The Journal of the Economics of Ageing 25 (2023) 100456

Contents lists available at ScienceDirect

The Journal of the Economics of Ageing

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

What explains different rates of nursing home admissions? Comparing the United States to Denmark and the Netherlands

Judith Bom [a,*], Pieter Bakx [a], Eddy van Doorslaer [a,b,c], Mette Gørtz [d], Jonathan Skinner [e,f]

[a] Erasmus School of Health Policy & Management, Erasmus University Rotterdam, the Netherlands
[b] Erasmus School of Economics, Erasmus University Rotterdam, the Netherlands
[c] Tinbergen Institute, Rotterdam, the Netherlands
[d] Department of Economics and CEBI, University of Copenhagen, Denmark
[e] Dartmouth Institute for Health Policy & Clinical Practice, Lebanon, New Hampshire, United States
[f] Department of Economics, Dartmouth College, Hanover, New Hampshire, United States

ARTICLE INFO

Keywords:
Long-term care
Nursing home admission
Decomposition
Cross-country comparison

ABSTRACT

The share of older adults residing in a nursing home is much higher in the Netherlands and Denmark than in the US, while in the US, perhaps surprisingly, individuals are much more likely to be admitted to a nursing home. We explore reasons for the higher US admission rates and aim to understand to what extent these differences are due to (i) differences in the composition of the population aged 65+ or (ii) differences in LTC system features.

We use data from HRS and SHARE merged to administrative data to compare total nursing home admission rates and long-term nursing home admission rates in The Netherlands (N = 1,800) and Denmark (N = 1,859), with comparable rates from the US (N = 6,553). We use decomposition techniques to quantify the differences in determinants of nursing home admissions.

We find that elders in the US are more likely to be disabled, but even after adjusting for disability, they are more likely to be admitted to a nursing home. Because nearly half of these stays in the US are for fewer than 20 days, there is a shorter average length of stay; by contrast in the Netherlands and Denmark nursing home admissions are generally much longer term. These findings indicate that nursing home admissions are not solely determined by personal characteristics; also system and cultural differences are important reasons why nursing home use varies across countries.

Introduction

Aging in place has become an important policy goal for many developed countries around the world. This trend of delaying or substituting nursing home use has received even more attention during the recent COVID-19 pandemic which hit nursing home residents particularly hard (Who cares, 2020). However, nursing home use is not equally common in all countries. The share of older adults residing in a nursing home is much higher in the Netherlands and Denmark than in the US: 5.3% of the Dutch and 3.9% of the Danish elders were living in a nursing home in 2014 compared to only 2.5% in the US (OECD, 2020).

These cross-country differences in nursing home care rates could be driven by population characteristics, like differences in the share of individuals in very old age or differences in health of elders, but also by differences in cultural factors or the organization of long-term care (LTC) systems. While differences in nursing home admission rates across the US and European countries are commonly reported, it is not so clear what is the origin of these differences. A recent comparison of LTC use across Europe and the US by Barczyk and Kredler (2019) highlighted large differences in nursing home care use among elders in similar need for LTC, indicating that culture and LTC policies shape individual care decisions. They also show differences in disability rates across countries, highlighting cross-country differences in care needs. Their study, however, did not investigate the relative importance of differences in personal characteristics like health versus other elements when explaining differences in nursing home care use.

This study analyzes nursing home admission rates in Denmark, the Netherlands and the United States and is the first to explain whether cross-country differences are due to (i) differences in the composition of the 65+ population or (ii) differences in LTC system features. It extends

* Corresponding author.
E-mail address: bom@eshpm.eur.nl (J. Bom).

https://doi.org/10.1016/j.jeoa.2023.100456

Available online 30 March 2023

earlier work that investigated drivers of differences in LTC use based on European data (Bakx et al., 2015; Heger & Korfhage, 2018). Bakx et al. (2015) for example showed that the large differences in use of formal and informal care between the Netherlands and Germany are predominantly driven by system differences, not differences in characteristics of the older population. Heger & Korfhage (2018) showed similar results when studying other European countries. Due to data limitations these studies were however unable to differentiate between different types of formal LTC. Additionally, these studies only compare European countries whereas the US, given its different LTC system, provides an interesting comparator as well.

Moreover, in contrast to earlier papers focusing on survey data, this study exploits the opportunity that Dutch and Danish administrative data on nursing home use is linked to data from the Survey of Health Ageing and Retirement in Europe (SHARE). Given that nursing home residents showed to be underrepresented in SHARE survey data (De Luca et al., 2015; Barczyk & Kredler, 2019), this linkage allows us to investigate what drives cross-country differences in nursing home care use between these two European countries and the US. Understanding the impact of different drivers on care use can aid policy makers when considering different LTC scenarios.

Background – differences in determinants of nursing home use

We distinguish between two general determinants of nursing home use. The first is the demand for services, which include factors such as the health of the population, prices, and income or wealth; the second is related to the supply of nursing home services, which are more likely to depend on country-level organizational factors including nursing home supply, reimbursement rates, and eligibility criteria. We consider each in turn.

The most important demand factor is the level of disability in terms of cognitive and functional impairments. Therefore, we expect higher nursing home admission rates and longer-term nursing home stays in countries with a greater share of frail individuals. Evidence suggests that seniors in the US report more disabilities at younger ages (Barczyk & Kredler, 2019) and lower levels of physical and mental health than their European counterparts at all socioeconomic levels (Avendano et al., 2009). Another important component of demand is the availability of informal support and assistance (Gaugler et al., 2007; Luppa et al., 2010; de Meijer et al, 2009); a greater supply of informal care (a substitute for nursing home care) is therefore predicted to reduce the demand for long-term nursing home care.

Demand is also affected by income and wealth. Various economic models for example view older adults as principals in a principal-agent setting where they can convince their children to provide care through the prospect of a bequest (e.g. Zweifel and Strüwe, 1996; Cremer & Roeder, 2017). Elders with more wealth may therefore be more likely to receive informal care. Housing wealth could in this regard act in a similar manner, as informal care by children may prevent older parents from having to spend down their housing wealth to finance a nursing home stay (Barczyk et al., 2023). Moreover, homeownership may affect nursing home care use as it can offer more possibilities to make homes accessible which may prevent health issues or allow better ways of coping with limitations (Diepstraten et al., 2020).

A second set of supply-related characteristics potentially explain differences in nursing home use at the country level. Cultural differences that help to shape LTC policies may result in differences in the availability of and eligiblity for public subsidies for nursing homes and substitute services such as home care which in turn drive decisions to use nursing home care.

Both the Netherlands and Denmark have universal, comprehensive public long-term care covering expenditures from public sources. Their public policies aim to keep older adults at home for as long as possible, if needed with formal care services and support at home. At the individual level, most of this care is provided for free, at very low rates of copayment or highly subsidized for individuals with limited income (Bakx et al., 2020; Christensen et al., 2016; Aeldresagen, 2020). In these systems, the threshold for institutionalization is relatively high: individuals must be severely disabled or dependent before they can be admitted to a nursing home (CIZ, 2023; Danish Ministry of Social Affairs, 2015). Consequently, most of the nursing home stays imply a permanent move for someone in the last years of life. Next to these longer-term nursing home stays, Dutch nursing homes provide short-stay nursing home care, for example for rehabilitation care after a medical event (De Groot & Vreeburg, 2019). In Denmark, such rehabilitative services are not delivered in nursing homes, but provided within the hospital setting, in outpatient-settings such as rehabilitation centers or at home (WHO, 2019).

The American LTC system is quite different. Home and nursing home care is either (i) self-funded out-of-pocket or via private LTC insurance; (ii) covered by Medicaid for individuals with low income and wealth or (iii) covered by Medicare (Osterman, 2017). However, Medicare coverage for both home care and nursing home care is limited. Home care coverage is almost exclusively restricted to nursing to treat an illness or injury, while personal care, activities and home help are not covered. Nursing home care is fully covered, but only for the first 20 days of nursing home care after a hospital discharge, after which a copayment of 164.5 USD/day is to be paid up to 100 days of nursing home use (US Department for Health and Human Services, 2020a). Medicaid beneficiaries are entitled to home care, including personal care, and nursing home care (US Department for Health and Human Services, 2020b), although waiting lists are a potential barrier (Musumeci et al, 2019). These policy differences are likely to affect both the demand for short- versus long-term care (as the copayment is imposed only after 20 days, and Medicare coverage ends after 100 days), and the supply, as Medicaid reimbursement rates for long-term stays are lower than Medicare rates. Table 1 provides an overview of the most important population and system related differences between the three countries, demonstrating that in the US there is a higher percentage of people aged 65+ who need at least 3 h of care per day, a higher rate of out-of-pocket payments, and a lower level of spending for formal LTC.

Data and methods

Data and sample selection

We use data from the Health and Retirement Study (HRS) for the United States and SHARE for the Netherlands and Denmark. Both datasets are panel surveys collecting individual level data on health,

Table 1
Aggregate-level statistics.

	United States	Netherlands	Denmark
Share of population 65+	15.6	18.7	19.2
Share of population 80+	3.8	4.5	4.4
Share of population 65+ who needs at least 3 h of care a day[1]	11.9	9.6	9.6
Formal LTC expenditures (only health component) (% of GDP) (2014)[2]	0.9	3.0	2.5
Formal LTC beds in facilities & hospitals per 1000 individuals aged 65+	34.6	76.4	48.9
Formal LTC recipients in institutions (% 65+) 2014[2]	2.5	5.3	3.9
Formal LTC recipients at home (% 65+) 2014[2]	8.8	13.1	12.2
OOP spending on formal LTC as share of health spending on LTC[3]	27	8	8
Share of 50+ population providing informal care weekly	7	12	10

Source: Results based on OECD (2019a) unless specified otherwise 1. Based on SHARE/HRS data from Barczyk & Kredler (2019) 2. Based on 2014 data from OECD (2020). 3. Based on 2016 data from OECD (2019b).

socio-economic status and personal characteristics for persons aged 50+ and their spouses. The HRS began in 1991, and SHARE was developed in 2004 closely following the design of the HRS (Juster & Suzman, 1995; Börsch-Supan & Jürges, 2005). For all three countries, we use the data collected in 2012/2013 (wave 11 in HRS and wave 5 in SHARE) as baseline information. Our focus is on individuals aged 65 and older who were not living in a nursing home at the time of answering the survey. Answers are either self-reported or based on a proxy-interview in case the individual was not able to respond personally.

For the Netherlands and Denmark, we exploit the unique feature that – only for these two countries – the SHARE data were linked to administrative data on nursing home use of respondents in the two calendar years after the survey. Linkage to administrative data to capture nursing home admissions in Denmark and the Netherlands is essential (i) because SHARE only asks for nursing home use in the previous year (instead of the two years between the survey waves in the HRS) and (ii) to avoid the underrepresentation of residents of nursing homes that has been observed in SHARE surveys (De Luca et al., 2015; Barczyk & Kredler, 2019).

While the surveys are set up in a very similar manner, there are small differences between the used administrative and survey datasets. First, of all, there are differences in the type of nursing home admissions included. The HRS captures both short and longer-term nursing home stays by asking respondents whether they have been a patient overnight in a nursing home, convalescent home, or other long-term health care facility. For the Danish sample this distinction cannot be made as the Danish administrative data predominantly captures individuals who made a permanent move to a nursing home (by means of registering a new permanent address). The Dutch administration data does capture both short and longer-term nursing home stays, however we miss information regarding rehabilitative care for 2015. While this missing data might lead to an underestimation of the nursing home admission rate (especially regarding short-term admissions), we argue that this is limited because: (a) We only miss observations on this type of care for 2015, in 2014 short-term admissions were still present in our data; (b) about 25% of these users are captured in our data as they transfer to 'regular' nursing home use after making use of *eerstelijnsverblijf* (CIZ, 2015). Moreover, for this type of care, the length of stay is not recorded in the administrative datasets we use, solely the cost of this type of care paid by the health insurer. We estimate the average cost of one day of rehabilitative care based on nationally set integrated tariffs which are based on care duration. More information about these differences can be found in Appendix A1.

A second difference between the HRS and Dutch and Danish administrative data is the observation period of nursing home use. In HRS the observation period of nursing home use is defined as the time between two interviews. In the Dutch and Danish data, it is not possible to set the observation period of nursing home admissions to two years after the interview: The Danish nursing home information in 2013 and the Dutch data for rehabilitative care do not contain entry/exit dates. For the Dutch and Danish samples, the observation period is therefore set to the two calendar years after the survey. Additional robustness checks presented in Appendix A2 show that this approach does not seem to affect the used nursing home rates strongly.

Lastly, while the linkage between administrative and survey data allows us improved insight into nursing home care use, some underrepresentation of nursing home respondents might still be present in the linked SHARE data. A comparison of the SHARE samples with the overall Danish and Dutch 65+ population shows that the share of nursing home users is lower in the sample than in the study population, although the sample shows to be representative for the overall population in terms of home care use (see Appendix A3).

Outcome: Nursing home admissions two years post-survey

Our main outcome variable is a binary variable indicating admission to a nursing home for at least one day in the two years after responding to HRS/SHARE. For Dutch and Danish results, we use administrative data regarding nursing home use. For the US sample, we do not use administrative data, but derive this variable based on data collected in the next wave (wave 12); we include data from the regular survey as well as information based on exit interviews with relatives in case individuals died between the two waves.

There is an important distinction between post-acute nursing home care that lasts for only a few weeks or months versus long stay admissions that are of a more permanent nature. Therefore, we distinguish between three definitions of the outcome: (1) any nursing home stay, (2) a nursing home stay of at least 20 days and (3) a nursing home stay of at least 100 days. For the Danish sample, we restrict ourselves to nursing home stays of at least 100 days, given data limitations as discussed above.

In all cases, the variables indicating nursing home admissions represent a mix of more permanent nursing home care, as well as shorter-term nursing care mostly for rehabilitative purposes if these services are provided in that country. While LTC systems and hence the length of a typical nursing home stay differ per country, we compare like with like, i.e. all registered nursing home admissions for a certain duration of stay. The small samples of the Dutch and Danish elderly population do, however, limit the statistical power of the study as in both samples only a very small proportion of the respondents is admitted to a nursing home in the two years after responding to the survey.

Disability index

One of the main determinants of a nursing home admission is disability (De Meijer et al., 2009). To compare disability levels across countries, we construct a disability index (DI), a variable that captures someone's level of disability. We create this variable based on multiple variables regarding difficulties with (instrumental) activities of daily living (ADLs and iADLs) and mobility using principal component analysis (see Table A4 in the appendix for an overview of the used variables). Both surveys ask respondents identically worded questions on these topics, and HRS and SHARE have shown to exhibit measurement equivalence for ADL and iADL questions (Chan et al., 2012). To construct the disability score we use the first component of a polychoric principal component analysis as we are dealing with binary variables (Kolenikov & Angeles, 2004). For every country we separately construct a disability index, these indices are assumed to be comparable as we construct them using the same variables (Vyas & Kumaranayake, 2006). The index is rescaled from 0 (non-disabled) to 10 (severely disabled) and categorized to allow for nonlinearity of the relationship between disability and LTC use. We identify four levels of disability: no disabilities ($DI = 0$); mild disabilities ($0 > DI < 2$); moderate disabilities ($2 \geq DI < 5$); severe disabilities ($DI \geq 5$).

Other covariates

We include age, gender, level of education, income, homeownership, and housing wealth to capture differences in demographics and socio-economic status (SES). In addition, we construct a dummy variable indicating memory problems based on the immediate word recall task. As proxy respondents did not perform the word recall task, we also include a variable indicating a proxy interview. We follow variable harmonization guidelines (Beaumaster et al., 2017; 2018) to assure comparability between the surveys. An overview of the constructed variables and their comparability across surveys can be found in Appendix A5.

Model specification and decomposition analysis

We estimate the probability of any and longer-term nursing home admissions in the next two years conditional upon not being

Table 2
Descriptive statistics sample populations (community dwelling population aged 65+).

	United States (1)	Netherlands (2)	Diff. (3) = (1)-(2)	Denmark (4)	Diff. (5) = (1)-(4)
Dependent variable					
% of 65 + individuals admitted to nursing home in coming two years	6.2%	4.4%	***	NA	
- % of 65 + admitted for > 20 days	3.2%	3.9%		NA	
- % of 65 + admitted for > 100 days	1.2%	1.9%	**	1.8%	**
Explanatory variables					
Age 65–74	62.8%	61.3%		60.6%	*
Age 75 – 84	29.6%	30.2%		30.0%	
Age 85+	7.6%	8.5%		9.4%	**
Female	53.4%	53.6%		53.5%	
Partner in household	62.8%	61.9%		61.0%	
Household income – < $15,000	30.2%	15.0%	***	10.3%	***
Household income –$15,000 – $35,000	43.2%	68.0%	***	72.9%	***
Household income > $35,000	26.7%	17.0%	***	16.8%	***
Homeownership (yes)	84.8%	59.9%	***	45.3%	***
Value House in $100,000s[1]	1.90	2.21	***	2.39	***
Education Low	48.7%	55.9%	***	25.8%	***
Education Mid	24.1%	21.7%	**	39.7%	***
Education High	27.2%	22.4%	***	34.5%	***
Disability level 1 – no disabilities	28.7%	52.9%	***	52.6%	***
Disability level 2 – mild disabilities	49.5%	38.6%	***	36.4%	***
Disability level 3 – moderate disabilities	18.6%	7.2%	***	8.0%	***
Disability level 4 – severe disabilities	3.1%	1.3%	***	3.0%	
Having memory problems	11.1%	15.6%	***	12.7%	*
Proxy interview	3.4%	1.0%	***	0.9%	***
N	6,553	1,800		1,859	

Source: Authors' analysis of weighted 2012/2013–2014/2015 data from SHARE, HRS and Dutch and Danish administrative data. Notes: Weighted results. All values are converted to PPP adjusted 2013 dollars. 1. Value House 100 K is unconditional of homeownership, the conditional mean can be calculated using the variable 'Homeownership'. Diff. column represents p-values of t-tests regarding the difference between US and Dutch and US and Danish results. *p < 0.10, ** p < 0.05 *** p < 0.01.

institutionalized in the 2012/2013 survey wave using a logit prediction model with socio-demographic characteristics, level of education, memory and the disability index included as determinants of nursing home admission. To ensure representativeness of our sample to the overall population in terms of demographic characteristics, we apply sampling weights provided by HRS/SHARE.

After estimating the probability of different durations of nursing home admissions, we use decomposition models to study the US-Netherlands difference in the probability of *any* nursing home admission. Given that the Danish data only captures longer-term nursing home stays, Danish results cannot be used for this comparison. The models decompose differences into (i) one part that is due to compositional differences between the groups and (ii) another part that is attributable to differences in the effects (or coefficients) of these characteristics. As we use nonlinear non-additive prediction models, the standard Oaxaca decomposition model does not hold. We therefore use the following decomposition model adjusted for a binary dependent variable, as proposed by Yun (2004):

$$\overline{NH}_{NL} - \overline{NH}_{US} = \sum_{i=1}^{i=K} W^i_{\Delta X}[\overline{F(X_{NL}\beta_{NL})} - \overline{F(X_{US}\beta_{NL})}] + \sum_{i=1}^{i=K} W^i_{\Delta\beta}[\overline{F(X_{US}\beta_{NL})} - \overline{F(X_{US}\beta_{US})}]$$

$$\overline{NH}_{NL} - \overline{NH}_{US} = \overline{F(X_{NL}\beta_{NL})} - \overline{F(X_{US}\beta_{US})} =$$

$$[\overline{F(X_{NL}\beta_{NL})} - \overline{F(X_{US}\beta_{NL})}] + [\overline{F(X_{US}\beta_{NL})} - \overline{F(X_{US}\beta_{US})}]$$

Here NH represents the probability of a nursing home admission in the next two years, X and β represent vectors of covariates and coefficients and F represents the logit function. The first part of the equation represents the contribution of the differences in covariate means to the overall difference whereas the second part represents the contribution of the difference in estimated coefficients.

In our analysis we thus decompose the difference in nursing home admission rates between the US and the Netherlands into a part that results from differences in the covariates such as the age distribution and disability levels of the 65+ population in both countries, and a part that captures differences in regression coefficients. Following earlier papers (Bakx et al., 2015; Heger & Korfhage, 2018), we interpret the latter differences as differences in the way culture and health system features affect nursing home admissions.

We further disentangle these differences by separately estimating the contribution of each variable. To weigh the contribution of every variable to both effects we conduct this detailed decomposition using a Taylor expansion to linearize the effects at the sample averages as proposed by Yun (2004). We generate weights W that weigh the contribution of each variable to the endowments and coefficients effects:

The weights are calculated as follows:

$W^i_{\Delta X} = \frac{(\overline{X}^i_{NL} - \overline{X}^i_{US})\beta^i_{NL}}{(\overline{X}_{NL} - \overline{X}_{US})\beta_{NL}}$ and $W^i_{\Delta\beta} = \frac{\overline{X}^i_{US}(\beta^i_{NL} - \beta^i_{US})}{\overline{X}_{US}(\beta_{NL} - \beta_{US})}$, where both weights equal 1 (Yun, 2004).

We normalize the contribution of differences in coefficients of dummy variables and calculate standard errors using the delta method (Yun, 2008).

We examine the sensitivity of our results to excluding proxy-respondents from the analysis and to a different classification of

education. This different classification (see Appendix Table A7.2) mainly entails a difference in classifying American high school as either low of middle education level and hence affects the distribution of personal characteristics of our samples. Additionally, we perform the decomposition in 'reverse' order using the other country (i.e. the Netherlands) as the reference point.

Results

Descriptive analysis

The overall probability of a nursing home admission in the two years after the survey interview is much higher in the US (6.2%) than in the Netherlands (4.4%) (Table 2), but these admissions are more likely to be for short spells. For example, for rehabilitative purposes after discharge from a hospital, nearly half of the US admissions last less than 20 days versus less than one-eighth of admissions in the Netherlands. When comparing longer-term nursing home stays (>100 days), the admission rate is higher in both European countries than in the US.

Nearly all population characteristics are statistically significantly different in the US versus the Netherlands and Denmark (Table 2). On average, the US sample, while slightly younger, reports greater disability than the two European samples. By contrast, the Dutch and Danish report dealing with memory problems more often. Homeownership is much more common in the US sample compared to the Netherlands and Denmark, while income is more unequally distributed in the US. Differences in the community residing population may be due to differences in the share of long-term nursing home stays, as in both European countries the frailest elders are more likely to be living in a nursing home.

Determinants of nursing home admissions

Using logit regressions, we estimate which characteristics are associated with the probability of admission to a nursing home in the subsequent two years separately for the Netherlands and the US. As nonlinearity complicates interpretation of coefficients, we depict the average partial effects (Fig. 1), the underlying results can be found in Appendix 6. The results indicate that being over 85 years old (compared to the 65–74 age group) is associated with a 5–8 percentage point higher probability of a nursing home admission. Additionally, the more severe the disabilities one faces, the larger the probability of a nursing home admission. Other health-related factors, as captured in either memory problems or inability to answer the survey independently, are also positively associated with an admission.

When only considering longer-term nursing home stays, we can include Denmark in the comparison. For these longer-term nursing home admissions, the US admission rate is lower than in the Netherlands and Denmark. Most results remain rather similar, with a few exceptions (Appendix A6). For individuals facing severe disabilities, compared to those without any disabilities, the probability of a long-term stay in the US is 3.2%, far below the likelihood in the Netherlands (9.5%). Additionally, individuals aged 75–84 (compared to those aged 65–74) face an increased probability of nursing home admission of 0.9% in the US,

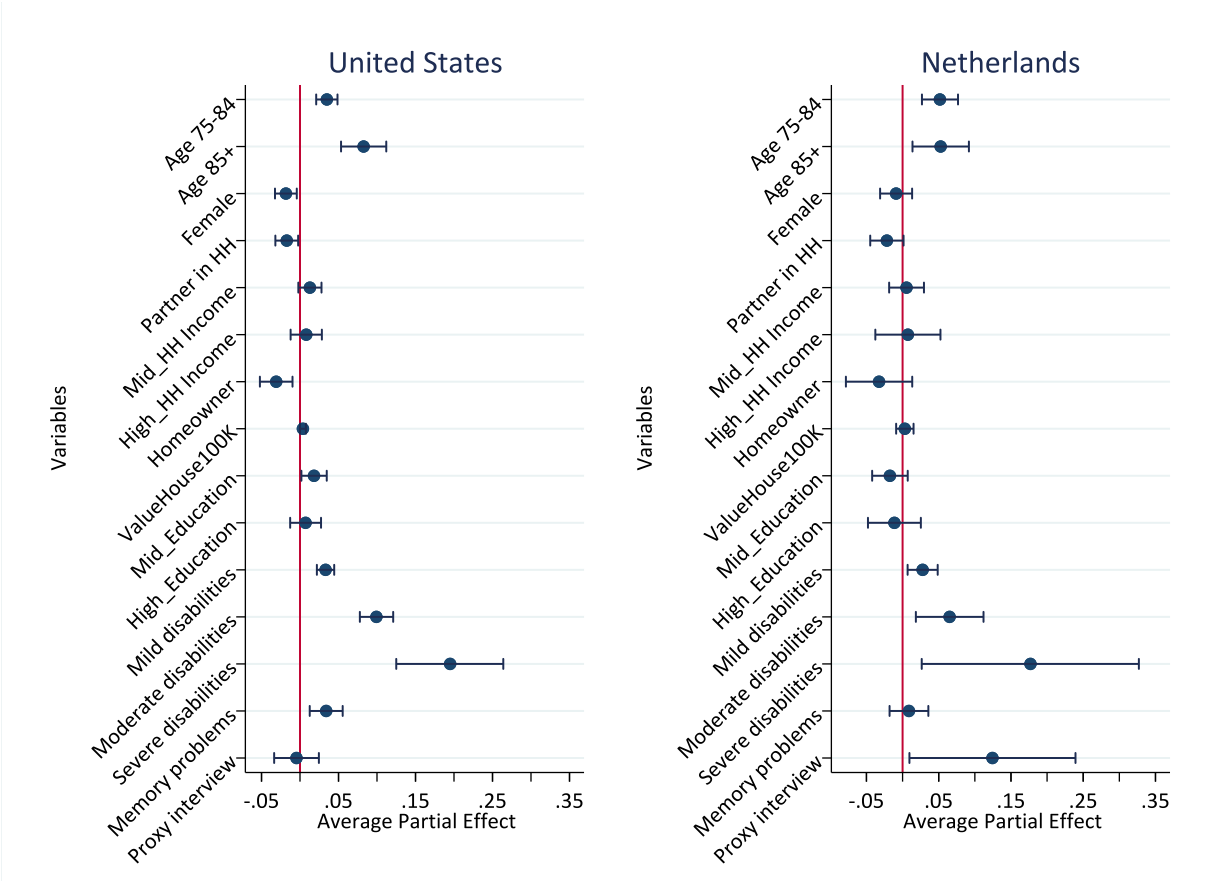

Fig. 1. Average partial effects of covariates on likelihood of nursing home admission Source: Authors' analysis of weighted 2012/2013–2014/2015 data from SHARE, HRS and Dutch administrative data. Notes: The relevant horizon is over the next 2 years. The graphs present the average partial effects (APEs) with confidence intervals depicted at 95%. The APE represents the effect of a 1 unit (representing a change from 0 to 1 for dummy variables) increase of a specific variable on the probability of being admitted to a nursing home. All variables are categorical/dummy variables except the continuous variable "ValueHouse100K". Coefficients, standard errors and average partial effects are also reported in Table A6.3.

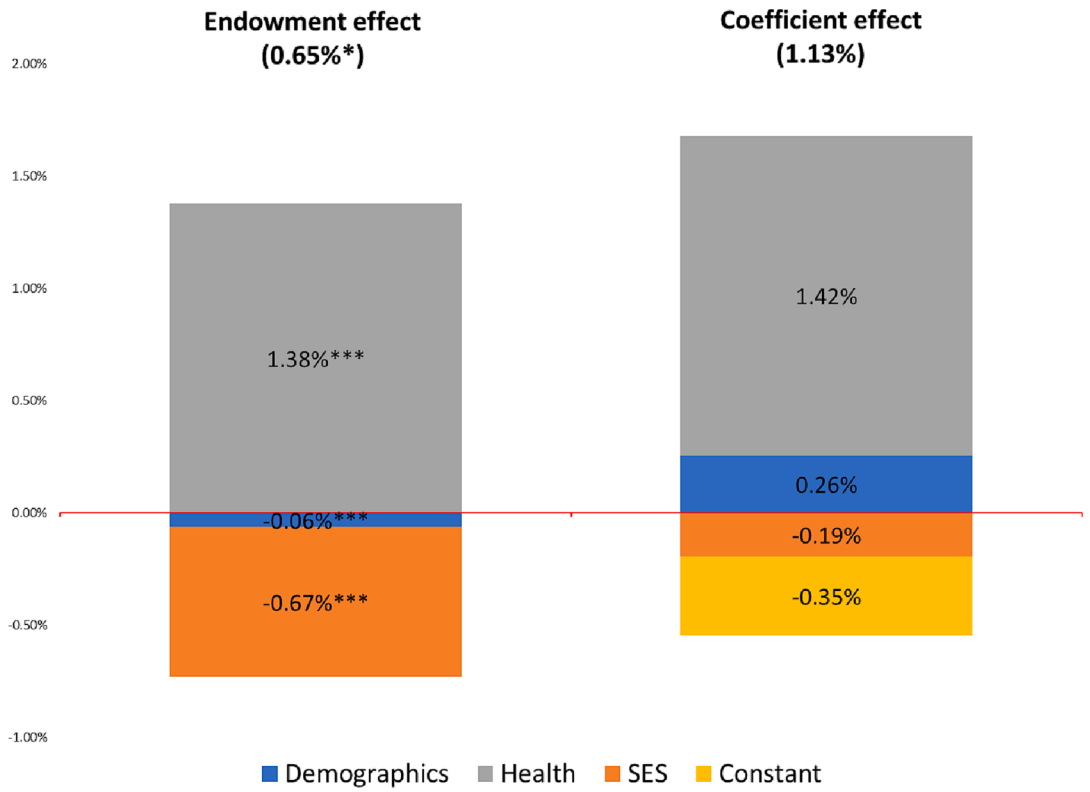

Fig. 2. Decomposition. Contributions to the 1. 8 percentage point difference in nursing home admission rates (US rate – Dutch rate), by explanatory variable subgroups (in percentage points) Source: Authors' analysis of weighted 2012/2013–2014/2015 data from SHARE, HRS and Dutch administrative data. Notes: Graphs represent results of decomposition; underlying estimates can be found in Appendix A6. Results are based on 1,800 Dutch and 6,553 American observations. The endowment and coefficient effect represent the overall value of the difference that can be attributed to either the composition of the countries or the system differences. The characteristics are presented in 4 broad categories: demographics (including age, gender, partner), socio-economic status (SES) (income, homeownership, value of residence, education), health (DI, cognition, proxy respondent) and the intercept. Weighted results. *p < 0.10, ** p < 0.05 *** p < 0.01.

compared to 2.3% and 2.6% in the Netherlands and Denmark.

Decomposing differences in nursing home admission rates

The overall difference in the nursing home admission rate between the US and the Netherlands is 6.2% – 4.4% = 1.8 percentage points. What drives this higher rate in the US? Fig. 2 indicates the extent to which this difference can be explained by (i) differences in the mean characteristics of the samples (the endowment effect) and (ii) differences in the estimated association of these characteristics with the admission probability (the coefficient effect).

As shown in Fig. 2, 36% of the difference (0.65 percentage points) is explained by compositional differences between both countries' populations. That is, the US sample admission rate would be 0.65 percentage points lower if they had the same (observed) characteristics as the Dutch sample, largely because of health differences. If the US sample had the same *health* characteristics as the Dutch, its admission rate would decrease by 1.38 percentage points, but this effect is offset partially by *SES* (defined by income, homeownership, value of residence and education) and *demographic characteristics* (age, gender and partner). Related to the SES characteristics, the results are predominantly driven by the higher share of homeowners in the US, whereas with regards to demographics the sample in the US is slightly younger than the Dutch. The largest share, 64% of the difference (1.13 percentage points) in nursing home admission rates can be attributed to country-specific differences in coefficients, owing to cultural norms, health systems and social support/policies.

As sensitivity analyses, we conducted decomposition in reverse order and two other decompositions where we (i) exclude proxy-respondents and (ii) use an alternative definition of the level of education. These alternative decompositions present a qualitatively similar picture in terms of the main conclusion that differences in admission rates are predominantly driven by differences in coefficients (Appendix 7).

Conclusion and discussion

We have used highly comparable survey data from the US, Netherlands, and Denmark to study differences in nursing home admission rates across the three countries. We set out to better understand the puzzle that more Dutch and Danish seniors are residing in a nursing home, while US seniors are more likely to be admitted to a nursing home. This seemingly counterintuitive fact can be explained, in part, by the higher rates of disability among US community residing elders, but system differences also play a role. Short-term nursing home admissions of individuals with moderate disability, for example post-acute care after hospital discharge, are more common in the United States. These findings highlight the importance of distinguishing between different types of nursing home care; the separation of admission to short (often post-acute) and longer-term nursing home stays turns out to be critical for understanding the differences between US and European nursing home admission rates.

Our findings are consistent with the importance of demand-side pricing mechanisms explaining why the US is so different from Denmark and the Netherlands; that coinsurance rates for the US Medicare program favor short-term stays and discourage long-term stays is likely related to the sharply different patterns of nursing home utilization in the US compared to the other two countries. Similarly, higher rates of homeownership in the US also appear to reduce the use of longer-term formal LTC (Barczyk et al., 2023).

Our findings may be interpreted in three different ways. First, they

may imply potential overuse of short-term nursing home care by US older adults for lack of (affordable) alternatives in outpatient or home care. Other studies indeed report that short-term admissions in the US have been increasing (Hurd et al., 2017), which might partly be driven by nursing homes admitting short-term Medicare residents, which is attractive as these are associated with higher profit margins (Grabowski, 2007). Second, the higher rate of post-acute admissions in the US may be caused by a higher propensity to admit older adults to a hospital at the end of their life. French et al. (2017) suggest that hospital expenditures account for roughly 46% of medical spending in the last year of life in the US compared to 36% of expenditures in the Netherlands, indicating a higher need for post-acute care. Third, the results could also imply underuse of short-term nursing home stays in the European countries. In the Netherlands, for example, the number of older people entering acute care in hospitals is rising (NZa, 2017). Some speculate that some of these (re)admissions may be avoided by organizing more integrated home care and short-stay facilities for these older patients (Buurman-van Es, 2020).

Our findings have several potential policy implications. First, the European countries make much less use of nursing home care for post-acute events; this is most likely to be related to better availability of home care supply but may also derive from weaker financial incentives in Denmark and the Netherlands for post-acute admissions. Given the evidence that excessive post-acute care may be negatively associated with health outcomes (Doyle et al., 2017), our findings suggest that the experience of the two European countries holds some lessons for the redesign of US post-acute care incentives. Second, in case it is not fully driven by financial barriers, the lower reliance of American elders on longer-term care stays may also indicate a potential for the Dutch and Danish to be cared for at home more often. The decision to stay home, however, comes with a trade-off: while most individuals prefer to stay living at home as long as possible, it also comes with more frequent hospitalizations and associated post-acute short-term nursing home admissions which may also be undesirable for individuals in their last years of life.

All in all, ageing populations highlight the importance of understanding the determinants of nursing home admission rates. The paradox that in the US compared to the Netherlands and Denmark, older adults are more likely be admitted to a nursing home is explained in part by the higher rates of disability among US seniors, but also because most US admissions are for much shorter (post-acute) stays than is typically the case in the Netherlands and Denmark. Such short-term nursing home stays might lead to worse health outcomes (Doyle et al., 2017), suggesting the need for the US to consider alternative ways of delivering post-acute care.

Funding

This study received financial support from the Network for Studies on Pensions, Ageing and Retirement Grant optimal saving and insurance for old age: The role of public-long term care insurance. Gørtz received funding from the Novo Nordisk Foundation (grant no. NNF17OC0026542) and the Danish National Research Foundation (grant DNRF-134).

CRediT authorship contribution statement

Judith Bom: Conceptualization, Formal analysis, Writing – original draft. **Pieter Bakx:** Conceptualization, Formal analysis, Writing – review & editing. **Eddy van Doorslaer:** Conceptualization, Writing – review & editing. **Mette Gørtz:** Conceptualization, Formal analysis, Writing – review & editing. **Jonathan Skinner:** Conceptualization, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We gratefully acknowledge valuable contributions to this study from Julie Uldum Lyhr. Additionally, we acknowledge comments to earlier versions of this paper provided by Marianne Tenand. This study received financial support from the Network for Studies on Pensions, Ageing and Retirement Grant *optimal saving and insurance for old age: The role of public-long term care insurance.*

Data acknowledgements

This paper uses data from several sources. For the US data, data from wave 11 and 12 of the Health and Retirement Study is used. This dataset is produced and distributed by the University of Michigan with funding from the National Institute on Aging (grant number NIA U01AG009740). Ann Arbor, MI. It uses data from RAND HRS Longitudinal File 2014 V3 (2019) and RAND HRS Tax Calculations 2014 V2 (2018) produced by the RAND Center for the Study of Aging, with funding from the National Institute on Aging and the Social Security Administration. Santa Monica, CA.

For the European data the paper uses data from SHARE Wave 5 (DOI: 10.6103/SHARE.w5.700), see Börsch-Supan et al. (2013) for methodological details. The SHARE data collection has been funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N°211909, SHARE-LEAP: GA N°227822, SHARE M4: GA N°261982) and Horizon 2020 (SHARE-DEV3: GA N°676536, SERISS: GA N°654221) and by DG Employment, Social Affairs & Inclusion. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the US National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C) and from various national funding sources is gratefully acknowledged *(see www.share-project.org)*.

The Dutch SHARE results are linked to Dutch administrative data using non-public microdata from Statistics Netherlands (CBS). Under certain conditions and a confidentiality agreement, these microdata are accessible for statistical and scientific research. For further information: microdata@cbs.nl. Exploitation of the data and publication of the results are made in compliance with the European privacy legislation (GDPR, May 25th 2018).

The Danish SHARE results has been linked to several Danish administrative registers through social security numbers. Physically these administrative micro data are located on specific computers at Statistics Denmark and may not be transferred to computers outside Statistics Denmark due to data security considerations. Researchers and their research assistants are allowed to use these data under certain conditions and a confidentiality agreement, if their research project is approved by Statistics Denmark, and if they are affiliated with a research institution accepted by Statistics Denmark. For further information: https://www.dst.dk/da/TilSalg/Forskningsservice/brug-af-forskermaskiner.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jeoa.2023.100456.

References

Aeldresagen, 2020. Nursing homes. https://www.aeldresagen.dk/viden-og-raadgivning/hjaelp-og-stoette/plejebolig-og-plejehjem.

Avendano, M., Glymour, M., Banks, J., Mackenbach, J., 2009. Health disadvantage in US adults aged 50 to 74 years: a comparison of the health of rich and poor americans with that of Europeans. Am. J. Public Health 99 (3). https://doi.org/10.2105/AJPH.2008.139469.

Bakx, P., De Meijer, C., Schut, F., Van Doorslaer, E., 2015. Going formal or informal, who cares? The influence of public long-term care insurance. Health Econ. 24, 631–643. https://doi.org/10.1002/hec.3050.

Bakx, P., Bom, J., Tenand, M., Wouterse, B., 2020. Eigen bijdrage aan ouderenzorg. Netspar Design Paper 13. https://www.netspar.nl/publicatie/eigen-bijdrage-aan-ouderenzorg/.

Barczyk, D., Kredler, M., 2019. Long-term care across Europe and the United States: the role of informal and formal care. Fisc. Stud. 40 (3), 329–373. https://doi.org/10.1111/1475-5890.12200.

Barczyk, D., Fahle, S., Kredler, M., 2023. Save, spend or give? A model of housing, family insurance, and savings in old age. Forthcoming Rev. Econ. Stud.

Beaumaster, S., Chien, S., Lau, S., Lin, A., Meijer, E., Phillips, D., et al., (2017). Harmonized SHARE Documentation. Version D2 2017. USC Dornsife, Centre for Economic and Social Research, Program on Aging, Health, and Policy.

Beaumaster, S., Chien, S., Crosswell, A., Lin, A., Phillips, D., Valev, M., et al., (2018). Harmonized HRS Documentation. Version B 2018. USC Dornsife, Centre for Economic and Social Research, Program on Aging, Health, and Policy.

Börsch-Supan, A., & Jürges, H. (2005). The Survey of Health, Aging, and Retirement in Europe – Methodology. http://www.share-project.org/fileadmin/pdf_documentation/ Methodology/Methodology_2005.pdf.

Buurman-van Es, B., 2020. Kortdurende zorg bij ouderen als antwoord op spoedzorg. *Huisarts en Wetenschap,* 63 (1), 37-40. Doi:10/10.1007/s12445-019-0362-x.

Chan, K.S., Kasper, J.D., Brandt, J., Pezzin, L.E., 2012. Measurement equivalence in ADL and IADL difficulty across international surveys of aging: findings from the HRS, SHARE, and ELSA. J. Gerontol. B Psychol. Sci. Soc. Sci. 67 (1), 121–132.

Christensen, B.J., Gørtz, M., Kallestrup-Lamb, M., 2016. Medical spending in Denmark. Fiscal studies 37 (3–4), 461–497. https://doi.org/10.1111/j.1475-5890.2016.12119.

CIZ (2015). Eerstelijnsverblijf. Gebruik subsidieregeling 2015.

CIZ (2023). Beleidsregels Wet langdurige zorg. https://www.ciz.nl/zorgprofessional/over-de-wlz/beleidsregels-wet-langdurige-zorg.

Cremer, H., Roeder, K., 2017. Long-term care policy with lazy rotten kids. J. Public Econ. Theory 19, 583–602.

Danish Ministry of Social Affairs (2015). Consolidation act on social services no. 2015-4958. http://english.sm.dk/media/14900/consolidation-act-on-social-services.pdf.

de Groot, A.J., Vreeburg, E.M., 2019. Geriatrische revalidatiezorg: samen werken aan herstel! Bijblijven: tijdschrift praktische huisartsengeneeskunde 35 (2), 8–14. https://doi.org/10.1007/s12414-019-0016-8.

De Luca, G., Rossetto, C., Malter, F., 2015. "Sample design and weighting strategies in SHARE Wave 5". In: SHARE Wave 5: Innovations & Methodology. Munich: MEA, Max Planck Institute for Social Law and Social Policy: 75–84.

de Meijer, C.A.M., Koopmanschap, M.A., Koolman, X.H.E., van Doorslaer, E.K.A., 2009. The role of disability in explaining long-term care utilization. Med. Care 47 (11), 1156–1163. https://doi.org/10.1097/MLR.0b013e3181b69fa8.

Diepstraten, M., Douven, R., Wouterse, B., 2020. Can your house keep you out of a nursing home? Health Econ. 29 (5), 540–553.

Doyle Jr, J.J., Graves, J.A., Gruber, J., 2017. Uncovering waste in US healthcare: evidence from ambulance referral patterns. J. Health Econ. 54, 25–39.

French, E.B., McCauley, J., Aragon, M., Bakx, P., Chalkley, M., Chen, S.H., Fan, E., 2017. End-of-life medical spending in last twelve months of life is lower than previously reported. Health Aff. 36 (7), 1211–1217.

Gaugler, J.E., Duval, S., Anderson, K.A., Kane, R.L., 2007. Predicting nursing home admission in the U.S: a meta-analysis. BMC Geriatr. 7 (13) https://doi.org/10.1186/1471-2318-7-13.

Grabowski, D.C., 2007. Medicare and Medicaid: conflicting incentives for long-term care. Milbank Q. 85, 579–610.

Heger, D., Korfhage, T., 2018. Care choices in Europe: to each according to his or her needs? INQUIRY: The Journal of Health Care Organization, Provision and Financing 55, 1–16.

Hurd, M. Michaud, P., Rohwedder, S. (2017). Distribution of lifetime nursing home use and of out-of-pocket spending. *PNAS,* 12, 114 (37) 9838-9842. doi: 10.1073/pnas.1700618114.

Juster, F.T., Suzman, R., 1995. An overview of the Health and Retirement Study. J. Hum. Resour. 30 (suppl), S7–S56. https://doi.org/10.2307/146277.

Kolenikov, S., Angeles, G. (2004). The use of discrete data in PCA: theory, simulations, and applications to socioeconomic indices. Chapel Hill: Carolina Population Center, University of North Carolina, 20, 1-59.

Luppa, M., Luck, T., Weyerer, S., König, H.-H., Brähler, E., Riedel-Heller, S.G., 2010. Prediction of institutionalization in the elderly. A systematic review. Age and Ageing 39 (1), 31–38. https://doi.org/10.1093/ageing/afp202.

Musumeci, M., Chidambaram, P., O'Malley Watts, M., 2019. Key Questions About Medicaid Home and Community-Based Services Waiver Waiting Lists. Kaiser Family Foundation. https://www.kff.org/medicaid/issue-brief/key-questions-about-medicaid-home-and-community-based-services-waiver-waiting-lists/.

NZa (2017). Marktscan acute zorg 2017. https://puc.overheid.nl/nza/doc/PUC_3650_22/.

OECD (2019a). Health at a Glance 2019: OECD Indicators, OECD Publishing, Paris, doi: 10.1787/4dd50c09-en.

OECD (2019b). Focus on Out-of-Pocket Spending: Access to care and Financial protection. https://oecd.org/health/health-systems.

OECD (2020). Long-Term Care Resources and Utilisation. https://stats.oecd.org/.

Osterman, P., 2017. Who Will Care for Us? Long-term Care and the Long-term Workforce. Russell Sage Foundation, New York.

US Department for Health and Human Services (2020a). Medicare. https://acl.gov/ltc/medicare-medicaid-and-more/medicare.

US Department for Health and Human Services (2020b). State Medicaid programs. https://acl.gov/ltc/medicare-medicaid-and-more/medicaid/medicaid-long-term-care-services.

Vyas, S., Kumaranayake, L., 2006. Constructing socio-economic status indices: how to use principal components analysis. Health Policy Plan. 21 (6), 459–468.

Who cares? The pandemic shows the urgency of reforming care for the elderly. (2020, July 25). *The Economist.* https://www.economist.com/international/2020/07/25/the-pandemic-shows-the-urgency-of-reforming-care-for-the-elderly.

World Health Organization (2019). Denmark. Country case study on the integrated delivery of long-term care. https://www.euro.who.int/en/health-topics/Life-stages/healthy-ageing/publications/country-case-studies-on-the-integrated-delivery-of-long-term-care.

Yun, M.S., 2004. Decomposing differences in the first moment. Econ. Lett. 82, 275–280. https://doi.org/10.1016/j.econlet.2003.09.008.

Yun, M.S., 2008. Identification problem and detailed Oaxaca decomposition: a general solution and inference. J. Econ. Soc. Meas. 33 (1), 27–38.

Zweifel, P., Strüwe, W., 1996. Long-term care insurance and bequests as instruments for shaping intergenerational relationships. J. Risk Uncertain. 12 (1), 65–76.