Network for Studies on Pensions, Aging and Retirement

Netspar THESES

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Determinants of Long-Term Care Use

MSc Thesis 2010

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Master Thesis
Master in Health Economics, Policy, and Law
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Summary

As a result of population ageing, long-term care (LTC) use will increase over the next decades. To predict and influence future LTC use, we need knowledge about the determinants of long-term care use, about what determines what type of LTC people use and what explains changes (transitions) from one type of care to another. This paper studies which personal characteristics and supply conditions determine LTC use and transitions in LTC use for the 50+ population in the Netherlands.

It uses data from the first two waves of the Survey on Health, Ageing and Retirement in Europe (SHARE) and publicly available data on regional supply conditions. LTC use is analyzed using a mixed multinomial logit model with three choice alternatives: no care, informal care only, and professional care (+ informal care). Transitions are modeled using a logit model with two choice alternatives: using no care/only informal care in 2004 and using professional care (+ informal care) in 2006 or using no care/only informal care in both years.

Living alone, age, difficulties with instrumental activities of daily living (IADL) and mobility, mental and physical health increased the probability of using informal and professional LTC. Difficulties with activities of daily living (ADL), being female and not having children increased the probability of using professional LTC. Two measures of supply -the number of nursing home beds and the region of residence- affect the use of LTC as well.

The probability of a transition was higher if respondents were initially living alone or no longer living together in 2006, experienced decreased mobility or deteriorating mental or physical health, had more assets and had a higher age. A transition was also associated with improved self-assessed health, which suggests that in some cases a transition may improve general well being. Cognitive ability, urbanization, and initial use of informal care were not associated with LTC use or a transition.

In broad terms, these results corroborate the findings of previous studies. There are two notable differences, however. First, in both models ADL only has a minor effect because there is some overlap between ADL and the comprehensive mobility measure. The latter has more explanatory power and hence this model suggests that more attention should be paid to interventions aimed at mobility than to interventions aimed at ADL problems**.** Second, the measures of general health have a large effect on use and transitions in use of LTC, which suggests that ADL, IADL and mobility do not cover all aspects of disability and that investing in health reduces LTC costs. The results are in line with the eligibility criteria for publicly financed LTC and reconfirm that the social insurance system distributes LTC according to need rather than ability to pay.

1. Introduction

As a result of population ageing, long-term care (LTC) use will increase over the next decades. To predict and influence future LTC use, we need knowledge about the determinants of long-term care use, about what determines what type of LTC people use and what explains changes (transitions) from one type of care to another. This paper is about personal characteristics and supply conditions determine LTC use and transitions in LTC use for the 50+ population in the Netherlands.

I present my findings on both utilization transitions because the models used have complementing strengths. The main strength of the transition model is its dynamic perspective: it studies changes in LTC utilization over time. The utilization model has the advantage that it makes full use of all available observations and that the used panel data model corrects for unobserved heterogeneity.

Relevance

In view of ageing populations and limited public budgets, LTC financing and provision has increasingly become a source of concern in developed countries. Policy reforms have been on the political agenda in the Netherlands for more than a decade now and are politically sensitive. Aggregate LTC expenditures in the Netherlands have increased by 3 to 4 percent per year over the past decades**.** Two concerns are to keep LTC affordable in an ageing society and to provide it according to need. (SER 2008: 9, 237; Ministry of Health, Welfare and Sport, 2009: 1, 6-7)

This study aims to provide insight in patterns of LTC use and (and possibly predicts) changes in LTC consumption at the individual level in the Netherlands. As a result, it sheds light on the choices consumers made in the LTC sector given the institutional context and on the (future) allocation of LTC. As the definitions of the variables are independent of the institutional structure, they provide an objective profile of the respondent and his choices. This conclusions if this study may be used to fine-tune policy in order to improve the allocation of funding and care.

Institutional context

Despite ongoing reforms of the Exceptional Medical Expenses Act (Algemene Wet Bijzondere Ziektekosten - AWBZ) and related legislation, the way in which the financing and provision of LTC is organized in the Netherlands has largely been unchanged since the enactment of the AWBZ. Patients apply for care at the Needs Assessment Agency (Centrum

Indicatiestelling Zorg – CIZ)[1]. The CIZ decides about the applicant's eligibility on the basis of two criteria: the patient's need and the availability of informal care. These criteria are based on international classifications, e.g. the ICD-10 classification[2] for diseases and related health problems and the ICF-classification on health, functioning, disability and contextual factors such as the availability of informal care.

If a patient is deemed eligible for publicly financed LTC, he can choose whether he receives care in kind or a personal care budget. In both cases patients still pay an income-related co-payment. The personal care budget may be spent on professional care but also on informal care. (CIZ, 2009: 15; Ministry of Health, Welfare and Sport, 2007: 1) In addition to this restriction on demand, supply is restricted by regional budgets and entry restrictions that are set at the national level. Beyond this system of publicly financed care, patients are free to consume privately financed care.

Literature review

Earlier micro-level empirical studies that sought to explain LTC utilization considered need-related as well as socio-economic and demographic characteristics. While need-related differences are often perceived as legitimate sources of differences in health care utilization, socio-economic differences are regarded as an illegitimate source of inequality (Wagstaff and van Doorslaer 2000: 1810-1811). Need-related determinants were found to have a larger effect on LTC use than socio-economic and demographic differences. Manton *et al.* (2006, 2007) concluded in their longitudinal study that declining disability prevalence led to a decrease in use and costs in the United States; de Meijer *et al.* (2009) found the same positive relationship between disability and LTC use in a Dutch cross-sectional study, while correcting for socio-economic and demographic characteristics of the respondents. More specifically, elderly using institutional LTC were substantially more disabled than elderly who relied on home care; the difference in disability between home care users and elderly who did not use LTC was much smaller. In addition, they found that being female, having a higher age and living alone influenced the probability of using LTC.

Recent studies distinguished three major choice alternatives with respect to LTC utilization: no care, professional home care and institutional care (de Meijer *et al.* 2009; Weaver *et al.* 2009) or focused on one (aggregate) category of LTC, such as professional (home) care

[1] The agency that assesses eligibility has changed. Before 2005 the decision whether LTC would be financed publicly was taken by one of the regional indication offices (Regionaal Zorgkantoor).

[2] The WHO website provides more information on these classifications. On ICD-10: www.who.int/whosis/icd10. On ICF: http://www.who.int/classifications/icf/en/

(Bonsang 2009; Bolin *et al.* 2008; Manton *et al.* 2006; 2007). This study distinguished both types of LTC mentioned in the introduction - informal care and professional home care (the latter is combined with institutional care in one category) because of the complex relationship between these two types of home care.

This relationship has been described in a number of recent articles. Bolin and colleagues (2008) concluded that in European countries, informal care served as a substitute for professional care. This finding was reconfirmed by Bonsang (2009) for elderly in Europe who had minor impairments and hence only needed unskilled help. Geerlings *et al.* (2005: 112, 126), on the other hand, found evidence for two relationships between professional and informal care: informal care is not always a substitute for professional care but may also facilitate formal LTC use.

Unlike LTC utilization, which has been studied before (see above), little is known about determinants of transitions from one LTC setting to another[3]. A transition is defined as a change in the composition of the mix of care that is consumed (Geerlings *et al*., 2005: 113-114). Both Geerlings *et al*. (2005) and Glaser *et al*. (2006) studied how a change in some explanatory variables between t_0 and t_1 had affected the probability of a transition. In their study on LTC utilization by Dutch elderly, Geerlings *et al.* (2005) explained these transitions. They concluded that need factors as well as demographic and resource-related (e.g. marital status, income) factors influence the probability of a transition in the use of informal care and professional care. While Geerlings *et al*. (2005) focused on explaining and predicting transitions making use of information on changes in the respondent's illness level, Glaser *et al.* (2006) showed for the United Kingdom that a late-life marital disruption (divorce or dead) also affected the probability of a transition: it led to a loss of informal support and care and increased the probability of using professional home care.

The contribution of this study to the literature is threefold. First, it shows that the findings of these previous studies with respect to the determinants of LTC use also hold if a model is used that is not affected by the IIA assumption and that makes use of the panel structure of the data to correct for unobserved heterogeneity. Second, it shows that the probability of a transition from using no professional care to using professional care is affected by the initial disability status, initial household composition, use of informal care as well as changes in disability status and household composition. Third, it considers supply conditions as independent variables.

Outline

The remainder of this article is organized as follows. Section 2 discusses the data set used, and provides an overview of the methods applied to achieve the goals set out in the introduction. In Section 3 the empirical results are presented; section 4 discusses these results and limitations of this study as well as their implications.

2. Methods

I first simultaneously analyzed use of no LTC, informal care, and professional care among a sample of the Dutch 50+-population. Next, I examined transitions in the use of care. Because of data limitations this part only considered transitions from no care and informal care to professional care. For both parts –the part on use of LTC and the part on transitions- discrete choice regression models were used to analyze the data. This section subsequently describes the used data set (§2.1), variables (§2.2), and methods (§2.3 for the utilization model and §2.4 for the transition model).

2.1 Data

The data used in this study came from the Survey on Health, Ageing, and Retirement in Europe (SHARE). SHARE is a cross-national panel collecting data at the micro level on health, socio-economic status, and other personal and household characteristics of individuals aged 50 years and their spouses. For this study only the Dutch study sample was used; those under 50 years of age were also excluded. 1766 Dutch individuals were interviewed twice: in 2004 and 2006. In 2006 the sample was refreshed by adding 895 new respondents to compensate for attrition. If the individual was not able to answer the questions himself, a proxy respondent was allowed to answer (part of) the questions. The individual response rate was 87,8% in 2004[4]; the response rate for 2006 is not reported on the SHARE website. Only respondents with complete information on the variables of interest were selected (89% of the original sample for the utilization model, 84% for the transition model). The study sample is not entirely representative for the Dutch 50+ population: while the percentage of women in the sample is sufficiently close to the population mean, the average age of the study sample is higher than the average age of the 50+ population.

The data on regional supply conditions are publicly available and come from the Zorgatlas website of the Dutch National Institute for Public Health and Environment (RIVM). According to this website, the data used in this study were collected by Prismant. This

[3] Most studies examine transitions from one curative care setting to another, see e.g. Coleman *et al.* 2004)

[4] Information about SHARE comes from the project website: www.share-project.org.

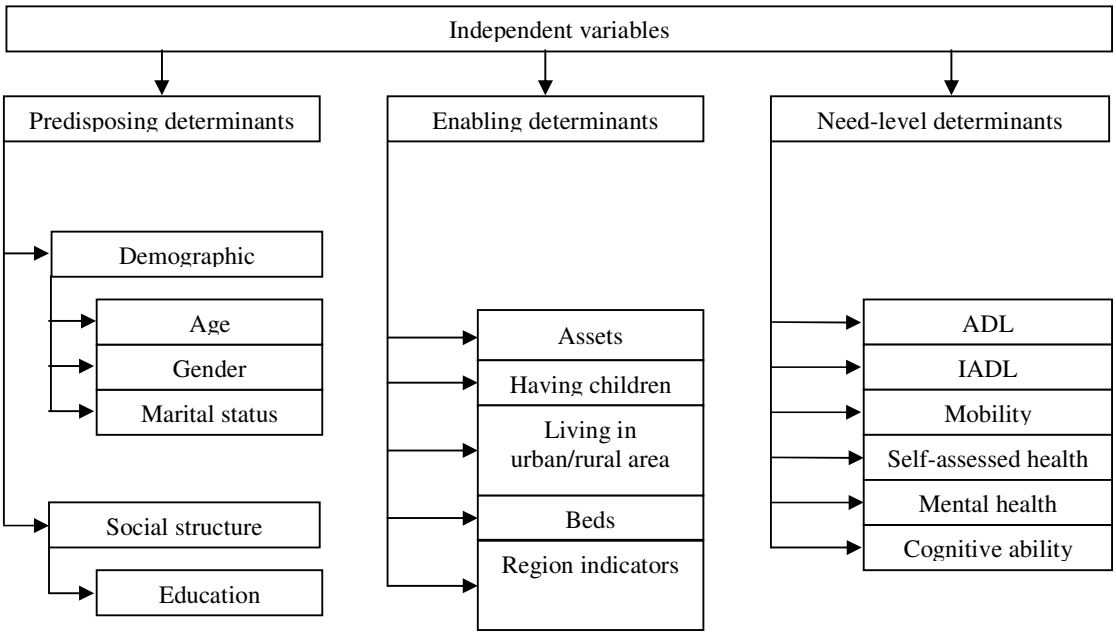
information was merged with the SHARE data file using the information in SHARE on the province in which the respondents lived. The data for 2004 are available on the level of the AWBZ regions. Often a province consists of one or more AWBZ regions. Yet, 9 municipalities (out of 458) belonged to an AWBZ region that further consisted of municipalities in another province.

2.2 Variables

The dependent variable of the utilization model was the probability that the respondent chooses one of the available alternatives. To reflect that people take one decision on the mix of LTC they consume rather than a sequence of decisions on types of care, at best the dependent variable consists of the mutually exclusive alternatives: no care, only informal care, and professional care (possibly combined with informal care). Exact definitions for each of the alternatives are listed in appendix 1. Informal care was defined as personal care, domestic help or help with paperwork. The latter two categories counted as informal care only if it was given by someone from outside the household. Professional care was home care or institutional care. Professional home care consisted of three categories: professional or paid help with domestic tasks, or professional or paid nursing or personal care. If the respondent stayed (temporarily) in a nursing home or residential home, he received institutional care. Professional care included both publicly and privately financed care. The category 'professional care' was combined with the category 'professional care and informal care' because professional care was often accompanied by informal care. The remainder of this subsection discusses the set of explanatory variables.

Following the behavioral model of health service use of Andersen and Newman (1974), I distinguished three categories of individual determinants of health care utilization: predisposing, enabling and need-level determinants. Compared with Wagstaff and van Doorslaer (2000), who distinguished two categories of determinants –socio-economic and need-related determinants, the former is split in two. Figure 1 displays which indicators have been selected for each of the three dimensions. Appendix 1 provides an overview of the definitions of the variables used.

Figure 1: Independent variables



Predisposing determinants are socio-economic variables that reflect the individual's 'propensity toward use' (Andersen and Newman 1974: 14-15; Geerlings *et al.* 2005: 112). This concept has two dimensions: the demographic dimension, and the social structure dimension. Andersen and Newman (1974: 14-15) included a third dimension: beliefs about health care. Yet, the available data set does not include a variable on the respondent's beliefs and values concerning health and illness or a variable that could function as a proxy. However this dimension is filtered out as unobserved heterogeneity by the panel data model as it is expected to have remained constant over time.

Enabling determinants concern the resources available to 'act on a value or satisfy a need regarding health service use' (Andersen and Newman 1974: 15). An enabling determinant that is considered to be important but that is not included in this study is the level of health insurance coverage. This determinant is omitted because the AWBZ insurance scheme is universal and covers a broad range of LTC services. A variable on total household assets (net household worth) was included to test whether the financial situation affected LTC use. As I noted above, elderly who receive publicly financed LTC have to pay an income-related co-payment.

To correct for regional differences in supply conditions, I included a variable on the number of beds in nursing homes and residential homes per 1000 inhabitants that are 65 years of age or older. Furthermore, three dummy variables were included to correct for further differences

among regions. Unfortunately there is no information available on regional differences in supply of professional home car, while information on waiting lists was thought to be endogenous.

Need-level determinants measure the illness and disability levels of the respondent. All included scores are self-reported. For three indicators of disability - activities of daily living (ADL), instrumental activities of daily living[5] (IADL), and mobility - multiple measures are reported in the data set that are to some extent overlapping and to some extent complementary. These measures are combined into one summarizing indicator using the polychoric principle component analysis (PCA) method in order to capture the more complex relationship among the indicators fully[6].

2.3 The utilization model

To model use of the two LTC alternatives, I selected the mixed multinomial logit model. This model is more flexible and does not depend on the Independence from Irrelevant Alternatives (IIA) assumption. While the results of the Small-Hsiao test[7] (table 1) showed that whether the IIA assumption was violated depended on small changes in the model specification, a comparison of the log likelihood of a mixed multinomial logit model with a simple multinomial logit model indicated that the former performed significantly better. The mixed logit model achieves its flexibility by assuming the error terms follow the extreme value distribution and by allowing the estimated coefficients to be random and to follow any distribution (Borah 2006: 917-919; Train 2003: 138). Furthermore, in this study the standard deviations of the randomly estimated coefficients were allowed to be correlated. Unlike the nested logit model, it does not impose any decision structure upon the data set and relaxes the IIA assumption for any pair of alternatives. In addition, the mixed logit model has the advantage that it allows for unobserved correlation over time. Hence, the mixed logit model is able to handle panel data properly and filters out unobserved personal preferences and characteristics, e.g. assertiveness (Train 2003: 81**,** 138, 145).

[5] For more information on the Activities of Daily Living measure see e.g. Katz and Akpom (1976). For Instrumental Activities of Daily Living see e.g. Lawton and Brody (1969).

[6] Originally designed for continuous variables, polychoric PCA works for categorical variables as well. See Kolenikov and Angeles (2009)

[7] We decided to use the results of the Small-Hsiao test because the Hausman test, which is regularly performed to test the IIA assumption, failed in some cases: the variance-covariance matrix was not always positive definite. This occurs e.g. when neither of the tested model specifications is efficient (Stata help file on 'hausman'). See Small and Hsiao (1985) for more information on the Small-Hsiao test.

2.4 The transition model

The second part of this study concerned transitions in the use of care. As a result of the small number of transitions from 2004 to 2006 in the data set, I only considered changes from no care/informal care to professional care. Table 1 furthermore shows that a disproportional number of respondents who used LTC died between 2004 and 2005.

Table 1: transitions (Subsample in red; transitions in italics)

2006 / **2004**	**No care**	**Informal care**	**Professional care**	**Dead**	Total
No care	1256	50	*69*	24	1399
Informal care	46	10	*17*	4	77
Professional care	33	8	63	19	123
Total	1335	68	149	47	1599

The dependent variable was a dichotomous variable that took the value 1 when a change from no care/informal care to professional home care/institutional care has occurred and 0 if the respondent used no care/only informal care in both years. This approach is similar to the approach used by Geerlings and colleagues (2005). The dichotomization between formal and no formal care is a natural one and this specification ignored only 104 observations (see table 2) plus those respondents who had deceased. Because the dependent variable was dichotomous, I analyzed the transitions with a logit regression model. To correct for correlation within households, I clustered the respondents by household and used cluster robust standard errors.

This model took into account 'state dependency': I controlled for the type of care that the respondent initially used (Martinez-Granado, 2002). State dependency is plausible in the context of transitions: a change from no care to professional care is for example more drastic and therefore less likely to occur than a change from informal care to professional care. The conclusion of Geerlings *et al* (2005) that informal care may function as a stepping stone towards professional care reconfirms the importance of state dependency. To correct for state dependency, a dichotomous variable was included indicating whether the respondent used informal care.

The set of independent variables for the transition consisted of two types: variables that could have changed between 2004 and 2006 ('time-dependent' variables) and variables that had not. For both types of variables the value for 2004 was included in the regression. In addition, for each time-dependent variable, a second variable was included that represented the change that had occurred. Unlike in the study by Geerlings *et al.* (2005: 114-115), for continuous

changing variables (ADL, IADL, Mobility, Cognitive ability) the change variable was the value in 2006 and hence this variable measured not only the direction but also the magnitude of the change. For categorical variables, two dummy variables indicated the direction of the change. Because it is unknown when the changes in the independent variables and the transition exactly occurred, the direction of the causal effect is unclear for indicators of changes in perceived illness, e.g. self-assessed health.

3. Results

3.1 Descriptive statistics

The first and the second column of table 2 show the descriptive statistics for the full panel sample, the statistics for care users in the full panel sample and the 2004 statistics for the sample of respondents for the transition model. These statistics show that compared to the entire sample, the respondents who used LTC on average are older, more disabled, more ill and in worse general health, are more often female, more often living alone, have less assets and are less educated. There are no differences between those groups in cognitive ability, region of residence and supply conditions, whether they are living in a city and whether they have at least one child.

The statistics from the transition sample were not in line with the 2004 statistics from the entire study sample. T-tests (not shown) showed that the subsample was healthier than the entire 2004 sample, which is reflected by lower scores on the dependent variable, ADL, IADL, mobility, self-assessed health and a higher score on cognitive ability. In addition, the subsample is better educated. However, no weights were applied to ensure that the subsample used for transitions is a good representation of the entire sample.

Table 3 shows additional descriptive statistics from the subsample used for the transition model. Roughly 23% of the respondents who initially received informal care experienced a transition compared to 5% of the respondents who initially received no LTC. On average, the respondents who experienced a transition faced a larger deterioration in disability than the respondents who did not have a transition. Furthermore, they were more often no longer living together with their former spouse. The difference between respondents who experienced and respondents who did not experience a transition is significant for changes in ADL, IADL, mobility, receiving informal care and mental health ($p < 0.01$). The difference between these groups is weakly significant for the chance that someone is no longer living together or became widowed ($p < 0.10$)

Table 2: Descriptive statistics

	Panel	Conditional on using any care	Transition sample (2004)
Number of observations	5011	682	1455
2004	2652	381	1455
% No care consumed	86.39	N/A	94.85
% Only informal care consumed	4.43	32.55	5.15
% Professional care (+ informal care)	9.18	67.45	N/A
% Female	53.50	68.04	52.23
Age	63.54 ± 9.54	70.89 ± 11.55	62.57 ± 8.68
% Living together / married	81.38	50.29	84.33
Education	11.31 ± 3.24	10.16 ± 3.55	11.43 ± 3.15
Assets	60764 ± 517244	26950 ± 99046	74337.26 ± 770721
% Having at least one child	90.08	85.48	90.58
% living in (the suburbs of) a city	45.70	51.17	46.25
Beds	76.24 ± 3.49	76.08 ± 3.60	76.45 ± 2.69
Noord	15.53	15.69	15.67
Oost	18.00	15.40	18.63
Zuid	24.43	24.49	22.81
ADL*	0.20 ± 0.99	1.04 ± 2.20	0.07 ± 0.48
iADL*	0.29 ± 0.98	1.33 ± 1.99	0.21 ± 0.77
Mobility*	1.08 ± 1.87	3.36 ± 2.66	0.84 ± 1.49
% having a mental health problem	18.90	40.91	16.84
% having 1-2 chronic conditions	49.63	53.52	53.61
% having ≥ 3 chronic conditions	14.03	34.75	12.37
% Self-assessed health: fair	43.12	26.54	44.05
% Self-assessed health: bad	27.16	63.20	20.41
Cognitive ability#	7.08 ± 1.24	6.42 ± 1.45	7.15 ± 1.09

* rescaled on a 0 – 10 scale; a score of 0 indicates no disability

\# on a 0 – 8 scale; a score of 8 indicates perfect cognitive ability

Table 3: Additional descriptive statistics for sub sample used for the transition model

	Total sample	No transition	Transition
Number of observations	1455	1369	86
% No longer living together / widowed	5.50	5.19	10.47
Δ ADL	0.05 ± 0.75	0.02 ± 0.64	0.52 ± 1.68
Δ IADL	0.08 ± 0.74	0.05 ± 0.66	0.51 ± 1.49
Δ Mobility	0.03 ± 1.44	-0.01 ± 1.35	0.68 ± 2.43
Δ Cognitive ability	0.07 ± 1.04	0.07 ± 1.04	0.07 ± 1.17
Δ Chronic conditions	-0.18 ± 1.06	-0.18 ± 1.06	-0.16 ± 1.14
Δ Mental health	0.10 ± 0.30	0.09 ± 0.29	0.22 ± 0.42
% Better self-assessed health	18.14	18.04	19.77
% Worse self-assessed health	31.20	30.97	34.88
% Received informal care	5.15	4.24	19.77

3.2 Use of care

The results for the utilization model are reported in table 4. The results are for the correlated mixed multinomial logit model; the number of Halton draws per iteration, which affects the precision, was limited to 50 to reduce estimation time. Because the coefficients are difficult to interpret, I also list the average partial effects. These average partial effects are equal to the difference in predicted probabilities if the considered independent variable changes by one unit. No R^2-scores are reported for mixed multinomial logit models in Stata; the pseudo R^2-score for a comparable simple multinomial model was 0.35 for a pooled regression.

Living alone and age are estimated to have had a large effect on both the probability of using informal care and the probability of using professional care. Living alone increased the probability by 4.2 percentage point and 8.3 percentage points respectively, the average partial effect of age on the probability of using informal care was negligible, for professional care use it was 0.4 percentage point. Being female only significantly increased the probability of using professional care. The reported average partial effects for living alone are large in comparison with the average probabilities of using care, which have been reported in table 3 (see above). Education did not have a significant effect at all, nor did the amount of assets and living in (the suburbs of) a city. Having at least one child was only significant for professional care: it reduced the probability of receiving professional care by 2.1 percentage points. The number of beds decreased use of only informal care and respondents in the south or the east of the country less often used informal care only

IADL and mobility had a significant positive impact on the probability of using only informal care and the probability of using professional care. The average partial effects were similar as well**.** Having a mobility score of 1 point higher increased the likelihood of using informal care and professional care with 0.8 percentage point and 1.5 percentage point, respectively; a one-point increase in the IADL score increased the probabilities with 0.7 percentage point and 1.6 percentage point, respectively. ADL only had a significant impact on the probability of using professional care: a one-point increase in the ADL score resulted on average in a 0.7 percentage point higher probability of using professional care. Bad or very bad general health, the number of chronic conditions and mental health status had a positive effect on both the probability of using informal care and the probability of using professional care. Reporting a fair health and cognitive ability had no significant effect on care utilization at all.

Table 4: results for mixed logit regression for panel data analysis

	Only informal care		**Professional care**	
	Coefficients	**Average partial effects**	**Coefficients**	**Average partial effects**
Female	0.029 (0.183)	-0.009	1.046 (0.219)***	0.038
Age	0.027 (0.014)**	-0.000	0.126 (0.013)***	0.004
Living alone	1.453 (0.224)***	0.042	2.156 (0.252)***	0.083
Education	-0.032 (0.027)	-0.001	0.025 (0.031)	0.001
Assets	0.000 (0.000)	0.001	-0.001 (0.001)	-0.005
Having at least one child	0.054 (0.270)	0.006	-0.516 (0.284)*	-0.021
Living in (the suburbs of) a city	-0.177 (0.173)	-0.007	0.097 (0.198)	0.005
Beds	-0.061 (0.023)***	-0.001	-0.026 (0.032)	-0.000
North	0.080 (0.235)	0.003	-0.085 (0.284)	-0.004
East	-0.441 (0.261)*	-0.011	-0.472 (0.304)	-0.013
South	-0.527 (0.223)**	-0.015	-0.265 (0.249)	-0.005
ADL	0.089 (0.078)	0.001	0.200 (0.081)**	0.007
IADL	0.306 (0.094)***	0.007	0.494 (0.096)***	0.016
Mobility	0.345 (0.055)***	0.008	0.472 (0.066)***	0.015
Mental health	0.522 (0.185)***	0.017	0.386 (0.221)*	0.010
1-2 chronic conditions	0.616 (0.234)***	0.014	0.837 (0.268)***	0.024
≥ 3 chronic conditions	0.864 (0.279)***	0.021	1.130 (0.319)***	0.034
Self-assessed health: fair	0.360 (0.271)	0.010	0.180 (0.290)	0.003
Self-assessed health: bad	0.924 (0.293)***	0.022	1.236 (0.318)***	0.041
Cognitive ability	-0.033 (0.075)	-0.001	0.007 (0.082)	0.001
Intercept ± standard deviation	-1.785 (2.224)		-14.511 (2.911)***	
Covariance of the SDs	1.123 (0.251)***		1.993 (0.306)	
Number of observations: 5011				

Standard errors in parentheses; *, ** and *** indicate statistical significance at the 0.10, 0.05 and 0.01 level respectively.

3.3 The transition model

Table 5 presents the estimated coefficients and average partial effects for the transition model; table 6 shows the predicted probabilities for some subgroups. The pseudo R^2-score of the model was 0.31. The average probability of a transition was 5.9%.

The demographic indicators age, living alone and no longer living together were significant; education was not. The average partial effects reveal that for respondents who were no longer living together the probability of a transition increased most: by 8.4 percentage points. Living alone in 2004 increased the probability by 6.6 percentage points. The predicted probabilities indicate that the subgroup that was no longer living together and was aged 65 or older had a higher chance to start using professional care than those who were younger or experienced no change in their household composition. So predisposing variables were important in determining the probability of a transition. In contrast, the amount of assets was the only enabling determinant that had a significant effect on the probability of a transition.

The probability of a transition also increased if the respondent received informal care in 2004 but this effect is no longer significant when the regional dummies are included. Furthermore, elderly whose mobility decreased or mental health had deteriorated were significantly more likely to start using professional LTC. The predicted probabilities for the subgroups in table 9 show that respondents who were living alone and experienced decreased mobility had a larger probability of a transition than the subgroup with decreased mobility that was not living alone. Furthermore, both improved self-assessed health and worse self-assessed health were associated with a transition; (an increase in) the number of chronic illnesses had no impact.

Table 5 –Estimated coefficients and marginal effects for transition model

	Estimated coefficients	Average partial effects
Female	0.043 (0.299)	-0.002
Age	0.113 (0.018)***	0.005
Living alone	1.090 (0.332)***	0.066
No longer living together / widowed	1.280 (0.464)***	0.084
Education	0.004 (0.042)	0.000
Assets	-0.041 (0.023)*	0.002
Having at least one child	0.061 (0.480)	0.002
Living in (the suburbs of) a city	-0.061 (0.293)	-0.003
Beds	-0.0280 (0.052)	-0.001
North	0.513 (0.361)	-0.017
East	0.508 (0.386)	0.024
South	-0.511 (0.400)	0.023
ADL	-0.055 (0.260)	-0.002
Δ ADL	0.163 (162)	0.007
iADL	-0.008 (0.279)	-0.000
Δ IADL	0.064 (0.157)	0.003
Mobility	0.029 (0.104)	0.001
Δ Mobility	0.198 (0.084)**	0.008
Mental health	0.744 (0.342)**	0.035
Worse mental health	0.889 (0.346)***	0.045
1-2 chronic conditions	0.435 (0.416)	0.008
≥ 3 chronic conditions	0.494 (0.547)	0.009
Δ Chronic conditions	0.120 (0.120)	0.003
Self-assessed health: fair	-0.148 (0.354)	-0.006
Self-assessed health: bad	0.362 (0.513)	0.016
Better self-assessed health	0.879 (0.407)**	0.038
Worse self-assessed health	0.679 (0.343)**	0.027
Cognitive ability	-0.034 (0.148)	-0.001
Δ Cognitive ability	0.129 (0.123)	0.005
Received informal care	0.596 (0.377)	0.029
Intercept	-10.923 (4.219)***	
Number of observations	1453	
Pseudo R^2	0.31	

Table 6: predicted probability of a transition by subgroup

x	**x ≤ 0**	**x > 0**
Δ ADL	0.059 (n = 1535)	0.391 (n = 79)
Δ IADL	0.057 (n = 1456)	0.244 (n = 158)
Δ Mobility	0.053 (n = 1276)	0.158 (n = 338)
Δ Chronic conditions	0.069 (n = 1287)	0.098 (n = 327)
	No	**Yes**
No longer living together / widowed	0.072 (n = 1526)	0.130 (n = 88)
Worse mental health	0.065 (n = 1449)	0.164 (n = 165)
Better self-assessed health	0.074 (n = 1327)	0.078 (n = 287)
Worse self-assessed health	0.075 (n = 1121)	0.076 (n = 493)
Received informal care	0.062 (n = 1507)	0.261 (n = 107)
Age > 65	0.024 (n = 1032)	0.165 (n = 582)
Age > 75	0.043 (n = 1423)	0.316 (n = 191)
Age > 85	0.067 (n = 1590)	0.605 (n = 24)
Age > 65 given no longer living together	0.048 (n = 55)	0.268 (n = 33)
Age > 65 given that Δ Mobility > 0	0.057 (n = 167)	0.256 (n = 171)
Living alone given that Δ Mobility > 0	0.095 (n = 248)	0.331 (n = 90)

4. Discussion

This article covered two related topics. First, I discussed which personal characteristics and regional differences in supply conditions determined the type of LTC – no LTC, informal care or professional care - that the Dutch middle-aged and elderly used in 2004 and 2006. Second, I studied what determined transitions from no professional care use to professional care use between 2004 and 2006.

The contribution of this study to the literature is threefold. First, the IIA assumption and unobserved heterogeneity does not affect the sign and significance of the independent variables, yet it does increase the average marginal effects of some key determinants of LTC use. Second, it shows that the probability of a transition from using no professional care to using professional care is affected by the initial disability status, initial household composition, use of informal care as well as changes in disability status and household composition. Third, it considers supply conditions as independent variables.

The main findings from the utilization model are as follows. First, for both categories of LTC - only informal care and professional care - living alone, IADL disability and mobility have a significant positive effect. Furthermore, age, being female, ADL disability, having more than four chronic diseases and a poor self-reported health increases the probability of using professional care. Having at least one child, on the other hand, decreases the probability of using professional care in the utilization model but not in the transition model.

Second, this study shows that age is an important determinant of (transitions in) LTC use. The effect of age (and population ageing) on LTC is subject of scholarly discussion (see e.g. Werblow *et al.* (2007) and de Meijer *et al.* (2009)). According to these studies, age (Werblow *et al.* 2007) and time-to-death (de Meijer *et al.* forthcoming) may merely be proxies for what really drives LTC demand: disability and poor health. The significant effect of age may reflect that some dimensions of disability and frailty are not completely captured.

Third, supply conditions have an effect on use of informal care: in provinces with more supply of nursing homes and residential homes elderly use less informal care. The dummy variable that is included to pick up other regional differences shows that in the south and the east of the Netherlands elderly use less informal care than in the west. These effects are visible despite the crude variables used. More precise data, e.g. at the level of AWBZ regions or even at the local level would improve the estimates and allow us to make inferences at the level on which LTC policy is implemented. Such precise data are not available for the SHARE data but data sets from Dutch surveys (e.g. LASA and AVO) and administrative data do have information about the respondents' place of residence. Running the same model on these datasets may provide better results with regard to the supply conditions.

Finally, the counterintuitive finding that living alone leads to a higher probability of informal care use can be explained by the set up of the questionnaire: help with paperwork and practical household help are taken into account only if they are done by someone from outside the household. Another conclusion of this study that contradicts the conclusions of previous studies is that cognitive ability is not associated with LTC use. This may be explained by the fact that this sample contains only a limited number of respondents that live in an institution: diminished cognitive ability is often associated with increased probability of using institutional care. Yaffe and others (2002), for example, quote evidence that in the United States 90% of patients with dementia were institutionalized before they die.

The transition model shows that deteriorating mobility and worse mental health (e.g. depression) determine whether someone starts to use professional care. The literature on

nursing home use reconfirms the importance of mental health (see e.g. Tinetti *et al.* 1997). Furthermore, the transition model shows that better self-assessed health is associated with a transition. The causal relation may well run the other way here: it is not clear from the data whether the transition or the improvement in self-assessed health occurred first. It is not likely that a similar reverse causation is present for any of the other variables indicating change because these variables measure more objective aspects of need than self-assessed health. This problem could be solved when an additional wave of data becomes available by taking the difference in self-assessed health between t_0 and t_1 to explain a transition between t_1 and t_2.

The findings summarized here show that the allocation of professional care is consistent with the guidelines that the Needs Assessment Center used to assess eligibility for publicly funded care: disability, household composition (availability of informal support) and, to a lesser extent, illness and general health are the main determinants. I speculate that these guidelines, together with a universal access to LTC resulting from the Dutch social insurance system, affect the relative importance of the three categories of determinants. The relatively large role of need-level determinants and some predisposing determinants (most notably whether someone lives alone) as well as the negligible effect of education and the enabling determinants 'assets' and 'living in (the suburbs of) a city' may well be the effect of the comprehensive Dutch social insurance system, which aims to distribute LTC according to need rather than ability to pay.

If the institutional structure indeed affects the utilization of LTC and transitions of LTC, this study may yield different results if it is performed in countries with a different institutional setting. Preliminary findings based on German SHARE data, shows that the 50+ population in Germany more often uses informal care only than the Dutch middle-aged and elderly and that in Germany informal care use in 2004 has a large effect on the probability of a transition between 2004 and 2006. Furthermore, it shows that ADL has a larger effect on the probability of using care and of a transition in Germany than in the Netherlands, while IADL and the number of chronic diseases have a smaller effect in both the utilization model and the transition model. ADL and IADL have a central position the German guidelines on the allocation of LTC. Finally, the probability of a transition in Germany was affected by a decrease in cognitive ability in Germany but not in the Netherlands.

In addition to the eligibility guidelines, many other types of public policy influence demand for LTC. While an ageing society is predicted to increase demand as the coefficient for age is positive and significant, it also shows that demand would be reduced if the (impact of) disability can be reduced. A reduction in a disability may for example be accomplished by

reducing the number of years spent in a job that is physically challenging or by increasing the efficiency of health care, which would reduce disability for a given level of morbidity.

These results furthermore confirm common sense and corroborate the conclusions of previous studies (e.g. Bolin *et al.* 2008, Bonsang 2009, Geerlings *et al.* 2005, Glaser *et al.* 2006, and de Meijer *et al.* 2009), which showed that disability, household composition, mental health and general well being determine LTC use and transitions in LTC use across developed countries. Need-related as well as predisposing and, to a lesser extent, enabling determinants influence LTC use and transitions in LTC use.

The main differences with de Meijer et al. (2009) are that, despite having controlled extensively for disability status, general health status is an important determinant, whereas the ADL score only has a small effect on the probability of using care and no effect on the probability of a transition in use. One explanation for the small influence of the ADL score, is that I also included a measure of mobility, which overlaps with the measure of ADL problems: if someone is not able to move around, he will also have problems to perform activities of daily living such as walking across a room, getting out of bed or going to the toilet. When mobility is removed from the regression, the estimated coefficients for ADL are significant. Because of these differences, it may be insightful to check if the differences between this study and the study by de Meijer and colleagues (2009) are caused by the data sets or the used methods.

This study may be improved in a number of ways. The external validity of this study would be enhanced if weights would be applied to compensate for differences in age between the sample and the population and to compensate for differences between the sub samples and the full sample. Furthermore, the estimated effects of the determinants would be more accurate if the provided number of hours of care is the dependent variable (possibly conditional on being larger than zero). Such specific data is needed if, as has recently been proposed, a system of risk-adjustment subsidies would be introduced to enable the government to make competing health insurers (financially) responsible for administering and purchasing LTC (Ministry of Health, Welfare and Sport, 2009: 20-21).

The attitude towards LTC is the only major dimension of the Andersen and Newman model that has not been included in the regression and therefore ends in up the error term. Attitudes towards various types LTC, e.g. among immigrants and orthodox protestants are likely to be correlated with LTC use but not with the other regressors (possibly except for education). Hence, I do not expect that this has affected the estimates. Another variable that has not been

included but that was significant in other studies is hospitalization in the past, which indicates whether the respondent experienced a health shock.

All in all, I conclude that the elderly and those who have mental problems or are disabled are more likely to resort to formal care, whereas the others use informal care.

References

Andersen, R. and Newman, J.1973. 'Societal and individual determinants of medical care utilization in the United States'. *Milbank Fund Quarterly*. 51 (1): 95–124.

Bolin, K., B. Lindgren, and P. Lundborg. 2008. 'Informal and formal care among single-living elderly in Europe'. *Health Economics*. 17 (3): 393-409

Bonsang, E. 2009. 'Does informal care from children to their elderly parents substitute for formal care in Europe?' *Journal of Health Economics*. 28 (1): 143-154

Borah, B. 2006. 'A mixed logit model of health care provider choice: analysis of NSS data for rural India'. *Health Economics*. 15 (9): 915-932

CIZ. 2009. *Indicatiewijzer 2.0*. Driebergen: CIZ.

Coleman, E., S-J Min, A. Chomiak, and A. Kramer. 2004. 'Posthospital care transitions: patterns, complications, and risk identification'. *Health service research*. 39 (5): 1449-1465

de Meijer, C., M. Koopmanschap, X. Koolman, and E. van Doorslaer. 2009. 'The role of disability in explaining LTC utilization'. *Medical Care*. 47 (11): 1156-1163

de Meijer, C., M. Koopmanschap, T. Bago d'Uva, and E. van Doorslaer. 2009. ' Time to drop time-to-death? - Unraveling the determinants of LTC spending in The Netherlands'. *HEDG Working Paper Series*. WP 09/33. HEDG: York, UK.

Folstein M., S. Folstein, and P. McHugh (1975). 'Mini-mental state. A practical method for grading the cognitive state of patients for the clinician'. *Journal of psychiatric research*. 12 (3): 189–198.

Geerlings, S., A. Pot, J. Twisk, and D. Deeg. 2005. 'Predicting transitions in the use of informal and professional care by older adults'. *Ageing & Society*. 25 (1): 111-130

Glaser, K. C. Tomassini, F. Racioppi, and R. Stuchbury. 2006. 'Marital disruptions and loss of support in later life: a longitudinal study of the United Kingdom'. *European journal of ageing*. 3 (4): 207-216

Greene, W. 2003. *Econometric Analysis*. Upper Saddle River, NJ (USA): Prentice Hall. Fifth edition

Hole, A. 2007. 'Fitting mixed logit models by using maximum simulated likelihood'. *The Stata Journal*. 7 (3): 388-401

Katz, S., and C. Akpom. 1976. 'A measure of primary sociobiological functions'. *International Journal of Health Services*. 6 (3): 493-508

Kolenikov, S., and G. Angeles. 2009. 'Socioeconomic status measurement with discrete proxy vairable: is principal component analysis a reliable answer?'. *Review of Income and Wealth*. 55 (1): 128-165

Lawton. M., and E. Brody. 1969. 'Assessment of older people: self-maintaining and instrumental activities of daily living'. *Gerontologist*. 9 (3): 179-186

Martinez-Granado, M. 2002. 'Self-employment and labour market transitions: a multiple state model'. Centre for Economic Policy Research: London. Discussion paper 3661.

Manton, K., V. Lamb, and X. Gu. 'Change in chronic disability from 1982 to 2004/2005 as measured by long-term changes in function and health in the U.S. elderly population'. *Proceedings from the National Academy of Science*. 103 (48) : 18374-18379

Manton, K., V. Lamb, and X. Gu. 2007. 'Medicare costs effects of recent US disability trends in the elderly: future implications.' *Journal of Aging and Health*. 19 (3): 359 – 381

Ministry of Health, Welfare and Sport. 2007, *PGB in perspectief (letter to the parliament)*. The Hague: Ministry of Health, Welfare and Sport. [Applied on 7 February 2009] Accessible on http://www.minvws.nl/images/dlz-2811809a-_tcm19-155110.pdf

Ministry of Health, Welfare and Sport. 2009. *Nadere uitwerking toekomst AWBZ*. The Hague: Ministry of Health, Welfare and Sport. [Applied on 7 September 2009] Accessible on http://www.minvws.nl/kamerstukken/lz/2009/nadere-uitwerking-toekomst-van-de-awbz.asp

Prince, M., F. Reischies, A. Beekman, R. Fuhrer, C. Jonker, S. Kivela, B. Lawlor, A. Lobo, H. Magnusson, M. Fichter, H. van Oyen, M. Roelands, I. Skoog, C. Turrina, and J. Copeland. 1999. Development of the EURO-D scale, a European Union initiative to compare symptoms of depression in 14 European centres. *The British Journal of Psychiatrists*. 174 (4): 330-338

RIVM, 2009, *Informele zorg – Nationaal Kompas Volksgezondheid*, Bilthoven: RIVM. [Applied on 24 January 2009] Accessible on http://www.rivm.nl/vtv/object_class/kom_informzorg.html

SER. 2008. *Langdurige zorg verzekerd: Over de toekomst van de AWBZ*. The Hague: Social and Economic Council (SER). Publicatienummer 3

Small, K., and C. Hsiao. 1985. 'Multinomial Logit Specification Tests'. *International Economic Review*. 26 (3): 619-627

Tinetti, M., and C. Williams. 1997. 'Falls, injuries due to falls, and the risk of admission to a nursing home'. *New England Journal of Medicine*. 337(18): 1279-1284

Train, K. 2003. *Discrete choice methods with simulation*. Cambridge: Cambridge University Press.

Wagstaff, A., and E. van Doorslaer, 2000. Equity in health care finance and delivery In: A. Culyer and J. Newhouse, *Handbook of Health Economics, volume 1B*. Amsterdam: North Holland. Chapter 34: 1803-1862

Weaver, F., S. Stearns, E. Norton, and W. Spence. 2009. 'Proximity to death and participation in the long-term care market.' *Health Economics*. 18 (8): 867-883

Werblow. A., S. Felder and P Zweifel. 2007. 'Population ageing and health care expenditures: a school of red herrings?'. *Health economics.* 16(10): 1109-1126

Yaffe, K., P. Fox, and R. Newcomer. 2002. 'Patient and caregiver characteristics and nursing home placement in patients with dementia' *Journal of the American Medical Association*. 287(16): 2090-2097

Appendix 1: Variable definitions

No care	Respondent has not received any LTC over the past 12 months.
Only informal care	Respondent has received at least one hour of informal care because of health problems over the past 12 months.
Professional care (+ informal care)	Respondent has received at least one hour of professional home care or lived in a nursing home/residential home over the past 12 months.
Female	= 1 if female; = 0 if male.
Age	Age in years.
Living alone	= 1 if living alone; = 0 if living together / being married.
Education	Number of years of education
Assets	Household net worth (1 = 10000 euro)
Having at least one child	= 1 if respondent has at least one child; = 0 if not.
Living in (the suburbs of) a city	= 1 if respondent lives in the (suburbs) of a big city; = 0 if respondent lives in a small city, a town, or a rural area.
ADL[a]	Ability to perform Activities of Daily Living. Score rescaled on a 0 (no problems) -10 (severely limited) scale. See below for measure weights.
IADL[b]	Ability to perform Instrumental Activities of Daily Living. Score rescaled on a 0 (no problems) -10 (severely limited) scale. See below for measure weights
Mobility[c]	Ability to walk around. Score rescaled on a 0 (no problems) -10 (severely limited) scale. See below for measure weights
Mental health	= 1 if the score on the EURO-D[8] test to assess mental health is 4 or higher (scale range: 0 (good) – 12 (bad)); = 0 if score is lower than 4.
0 chronic conditions	Reference category. Respondent does not suffer from a chronic disease.
1-2 chronic conditions	= 1 if the respondent suffers from 1 – 2 chronic diseases; = 0 if else.
≥ 3 chronic conditions	= 1 if the respondent suffers from at least 3 chronic diseases (out of 14); = 0 if else.
Self-assessed health: excellent / very good / good	Reference category. = 1 if respondent rates own health as 'excellent', 'very good' or 'good'; =0 otherwise
Self-assessed health: fair	= 1 if respondent rates own health as 'fair'; = 0 otherwise
Self-assessed health: bad	= 1 if respondent rates own health as 'bad'; = 0 otherwise
Cognitive ability	Score on the Mini Mental State Examination (orientation, numeracy, and learning)[9], ranges from 0 (bad) to 10 (good)
Beds	Number of residential home beds and nursing home beds in the province per 1000 inhabitants that are at least 65 years of age
West	Reference category. Respondent lives in Noord-Holland, Zuid-Holland or Utrecht
North	= 1 if respondent lives in Friesland, Groningen or Drenthe
East	= 1 if respondent lives in Overijssel, Flevoland or Gelderland
South	= 1 if respondent lives in Zeeland, Noord-Brabant or Limburg
Informal care	= 1 if the respondent received at least one hour of informal care because of health problems over the past 12 months in 2004; = 0 else

[a] consists of: dressing; walking across a room; bathing; eating; getting in / out of bed; using the toilet

[b] using a map; preparing a hot meal; shopping; making phone calls; taking medication; doing work around the house; managing money

[c] Walking 100 meters; sitting for 2 hours; getting up from a chair; climbing stairs; stooping, kneeling or crouching; reaching your arms above shoulder level; pulling/pushing large objects; lifting/carrying weights; picking up a small coin

[8] See Prince et al. (1999) for more information on the EURO-D depression scale.

[9] See Folstein (1975) for more information on the Mini Mental State Examination.