monotonicity assumption requires that any applicant who is granted eligibility by a strict assessor would also be granted eligibility by a less strict assessor, and similarly that any applicant who is denied eligibility by a lenient assessor would also be denied eligibility by a stricter assessor. A testable implication of that assumption is that the relationship between assessor leniency and the probability of being rated eligible to move to a nursing home is positive for all observable subgroups (French and Song, 2014; Dahl et al., 2014; Dobbie et al., 2018). In this case, the leniency measure coefficient will always be nonnegative in subgroup-specific first-stage regressions. We found that, for all 19 subgroups considered, the first-stage coefficients were positive and close to the estimate for the entire population (Table 2).[28]

Finally, a survival analysis of the population that was eligible for nursing home care demonstrates that individuals who were assessed by a more lenient assessor move to a nursing home at a slower rate (results available upon request). This implies that individuals granted a nursing home admission by a stricter assessor are on average less healthy than those granted it by a more lenient assessor. Thus, this finding confirms that the monotonicity assumption is not rejected (cf. Maestas et al., 2013).

5. Results

5.1. Main analyses

As expected, being granted eligibility for a nursing home admission increases the probability of moving to a nursing home (Table 3). This effect varies over time for three reasons: i) because not all those eligible move to a nursing home; ii) because those who do move to a nursing home do not move there immediately; and, iii) because a

large share of applicants initially turned down eventually become eligible for a nursing home admission. The effect is 15.6 percentage points after three months. It peaks after six months when the impact is 18.4 percentage points and decreases to 11.1 percentage points after two years.

Being eligible for a nursing home admission has no significant impact on mortality, nor on hospitalizations for diagnoses associated with a high 1-year mortality risk as summarized by the Charlson index. The mortality estimates are not significant and closer to zero than the OLS estimates: the difference in the probability to die within one year after eligibility is 0.03 in the IV versus 0.05 in the OLS estimates, and the difference in the probability to die within two years 0 versus 0.07 (see Table A5 in Appendix A). This is an interesting finding in itself but it also means that there is no evidence that the estimates for the impact of eligibility on other outcomes are affected by selective mortality. Although relative to the 16 percent of our sample that dies within one year, the standard errors are not excessively large, they do imply that we cannot rule out effects on mortality smaller than 4.5 percentage points, which is non-negligible in absolute terms. Moreover, there seems to be substantial effect heterogeneity underlying the average mortality effect (see subsection C on Subgroup analyses for further details).

Being eligible for a nursing home admission means that an applicant is 8.9 percentage points (28 percent) less likely to incur a hospital admission.[29] Furthermore, being eligible for a nursing home admission also has a large impact on healthcare spending. As a consequence of the higher share of patients that is admitted to a nursing home among the eligible, their spending on nursing home care is 7991 Euro higher after a year (12,447 after two years), while their home-care expenditures are 6405 Euro lower (11,137 after two years). Moreover, the eligible are estimated to spend 1500 Euro *less* on medical care than the ineligible in the calendar year after the eligibility decision (Table 3). This drop fully offsets the increase in LTC spending, meaning that the total effect of becoming eligible for a nursing home admission on healthcare spending is close to zero. This drop in medical care costs is not the result of differences in mortality between home care and nursing home care recipients, as the 2SLS shows no significant effect of a nursing home admission on mortality. Hence, a nursing home admission limits the need to seek medical help and thus medical care spending, either because the nursing home provides this care itself, because living in a nursing home improves the health of the residents, or because the nursing home staff are able to improve timeliness of medical care.

5.2. Characteristics of compliers

The 2SLS results apply to the compliers. The size of the compliers group is equal to the first-stage coefficient multiplied by the difference between the eligibility rate of the

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[28] Although this does not necessarily mean that the monotonicity assumption holds at the individual level, Frandsen et al. (2019) have argued that IV estimates still have a causal interpretation under weaker monotonicity assumptions. Extending their argument to our study, this means that the covariance between the individual's assessor-specific eligibility status and the assessor's overall eligibility propensity should be weakly positive for each applicant. This means that applicants may violate monotonicity with specific assessors, as long as they comply with monotonicity for enough other assessors so that the overall covariance stays nonnegative. Frandsen et al. (2019) suggest assessing the plausibility of this assumption by checking that the first-stage coefficient is positive and significant for important observable subsamples, which is the case in our study (results available upon request).

[29] Subsequent analyses on the number of days stayed at the hospital (conditional on one admission), the number of unscheduled admissions and on the probability of being admitted at least once for specific groups of conditions did not yield significant results (results available upon request).

Table 3
The impact of becoming eligible for a nursing home admission.

	A nursing home admission within:				
	3 months	6 months	1 year	1.5 year	2 year
Effect of eligibility for a nursing home admission (γ)	0.156 (0.052)***	0.205 (0.048)***	0.184 (0.045)***	0.137 (0.045)***	0.111 (0.041)***
First stage					
Effect of leniency (λ)	0.973 (0.018)***	0.973 (0.018)***	0.973 (0.018)***	0.963 (0.020)***	0.963 (0.020)***
F-statistic leniency (p-value)	2863 (0.000)***	2863 (0.000)***	2863 (0.000)***	2390 (0.000)***	2390 (0.000)***
Partial R^2 leniency	0.035	0.035	0.035	0.035	0.035
Number of observations	51047	51047	51047	44261	44261

	Mortality within:					Charlson index	Having $\geq$ 1 hospital admission
	3 months	6 months	Next year	1.5 years	2 years	Next year	Next year
Effect of eligibility for a nursing home admission (γ)	0.010 (0.014)	0.019 (0.022)	0.032 (0.028)	0.022 (0.030)	−0.002 (0.029)	−0.035 (0.075)	−0.089 (0.041)**
First stage							
Effect of leniency (λ)	0.973 (0.018)***	0.973 (0.018)***	0.973 (0.018)***	0.973 (0.018)***	0.973 (0.018)***	0.955 (0.030)***	0.955 (0.030)***
F-statistic (p-value)	2863 (0.000)***	2863 (0.000)***	2863 (0.000)***	2863 (0.000)***	2863 (0.000)***	996 (0.000)***	996 (0.000)***
Partial R^2	0.035	0.035	0.035	0.035	0.035	0.034	0.034
Number of observations	51047	51047	51047	51047	51047	29371	29391

	Nursing home care expenditures		Home care expenditures	
	Next year	2 years later	Next year	2 years later
Effect of eligibility for a nursing home admission (γ)	7991.49 (1246.36)***	12447.46 (2735.47)***	−6404.96 (1185.54)***	−11137.42 (2220.44)***
First stage				
Effect of leniency (λ)	0.973 (0.018)***	0.963 (0.020)***	0.973 (0.018)***	0.963 (0.020)***
F-statistic (p-value)	2863 (0.000)***	2390 (0.000)***	2863 (0.000)***	2390 (0.000)***
Partial R^2	0.035	0.035	0.035	0.035
Number of observations	51047	44261	51047	44261

	Medical care expenditures		Total expenditures	
	Next calendar year	2 next calendar years	Next calendar year	2 next calendar years
Effect of eligibility for a nursing home admission (γ)	−1500.34 (575.73)**	−1419.60 (917.86)	619.49 (1812.53)	1358.60 (3834.82)
First stage				
Effect of leniency (λ)	0.991 (0.019)***	1.021 (0.024)***	0.991 (0.019)***	1.021 (0.024)***
F-statistic (p-value)	2627 (0.000)***	1764 (0.000)***	2627 (0.000)***	1764 (0.000)***
Partial R^2	0.036	0.037	0.036	0.037
Number of observations	44064	31986	44064	31986

Source: Authors' calculations.
Note: Standard errors in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.10. In all regressions we control for period, region, type of application, demographics and household characteristics and medication use and healthcare spending in the previous calendar year. All expenditures are in euros.

least and most-lenient assessor (Maestas et al., 2013). This means that 43 percent of the population is at the margin. The group of "always takers" (i.e. those always considered eligible) is equal to the share considered eligible by the strictest assessor, while the group of never takers is equal to the share considered ineligible by the most lenient assessor. In our case, a large share (57 percent) will always be considered eligible, while there are no never takers. The absence of never takers in the study population can be explained by our selection of individuals who apply for

a nursing home admission who are generally all in poor health.

The composition of the compliers group is different from the full study population. The relative likelihood estimates show that the compliers are substantially more likely to be aged 80−89 than the full study population (Table 2). They are also more likely to be in the lowest income quartile, to have submitted their application themselves and to have not been eligible for home care in the 30 days before the application. These groups that are overrepresented among

the compliers might provide more room —or more reason —for discretionary decisions by assessors. The findings also suggest that the difference between the OLS estimates and the 2SLS is the result of differences between compliers and the full population as well as the impact that self-selection has on the OLS estimates (Dahl et al. 2015).

5.3. Subgroup analyses

Table 4 shows that assessor leniency has a larger impact on eligibility for a nursing home admission for some groups than for others: the effect of assessor leniency was largest for applicants in the 80–90 age group, applicants who file the application themselves, and applicants not eligible for home care at the time of the application. For these three subgroups, we re-estimate the 2SLS regressions for the probability of a nursing home admission, mortality and LTC spending. For the first two subgroups, results are very similar to the overall result. However, applicants not eligible for home care at the time of application experience a drop of 8.4 percentage points in one-year mortality because of eligibility for a nursing home admission (Table 4). Conversely, the mortality of the group that was considered eligible for home care at the time of application is about 8.9 percentage points higher one year after they became eligible for a nursing home admission. The effects of eligibility on a nursing home admission and on LTC spending are similar for both subgroups and equal to those for the total population. Because the former group applies for a nursing home admission, without previously having used any form of home care, it seems likely that they have experienced a shock in their health or living conditions. We do, however, not find any consistent evidence for this in their healthcare use prior to their application or in any changes in their marital status. Discussions with experts and analysis of background characteristics of these subgroups did not provide insight into the underlying reason for this heterogeneity.

Effects of nursing home admission eligibility might also differ across groups with different unobserved characteristics (e.g. unobserved health). Estimating the marginal treatment effects is one way to test for heterogeneous treatment effects over unobserved characteristics (Heckman et al., 2006). If we suppose there is only one unobservable factor (unobserved health), then differences in leniency (conditional on the observables) across assessors can be interpreted as differences in the threshold the assessors apply regarding this unobserved factor: lenient assessors apply a lower threshold with regard to unobserved health than strict assessors. The differences in leniency across assessors, which should be uncorrelated to unobserved health, allow us to estimate effects for different margins of eligibility by first estimating the propensity of eligibility based on leniency, and then estimating the outcome as a function of this propensity score[30].

We estimate marginal treatment effects with nursing home admission and mortality as outcomes. We do not find evidence of heterogeneity in the outcomes according to the propensity score[31]. These findings (available upon request) suggest that the effects of eligibility for a nursing home admission do not differ across individuals with different severity of unobserved health problems. However, the effects can only be identified for compliers; always takers are likely to be in worse unobserved health than compliers. The results therefore cannot be generalized to the elderly population with very severe unobserved health problems. Furthermore, the idea of a single unobserved (health) factor may be an oversimplification of reality. When there is more than one factor that determines the eligibility decisions of the assessors (e.g. multiple health dimensions, such as morbidity, disability and frailty [Fried et al., 2004], or other factors such as living conditions), then the interpretation of the marginal treatment effects is less clear-cut since it becomes impossible to distinguish between the effects of the different factors.

5.4. Robustness checks

We perform three sets of robustness checks to verify whether the main results are sensitive to: i) the definition of the leniency measure; ii) decisions about the selection of control variables for applicant health status; and, iii) the linearity assumption for the instrument underlying the 2SLS regression models. The first set of tests revealed that the results are largely insensitive to decreasing (to 20 or 40 handled applications) or increasing (to 60, 80 or 100 applications) the threshold used to select assessors with sufficient numbers of observations to reliably calculate their leniency[32]. Further, using a version of the leniency measure that has not been corrected for characteristics of the application reconfirms the main analysis, except for the one-year mortality estimate, which is significant at the p < 0.05 level (Table 5). Finally, we test if inexperienced assessors may receive an easier caseload (which would bias their leniency scores downward) by leaving out the 2.2 percent of applications handled by an assessor with fewer than 100 applications in the prior year.[33] Leaving out these applications does not alter the main result: there is a positive effect of being eligible for a nursing home admission on the admission probability but not on mortality (Table 5).

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[30] Specifically, we follow a similar approach to Maestas et al. (2013) and proceed in four steps. We first estimate an adjusted leniency measure correcting for all covariates used in the main analysis. Second, we estimate a probit model of eligibility on this indicator. The predictions from this model provide the propensity score (i.e. the predicted probability of being eligible). Third, we regress the outcomes on this score, using a local polynomial regression model. Fourth, numerically taking derivatives of this model gives the marginal treatment effects.

[31] The estimates depend very strongly on the functional form (order of the polynomial) that is chosen and even a second-order polynomial seems to suffer from overfitting. However, scatterplots of the average outcome by percentiles of the propensity score clearly show there is no heterogeneity in the effects.

[32] We document one exception: the one-year mortality effect of eligibility for a nursing home admission becomes positive and significant at the p < 0.05 level when the threshold is set at 80 applications (but not at 100 applications).

[33] To measure the experience of the assessor, all types of application are taken into account, not just the type of applications used in the main analysis.

Table 4
Subgroup analyses.

	Age: 80−90	Applicant is patient	Home care user	Not a home care user
Effect of eligibility for a nursing home admission on:				
1-year mortality	0.026 (0.031)	0.006 (0.025)	0.089 (0.033)***	−0.084 (0.036)**
2-year mortality	−0.012 (0.034)	−0.000 (0.029)	0.028 (0.037)	−0.060 (0.039)
1-year nursing home admission	0.150 (0.050)***	0.210 (0.061)***	0.184 (0.045)***	0.156 (0.070)***
2-year nursing home admission	0.088 (0.049)**	0.156 (0.055)***	0.113 (0.043)***	0.081 (0.060)
1-year nursing home care spending	8037.695 (1359.477)***	4014.789 (1067.080)***	8633.287 (1569.87)***	6295.128 (1625.707)***
2-year nursing home care spending	11136.709 (3251.442)***	8401.952 (2713.867)***	12121.929 (3439.83)***	11181.462 (3563.811)***
1-year home care spending	−7831.589 (1561.130)***	−3657.784 (1143.409)***	−6983.781 (1589.74)***	−4702.529 (1383.017)***
2-year home care spending	−10702.293 (2969.476)***	−8050.732 (2251.490)***	−11375.838 (3006.73)***	−9350.112 (2505.655)***
First stage[a]				
Effect of leniency (λ)	1.038 (0.031)***	1.446 (0.051)***	0.901 (0.028)***	1.140 (0.055)***
F-statistic leniency (p-value)	1141 (0.000)***	789 (0.000)***	1046 (0.000)***	429 (0.000)***
Partial R^2 leniency	0.038	0.057	0.032	0.041
Number of observations	27748	15097	36889	14158

Source: Authors' calculations

[a] First-stage coefficient applicable to full sample. Note: Standard errors in parentheses; *** $p<0.01$, ** $p < 0.05$, * $p < 0.10$. In all regressions we control for period, region, type of application, demographics and medication use and household characteristics and healthcare spending in the previous calendar year. All expenditures are in euros. All other subgroup analyses are available upon request.

Second, to gauge whether there is omitted variable bias related to the health of the applicants, as a first step we include information on spending on five categories of medical care – hospital care, paramedical care, medical devices, medical transport and all other medical care – in the calendar year prior to the application.[34] For all outcomes, results are identical to those in Section 5.1.

To further verify whether we selected the correct covariates, we start with a much larger set of covariates including very detailed information on outpatient medicine use and diagnosis information from hospital admissions from the year prior to the application to the set of covariates used in the main analyses[35] and let the Lasso developed by Tibshirani (1996) select relevant covariates in a data-driven way (Appendix C contains further details about the procedure). Specifically, we let the Lasso select the covariates that are associated with the endogenous variable, the instrument or the probability of a nursing home admission (Belloni et al., 2014). This algorithm allows us to consider a much larger set of covariates in a more structured way than we could do otherwise. The Lasso selected only a small share of the covariates included in the main analyses, and only four of the hospital diagnoses groups that were not included. The 2SLS results are not affected by the covariate selection.

Third, we verify whether the assumption that the effect of the instrument on eligibility for a nursing home admis-

sion is linear by using dummy variables for ten leniency deciles as instruments rather than the continuous measure (cf. Dahl et al. 2015). The dummies reveal a linear effect and the estimates for the probability of a nursing home admission and for mortality are very similar to the results with the continuous measure. Hence, the assumption of a linear instrument effect appears to have no effect on the estimates.

6. Discussion and conclusion

The share of elderly living in nursing homes has been declining steadily in recent decades. This is one of the most striking trends in LTC, with potentially far-reaching consequences for the health and well-being of the elderly as well as for (publicly financed) expenditures. But how large are these consequences really? This article sheds more light on this question using a quasi-experimental approach.

In order to obtain a causal estimate of the effects of eligibility for a nursing home admission, we exploited two unique features of the Dutch institutional context. First, patients need to apply for eligibility for a nursing home admission and these applications are reviewed by arbitrarily assigned assessors who differ in their leniency to grant eligibility. Second, virtually all LTC is publicly funded (Centraal Bureau voor de Statistiek (CBS, 2017), meaning that there are almost no options to bypass the public system – and hence the eligibility application procedure – and there are few other barriers to LTC use.

We find that for a substantial share of the elderly applying for a nursing home admission, eligibility is affected by the leniency of the assessor handling their case. For this group, our two main findings are as follows. First, and sim-

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[34] This information is not available for patients applying in 2009 and hence these observations (n = 3,696) were removed.
[35] Specifically, we added the categories of the International Shortlist for Hospital Morbidity Tabulation (ISHMT) and all ATC level-4 codes to the set of potential covariates.

Table 5
Robustness checks.

	Lower bound on the number of observations needed to the calculate leniency of an assessor				
	20	40	60	80	100
Effect of eligibility for a nursing home admission on:					
1-year mortality	0.024 (0.023)	0.035 (0.026)	0.031 (0.028)	0.058 (0.031)*	0.046 (0.034)
2-year mortality	−0.011 (0.025)	−0.000 (0.028)	−0.007 (0.030)	0.017 (0.033)	−0.009 (0.038)
1-year nursing home admission	0.237 (0.044)***	0.189 (0.045)***	0.185 (0.046)***	0.156 (0.042)***	0.159 (0.049)***
2-year nursing home admission	0.140 (0.037)***	0.118 (0.039)***	0.113 (0.042)***	0.069 (0.041)*	0.072 (0.049)
1-year nursing home care spending	7038.263 (1066.068)***	7634.662 (1191.458)***	7714.693 (1270.146)***	8206.570 (1438.222)***	7730.504 (1612.081)***
2-year nursing home care spending	10562.006 (2360.357)***	11481.562 (2583.903)***	11987.496 (2809.537)***	13044.128 (3092.466)***	11924.927 (3375.359)***
1-year home care spending	−4535.525 (1046.524)***	−5966.951 (1147.921)***	−6764.837 (1189.610)***	−6981.734 (1412.757)***	−7588.123 (1615.977)***
2-year home care spending	−8234.621 (1967.073)***	−10387.997 (2131.315)***	−11661.382 (2256.949)***	−11656.574 (2658.543)***	−11422.365 (3011.719)***
First stage[a]					
Effect of leniency (λ)	0.955 (0.015)***	0.963 (0.023)***	0.970 (0.018)***	0.971 (0.020)***	0.976 (0.030)***
F-statistic leniency (p-value)	3909 (0.000)	3785 (0.000)	3067 (0.000)	2256 (0.000)	1090 (0.000)
Partial R^2 leniency	0.04	0.036	0.036	0.033	0.03
Number of observations	56075	52786	48985	42789	35542
	Raw leniency measure	Experienced assessors only	Controlling for confounding through additional health information	Using the Lasso to select covariates[c]	Using leniency decile indicators as instruments
Effect of eligibility for a nursing home admission on:					
1-year mortality	0.063 (0.035)*	0.034 (0.028)	0.036 (0.027)	0.035 (0.034)	0.035 (0.027)
2-year mortality	0.002 (0.038)	0.002 (0.029)	0.008 (0.029)	−0.011 (0.037)	0.001 (0.030)
1-year nursing home admission	0.205 (0.062)***	0.195 (0.045)***	0.193 (0.044)***	0.182 (0.068)***	0.181 (0.042)***
2-year nursing home admission	0.109 (0.054)**	0.120 (0.041)***	0.117 (0.039)***	0.102 (0.052)*	0.109 (0.039)***
1-year nursing home care spending	8355.818 (1606.511)***	7976.648 (1256.313)***	8173.871 (1240.674)***	8080.507 (1897.301)***	8396.388 (1292.481)***
2-year nursing home care spending	9771.729 (3554.656)***	12245.619 (2752.814)***	12574.342 (2733.022)***	15625.291 (3881.716)***	13632.275 (2850.075)***
1-year home care spending	−8789.195 (1533.589)***	−6506.958 (1215.350)***	−6668.339 (1194.439)***	−4734.161 (1912.457)**	−6026.848 (1244.097)***
2-year home care spending	−15082.627 (2848.391)***	−11360.770 (2274.526)***	−11616.974 (2234.865)***	−11411.966 (3376.592)***	−11106.662 (2285.350)***
First stage[a]					
Effect of leniency (λ)	0.745 (0.018)***	0.979 (0.018)***	0.977 (0.018)***	0.954 (0.033)***	[b]
F-statistic leniency (p-value)	1687 (0.000)	2884 (0.000)***	2951 (0.000)***	860 (0.000)***	189 (0.000)***
Partial R^2 leniency	0.023	0.035	0.035	0.034	0.034
Number of observations	51047	49942	49759	30065	51047

Source: Authors' calculations

[a] For population with at least one year of data available. [b] Coefficients for nine decile dummies range from .047 (.008)*** for the second decile to .232 (.007)*** for the tenth. [c] Covariates selected by the Lasso algorithm are: five period dummy variables, two region dummies, sixteen age-gender dummy variables, an indicator for being from Netherlands Antillean descent, Anatomical Therapeutic Chemical Classification System (ATC) codes A02, A16, B01, B03, C01, C03, G04, H02, L01, L02, M01, M04, N06, R03 and Y, ISHMT codes 202, 501, 1006, and 1302, whether application was filed by the patient herself, whether application was filed by a care provider, household size and whether the patient is eligible for home care at the date of application. The lambda statistic is 1789.965802. All expenditures are in euros. All other robustness checks are available upon request.

ilar to the finding of Werner et al. (2019), eligibility for a nursing home admission reduces the probability of having at least one hospital admission in the year following the eligibility decision. We do not find evidence for an effect on mortality: being eligible for a nursing home admission has no significant effect on survival on average, although there appears to be relevant heterogeneity as eligibility causes a

sharp, but transient, increase in mortality for elderly who were using home care at the time of their application. Conversely, eligibility leads to a temporary *decline* in mortality for elderly who did not use home care at the time of their application.

Second, eligibility for a nursing home admission has no impact on total healthcare spending. While nursing home

care is expensive and public LTC insurance not only covers care but also the room and board costs of the nursing home stay in the Netherlands, the eligible would otherwise have used an amount of home care that is almost equally expensive. Moreover, a nursing home admission leads to a substantial reduction in spending on medical care. This result is in line with the finding of Werner et al. (2019) who find a decrease in hospital spending, but in contrast with the finding of Kim and Lim (2015), who reported that a nursing admission slightly increases medical care expenditures for the group with the most severe functional limitations.

Our findings imply that policies aimed at further postponing nursing home admissions by tightening eligibility criteria might not be beneficial. While postponing a nursing home admission does not seem to come at the cost of higher mortality risk, it does increase the risk of a hospital admission. Moreover, postponing nursing home admissions does not lead to any cost savings. Such savings have often been cited as the main goal of these policies (Organization for Economic Cooperation and Development (OECD, 2011). However, our analysis suggests that the health problems of the LTC applicants at the margin of eligibility are so severe that intensive care is needed to enable them to continue living at home. Our results indicate that provision of these intensive types of care at home might actually not be cost saving at all, possibly due to lack of (economies of) scale.

While our analysis sheds light on the causal effects of eligibility for nursing home care on health and costs, we could not estimate all relevant societal costs and benefits of a nursing home admission. Such a complete analysis is inhibited by a lack of information on a number of outcomes, the most important ones being the well-being of the patients and the health, well-being, and labor supply of the informal caregivers. Elderly do not only move to a nursing home to prevent deterioration of their health; they might also move there to be able to cope with their health problems and limitations, and to lead a meaningful life despite these problems. Unfortunately, population-wide quality of life or happiness measures for people receiving home care or living in a nursing home are not available[36]. The same is true for data on informal care provision.

When generalizing the results to other institutional settings, two things are important. First, we have estimated a LATE for a specific subgroup. Our sample is restricted to applicants who themselves request eligibility for a nursing home admission, or on whose behalf such a request is made by a family member, GP or LTC provider. As already concluded by Kim and Lim (2015), the benefits of home care and nursing home care are heterogeneous across patients with a different severity of health problems. It is likely that the subgroup that we study contains few elderly with relatively mild health problems, and our sample thus excludes the applicants with the least severe health problems. Our estimates also do not pertain to the 57 percent of the applicants who are in such poor health that they are determined eligible even by the strictest assessors.

Second, the context of the Dutch LTC system should be taken into account, as the Netherlands has a relatively extensive public insurance for both nursing home care and home care. On the one hand, this means that a relatively large proportion of the Dutch older population lives in a nursing home (5.3 percent of the 65-year-olds in in 2014 compared to the OECD average of 3.8 percent (Organization for Economic Cooperation and Development (OECD, 2017). It is therefore likely that there is more scope to produce the same health outcomes with home care for the healthiest residents of Dutch nursing homes, than there might be for nursing home residents in countries where the access to nursing homes is restricted to the very severe patients only. On the other hand, The Netherlands also has very extensive publicly financed home-care provision. This means that, compared to other countries, individuals who are not eligible for a nursing home admission still receive substantial home care, which may explain the similarity of health outcomes, but also the limited difference in costs.

A final important element of the Dutch system is the assessment procedure: applicants who are not eligible for a nursing home admission now, can apply again later and obtain access to a nursing home if their health problems worsen. In such a system, a strict initial assessment may be less consequential for health as it prevents unnecessary admissions for elderly who can indeed stay at home, while elderly for whom an admission is needed can still get access to a nursing home in time.

All in all, we find that the Dutch LTC system provides equal outcomes for the elderly at both sides of the threshold between home care and nursing home care. Although our analysis only considers a subset of relevant outcomes, the general message is that, for this group of elderly, substitution of nursing home care by home care might not be the cost saver it is sometimes thought to be. Rather, providing the same level of care at home as in a nursing home, might also come at an equal cost. This finding suggests that there is a limit to the costs saving effect of substitution towards home care, at least when need-based eligibility rules are the main policy lever and public home care funding is generous, and that the Netherlands seems to be close to that limit.

CRediT authorship contribution statement

Pieter Bakx: Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Funding acquisition, Writing - original draft, Writing - review & editing, Conceptualization. **Bram Wouterse:** Methodology, Software, Validation, Formal analysis, Investigation, Funding acquisition, Writing - original draft, Writing - review & editing, Conceptualization. **Eddy van Doorslaer:** Conceptualization, Writing - original draft, Writing - review & editing. **Albert Wong:** Methodology, Software, Validation, Formal analysis, Investigation, Project administration, Funding acquisition, Writing - original draft, Writing - review & editing, Conceptualization.

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[36] Kok et al. (2015) report that elderly in Dutch nursing homes are happier than elderly receiving care at home, but they rely on propensity score matching to identify effects.

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Appendix A. Supplementary material

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.jhealeco.2020.102354.

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