Regional variation in public long-term home care

Regional differences in the Netherlands and the role of patient experiences

DAISY DUELL ^{1*}
ROOS VAN OORT ²
MAARTEN LINDEBOOM ³
XANDER KOOLMAN ¹
FRANCE PORTRAIT ¹

¹ Department of Life sciences Vrije Universiteit Amsterdam (VU), Talma Institute, Netherlands

² Department of Life sciences Vrije Universiteit Amsterdam (VU), Netherlands

³ Department of Economics, Vrije Universiteit Amsterdam (VU), Tinbergen Institute & Centre for Health Economics Monash University, Netherlands

Abstract: Practice variation is often defined as variation in access to healthcare - usually across regions - that cannot be explained by differences in patient populations. Practice variation may therefore lead to inefficiency and violate the principle of equal access to healthcare. The study of practice variation in long-term care (LTC) is a comparatively new area of research. This paper focuses on variation in publicly financed home care, which is gaining popularity as an alternative for institutional care. In addition, this paper focuses on whether and how patient experiences are associated with this variation. We use multinomial logistic regression analyses to assess regional variation in entitlements for publicly financed home care. Linear regression analyses were added to examine regional variation in intensity of entitled publicly financed home care, and the relationship between variation and patient experiences. The study showed a maximum difference of 34 percentage points across regions. Moreover, a maximum of 23 out of 31 regions showed significant differences in intensity of entitled care. Almost none of the observed variation can be explained by patient experiences. Our study showed evidence that eligibility for publicly financed home care depended partially on where a client lived. This study has been performed before the major decentralisation of the Dutch LTC system in January 2015. We expect regional variation to increase as a result of local demand, supply factors and the budgetary restrictions of the local stakeholders. This imposes challenges for countries as the Netherlands, which introduced a shift towards using more publicly financed home while striving towards equal access.

JEL classification: I18 (Health: Government Policy; Regulation; Public Health) and I14 (Health and Inequality)

Key words: long-term care, publicly financed home care, access, practice variation, patient experiences

* **Correspondence to:** Daisy Duell, Vrije Universiteit Amsterdam (VU), De Boelelaan 1105, 1081 HV Amsterdam, Netherlands. E-mail: d.duell@vu.nl

Published: Online December 2020. dx.doi.org/10.5617/njhe.6670

1 Introduction

Expenditure on long-term care (LTC)¹ is considerable in all OECD countries and has been rising steadily for several decades (OECD, 2016). In an attempt to slow the growth of LTC costs, many countries are currently reforming their LTC health systems. These reforms often focus on increasing private funding and on redefining the public funding arrangements (Gori et al., 2016). Opinion on how the public arrangements should be redefined differs between countries. A seemingly attractive policy measure is to use more publicly financed home care instead of institutional LTC, as such care is often cheaper while access to the care needed is still maintained (Maarse and Jeurissen, 2016). An additional reason is that this is often what people actually prefer. Most people want to remain living in their own home for as long as possible or at least in a homelike environment (Higginson, 2013; Bradshaw, 2012). Qualitative studies found e.g. a variety of negative effects associated with institutional relocation including loss of occupation, isolation from family, loneliness, loss of privacy and identity and the ability to make decisions concerning or for oneself. Residents also often report frustration around their lack of influence and independence (Theurer, 2015). As a result, even if the share of publicly financed home care within LTC expenses varies considerably across OECD countries (i.e. ranging from 11% in the Netherlands to 64% in Denmark), more and more LTC has been delivered within people's homes during the last decade in all OECD countries (OECD, 2017a).

Against this backdrop, it is increasingly important from a policy perspective to evaluate whether individuals with comparable needs have the same opportunities to access publicly financed home care, and to assess which factors influence equal access. One way of collecting information on the degree of access or inefficient use of care is to examine practice variation (Van Dijk et al., 2015; Corallo et al., 2014; Maassen, 2012).

Practice variation is defined as: variation in the way care is provided - usually across regions - that cannot be explained by differences in patient populations such as need, illness, certain risk factors or patient preferences (Corallo et al., 2014). Most international studies have focused on practice variation in healthcare (such as Corallo et al., 2014; Wennberg, 2010; OECD, 2017b; Skinner, 2012) but more recent research has looked into practice variation in LTC. Studies in Sweden and Denmark have reported that practice variation also exists in the care sector, particularly for older individuals (Jensen and Lolle 2013; Trydegård GB and Thorslund 2001; Davey et al., 2006). These studies revealed large variations in the use of LTC between municipalities. Another study on variation in LTC was performed in Italy and reported regional differences in the supply of home care and residential care (Gori, 2000). In contrast, a recent paper from Duell et al. (2017) shows relatively little variation in the granting of institutional Dutch LTC across regions which cannot be explained based on the patients' needs (up to 3%), compared to international standards and that only a small part of this variation could be accounted for by supply differences in local care facilities (Duell et al., 2017). Clearly, we cannot directly compare the results of the studies mentioned above since the geographical areas compared in these papers are of a different size. However, these studies do provide important context information on variation in LTC found in other developed countries. The current paper builds on these analyses and focuses on regional variation in publicly financed home care. To the best of our knowledge, very few other studies are currently available on regional variation in publicly financed care delivered

¹ LTC is defined as: "a range of services required by persons with a reduced degree of functional capacity, physical or cognitive, and who are dependent for an extended period of time on help with basic activities of daily living (ADL)" (Colombo et al., 2011).

at home. The first aim of this paper is therefore to assess the degree of regional variation in Dutch publicly financed home care.

Some degree of variation across geographical areas is clearly unavoidable. However, if after correcting for relevant differences in patient population (such as needs, illness and certain risk factors) a significant variation in health care practice between areas remains, we can conclude that unwarranted variation may occur (Corallo et al., 2014; Appleby et al., 2011; Faber, 2011; Wennberg, 2010). Whether variation is warranted or unwarranted does depend upon the funding of the LTC system (i.e. mostly public or mostly private) and we therefore deviate somewhat from the original definition of practice variation depending on whether or not the care system is publicly funded. In countries where LTC is to a large extent privately financed, variation is warranted when justified by patients' needs and preferences. In countries where LTC is to a large extent publicly funded, we believe that preferences should only play a minor role in explaining practice variation in publicly financed home care, as regions have to pay more to finance extra care on top of what is required based on actual health care need. The latter would for instance be the case when individuals are only willing to accept a certain type of home care while it would be easier and/or cheaper to use institutional care. In that case more, or more expensive, care is publicly financed than actually needed. Also, Gomes and Higginson (2006) show that not only patients but also care providers are willing to meet the patients' preferences in allocating LTC. Consequently, differences in patients' preferences regarding LTC could potentially lead to (inequitable) variation in access to LTC and to higher publicly financed costs.

The paper of Degenholtz et al. (1997) shows that previous experiences with LTC are a strong determinant of current patient preferences. In this paper we investigate the association between the reported experience of the quality of LTC of individuals and regional variation in publicly financed home care. The second aim of this paper is therefore to assess whether and how reported experiences with respect to LTC are related to regional variation in the provision of publicly financed home care in the Netherlands.

2 Background

During the time frame investigated within this paper (2013 / 2014), the Exceptional Medical Expenses Act (EMEA, in Dutch: Algemene wet Bijzondere Ziektekosten, AWBZ) covered everyone living in the Netherlands who needed formal LTC. This included both institutional LTC and home care. The act was fairly comprehensive covering different forms of care such as personal care, nursing, assistance, treatment and residential care.

A nationwide independent and objective committee evaluated every request for LTC covered by the EMEA: the Care Needs Assessment Centre (CNAC). As a gatekeeper without financial incentives, the CNAC evaluated every request for LTC based on a standardized protocol, as set by the Ministry of Health, Welfare and Sport (CNAC, 2012). This is a centrally regulated process, where care is granted based on the most important health problems, to enable equitable access to LTC across the Netherlands. Availability of informal care was also taken into account in the needs assessments (CNAC, 2012).

When the request was approved, the applicant received an entitlement, which provided access to a certain amount and types of care. In certain cases, some care providers were mandated to evaluate the request for LTC themselves (on behalf of the CNAC) (CNAC, 2014a). Ultimately, 32 regional care offices ensured that clients could use the granted care by processing the LTC applications (Mot 2010).

3 Methods

3.1 Assessing variation in Dutch publicly financed home care

Hypothesis 1

We expect practice variation in Dutch publicly home care to be small, as the practice variation found in the Dutch institutional long term care was only at maximum 3% (Duell et al., 2017).

Datasets and study population

Data were derived from the national database of the Care Needs Assessment Centre (CNAC). The CNAC gathered detailed demographic, social and health information on those applying for LTC as well as details of their requests and entitlement to LTC. Firstly, we selected all LTC entitlements granted by the CNAC in the period July 2013 until June 2014 (N=781,136). This period was selected to avoid influences of the introduction of the LTC Act in January 2015 since applicants may also have changed their behaviour in expectation of the major reform. Secondly, only applicants with an entitlement for home care in the Netherlands were included (N= 582,213 (74.6%)). The final study sample included N= 582,159 entitlements and 355,828 unique individuals. To ensure the privacy of the applicants all information that could be used to identify an individual was removed and social security numbers were converted into non-informative numbers.

Dependent variables

Applicants for LTC may be entitled to a large number (or a combination) of types of home care. The first dependent variable is a categorical variable that characterizes four alternatives of publicly financed home care, namely personal care (PC), nursing (NC), combined care (personal care and nursing) or other remaining types of publicly financed home care. The last category is used as the reference category. Personal care includes supporting or taking over activities in the field of personal care aimed at eliminating a deficiency in self-reliance. Nursing includes taking care of an individual aimed at repairing or preventing the disease from getting worse or limiting physical disability. The remaining types of home care include individual and group counselling, individual and group treatment and short stay in an institution.

The second dependent variable measures the intensity of the entitled home care package (measured per capita in euros per week) and is computed as the duration of the entitlement (in days per week) multiplied by the Dutch Healthcare Authority (Nederlandse Zorgautoriteit, NZa) tariff for the given class entitlement per week. These tariffs are set per type of entitlement each year and we used tariffs based on a post-calculation of the rates in 2011. The distribution of the intensity variable is right-skewed. We therefore performed a nonparametric, bootstrap analyses in order to control for the skewness of the intensity variable.

Independent variables

Regional care offices dummies

We assess variation between 32 regional care offices. In the multinomial analyses 32 dummy variables were included, each one of which took the value “1” for a different region. In the linear analysis 31 dummy variables were included and the reference category was chosen as the region with the number of home care entitlements close to the average number

of entitlements granted by all care office regions (region 32). The dummy coefficients capture regional fixed effects and are our main coefficients of interest.

Case-mix variables and other independent variables first analyses

Adjustments for differences in patient characteristics were needed in our study in order to assess regional variation accurately. These adjustments were done by using case-mix variables. Previous studies in this field have investigated the determinants which influence the eligibility of clients for LTC (Portrait, 2000; Van Campen and Van Gameren 2005; Wong et al., 2010). We followed these studies and included as case-mix variables in this study age, gender, marital status, health situation (dominant and secondary health problem) and household composition. Additionally, we corrected for the month an entitlement was granted to account for possible changes in the environmental conditions over time. Most importantly, the initial health status was defined by the categorical variable primary dominant health problem, for which we established six categories (see table 2). The variable secondary dominant health problem was also included. Also, the models included interaction variables: age squared, age * gender, age * dominant health problem, gender * dominant health problem. When performing the analysis on intensity of care the model was also corrected for the different types of publicly financed home care (i.e. personal care, nursing, institutional treatment, individual help, group help, individual treatment, group treatment).

Statistical Analyses

Firstly, descriptive statistics were performed. Differences between the 32 care offices were tested for statistical significance using one-way ANOVA.²

Secondly, multinomial logistic regression models were used as our first dependent variable “type of publicly financed home care granted” is a categorical variable. Our second dependent variable “intensity of care granted” is a continuous variable. Therefore, we used linear regression models in the third part of the analyses. All models were corrected for all independent variables mentioned above and were stratified for patients younger than 65 and those 65 and older as both age groups have different dominant health problems (CNAC, 2014b). The analyses can be summarized by the means of the following equations, (1) and (2):

² This study used a statistical significance level of 5%. The statistical analyses were performed using SPSS 22.0 (IBM SPSS version 22; SPSS Inc., Chicago, IL, USA) and R studio.

$$\text{Prob}(Y_i^1 = K) = \frac{\exp(\sum_{h=1}^H X_{hi} \beta_{hk}^1)}{1 + \sum_{c=1}^{C-1} \exp(\sum_{h=1}^H X_{hi} \beta_{hc}^1)} \quad (1)$$

$$\text{Prob}(Y_i^1 = C) = \frac{1}{1 + \sum_{c=1}^{C-1} \exp(\sum_{h=1}^H X_{hi} \beta_{hc}^1)} \quad \text{for } C \text{ (reference category)}$$

$$Y_i^2 = \beta_0^2 + \sum_{h=1}^H X_{hi} \beta_h^2 + u_i^2 \quad (2)$$

Y_i^1 = Type of publicly financed home care taking the value 1, 2, 3 or 4 for client i

X_i = Set of H independent variables for client i

β_{hc}^1 = Parameter of the independent variable h for type care c

C = the reference category of home care, takes the value 4 (for other types of home care)

K = takes the value 1 (for Personal Care), 2 (for Nursing Care) or 3 (for combination of Personal and Nursing care)

Y_i^2 = Intensity of care in euros per week for client i

β_h^2 = Parameter of the independent variable h for the intensity of care

u_i^2 = Stochastic error term for the intensity of care for client i

In order to improve our estimated results based on equation 1 and 2 we used a parametric bootstrap procedure to calculate the average marginal effect per region and the corresponding confidence interval. We estimated our models taking into account possible individual correlation (i.e. some individuals have more than one entitlement during our observation window) while bootstrapping to obtain confidence intervals that allow for intra-individual correlation between observations.

Also, we calculated the average marginal effect over all regions. There was statistical evidence of regional variation (or practice variation) if the confidence interval for a region did not overlap the average marginal effect over all regions. In addition, there was statistical evidence of regional variation in intensity of care (results based on equation 2) when the coefficients of the regions were statistically significant and the confidence intervals of the care office regions did not overlap.

Finally, several sensitivity analyses were performed. Firstly, the multinomial logistic regression analyses were repeated for the total dataset. This was done to see whether our overall conclusions change if we do not stratify for the two age groups. Secondly, the multinomial logistic analysis was stratified for entitlements processed by the CNAC or by care providers. This was to explore whether regional variation increased when the care providers initiated the entitlements. Results are shown in Appendix 1.

3.2 Assessing how patient experiences relate to variation in the Dutch publicly financed home care

Hypothesis 2

We expect the degree of practice variation to increase due to reported patient experiences for LTC, as individuals with different experiences may demand care differently.

Datasets on patient experiences

We used publicly available regional data from 2013 on patient experiences with publicly financed home care (in Dutch: Zorginzicht).³ Clients were asked to fill in a questionnaire, the consumer quality (CQ) index, to share their experiences of the most relevant aspects of quality of care received from their health care provider. The CQ-index is derived from the American Consumer Assessment of Health Plan Surveys (Delnoij et al., 2006) and collects information on 1) the quality of the organization of care, 2) the quality of care provision and 3) the care-related quality and safety (ZN, 2013). The CQ-index on publicly financed home care includes 14 quality domains (as shown in table 4), each of them being addressed using a set of questions. Each question has four answering categories, ranging from 1 = 'never having positive experiences' to 4 = 'always having positive experiences' with respect to publicly financed home care. An average score per quality domain is calculated as a measure for patient experience.

Dependent variables

The marginal effects derived from the first analysis (equation 1, i.e. one for each regional care office 65 and older) are used as dependent variables for the analyses on patient experiences, i.e. three sets of 32 parameters (one for personal care, one for nursing and one for personal care and nursing care combined). For reasons of conciseness, we focus only on individuals 65 and older as this is the subgroup in which most variation is observed.

Independent variables

The data on experience / perceived quality is measured on a regional level and cannot be directly linked to the individuals from our CNAC dataset. The average rated experience per aspect of quality of care and per 4 digit postal code was merged to the CNAC dataset using the postal code of residence of the client.

Statistical Analyses

As it best suits our data and research question, we have chosen to perform a linear regression analysis to estimate which aspects of experiences are most strongly related to practice variation across regions. As mentioned, we used the results from the first equation (i.e. the calculated marginal effect of each region for all individuals 65 and older) in order to investigate whether patient experiences can explain the differences between regions. This can be summarised by means of the analyses shown in equation 3:

³ <https://www.zorginzicht.nl/opendata/Paginas/aangeleverdebestanden.aspx?sub=1&fLvIT=Openbare%20data&subIdx=3#vvt>

$$Y_r^3 = \beta_0^2 + \sum_{e=1}^E X_{er} \beta_e^3 + u_r^3 \quad (3)$$

Y_r^3 = The marginal effect of the probability of using publicly financed home care for each region r , for r in $[1,32]$

X_{er} = Set of E independent variables on patient experiences for region r

β_e^3 = Parameter of the independent variable e

4 Results

4.1 Descriptive statistics

The study sample included 582,159 publicly financed home care entitlements granted by 32 care offices in 400 municipalities in the period July 2013 until June 2014. Table 1 reports the frequency of entitlements per type of publicly financed home care. Personal care was granted most often.

Table 1: Number and percentage of publicly financed home care entitlements in July 2013 – June 2014

Variable name	July 2013 – June 2014
Number of publicly financed home care entitlements (N)	582,159
Percentage of home care entitlement for (%):	
Personal care	37.3
Nursing	14.1
Both personal care and nursing)	18.6
Remaining types of publicly financed home care	30.0
Intensity of home care per capita (€):	
Minimum	0.0
Mean	549.1
Maximum	39,718.9
SD	1,003.9

Table 2 sets out the characteristics of our study sample. An entitlement for publicly financed home care was granted to 355,828 unique clients the majority of whom were between 75 and 84 years old. Most clients were female and had a somatic illness as a dominant health problem. Only 14.1% of the clients were also registered as having a secondary health problem. The majority of the clients lived alone, were independent, married or had been married in the past. It appears from this table that mandated care providers granted more than half of the entitlements and that the majority of clients with a publicly financed home care entitlement lived in an urban area. The results of the one-way ANOVA analyses showed small p -values ($p < 0.05$) which confirmed large differences in case-mix variables and patient experience variables across care office regions.

Figure 1 illustrates the distribution of specific types of publicly financed home care entitlement granted (i.e. personal care, nursing, personal care and nursing or remaining publicly financed home care) amongst care offices and Figure 2 presents the distribution of the observed average care intensity in euros per week between the care office regions. Both figures show sizeable differences across care offices regions. Please note however that all these differences could be explained by differences in case-mix across the care regions.

Table 2: Characteristics and percentages of clients with an extramural care entitlement in the period July 2013 until June 2014

		Percentage
Unique clients (n=355,828)		
Average income (M ± SD)		€ 21,681 ± 4,398
Average week tariff granted care* (M ± SD)		€ 549.14 ± 1003.89
Age in years (M ± SD)		71.49 ± 19.68
	0 - 17	3.4
	18 – 64(<i>reference for 65-</i>)	20.2
	65 – 74	17.5
	75 – 84 (<i>reference for 65+</i>)	34.4
	> 85	24.5
Gender	Female (<i>reference</i>)	61.0
	Male	39.0
Clients with a dominant health problem	A somatic illness (<i>reference</i>)	78.5
	A psychiatric problem	5.4
	A psychogeriatric illness	6.5
	A physical disability	4.5
	An intellectual disability	4.7
	A sensory disability and psychosocial problems	0.3
	Missing case's	<0.1
Clients with a secondary health problem	Yes	14.1
	No (<i>reference</i>)	85.9
Marital status	Married (<i>reference</i>)	34.0
	Unmarried	20.4
	Widow	34.0
	Otherwise**	5.8
	Missing cases	5.7
House composition	Living alone & independently (<i>reference</i>)	53.1
	Multi-person household	3.6
	Household with partner and children	2.3
	Independent household with partner	32.2
	Household with a partner and more than one child	1.8
	Child living with his/her parents	4.4
	Care institution***	0.4
	Unknown	2.1
Entitlements processed by	Healthcare provider	57.3
	CNAC	42.7
Urbanisation	Percentage of ≥ 1000 addresses per km ²	66.1

The results of a one-way ANOVA analyses showed small p-values ($p < 0.000$) for all variables across care office regions.

* Average tariff granted care is the intensity of care in euros per week.

**The category “otherwise” includes a small group of individuals within our dataset such as individuals that are: 1) divorced, 2) registered as partners but not officially married, or 3) have been registered partners in the past.

*** Individuals that are registered as living in a care institution, but do not receive institutional long-term care, are individuals who receive home care but who had to move to an institutionalised setting to accompany their partner in need of institutional care.

Figure 1: The percentage of a specific type of publicly financed home care granted relative to the total number of publicly financed home care granted per care office region

Figure 2: Average care intensity per week for the total amount of publicly financed home care entitlements per care office region

4.2 Results of the multinomial regression analyses

Probabilities of a publicly financed home care entitlement for the average individual

Figure 3.1 presents the results of the multinomial logistic regression analyses for the average individual of 65 and older. An “average individual” was defined as a client with average characteristics (defined as average case-mix variables). For personal care the marginal effect per region showed a statistically significant difference from the average in 15 out of 32 regions. In addition, the marginal effect had a maximum difference of 22 percentage points indicating that when an individual is living in the region with the highest marginal effect, as compared to an individual living in the region with the lowest marginal effect, that person on average has an increase of 22 percentage points in the probability of receiving personal care, as compared to receiving other forms of publicly financed home care. For nursing the marginal effect per region showed a statistically significant difference from the average in 20 out of 32 regions and had a maximum difference of 34 percentage points. For personal care and nursing combined the marginal effect per region showed a statistically significant difference from the average in 18 out of 32 regions and had a maximum difference of 25 percentage points.

Figure 3.2 presents the results of the multinomial logistic regression analyses for the average individual of younger than 65. For personal care the marginal effect per region showed a statistically significant difference from the average in 2 out of 32 regions and had a maximum difference of 13 percentage points. For nursing the marginal effect per region showed a statistically significant difference from the average in 9 out of 32 regions and had a maximum difference of 25 percentage points. For personal care and nursing combined the marginal effect per region showed a statistically significant difference from the average in 3 out of 32 regions and had a maximum difference of 22 percentage points.

As expected, the majority of the case-mix variables were significantly related to the probability of getting an entitlement for one of the types of publicly financed home care. The odds ratios and the p-values of these case-mix variables are shown in tables 3.1 and 3.2.

Table 3.1: Model 1 multinomial logistic model for the probability of an home care entitlement 65 and older

Type of extramural care entitlement Mcfadden's pseudo R-squared= 0.171		Personal care only		Nursing only		Both Personal care & Nursing	
		Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value
Care office region							
	region 1	0.857	0.000	0.989	0.000	0.681	0.000
	region 2	0.972	0.000	0.970	0.000	0.836	0.000
	region 3	0.687	0.000	1.071	0.000	0.671	0.000
	region 4	1.197	0.000	1.280	0.000	1.349	0.000
	region 5	1.048	0.000	1.731	0.000	1.100	0.000
	region 6	0.961	0.000	1.362	0.000	0.859	0.000
	region 7	1.326	0.000	1.203	0.000	1.060	0.000
	region 8	1.140	0.000	0.833	0.000	0.914	0.000
	region 9	1.200	0.000	1.170	0.000	1.127	0.000
	region 10	1.270	0.000	2.266	0.000	1.410	0.000
	region 11	0.719	0.000	0.673	0.000	0.516	0.000
	region 12	1.102	0.000	1.495	0.000	0.896	0.000
	region 13	1.726	0.000	0.806	0.000	1.176	0.000
	region 14	1.059	0.000	1.627	0.000	0.983	0.000
	region 15	1.347	0.000	1.054	0.000	1.319	0.000
	region 16	1.080	0.000	0.910	0.000	0.982	0.000
	region 17	1.134	0.000	1.325	0.000	1.195	0.000
	region 18	0.983	0.000	0.589	0.000	0.551	0.000
	region 19	0.678	0.000	1.026	0.000	1.007	0.000
	region 20	1.360	0.000	0.937	0.000	1.354	0.000
	region 21	1.023	0.000	1.159	0.000	1.083	0.000
	region 22	0.974	0.000	0.899	0.000	0.906	0.000
	region 23	1.439	0.000	0.787	0.000	1.348	0.000
	region 24	1.280	0.000	0.926	0.000	1.054	0.000
	region 25	1.035	0.000	0.884	0.000	1.106	0.000
	region 26	1.456	0.000	2.356	0.000	1.232	0.000
	region 27	1.094	0.000	0.817	0.000	0.936	0.000
	region 28	1.140	0.000	1.433	0.000	1.239	0.000
	region 29	0.995	0.000	1.022	0.000	1.014	0.000
	region 30	1.198	0.000	1.770	0.000	1.026	0.000
	region 31	1.105	0.000	1.099	0.000	1.224	0.000
	region 32	0.782	0.000	1.043	0.000	0.784	0.000
Gender	(reference female)						
	Male	0.854	0.000	2.222	0.000	0.248	0.000
Age	(reference 75 – 84 year)						
	65 – 74 year	0.740	0.000	0.773	0.000	0.830	0.000
	> 85 year	1.105	0.000	1.166	0.000	1.096	0.000
Dominant health problem	(reference somatic illness)						
	Psychiatric problem	0.034	0.000	0.000	0.000	0.000	0.000
	Psychogeriatric illness	0.000	0.000	0.040	0.000	0.024	0.000
	Physical disability	0.009	0.000	0.000	0.000	0.006	0.000
	Intellectual disability	0.042	0.000	0.117	0.000	0.196	0.000
	Sensory disability & psychosocial problems	0.000	0.000	0.836	0.000	0.000	0.000
Secondary health problem	(reference no)						
	Yes	0.245	0.000	0.062	0.000	0.383	0.000
Marital status	(reference married)						
	Unmarried	0.688	0.000	0.680	0.000	1.052	0.000
	Widow	0.738	0.000	0.767	0.000	0.999	0.000
	Otherwise	1.132	0.000	1.329	0.000	1.186	0.000
	Missing cases	1.175	0.000	1.634	0.000	1.428	0.000

Table 3.1: Model 1 multinomial logistic model for the probability of an home care entitlement 65 and older (Continued)

Type of extramural care entitlement Mcfadden's pseudo R-squared= 0.171		Personal care only		Nursing only		Both Personal care & Nursing	
		Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value
House composition	<i>(reference living alone & independently)</i>						
	Multi-person household	0.628	0.000	0.679	0.000	0.833	0.000
	Household with partner and children	0.455	0.000	0.532	0.000	0.805	0.000
	Independent household with partner	0.556	0.000	0.826	0.000	0.730	0.000
	Household with a partner and more than one child	0.572	0.000	0.947	0.000	0.749	0.000
	Child living with his/her parents	1.392	0.000	1.940	0.000	0.915	0.000
	Care institution	0.626	0.000	0.366	0.000	0.404	0.000
	Unknown	0.803	0.000	1.659	0.000	0.656	0.000
Interaction variables	Age*age	1.000	0.000	1.000	0.000	1.000	0.000
	Male*age	1.030	0.000	1.021	0.000	1.031	0.000
	Psychiatric problem* male	1.043	0.000	0.820	0.000	0.281	0.000
	Psychogeriatric illness* male	2.183	0.000	57.045	0.000	0.002	0.000
	Physical disability* male	0.846	0.000	0.519	0.000	0.877	0.000
	Intellectual disability* male	0.945	0.000	0.818	0.000	0.001	0.000
	Sensory disability & psychosocial problems* male	1.315	0.000	1.002	0.000	0.047	0.000
	Psychiatric problem* age	1.010	0.000	1.164	0.000	1.160	0.000
	Psychogeriatric illness* age	1.081	0.000	0.966	0.000	0.988	0.000
	Physical disability* age	1.056	0.000	1.145	0.000	1.056	0.000
	Intellectual disability* age	1.006	0.004	1.025	0.000	0.977	0.000
	Sensory disability & psychosocial problems* age	1.035	0.000	0.971	0.000	0.978	0.000
Month entitlement granted	<i>(reference July 2013)</i>						
	August 2013	1.048	0.000	0.904	0.000	0.988	0.000
	September 2013	0.960	0.000	0.880	0.000	0.879	0.000
	October 2013	0.933	0.000	0.760	0.000	0.917	0.000
	November 2013	1.000	0.000	0.861	0.000	0.854	0.000
	December 2013	1.026	0.000	0.676	0.000	0.994	0.000
	January 2014	1.019	0.000	0.788	0.000	0.941	0.000
	February 2014	1.037	0.000	0.885	0.000	1.004	0.000
	March 2014	1.030	0.000	0.885	0.000	0.964	0.000
	April 2014	1.044	0.000	0.859	0.000	1.031	0.000
	May 2014	0.985	0.000	0.825	0.000	0.954	0.000
	June 2014	1.022	0.000	0.958	0.000	0.965	0.000

Table 3.2: Model 1 multinomial logistic model for the probability of an home care entitlement younger than 65

Type of extramural care entitlement Mcfadden's pseudo R-squared= 0.466		Personal care only		Nursing only		Both Personal care & Nursing	
		Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value
Care office region							
	region 1	0.820	0.000	0.912	0.000	0.858	0.000
	region 2	0.914	0.000	0.823	0.000	0.720	0.000
	region 3	0.929	0.000	1.058	0.000	0.795	0.000
	region 4	1.148	0.000	1.123	0.000	1.127	0.000
	region 5	1.091	0.000	1.311	0.000	1.228	0.000
	region 6	0.872	0.000	1.005	0.000	1.111	0.000
	region 7	1.080	0.000	1.372	0.000	1.357	0.000
	region 8	0.996	0.000	0.894	0.000	0.906	0.000
	region 9	1.090	0.000	1.107	0.000	0.906	0.000
	region 10	1.023	0.000	1.847	0.000	1.413	0.000
	region 11	1.145	0.000	0.707	0.000	0.829	0.000
	region 12	0.915	0.000	1.105	0.000	0.941	0.000
	region 13	1.121	0.000	0.685	0.000	0.858	0.000
	region 14	0.969	0.000	1.052	0.000	0.642	0.000
	region 15	1.035	0.000	0.978	0.000	0.993	0.000
	region 16	0.896	0.000	0.701	0.000	0.873	0.000
	region 17	1.086	0.000	1.158	0.000	1.238	0.000
	region 18	1.208	0.000	0.877	0.000	0.947	0.000
	region 19	0.731	0.000	0.982	0.000	0.865	0.000
	region 20	1.020	0.000	0.752	0.000	1.171	0.000
	region 21	1.083	0.000	0.982	0.000	1.013	0.000
	region 22	1.337	0.000	1.049	0.000	1.345	0.000
	region 23	1.221	0.000	0.920	0.000	1.152	0.000
	region 24	1.074	0.000	0.996	0.000	0.968	0.000
	region 25	0.822	0.000	0.731	0.000	0.790	0.000
	region 26	0.880	0.000	1.421	0.000	0.860	0.000
	region 27	0.920	0.000	0.997	0.000	0.994	0.000
	region 28	0.964	0.000	1.159	0.000	0.966	0.000
	region 29	1.077	0.000	1.459	0.000	1.260	0.000
	region 30	1.326	0.000	1.306	0.000	1.112	0.000
	region 31	0.942	0.000	1.157	0.000	0.977	0.000
	region 32	0.796	0.000	0.950	0.000	0.878	0.000
Gender	(reference female)						
	Male	1.027	0.000	1.478	0.000	0.850	0.000
Age	(reference 18 – 64 year)						
	0 -17 year	1.122	0.000	1.507	0.000	1.214	0.000
Dominant health problem	(reference somatic illness)						
	Psychiatric problem	0.027	0.000	0.144	0.000	0.079	0.000
	Psychogeriatric illness	0.000	0.000	0.000	0.000	0.004	0.000
	Physical disability	0.000	0.000	0.000	0.000	0.000	0.000
	Intellectual disability	0.000	0.000	0.000	0.000	0.000	0.000
	Sensory disability & psychosocial problems	0.000	0.000	0.000	0.000	0.000	0.000
Secondary health problem	(reference no)						
	Yes	0.483	0.000	0.315	0.000	0.640	0.000
Marital status	(reference married)						
	Unmarried	0.755	0.000	0.592	0.000	0.917	0.000
	Widow	1.006	0.001	0.735	0.000	1.069	0.000
	Otherwise	1.049	0.000	1.082	0.000	1.029	0.000
	Missing cases	1.315	0.000	1.445	0.000	1.427	0.000
	Missing cases	1.175	0.000	1.634	0.000	1.428	0.000

Table 3.2: Model 1 multinomial logistic model for the probability of an home care entitlement younger than 65 (Continued)

Type of extramural care entitlement Mcfadden's pseudo R-squared= 0.466		Personal care only		Nursing only		Both Personal care & Nursing	
		Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value
House composition	<i>(reference living alone & independently)</i>						
	Multi-person household	0.926	0.000	0.803	0.000	0.885	0.000
	Household with partner and children	0.588	0.000	0.611	0.000	0.653	0.000
	Independent household with partner	0.670	0.000	0.903	0.000	0.798	0.000
	Household with a partner and more than one child	0.648	0.000	0.617	0.000	0.661	0.000
	Child living with his/her parents	0.922	0.000	1.255	0.000	0.890	0.000
	Care institution	0.185	0.000	0.175	0.000	0.177	0.000
	Unknown	0.727	0.000	1.613	0.000	0.629	0.000
Interaction variables							
	Age*age	1.000	0.000	1.000	0.000	1.000	0.000
	Male*age	0.996	0.000	0.997	0.000	0.991	0.000
	Psychiatric problem* male	2.545	0.000	1.333	0.000	1.341	0.000
	Psychogeriatric illness* male	0.865	0.000	1.098	0.000	1.311	0.000
	Physical disability* male	0.941	0.000	0.745	0.000	1.026	0.000
	Intellectual disability* male	0.816	0.000	1.186	0.000	1.282	0.000
	Sensory disability & psychosocial problems* male	1.114	0.000	0.513	0.000	1.007	0.000
	Psychiatric problem* age	1.000	0.953	0.988	0.000	0.970	0.000
	Psychogeriatric illness* age	1.171	0.000	1.101	0.000	1.025	0.000
	Physical disability* age	1.004	0.000	1.009	0.000	0.995	0.000
	Intellectual disability* age	0.966	0.000	0.997	0.209	1.002	0.404
	Sensory disability & psychosocial problems* age	0.892	0.000	1.004	0.402	1.030	0.000
Month entitlement granted	<i>(reference July 2013)</i>						
	August 2013	1.005	0.032	1.273	0.000	1.174	0.000
	September 2013	1.068	0.000	0.891	0.000	0.909	0.000
	October 2013	0.861	0.000	0.742	0.000	0.759	0.000
	November 2013	1.030	0.000	0.782	0.000	0.914	0.000
	December 2013	0.955	0.000	0.823	0.000	0.825	0.000
	January 2014	0.932	0.000	0.721	0.000	0.778	0.000
	February 2014	0.942	0.000	0.708	0.000	0.837	0.000
	March 2014	0.994	0.000	0.719	0.000	0.868	0.000
	April 2014	0.957	0.000	0.681	0.000	0.815	0.000
	May 2014	1.037	0.000	0.824	0.000	0.962	0.000
	June 2014	0.998	0.003	0.829	0.000	0.904	0.000

Figure 3.1: Variation in the personal care entitlements granted regarding nursing and personal care and nursing combined 65 and older

Figure 3.2: Variation in the personal care entitlements granted regarding nursing and personal care and nursing combined younger than 65

4.3 Results of the linear regression model

Figure 4.1⁴ presents the results of the linear regression analyses 65 and older, 15 out of 31 regions were significantly different from the reference care office, which indicates the presence of practice variation in intensity of entitled care between many regions. The maximum difference between regions was equal to 47.51% (ranging between -20.32% and 27.19%). Figure 4.2⁵ presents the results of the linear regression analyses younger than 65, 23 out of 31 regions were significantly different from the reference care office, which indicates more practice variation in intensity of entitled care for people younger than 65. The maximum difference between regions was equal to 21.62% (ranging between -9.05% and 12.56%). More information on how the different case-mix variables are related to the average intensity of home care is included in Appendix 2 (table A1).

Figure 4.1: Linear regression model for the average intensity of care 65 and older

Figure 4.2: Linear regression model for the average intensity of care younger than 65

⁴ Excluding the reference region (region 32), at an average intensity cost of 569.82.

⁵ Excluding the reference region (region 32), at an average intensity cost of 1008.32.

4.4 Results on patient experiences

Table 4 presents the results of the linear regression analyses on the relation between estimated regional effects for individuals 65 and older (also: practice variation) and patient experience scores. Even though patient experiences seem to have a small explanatory power, the results show that experience with physical care is significantly associated with the degree of practice variation in home care entitlements granted for personal care. In addition, we found no statistically significant effect for the patient experiences in relation to nursing.

Table 4: Linear regression model for patient experiences in relation to variation

Variable name	Personal Care only Coefficients	Nursing only Coefficients	Both personal Care & Nursing Coefficients
	Adjusted R ² = .013	Adjusted R ² = -.030	Adjusted R ² = .020
Intercept	-0.684	-0.936	-1.109*
Percentage of individuals that had falling incident	0.004	0.001	0.002
Percentage of prevalence that encountered freedom restraints	0.002	0.001	0.004
Treatment experiences	-0.065	-0.150	-0.032
Experiences regarding the availability of staff	0.025	0.038	0.024
Experience providing information	0.051	-0.014	0.033
Experience regarding participation	0.021	-0.023	0.039
Experience regarding the quality of staff	-0.109	0.167	-0.079
Experience of safety	0.027	0.009	0.007
Experience of physical care	0.229*	0.274	0.289*
Experience of food and drinks	-0.019	-0.004	0.013
Experience of the taste of food and drinks	0.027	-0.030	-0.010
Privacy experienced	0.035	0.009	0.048
Experience of cleaning	-0.013	0.005	0.000

* Statistically significant at a p-value of 0.05.

5 Discussion

The results suggest practice variation in the probability of receiving publicly financed home care entitlements, i.e. personal care, nursing, combined (personal and nursing) care and the remaining types of publicly financed home care. The marginal effects showed differences across regions up to 34 percentage points. We observed variation in the average intensity of care between the regional care offices. Results show more statistically significant differences between regions in the population aged 65 and older as compared to the younger population. We observed a maximum difference of 47.51%. The analyses of patient experiences show that almost none of the practice variation can be explained by patient experiences. In addition, when analysing the part of practice variation that can be explained by patient experiences, we concluded that ‘access to personal care’, solely or in combination with nursing, is most likely to be influenced by patient experiences. This type of care may be more difficult to regulate as compared to other types of care and therefore more preference sensitive. The sensitivity analyses regarding all individuals, but also the way in which an entitlement was processed (by the CNAC or by a care provider) resulted in somewhat different marginal effects within care office regions, but a quite similar level of variation between these regions.

Our study showed evidence that eligibility for publicly financed home care depended partially on where a client lived, while striving towards equal access. Also in Sweden equal access to care is the general principle of their healthcare system (Trydegård and Thorslund, 2001). There the difference in the coverage rate of home help was up to 47% for people aged 80 years or older whereas the coverage rate for people aged 65 to 79 years differed by 13% (Trydegård and Thorslund, 2001). In addition, when comparing our study to the Dutch

healthcare system for medical care, the findings of the current study show a much lower degree of regional variation. Previous research reported a large degree of practice variation in the healthcare sector, especially among elective interventions (Vektis and Plexus, 2011). For example, in the treatment of a spinal hernia, surgeons in some hospitals are operating 550 percentage points more often than in other hospitals (Vektis and Plexus, 2011). This is probably due to the way (Dutch) LTC is organized and financed. Patients in the medical care sector may be more dependent on their health care providers' experience and knowledge which could result in more practice variation. Furthermore, in the Netherlands, as a consequence of regulated competition, the health care sector is largely organised by private health insurers. This is in contrast to the LTC sector, which was, with the exception of domestic help, until 2015 centrally managed by the government. Having no centrally organized system for assessing needs could also substantially contribute to more practice variation.

As explained in the introduction, the variation in institutional LTC granted was at maximum of 3% between 32 Dutch regional care offices (Duell et al., 2017). Looking at the results from our current study we have to conclude that more regional variation is present in the publicly financed home care entitlements granted. This is in line with the theory of Wennberg (2002) due to institutional LTC being less preference sensitive, as the need for care is larger and there are fewer options that are available and medically equal. When looking more closely at the sensitivity to experiences, we conclude that there is a positive association between regional variation in personal care and experience regarding patients' physical care. As the rated experience varies with regional variation it could indicate either 1) more use of other forms of care than expected (informal), 2) less use of publicly financed home care than expected, or 3) more use of publicly financed home care than expected, of which the last two are unwarranted. We argue that a central procedure/guideline based on expert opinion and incorporating variation in patient need, such as the one in force in the Netherlands, may prevent patients from using more than expected based on their needs. Preventing patients to use less than expected based on their needs, especially related to experiences, is however more difficult. A literature search within this context has led us to a policy recommendation to intensify processes of shared decision-making before granting personal care in order to prevent patients from using less than needed. O'Connor et al. (2004) has shown that this can be done by means of patient decision aids. The extent to which informal care can replace formal / publicly financed care and the extent to which there is less use or more use of publicly financed home care than expected based on a patients' needs would be an interesting topic for further research.

One of the main strengths of this study is the availability of a large national population-wide dataset. Data was collected from 2005 until 2015, which gave us the opportunity to select the most relevant time period. The dataset also provided detailed information regarding demographic, health and social characteristics of the applicants. This information made it possible to adjust for a large number of case-mix and other variables. In addition, several sensitivity analyses were performed in order to further explore the impact of some factors on the main results. In order to produce detailed results, the probability of getting some form of publicly financed home care for different types of clients was computed.

This study also has some limitations. For instance, there was no direct information available about the use of informal care, while a spouse's ability to provide informal care affects the entitlements of publicly financed home care in the Netherlands (Bakx et al., 2015). However, the process of assessing needs and granting entitlements is organised centrally and has a verifiable standardized procedure taking into account access to informal care, formal home care and institutional care at the moment of applying for care. Whether

or not someone received informal care is therefore part of the granting procedure. We therefore had the possibility to indirectly control for informal care. In addition, latent demand for care could be a potential problem influencing our results. However, in the Netherlands the general practitioner (GP) functions as a ‘gatekeeper’ (Duell et al., 2017). Visiting the GP and applying for care do not bring along any costs. Consequently, people in need of long-term care face no meaningful barrier to enter the assessment process.

This study is one of the first studies on regional variation (or practice variation) in publicly financed home care before the major reform in January 2015 after which municipalities and health insurers became responsible for the administration of and access to publicly financed home care. This reform also involved a shift from institutional LTC to publicly financed home care, and intensification of home care. We expect regional variation to increase as a result of local demand, supply factors and the budgetary restrictions / priorities of the municipalities. Previous research has already reported a larger degree of variation in expenditure causing local variability in long-term care provision for older people in England. The majority of the disparities in expenditure was caused by demand and supply factors and to some extent local political preferences (Fernandez and Forder, 2015). These factors will also become increasingly important with the shift towards publicly financed home care in the Netherlands and all other countries that are trying to keep LTC affordable.

6 Conclusion

This paper shows evidence of significant variation in the probability of receiving publicly financed home care entitlements across the Netherlands. In addition, variation between regions is larger for the population aged 65 and older. Also, we found that almost none of the observed variation can be explained by patient experiences. This study has been performed before the major decentralisation of the Dutch LTC system in January 2015. We expect regional variation to increase as a result of local demand, supply factors and the budgetary restrictions of the local stakeholders. This poses challenges for countries as the Netherlands, which introduced a shift towards using more publicly financed home while striving towards equal access.

Acknowledgements

We thank the Dutch Care Needs Assessment Centre (CNAC) for providing us with access to the data used in this study.

Ethics

Under Dutch law, this study did not require approval from an Ethics Review Board because it did not fall within the scope of the Medical Research Involving Human Subjects Act (WMO).

Funding

No sources of funding are applicable to this research.

Competing interest

The first author, third and fourth author did not receive any financial grants to conduct this study. Two of the other researchers had an appointment as a researcher with the CNAC; the second author had an appointment as an intern and fifth author had an appointment of one day a week. We would like to emphasize that this study does not necessarily reflect the view of CNAC on unexplained practice variation.

References

- Appleby J, Raleigh V, Frosini F, Bevan G, Gao H, Lyscom T (2011) *Variations in Health care*. The King's Fund, London.
- 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 Economics*. 24(6):631–643.
- Bradshaw SA, Playford ED, Riazi A (2012) Living well in care homes: a systematic review of qualitative studies, *Age and Ageing*, 41(4):429–440.
- CNAC (2012) “CIZ Indicatiewijzer 5.0. Retrieved from https://www.ciz.nl/voor-professionals/Documents/Indicatiewijzer_50.pdf. Accessed on February 20, 2016.
- CNAC (2014a) “Informatieprotocol Toezicht indicatiestelling met taakmandaat”. Retrieved from:
<https://www.zorgkennis.net/downloads/kennisbank/ZK-kennisbank-ciz-Informatieprotocol-2202.pdf>. Accessed on May 19, 2016.
- CNAC (2014b) *CIZ Trendrapportage 2013* “Ontwikkelingen in de aanspraak op AWBZ-zorg 2010-2013”. <https://www.zorgkennis.net/downloads/kennisbank/ZK-kennisbank-CIZ-Trendrapportage-2013-2647.pdf>. Accessed on February 20, 2016.
- Colombo F, Llena-Nozal A, Mercier J, Tjadens F (2011) Help Wanted?: Providing and Paying for Long-Term Care, *OECD Health Policy Studies*, OECD Publishing, Paris.
- Corallo AN, Croxford R, Goodman DC, Bryan EL, Srivastava D, Stukel TA (2014) A systematic review of medical practice variation in OECD countries. *Health Policy*. 114(1):5–14.
- Davey A, Johansson L, Malmberg B, Sundström G (2006) Unequal but equitable: An analysis of variations in old-age care in Sweden. *European Journal of Ageing*. 3(1):34–40.
- Degenholtz H, Kane RA, Kivnick HQ (1997) Care-related preferences and values of elderly community-based LTC consumers: Can case managers learn what's important to clients? *The Gerontologist*. 37(6):767-776.
- Delnoij DMJ, Ten Asbroek G, Arah OA, De Koning JS, Stam P, Poll A, Vriens B, Schimdt P, Klazinga NS (2006) Made in the USA: the import of American Consumer Assessment of Health Plan Surveys (CAHPS®) into the Dutch social insurance system. *European Journal of Public Health*, The 16(6):652-659.
- Duell D, Koolman X, Portrait F (2017) Practice variation in the Dutch long-term care and the role of supply-sensitive care: Is access to the Dutch long-term care equitable? *Health Economics*. 26(12):1728-1742.
- Faber M (2011) The Dutch approach to unwarranted medical practice variation. *British Medical Journal*. 342(7799):688–689.
- Fernandez JL, Forder J (2015) Local variability in long-term care services: Local autonomy, exogenous influences and policy spillovers. *Health Economics*. 24(S1):146–157.
- Gomes B, Higginson IJ (2006) Factors influencing death at home in terminally ill patients with cancer: systematic review. *BMJ*. 332(7540):515-521.
- Gori C (2000) Solidarity in Italy's policies towards the frail elderly: a value at stake. *International Journal of Social Welfare*. 9(4):261–269.
- Gori C, Fernandez JL, Wittenberg R (2016) *Long-Term Care Reforms in OECD Countries*. Policy Press. ISBN: 9781447334644.

- Higginson IJ, Sarmiento VP, Calanzani N, Benalia H, Gomes B (2013) Dying at home – is it better: A narrative appraisal of the state of the science. *Palliative Medicine*. 27(10): 918-924.
- Jensen P, Lolle H (2013) The Fragmented Welfare State: Explaining Local Variations in Services for Older People. *Journal of Social Policy*. 42(2):349-370.
- Maarse JAM, Jeurissen PP (2016) The policy and politics of the 2015 long-term care reform in the Netherlands. *Health Policy* 120:241–245.
- Maassen H (2012) “Praktijkvariatie ongelooflijk groot.” *Medisch Contact*. 67(38):2062–2065. Retrieved from: <http://www.medischcontact.nl/archief-6/Tijdschriftartikel/120953/Praktijkvariatie-ongelooflijk-groot.htm>. Accessed on February 16, 2016.
- Mot E (2010) The Dutch system of long-term care. *Assessing Needs of Care in European Nations WP 1: Overview of long-term care systems*. CPB Netherlands Bureau for Economic Policy Analysis.
- O'Connor AM, Llewellyn-Thomas HA, Flood AB (2004) Modifying Unwarranted Variations In Health Care: Shared Decision Making Using Patient Decision Aids. *Health Affairs*. 23(2) web exclusives collection.
- OECD (2016) *OECD Health Statistics*. <http://www.oecd.org/els/health-systems/health-data.htm>. Accessed on August 14, 2017.
- OECD (2017a) *Health at a Glance 2017*. <http://www.oecd.org/health/health-systems/health-at-a-glance-19991312.htm>. Accessed on December 21, 2018.
- OECD (2017b) *Health Inequalities*. <http://www.oecd.org/health/inequalities-in-health.htm>. Accessed on November 29, 2017.
- Portrait F, Lindeboom M, Deeg D: The use of long-term care services by the Dutch elderly (2000). *Health Economics*. 9(6):513–531.
- Skinner J (2012) Causes and Consequences of Regional Variations in Health Care 1. *Handbook of Health Economics*, Volume 2 (Vol. 2). Elsevier B.V. P. 45-93.
- Theurer K, Mortenson WB, Stone R, Suto M, Timonen V, Rozanova J (2015) The need for a social revolution in residential care. *Journal of Aging Studies*. 35:201-210.
- Trydegård GB, Thorslund M (2001) Inequality in the welfare state? Local variation in care of the elderly - the case of Sweden. *International Journal of Social Welfare*. 10(3):174–184.
- Van Campen C, Van Gameren E (2005) Eligibility for long-term care in The Netherlands: development of a decision support system. *Health Soc. Care Community*. 13(4):287–296.
- Van Dijk W, Groenewoud S, Stadhouders N, Van der Wees P, Tanke M, Jeurissen P (2015) “Verspilling in de langdurige zorg; een verkenning van de literatuur.” Celsius Academy for affordable care.
<https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2015/03/04/verspilling-in-de-langdurige-zorg/verspilling-in-de-langdurige-zorg.pdf>. Accessed on March 7, 2018.
- Vektis and Plexus (2011) “Rapportage indicatoren indicatiestelling (praktijkvariatie)”. http://www.vektis.nl/downloads/onderzoeksrapport_praktijkvariatie.pdf. Accessed on March 4, 2016.

- Wennberg JE (2002) Unwarranted variations in healthcare delivery: implications for academic medical centres. *BMJ (Clinical research ed.)*. 325(7370): 961–964.
- Wennberg JE (2010) *Tracking Medicine: A Researcher's Quest to Understand Health Care*. Oxford University Press, New York.
- Wong A, Elderkamp-de Groot R, Polder J, van Exel J (2010) Predictors of long-term care utilization by Dutch hospital patients aged 65+. *BMC Health Services Research*. 10: 110.
- ZN (2013) “Handboek Kwaliteitsdocument 2013 Verpleging Verzorging & Thuiszorg, Het meten van goede zorg in de VV&T.”
<https://www.zorginzicht.nl/bibliotheek/VVT/RegisterMeetinstrumentenDocumenten/Handboek%20VVT.pdf> Accessed on December 21, 2018.

Appendix 1

Sensitivity analyses

The results of the sensitivity analyses are shown in graphs A1 – A5, shown beneath. First, the results of the analysis for all age groups together (figure A1) showed that the marginal effect across regions are somewhat different within care office regions, as compared to our main analyses per age group, but have a quite similar level of practice variation between these regions. The results of the second sensitivity analysis, in which the study sample was stratified in entitlements processed by the CNAC (shown in figure A2 and A4) and not processed by the CNAC (shown in figure A3 and A5), showed that the average marginal effect across regions is lower, closer to a marginal effect of 0, when entitlements are processed by CNAC indicating that practice variation is less when the entitlements are processed by CNAC.

Figure A1: Variation in homecare entitlements granted for both 65- and 65+

Figure A2: Variation in home care entitlements granted processed by CNAC 65+

Figure A3: Variation in home care entitlements granted not processed by CNAC 65+

Figure A4: Variation in home care entitlements granted processed by CNAC 65-

Figure A5: Variation in home care entitlements granted not processed by CNAC 65-

Appendix 2

Table A1: Model 2 linear model for home care intensity younger than 65 (excerpt: excluding care office regions)

		Intensity of care Adjusted R ² = 0.384	
		Coefficient	P-value
Intercept		-457.500	0.000
Gender	(reference female)		
	Male	109.000	0.000
Age	(reference 18-64 year)		
	0 -17 year	35.940	0.004
Dominant health problem	(reference somatic illness)		
	Psychiatric problem	-592.600	0.002
	Psychogeriatric illness	-296.300	0.000
	Physical disability	-119.500	0.000
	Intellectual disability	-9.534	0.577
	Sensory disability & psychosocial problems	-215.200	0.004
Secondary health problem	(reference no)		
	Yes	-240.800	0.000
Marital status	(reference somatic married)		
	Unmarried	-143.300	0.000
	Widow	-96.860	0.000
	Otherwise	-75.870	0.000
	Missing cases	-87.150	0.000
House composition	(reference living alone & independently)		
	Multi-person household	85.760	0.000
	Household with partner and children	129.400	0.000
	Independent household with partner	136.400	0.000
	Household with a partner and more than one child	69.480	0.000
	Child living with his/her Parents	164.700	0.000
	Care institution	123.700	0.000
	Unknown	130.800	0.000
Type of home care			
	Personal care	517.100	0.000
	Nursing Institutional treatment	856.700	0.000
	Individual help	1029.000	0.000
	Group help	223.000	0.000
	Individual treatment	213.000	0.000
	Group treatment	461.900	0.000
Interaction variables			
	Age*age	0.036	0.000
	Male*age	-0.607	0.025
	Psychiatric problem*Male	15.510	0.754
	Psychogeriatric illness*Male	-43.390	0.000
	Physical disability*Male	-40.860	0.012
	Intellectual disability*Male	-54.030	0.000
	Sensory disability & psychosocial problems*Male	-54.320	0.344
	Psychiatric problem*Age	6.383	0.047
	Psychogeriatric illness*Age	-2.662	0.000
	Physical disability*Age	-2.606	0.000
	Intellectual disability*Age	-9.398	0.000
	Sensory disability & psychosocial problems*Age	-6.036	0.000
Month entitlement granted	(reference July 2013)		
	August 2013	23.770	0.012
	September 2013	39.520	0.000
	October 2013	20.460	0.035
	November 2013	44.500	0.000
	December 2013	46.320	0.000
	January 2014	58.180	0.000
	February 2014	45.960	0.000
	March 2014	35.430	0.000
	April 2014	46.890	0.000
	May 2014	58.780	0.000
	June 2014	44.630	0.000

Table A2: Model 2 linear model for home care intensity 65 and older (excerpt: excluding care office regions)

		Intensity of care Adjusted R ² = 0.495	
		Coefficient	P-value
Intercept		-287.700	0.000
Gender	(reference female)		
	Male	417.300	0.000
Age	(reference 75-84 year)		
	65 – 74 year	74.060	0.000
	> 85 year	-3.201	0.440
Dominant health problem	(reference somatic illness)		
	Psychiatric problem	-648.200	0.000
	Psychogeriatric illness	-3481.000	0.000
	Physical disability	-1312.000	0.000
	Intellectual disability	-4093.000	0.000
	Sensory disability & psychosocial problems	-2765.000	0.000
Secondary health problem	(reference no)		
	Yes	-123.700	0.000
Marital status	(reference married)		
	Unmarried	-84.340	0.000
	Widow	19.420	0.002
	Otherwise	-0.646	0.927
	Missing cases	5.272	0.483
House composition	(reference living alone & independently)		
	Multi-person household	44.170	0.000
	Household with partner and children	114.000	0.000
	Independent household with partner	102.800	0.000
	Household with a partner and more than one child	22.860	0.055
	Child living with his/her Parents	90.500	0.290
	Care institution	133.100	0.000
	Unknown	53.030	0.000
Type of home care			
	Personal care	-287.700	0.000
	Nursing Institutional treatment	155.700	0.000
	Individual help	436.600	0.000
	Group help	2082.000	0.000
	Individual treatment	96.290	0.000
	Group treatment	-225.900	0.000
Interaction variables			
	Age*age	0.032	0.000
	Male*age	-4.386	0.000
	Psychiatric problem*Male	9.242	0.291
	Psychogeriatric illness*Male	-172.300	0.000
	Physical disability*Male	-83.710	0.000
	Intellectual disability*Male	-246.600	0.000
	Sensory disability & psychosocial problems*Male	-9.897	0.827
	Psychiatric problem*Age	5.012	0.000
	Psychogeriatric illness*Age	35.330	0.000
	Physical disability*Age	16.870	0.000
	Intellectual disability*Age	38.880	0.000
	Sensory disability & psychosocial problems*Age	25.130	0.000
Month entitlement granted	(reference July 2013)		
	August 2013	10.150	0.053
	September 2013	12.930	0.013
	October 2013	16.650	0.001
	November 2013	19.130	0.000
	December 2013	35.770	0.000
	January 2014	21.680	0.000
	February 2014	15.120	0.004
	March 2014	23.170	0.000
	April 2014	15.290	0.003
	May 2014	25.980	0.000
	June 2014	18.040	0.001