Regional variation in public long-term home care

Regional differences in the Netherlands and the role of patient experiences

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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 care while striving towards equal access.

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

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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 homecare. 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):

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\(^2\) 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.
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). 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:

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3 https://www.zorginzicht.nl/opendata/Paginas/aangeleverdebestanden.aspx?sub=1&fLvIT=Openbare%20data&subIdx=3#vvt
\[ Y_r^3 = \beta_0^3 + \sum_{e=1}^{E} X_{er} \beta_e^3 + u_r^3 \] 

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.

| 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 (reference for 65-) | 20.2                      |                                              |                                                               |                                       |
| 65 – 74    | 17.5                        |                                              |                                                               |                                       |
| 75 – 84 (reference for 65+) | 34.4                      |                                              |                                                               |                                       |
| > 85       | 24.5                        |                                              |                                                               |                                       |
| Gender     |                                             |                                             |                                                               |                                       |
| Female (reference) | 61.0                       |                                              |                                                               |                                       |
| Male       | 39.0                         |                                              |                                                               |                                       |
| Clients with a dominant health problem |                                             |                                             |                                                               |                                       |
| A somatic illness (reference) | 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 (reference) | 85.9                       |                                              |                                                               |                                       |
| Marital status |                                             |                                             |                                                               |                                       |
| Married (reference) | 34.0                       |                                              |                                                               |                                       |
| Unmarried | 20.4                        |                                              |                                                               |                                       |
| Widow | 34.0                        |                                              |                                                               |                                       |
| Otherwise** | 5.8                         |                                              |                                                               |                                       |
| Missing cases | 5.7                         |                                              |                                                               |                                       |
| House composition |                                             |                                             |                                                               |                                       |
| Living alone & independently (reference) | 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 km² | 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 | Personal care only | Nursing only | Both Personal care & Nursing |
|-------------------------------------|--------------------|--------------|----------------------------|
| McFadden's pseudo R-squared= 0.171  |                    |              |                            |
|                                     | 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 | Personal care only | Nursing only | Both Personal care & Nursing |
|-------------------------------------|--------------------|--------------|-----------------------------|
|                                     | Odds ratios | P-value | Odds ratios | P-value | Odds ratios | P-value |
| **House composition**              |             |         |             |         |             |         |
| Reference living alone & independently |           |         |             |         |             |         |
| 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**      |             |         |             |         |             |         |
| Reference July 2013                |           |         |             |         |             |         |
| 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   |
| Care office region | Odds ratios | P-value | Odds ratios | P-value | Odds ratios | P-value |
|-------------------|------------|---------|------------|---------|------------|---------|
| 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           | Odds ratios | P-value | Odds ratios | P-value | Odds ratios | P-value |
|------------------|-------------|---------|-------------|---------|-------------|---------|
| Male             | 1.027       | 0.000   | 1.478       | 0.000   | 0.850       | 0.000   |

| Age              | Odds ratios | P-value | Odds ratios | P-value | Odds ratios | P-value |
|------------------|-------------|---------|-------------|---------|-------------|---------|
| 0–17 year        | 1.122       | 0.000   | 1.507       | 0.000   | 1.214       | 0.000   |

| Dominant health problem | Odds ratios | P-value | Odds ratios | P-value | Odds ratios | P-value |
|-------------------------|-------------|---------|-------------|---------|-------------|---------|
| Psychiatric problem     | 0.027       | 0.000   | 0.144       | 0.000   | 0.079       | 0.000   |
| Psychogeriatric illness | 0.000       | 0.000   | 0.000       | 0.004   | 0.000       | 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 | Odds ratios | P-value | Odds ratios | P-value | Odds ratios | P-value |
|--------------------------|-------------|---------|-------------|---------|-------------|---------|
| Yes                      | 0.483       | 0.000   | 0.315       | 0.000   | 0.640       | 0.000   |

| Marital status           | Odds ratios | P-value | Odds ratios | P-value | Odds ratios | P-value |
|--------------------------|-------------|---------|-------------|---------|-------------|---------|
| Unmarried                | 0.755       | 0.000   | 0.592       | 0.000   | 0.917       | 0.000   |
| Widow                    | 1.006       | 0.01    | 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 | Personal care only | Nursing only | Both Personal care & Nursing |
|-------------------------------------|--------------------|--------------|-------------------------------|
|                                    | Odds ratios | P-value | Odds ratios | P-value | Odds ratios | P-value |
| House composition                   |            |        |            |        |            |        |
| (reference living alone & independently) |            |        |            |        |            |        |
| 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   | 0.648      | 0.000  | 0.617      | 0.000  | 0.661      | 0.000  |
| than one child                      |            |        |            |        |            |        |
| 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           |            |        |            |        |            |        |
| (reference July 2013)                |            |        |            |        |            |        |
| 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 4.1 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 4.2 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

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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 incidents| 0.004                           | 0.001                     | 0.002                                    |
| Percentage of prevalence                           | 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 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 care while striving towards equal access.

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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).

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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.
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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 R² = 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                                       | -213.200            | 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 R²= 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 208.200 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