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Equal long-term care for equal needs with universal and comprehensive coverage? An assessment using Dutch administrative data

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Abstract

The Netherlands is one of the few countries that offer generous universal coverage of long-term care (LTC). Does this ensure that the Dutch elderly with similar care needs receive similar LTC, irrespective of their income? In contrast with previous studies of inequity in care use that relied on a statistically derived variable of needs, our paper exploits a readily available, administrative measure of LTC needs, stemming from the eligibility assessment organized by the Dutch LTC assessment agency. Using exhaustive administrative register data on 616,934 individuals aged 60 and older eligible for public LTC, we find a substantial pro-poor concentration of LTC use that is only partially explained by poorer individuals' greater needs. Among those eligible for institutional care, higher-income individuals are more likely to use – less costly – home care. This pattern may be explained by differences in preferences, but also by their higher copayments for nursing homes and by greater feasibility of home-based LTC arrangements for richer elderly. At face value, our findings suggest that the Dutch LTC insurance ‘overshoots’ its target to ensure that LTC is accessible to poorer elderly. Yet, the implications depend on the origins of the difference and one’s normative stance.

JEL: J14; I14; D63

Keywords: Long-term care; Equity in care use; Horizontal equity; Socio-economic inequality.

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Access to and use of individual-level data

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Declaration of interests

The authors have no conflict of interests to declare.

1. INTRODUCTION

In view of the current rate of population aging, OECD countries expect the number of elderly requiring assistance in activities of daily living to rise sharply in the coming decades. As all developed countries have introduced schemes for financing the use of long-term care (LTC hereafter) by the disabled elderly, public spending on LTC is projected to soar, from 1.4% of GDP in 2014 to 4.3% by 2060 in Europe ([Economic Policy Committee, 2015](#)). On top of concerns relating to its sustainability, public LTC financing raises another critical policy question: does public funding ensure an equitable distribution of LTC? While the cross-country variation in the organisation and financing of LTC systems is large ([Colombo *et al.*, 2011](#); [Muir, 2017](#)), empirical evidence on the ability of existing policies to ensure that all individuals have access to adequate LTC, regardless of their socio-economic resources, is still scarce. Yet, such evidence is essential to inform the public debate, as many countries are currently reforming their LTC systems, either to broaden coverage or to reign in increasing spending.

The aim of our paper is twofold. We first assess whether LTC is allocated according to care needs in the Netherlands, irrespective of income – that is to say, whether LTC use is distributed according to the traditional principle of socio-economic horizontal equity. In a second step, we discuss the normative and policy implications of our results, in terms of the ability of the Dutch public insurance to ensure equitable LTC use.

Studying inequalities in the Dutch LTC system is highly relevant, as the Netherlands stands out as a model from an international perspective. With the second highest spending in terms of GDP of all OECD countries (4.3% of GDP in 2014 ([OECD, 2017](#))), the Dutch LTC system provides universal and comprehensive coverage, and has demonstrated an ability to insure the elderly against high out-of-pocket payments on home care and institutional care ([Mot, 2010](#); [Schut *et al.*, 2013](#), [Bakx *et al.*, 2015a](#)). Most importantly, ability to pay is not one of the criteria taken into account for eligibility for publicly-subsidized LTC.¹ As a result, the system is often perceived as leaving little room for inequalities, as stated by [Mot \(2010\)](#) (p. 66): “While the system in the Netherlands is not completely egalitarian, it is not too far from it”. However, empirical support for this claim is scant.

Another distinctive feature of the Netherlands is the quality of available data on LTC. We exploit exhaustive administrative registers providing information both on the eligibility

¹ Criteria are listed in the Decree on care-related assessments (*Het Zorgindicatiebesluit, 1997*), Art. 6.

decisions made by the Dutch agency in charge of assessing the needs of all individuals applying to LTC benefits, and on the actual use of publicly-subsidized LTC.

The empirical literature on the determinants of LTC use suggests that there is an income gradient in formal LTC use in some European countries but not in others (Bonsang, 2009; Bakx *et al.*, 2015b). Only four papers have specifically investigated socio-economic horizontal inequity in LTC use. García-Gómez *et al.* (2015) find pro-rich horizontal inequity among the elderly in Spain in 2008, i.e. before public support for the disabled elderly was effectively expanded. Exploiting the SHARE survey, Ilinca *et al.* (2017) and Rodrigues *et al.* (2017) find that formal home care use is roughly proportionately distributed across income in most European countries. Also using SHARE, Carrieri *et al.* (2017) conclude that there is at most limited income-related pro-rich horizontal inequity in the use of nursing care, in Southern Europe and in Nordic countries.

However, these studies are limited by data constraints in four ways. First, they *do not* include institutional care, which still represents the vast majority of LTC spending in OECD countries (two thirds in the Netherlands in 2012 (Statistics Netherlands, 2012a; 2018a,b,c)). Second, they only study whether one uses care, but ignore *how much* is being used, which may contribute to inter-personal variation in care use correlating with socio-economic status. Third, income information obtained from surveys is subject to substantial reporting biases. Fourth, while SHARE is a large panel data set, the number of observations of elderly with functional limitations per country is limited. Reporting bias and limited sample sizes severely reduce the possibility to statistically detect differences in LTC use patterns across income. We overcome all of these problems by using administrative data on the universe of LTC applicants, their LTC use and their income.

Our paper also differs in the way horizontal inequity in care use is assessed. Distinguishing inequity from fair inequalities requires normative judgments about how to define needs and how different levels of care needs should result in different LTC uses – i.e. what the norm of *vertical equity* in LTC use is (van Doorslaer *et al.*, 2000; Sutton, 2002; Fleurbaey and Schokkaert, 2011). Usually, there is no directly observable measure of care needs.² Typically, studies of equity in care use derive an implicit norm of vertical equity in care use by regressing *actual* care use on the variables considered to lead to fair inequalities in care use (e.g. health

² In the health care system, the diagnosis and the provision of care are generally carried out by the same agent and through a decentralized process, at the level of care providers. Diagnosis then partly reflect providers' and system-wide incentives to deliver a certain type and amount of care, and are generally not recorded in a centralized way.

status) and potential confounders (Wagstaff and van Doorslaer, 2000b). By contrast, we face a unique setting in which a measure of needs and an explicit norm for vertical equity are readily observable. We use the monetary value of the entitlements decided upon by the independent, central agency in charge of LTC eligibility assessments (called CIZ) as the sole indicator of legitimate needs for LTC. Assuming that CIZ entitlements for LTC embody the norm of vertical equity prevailing in the Dutch public LTC system, we do not have to rely on the standard yet relatively strong assumption that there is no vertical equity in LTC use on average.³

In our empirical analysis, this implies that the index of horizontal inequity we compute does not rely on any econometric estimate. Coupled with the exhaustive nature of our sample, it results in a highly robust assessment of the discrepancy existing between the distribution of use and the distribution of needs across income.

We find LTC use to be more concentrated, in value, among the income-poor. Richer individuals are more likely not to use any care or to use home care services rather than (more costly) institutional care. These findings persist when differences in needs across income are controlled for. Interpreted literally, the marked income gradient in the need-standardized LTC use suggests that the poor elderly receive ‘too much’ LTC in comparison to richer elderly. Or in other words: the current Dutch LTC system appears to be ‘overshooting’ its target to keep LTC affordable to all by substantially subsidizing LTC use for poorer population groups. We discuss the potential mechanisms behind our findings as well as their equity implications, which depend on the reasons why the allocation of LTC deviates from the distribution of needs.

2. THE DUTCH LONG-TERM CARE SYSTEM

The Dutch public LTC insurance programme (AWBZ) was started in 1968.⁴ It offers universal and fairly comprehensive coverage. In 2014, 18% of the individuals aged 65 and older received public LTC support in the Netherlands (OECD, 2017; Muir, 2017). Private LTC is marginal.⁵ About 30% of public LTC beneficiaries aged 65 and older live in an institution,

³ We go one step further that Sutton (2002): he uses a data-driven method to come up with a norm of vertical equity in LTC use, but still has to draw an arbitrary line between those individual characteristics considered to induce fair differences in LTC use, and the non-need factors.

⁴ Between 2013 and 2015, the Dutch LTC system went through major changes (van Ginneken and Kroneman, 2015). We describe system as it stood in 2012, as we assess the pre-reform situation.

⁵ Households’ spending on non-publicly-subsidized long-term care services was estimated to amount to 19 million euros in 2013. This represents less than 0.1% of the 24 billion euros of public and private spending on AWBZ-financed LTC (Statistics Netherlands, 2017; 2018a,b,c).

where they receive a package of services tailored to the type and severity of their disability (Table I). At home, individuals mostly receive nursing care, personal care, individual and group guidance.⁶

Table I: Types of LTC services

	Home care	Institutional care
Types of care	Nursing care, personal care, individual or group guidance	Institutional stay
CIZ decision specifies:	Number of hours or half-days of care, period of eligibility	Type of institution and ‘package’ of services, period of eligibility

NOTES: LTC services financed by the public LTC insurance (AWBZ) in 2012.

Decisions regarding eligibility for publicly-financed LTC are made by an assessor of the central independent assessment agency (CIZ). They are based on the functional limitations of the applicant, her or his health status, and a limited number of specific background characteristics that are stated in a decision by the Minister of Health. Those do not include the applicant’s income or wealth. The presence of relatives somewhat reduces entitlements to LTC inasmuch as the members of the household are expected to provide some minimum personal care to their disabled relative (Mot, 2010).

Assessors decide on the type and volume of care the applicant will be eligible for, or whether the application is rejected altogether. Beneficiaries can receive in-kind care, but they can also opt for LTC vouchers to pay their own professional caregivers or informal caregivers. Those with a more severe condition and a less supporting environment are made eligible for a nursing home admission; they may choose to stay home and receive home care or vouchers instead.⁷ The provision of care is organized at a regional level: 32 regional purchasing agencies (*zorgkantoren*) are entrusted with buying the LTC to be provided in-kind. In 2012, waiting lists for nursing homes and home care were short, possibly thanks to the possibility to take up LTC vouchers instead of in-kind care (CVZ, 2013).

Mandatory social security contributions and general government revenue pay for 9/10 of total costs (Schut *et al.*, 2013); in 2012, only 8% was financed through cost-sharing (Maarse and Jeurissen, 2016). Co-payments increase with income;⁸ yet they do not exceed the cost of care nor the user’s income. Furthermore, co-payments are capped, with a monthly fee lower

⁶ Domestic help was delegated to municipalities in 2007 and is provided under a different scheme (Wmo).

⁷ A more detailed description of the needs assessment process can be found in Bakx *et al.* (2018).

⁸ The agency in charge of computing the individual co-payments, CAK, is fully distinct from CIZ.

than €20 for beneficiaries with lowest incomes. However, the co-payments are higher for institutional care than for home care for individuals with a median or high income.⁹

Financial barriers in the access to LTC are thus limited in the Netherlands, especially for low-income elderly. Yet, disparities in LTC use still might arise as a consequence of how LTC is delivered, for example if some groups have better information about care options or if they receive priority. The Dutch Audit Office (Netherlands Court of Audit, 2015) has documented that variation in LTC use from one LTC purchasing region to the other cannot be explained by differences in CIZ-assessed needs. Whether those regional disparities, or other features of the LTC system, induce socio-economic disparities in LTC use has yet not been documented to date.

3. EMPIRICAL STRATEGY

3.1. Measuring income-related inequality in LTC use

We assess income-related inequality in LTC use by computing the concentration index of LTC use, $CI(y)$ (Wagstaff and van Doorslaer, 2000a). This index takes a value between -1 and 1; a negative (positive) concentration index indicates that, overall, there is some pro-poor (pro-rich) inequality in LTC use: consumption is disproportionately concentrated among the less (more) well-off. We express $CI(y)$ as:

$$CI(y) = \frac{2}{\bar{y}} cov(y, r^I)$$

where r^I denotes the fractional rank in the income distribution of the population ($r_i^I = i/N$ if i is the i -poorest individual); y is a continuous and unbounded measure of LTC use, and \bar{y} denotes the population average LTC use.

3.2. Controlling for differences in care needs

Not all income-related inequality in LTC use should be considered as inequitable. In particular, heterogeneity in functional status may correlate with income and induce differences in LTC use along the income distribution that are considered to be fair. Finding out whether

⁹ In particular, co-payments are capped at roughly €2,248 per month for institutional care and at €1,750 per month for home care users. Co-payments also depended marginally on wealth before 2013.

individuals with equal needs receive similar LTC requires an empirical measure of legitimate care needs.

In the Netherlands, entitlements for publicly-subsidized LTC provide an explicit indicator of ‘eligible needs’ in the public LTC insurance. Taking advantage of this unique feature of the Dutch LTC system and the fact that there is barely any privately paid LTC, we address the question: ‘How much of income-related inequalities in the use of LTC services *cannot* be explained by differences in CIZ-assessed needs?’.

To compare the distribution of actual LTC *use* with the distribution of LTC *needs*, we rely on a standard method (see e.g. [van Doorslaer and Van Ourti \(2011\)](#)). We measure the concentration of needs, $C^N(y)$, by the concentration index of CIZ-assessed needs, multiplied by the ratio of population-average needs to population average use.¹⁰ We thus depart from the standard method, which consists in deriving the concentration of needs from a regression analysis of LTC use on LTC needs and potential confounding factors. Denoting by x the individual needs as assessed by CIZ, we define:

$$C^N(y) = \frac{\bar{x}}{\bar{y}} CI(x) = \frac{2}{\bar{y}} cov(y, r^I)$$

where \bar{x} is population-average needs. We then define the Horizontal Inequity index of LTC use $HI(y)$ as:

$$HI(y) = CI(y) - C^N(y)$$

$HI(y)$ varies between -1 and +1. When positive (negative), it indicates that the rich (poor) receive more (less) LTC services than the rich, relative to their needs.¹¹

Interpreting the magnitude of $HI(y)$ is not straightforward; we thus also derive *need-standardized* LTC use for individual i , y_i^{IS} , equal to:

$$y_i^{IS} = y_i - x_i + \bar{x}$$

¹⁰ We make this normalization to enable the decomposition of total inequality in the contributions of needs and other factors.

¹¹ Inference on $CI(y)$, $C^N(y)$ and $HI(y)$ is described in Appendix D.

y_i^{IS} ‘purges’ the individual measure of actual use from LTC needs. The distribution of need-standardized LTC use across income reflects the distribution of LTC use that we would observe if differences in needs across income were neutralized.^{12 13}

3.3. Decomposing inequality by sources and sub-populations

In order to gain insights into the mechanisms behind income-related inequalities in LTC use, we use the non-causal decomposition analysis presented in [Wagstaff et al. \(2003\)](#). The decomposition is based on an OLS regression of actual care use on care needs and other individual characteristics, as explained in [Appendix B](#). In addition, we replicate our baseline analysis on the subgroup of the elderly eligible for home care on the one hand, and on the subgroup of those eligible for institutional care on the other hand.

4. DATA AND DESCRIPTIVE STATISTICS

4.1. Exhaustive administrative register data on LTC eligibility and use

We use a rich set of data sources covering the entire Dutch population that we link to detailed information on the eligibility decisions of CIZ that were valid in 2012; in particular, we know the reasons for which each individual has become eligible for LTC and the types and amounts of services she is entitled to receive. We link these data to information on the actual use of publicly-subsidized LTC obtained from the Central Administration Office for public LTC insurance (*Centraal Administratiekantoor – CAK*). We further link tax records, which provide information on household income¹⁴ and assets, and data from the mandatory municipal registration (*Gemeentelijke Basisadministratie – GBA*) on the region of residence, demographic characteristics (gender, age, marital status, whether the individual has a foreign background) and household composition.

¹² We adopt an indirect standardization approach ([O’Donnell et al., 2008](#)).

¹³ Consistently, there is direct connection between need-standardized use and the Horizontal Inequity index, as: $HI(y) = CI(y_i^{IS})$.

¹⁴ Income includes labor income, pension benefits, income derived from assets and government transfers.

4.2. Population of interest and baseline sample

We focus on individuals aged 60 or older in 2012 and entitled to publicly-subsidized LTC for a somatic or a psycho-geriatric condition. Among those eligible only for institutional care in 2012, we exclude those who were eligible for a stay in a specialized institution other than a nursing home, a residential care home, a rehabilitation center or a palliative care facility.¹⁵ We do not include individuals who were not eligible for public LTC *at any point* in 2012, i.e. all individuals in our sample have non-zero LTC needs.¹⁶ Missing background information reduces sample size by less than 0.2%; the final sample includes 616,934 individuals.

4.3. Ranking variable

Individuals are ranked by their disposable income of year 2011, computed using the square root equivalence scale (OECD, 2011).¹⁷ We take income, rather than wealth, as the ranking variable because inequity in access to LTC is more likely to be related to income than to wealth in the Dutch context, for two reasons. First, there is a strong tie between income and the level of co-payments for LTC, unlike for wealth in 2012.¹⁸ Second, wealth differences in the Netherlands are rather small for two-thirds of the population. Many Dutch households hold only a negligible amount of liquid assets (van Ooijen *et al.* 2014),¹⁹ possibly because of extensive public insurance against financial risks at old age. We yet assess whether *wealth-related* horizontal inequity in LTC use goes in the same direction as income-related inequity in a robustness check.

¹⁵ Other institutions include psychiatric hospitals and centers for the physically handicapped. We exclude individuals eligible for LTC due to mental health problems (other than psychogeriatric problems) or a physical or cognitive handicap: they have often lived for years with functional limitations and their use of LTC services and income situation may follow different patterns than those observed in the population affected by disability at an old age.

¹⁶ Given that LTC that is entirely privately financed is marginal in the Netherlands, virtually all elderly who are not eligible for publicly-subsidized LTC have zero LTC use.

¹⁷ The income distribution is smooth; fewer than 500 individuals have an income equal to 0.

¹⁸ Until 2013, only 4% of taxable wealth in excess of 21,000 euros per capita was added to the income sources taken into account to compute copayments (Non, 2017).

¹⁹ This is especially true when social security wealth is not accounted for, as it is the case for the wealth information provided by tax records. Median wealth is of €38,000 in the 6th decile of the wealth distribution among the Dutch elderly, implying that 60% of the population have barely any wealth to spend on LTC (Statistics Netherlands, 2012b).

4.4. Measurement of LTC use and needs

The monetary value of annual LTC use is the sum of the value of in-kind services used and of the imputed value of LTC vouchers. For in-kind services, we multiply quantities used by their national actual tariff (for institutional care) or by the price cap (for home care) set by the Dutch Healthcare Authority (NZA). If individuals opt for LTC vouchers rather than in-kind care, we only observe whether they take up the vouchers, not the amount spent. We exploit the official matrix used to convert entitlements to in-kind LTC into vouchers.²⁰ On average, 89.5% of the value of vouchers granted is actually used (*Statistics Netherlands, 2018b*). We thus discount the imputed cash equivalent of entitlements to in-kind services by 10.5% to obtain the individual imputed monetary value of vouchers being used. Similarly, needs are computed as the monetary value of eligible LTC services.²¹ Finally, we pro-rate the *annual* monetary values of LTC use and needs of individuals who died in 2012 using the proportion of the year they were alive.²²

4.5. Descriptive statistics

Table II provides summary statistics for the baseline sample.

[Table II to be found on next page]

Almost 2/3 of individuals were eligible for home care services, while less than half were eligible for institutional care, and about 12% of individuals were eligible for both types of care in year 2012 (Panel A).²³ The average value of LTC an individual is eligible for is €31,000. The average value of needs for institutional care is higher than the average value of needs for home care, because institutional care is generally more costly and individuals entitled to a nursing home stay have a worse functional status.

²⁰ See Appendix A. The cash equivalent of in-kind services represents about 75% of their national price. LTC vouchers represented 9% of public spending on LTC in the Netherlands in 2013 (*Statistics Netherlands, 2017; 2018a,b,c*).

²¹ Eligibility for home care services is granted in hours per week and is expressed as a range (e.g., the individual can receive from 6 to 7 hours of nursing care per week); we take the middle point of the range (in our example, 6.5 hours) when computing the value of LTC the individual is eligible for, consistently with what is done when beneficiaries have their entitlements to in-kind services converted into vouchers.

²² E.g. for an individual who died at the end of June, we multiply the value of her actual use of (needs for) LTC services and CIZ entitlements by 2.

²³ An individual can be eligible for only one type of care at a point in time. However, she can have her needs reassessed and become eligible for another care setting

Table II: Sample descriptive statistics

	Entire sample		Eligible for	
	Mean	Std. Dev.	Home care	Institutional care
<i>Panel A: Eligibility</i>				
Eligible for home care (yes/no)	65.0%	-	100.0%	25.4%
Eligible for institutional care (yes/no)	46.7%	-	18.2%	100.0%
Value of entitlements to home care	12,179	25,686	18,726	4,052
Value of entitlements to institutional care	18,882	24,973	4,275	40,457
Value of total LTC entitlements	31,061	29,871	23,000	44,509
Number of days with eligibility for LTC	255	132	243	280
<i>Panel B: Use</i>				
Any use of in-kind home care (yes/no)	61.5%	-	85.4%	36.4%
Any use of institutional care (yes/no)	38.7%	-	13.4%	82.9%
Any take-up of LTC vouchers (yes/no)	4.4%	-	5.8%	2.4%
Any use of LTC (yes/no)	91.8%	-	90.5%	95.6%
Value of in-kind home care used	7,430	17,565	9,929	5,643
Value of institutional care used	14,595	23,580	2,216	31,271
Value of LTC vouchers used	935	6,572	1,161	823
Value of total LTC used	22,960	26,664	13,307	37,737
<i>Panel C: Socio-demographic characteristics</i>				
Gender: woman	67.0%	-	64.5%	70.4%
Age: 60-69	12.5%	-	15.9%	6.4%
Age: 70-79	25.8%	-	30.2%	19.2%
Age: 80-84	22.7%	-	23.3%	22.7%
Age: 85-89	22.2%	-	19.5%	26.9%
Age: 90+	16.8%	-	11.1%	24.7%
Has died in 2012	16.0%	-	13.1%	21.1%
Married/In a civil partnership	34.5%	-	40.4%	26.2%
Partner in household	30.9%	-	39.6%	19.0%
Number of household members	1.4	0.7	1.5	1.3
Origin: the Netherlands	88.0%	-	86.9%	89.8%
Origin: foreign Western country	8.8%	-	9.0%	8.5%
Origin: non-Western foreign country	3.2%	-	4.1%	1.8%
<i>Panel D: Economic characteristics</i>				
Disposable income	29,519	24,188	30,569	27,722
Net wealth (per capita)	159,302	537,158	170,840	142,607
Owner of main residence	32.2%	46.7%	36.7%	26.3%
Observations	616,934	-	401,262	287,932

SAMPLE: Individuals 60 and older eligible for LTC in the Netherlands in 2012 due to a somatic or psychogeriatric condition.

NOTES: Values of LTC entitlements and use, income and wealth are expressed in euros.

As shown in Panel B, the average value of LTC use is about €23,000: 70% of individuals have a LTC use below what they are eligible for (in value), and about 8% did not use any in-kind care or vouchers. This might be due to precautionary behavior in applying for eligibility for LTC, or the result of the elderly and their families trading off the marginal utility of formal LTC with its (monetary and non-monetary) costs. Individuals opting for vouchers represent less than 5% of the sample.

Most individuals in the study population are women and in their 80s (Panel C). 70% of the sample lived without a partner for most of 2012; only 7% of them spent more than half of the year in a nursing home.

5. RESULTS

5.1. Differential care use for equal needs

As shown in Table III, the concentration index of LTC use is negative, reflecting a pro-poor concentration of LTC use. The concentration curve of LTC use (see Wagstaff and van Doorslaer, 2000a) is above the line of equality almost over the entire income distribution (Figure 1): this means that, for instance, the 30% poorest individuals consumed 37.6% (i.e. more than 30%) of the total value of LTC services used in 2012.

Table III: Concentration and Horizontal Inequity indexes of LTC use

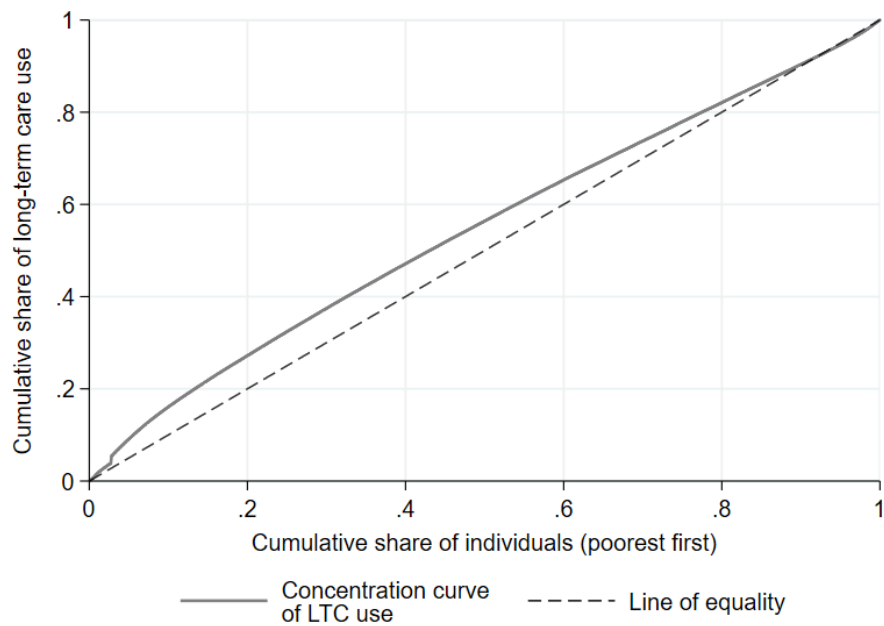
	$CI(y)$	$CI(y)^N$	$HI(y)$	N
	(1)	(2)	(3)	
Entire sample	-0.0853*** (0.0008)	-0.0485*** (0.0006)	-0.0368*** (0.0007)	616,934
Subgroup eligible for home care	-0.0358*** (0.0018)	+0.0254*** (0.0009)	-0.0612*** (0.0009)	401,262
Subgroup eligible for institutional care	-0.0453*** (0.0008)	-0.0238*** (0.0010)	-0.0214*** (0.0010)	287,932

SAMPLE: Individuals 60 and older eligible for home care in the Netherlands in 2012 due to a somatic or a psycho-geriatric condition.

NOTES: Standard errors in parentheses; * p<0.10; ** p<0.05; *** p<0.01.

[Figure 1 on the following page]

Figure 1: Concentration curve of LTC use



SAMPLE : Individuals 60 and older eligible for public LTC in the Netherlands in 2012 due to a somatic or a psycho-geriatric condition (N=616,934).

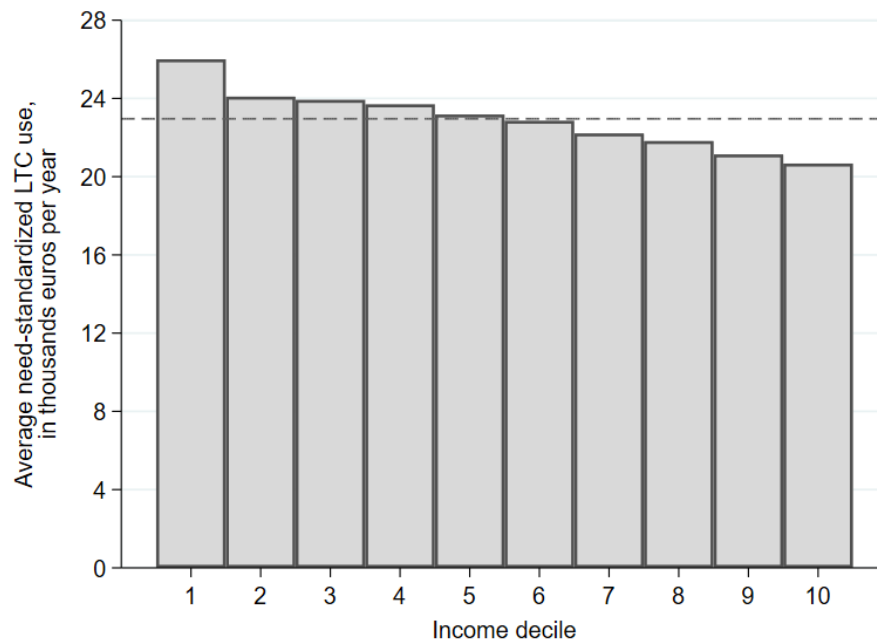
NOTES: LTC use is expressed in annual monetary value. Individuals are ranked by their 2011 disposable income.

However, poorer elderly also have higher assessed needs: the index of the concentration of needs, $C^N(y)$, is negative (-0.0485). The pro-poor concentration of needs is yet lower than the pro-poor concentration of actual use; this results in a negative Horizontal Inequity index (of -0.0368), which implies that - even when correcting for differences in needs -, the poor receive more LTC (in value) than the rich.

Figure 2 displays the average need-standardized LTC use per income decile and it highlights two findings. First, the differences are sizable: after need standardization, all deciles should be using the same amount of care, but the 10% poorest elderly are predicted to use 26% LTC more than the 10% richest. Second, the negative gradient is observed throughout all income deciles.

[Figure 2 on the following page]

Figure 2: Distribution of need-standardized LTC use across income deciles



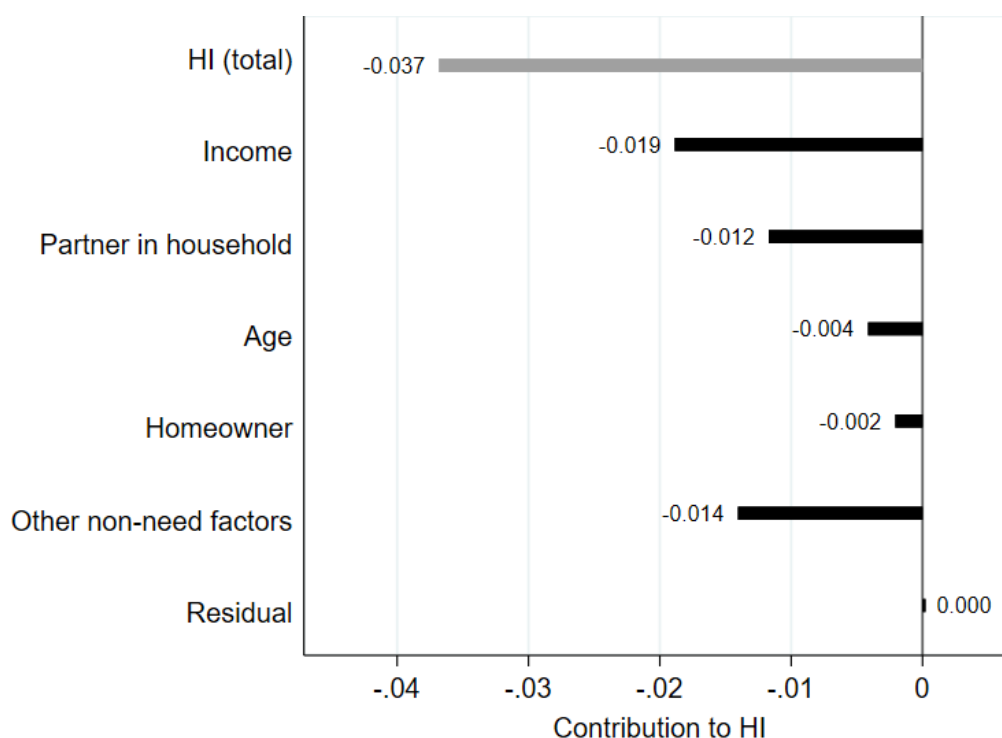
SAMPLE : Individuals 60 and older eligible for public LTC in the Netherlands in 2012 due to a somatic or a psycho-geriatric condition (N=616,934).

NOTES: Need-standardized LTC use is expressed in annual monetary value. The dashed horizontal line indicates the population-average value of LTC use.

5.2. Decomposition of the horizontal inequity index

What factors are associated with the discrepancy between needs and use? We decompose the Horizontal Inequity index into the contributions of non-need factors.²⁴ Results are shown in Figure 3. Characteristics can only contribute to the Horizontal Inequity index when they correlate with income (i.e. have a non-zero regression coefficient) and are unequally distributed across income (i.e. show a non-zero concentration index).

Figure 3: Decomposition of the horizontal inequity index of LTC use



SAMPLE : Individuals 60 and older eligible for public LTC in the Netherlands in 2012 due to a somatic or a psycho-geriatric condition (N=616,934).

NOTES: Variables depicted on the right-hand side of 0 contribute to pro-rich inequality in LTC use; variables depicted on the left-hand side of 0 would contribute to pro-poor inequality. Gender, migrant background, wealth and region of residence are grouped in the category “Other non-need factors” as the contribution of each of these factors is lower than 0.002 in absolute value.

READING: On a total horizontal inequity index of -0.037, income, for example, contributes to pro-poor inequality by – 0.019.

²⁴ The results from the OLS regression as well as the concentration indexes of non-need factors are presented in Appendix B. We include age (in 5 brackets), gender, whether the individual has a partner living in the house, the number of household members, the migrant background of the individual or of her parents (7 origins), home ownership, income decile, wealth decile and a dummy for the LTC purchasing region the individual lives in.

The LTC contracting region in which individuals live does not significantly contribute to the *income-related* Horizontal Inequity index. We do find evidence of regional disparities in LTC use even when needs and the socio-economic and demographic composition of the disabled elderly population have been taken into account.²⁵ However, it is not the case that regions with relatively higher use are on average poorer than ‘under-consuming’ regions.

By contrast, the age composition *does* contribute to the disproportionate LTC use of low-income elderly: being older is associated with higher use, even for given needs, and the eldest also tend to be poorer. Having a partner in the house is associated with a lower value of LTC use, and this situation is more frequently encountered among the rich, because they are more likely to have a spouse alive and less likely to live in an institution.

5.3. Patterns of use of competing long-term care services across the income distribution

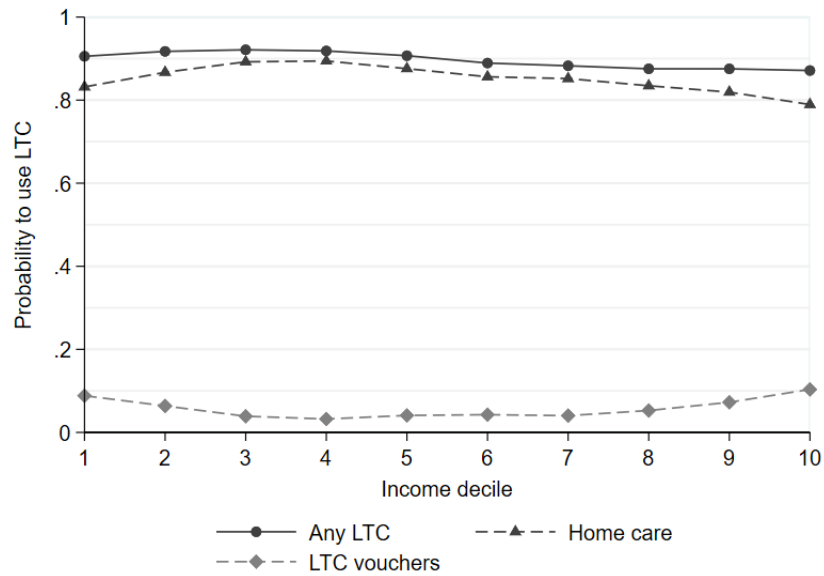
While our baseline analysis provides an overall picture of inequalities in LTC use, it combines two very heterogeneous populations: individuals eligible for institutional care and those eligible for home care. We replicate the analysis for these two (overlapping) subgroups. LTC use is then equal to all LTC consumed *while* the individual was eligible for either home care or institutional care. Individuals eligible for institutional care are on average older, more often female, single and with no migrant background, and have lower wealth and income than those eligible for home care (Table II).

We observe five main findings. First, in both subgroups, the pattern of LTC use changes with income (Figure 4). Among the elderly eligible for institutional care, the probability to use some institutional care decreases from 92% in the bottom income decile, to less than 80% for the 4 top deciles (Panel B); among those eligible for home care, the probability to take up LTC vouchers rather than in-kind care is highest at both the bottom and the top of the income distribution.

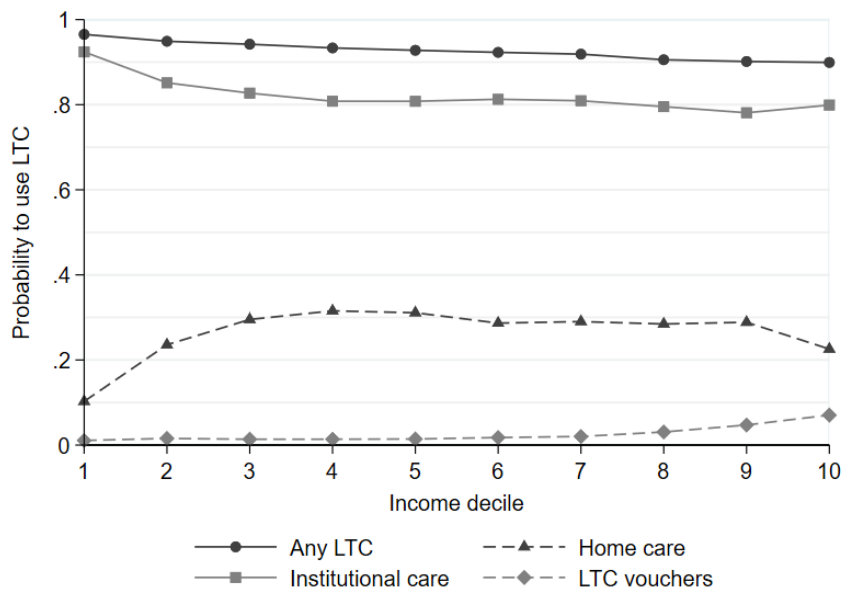
[Figure 4 on the following page]

²⁵ Duell *et al.* (2017) find that regional variation in *eligibility* for LTC is limited in the Netherlands. Our results suggest that it is relevant to look at actual use, beyond eligibility, when assessing inequities in the Dutch LTC system.

Figure 4: Probability of using a given type of LTC, by subgroup



Panel A (top): Individuals eligible for home care



Panel B (bottom): Individuals eligible for institutional care

SAMPLE : Individuals 60 and older eligible for public home care (Panel A) or institutional care (Panel B) in the Netherlands in 2012 due to a somatic or a psycho-geriatric condition (N=401,262 in Panel A; N=287,932 in Panel B).

NOTES: A given individual may use several types of care over the period she is entitled to receive home care or institutional care.

Second, these patterns persist when we control for differences in needs across the income distribution in each subgroup. Specifically, €1 more of entitlements for home (resp. institutional) care results in €0.55 (resp. €0.99) additional LTC use for individuals in the bottom half of the income distribution *versus* €0.46 (resp. €0.96) in the top half of the income distribution.²⁶ Consistently, $HI(y)$ is negative in both subgroups (Table III).

Third, C^N is positive in the subgroup eligible for home care. This may be because higher income individuals are better able to postpone a nursing home admission (*selection effect*), e.g. because they are more likely to have a house that is fit for ageing in place or that may be adapted more easily. Furthermore, differences in gender and household composition across income also contribute to community-dwelling individuals in upper income deciles showing greater needs (*composition effect*). Finally, the positive C^N may reflect income-related differences in the ability to navigate the LTC system and in the propensity to claim LTC.²⁷

Fourth, when decomposing $HI(y)$, the contribution of income is especially high in the subgroup eligible for institutional care, relative to the contributions of other factors (Figure 5). This may reflect that: (i) the larger difference in co-payments between institutional care and home care for richer individuals provides them with a stronger financial incentive to use home care or vouchers than the poor;²⁸ or (ii) that institutional care is an inferior good (in microeconomic terms) for the elderly.

[Figure 5 on the following page]

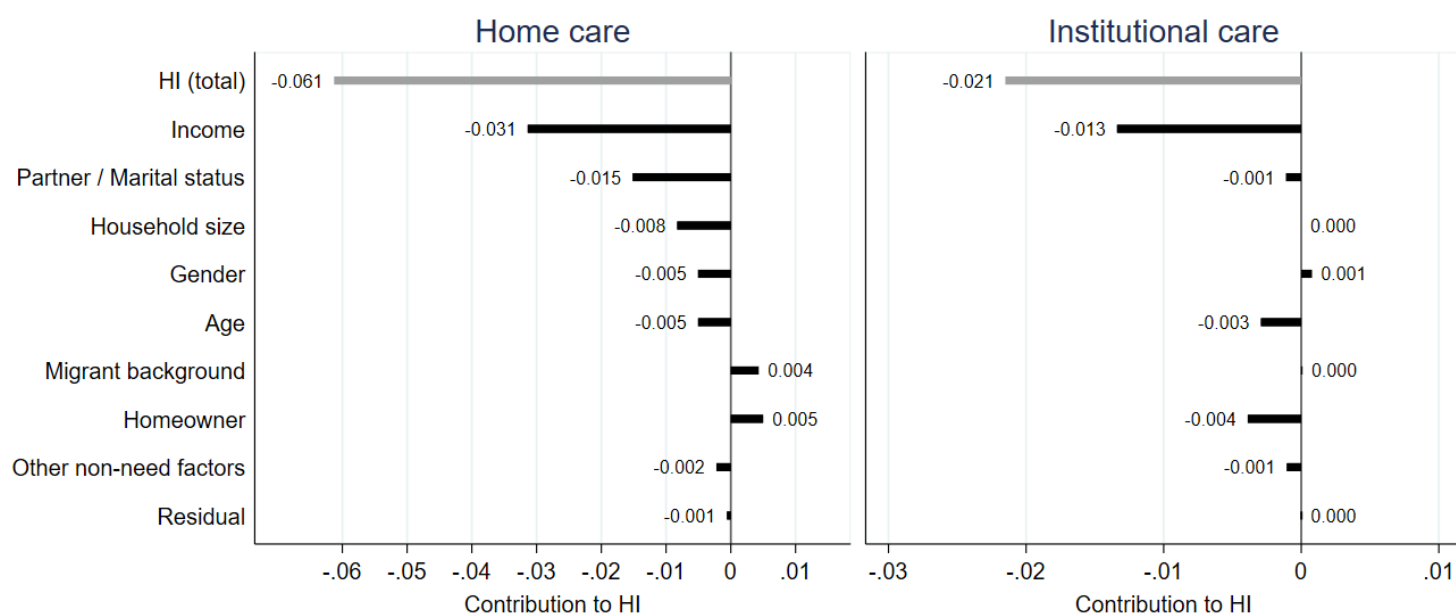
Fifth, gender differences contribute to the pro-poor inequity in home care use: women — who rank on average lower in the income distribution than their male counterparts — use more (formal) home care than men after standardizing for needs. Notably, this difference is larger for those living with their partner. It may be due to women receiving less informal care from their spouse than men (Katz *et al.*, 2000).

²⁶ Among the elderly eligible for institutional care, the differences in the correlation between needs and use across income seem limited; they are yet amplified by the high average value of LTC needs for the elderly eligible for institutional care.

²⁷ When claiming LTC, individuals may also specify which types of care they would like to receive; a stronger preference for home care over institutional care among higher-income elderly could then explain our finding. Yet documentation about the assessment procedure shows that the preferences expressed by applicants need not be taken into account. According to Bakx *et al.* (2018) who interviewed several CIZ assessors, these preferences rarely play a role in the assessment process.

²⁸ Evidence on the price-elasticity of residential care use is mostly grounded in the contexts of Medicaid and Medicare. Some papers have found the elderly not to adjust their use of institutional care to its out-of-pocket price (e.g. Grabowski and Gruber (2007)), while others have found non-zero price elasticities of nursing home stays (e.g. Reschovsky (1998)).

Figure 5: Decomposition of the horizontal inequity index of LTC use, by subgroup



SAMPLE : Individuals 60 and older eligible for public home care ('HC'; N=401,262) or institutional care ('IC'; N=287,932) in the Netherlands in 2012 due to a somatic or a psycho-geriatric condition.

NOTES: When focusing on institutional care, the non-need factors 'having one's partner in own household' is replaced by marital status, and the contribution of "household size" is not estimated. Wealth and region of residence are grouped in the category "Other non-need factors" as the contribution of each of these factors is lower than 0.002 (in absolute value) for both subgroups.

5.4. Robustness of the results

We perform two robustness checks. First, we study the impact of how we deal with LTC users who died during 2012 (16% of the population). As mortality rates are not equal across income groups, excluding these individuals from our analysis may bias our assessment of income-related inequalities in LTC use. On the other hand, pro-rating the LTC needs and use of those who have died in the year creates some outliers with respect to our two main variables of interest. We have thus checked that the Concentration and Horizontal Inequity indexes remain pro-poor when we keep only individuals who have survived throughout the year (Table C.I, Appendix C.1).

As a complementary analysis, we use per capita household wealth as reported to the Tax Office rather than income as the ranking variable. There are differences in need-standardized LTC use across wealth deciles, yet they are smaller than those observed across the income

distribution (Appendix C.2). While the estimated index values differ,²⁹ the pro-poor inequality index for LTC use also exceeds the one for needs when we use wealth (instead of income) as the ranking variable.

6. DISCUSSION AND CONCLUSION

We have tested whether the Dutch elderly receive equal care for equal needs by using their entitlements to publicly-subsidized LTC as a measure of care needs. Five key results emerge. First, rich or poor, most elderly use less publicly-subsidized LTC than what they are entitled to. This appears to be a deliberate choice, since there was no shortage of LTC supply in 2012. Second, under-use compared to assessed needs is more pronounced among the rich than among the poor. That is, the concentration of LTC use is pro-poor even when we control for differences in needs across income. Third, we find a pro-poor Horizontal Inequity index both in the subgroup eligible for home care and in the subgroup eligible for institutional care. However, among the elderly eligible for home care, CIZ-assessed needs appear to be higher for richer individuals, possibly due to composition and selection effects. Fourth, among the elderly eligible for institutional care, richer individuals are more likely to forgo LTC or to use home care instead. Fifth, regional disparities in need-standardized LTC use cannot be explained by regional differences in the socio-demographic composition of the disabled elderly population, nor by ‘under-consuming’ regions being systematically richer or poorer than the other regions. On the contrary, differences in the propensity to use formal LTC by gender and marital status do contribute to the pro-poor horizontal inequity index.

What do our results imply for the performance of the Dutch LTC system and its capacity to ensure horizontal equity in LTC use?

We believe that CIZ eligibility decisions are informative of the policy objectives regarding access to LTC in the Netherlands, because the guidelines for needs assessments are derived from a Ministerial decision on eligibility and CIZ is an independent and centralized organization exclusively in charge of conducting needs assessments (RMO, 2010; Schut and van den Berg, 2010). Thus, the finding that income-related disparities in LTC use do not fully mirror income-related disparities in CIZ-assessed needs suggests that the Dutch system falls

²⁹ Rodrigues *et al.* (2017) show that using wealth rather than income as the ranking variable results in a more pro-poor distribution of home care use when controlling for (statistically derived) needs, in most European countries – except for the Netherlands and Belgium.

short of its egalitarian objective in the provision of LTC services, and results in horizontal inequity in LTC use favoring the low-income elderly.

However, this interpretation hinges upon three conditions. These three conditions are not specific to our study setting only; they apply to the interpretation of most of the literature on equity in access to health care, including most seminal papers cited in [Wagstaff & Van Doorslaer \(2000\)](#) and [van Doorslaer and Van Ourti \(2011\)](#). However, they are often taken for granted in the context of access to medical care. We revisit them here because they aid to place the findings into perspective and suggest directions for further research. First, CIZ entitlements have to be a relevant and unbiased indicator of LTC needs. If the well-off are more able to navigate the LTC system and more likely to claim that they need care (e.g. out of precaution), relying on CIZ-assessed needs may hide socio-economic inequity at the stage of the eligibility decision.

Second, it has to be relevant to focus on inequalities in public *formal* LTC use, independently from the allocation of private LTC and informal care. The choice of the outcome depends on whether public LTC is provided independently from informal care and private LTC options, or merely intended as a safety net for when these other sources are not available. Societies may hold different viewpoints on this. In the Netherlands, public financing of formal LTC is comprehensive, yet the needs assessment process explicitly factors in the expectation that household members will provide some ‘usual care’. Whether the elderly have access to formal LTC independently from the informal care they may receive *beyond ‘usual’ informal care*, thus stands as the relevant metric, and it is the one we use in our analysis.

The third condition for our results to indicate that the Dutch LTC system unduly favors lower-income elderly is that a lower use of institutional care is considered a disadvantage. If differences in the propensity to age in place across the income distribution stem from *differences in preferences* over care arrangements, income-related disparities in need-standardized LTC use may not necessarily be unfair.³⁰ However, the schedule of income-dependent copayments for LTC may also explain why better-off elderly are more likely than low-income elderly to substitute home care or LTC vouchers for institutional care. And if home-based LTC is favored over institutional care, *irrespective of one’s socio-economic status*, then our results reflect that lower-income elderly do not have effective access to most-valued care options. The income-gradient in institutional care use would actually suggest *pro-rich* inequity.

³⁰ Respect for preferences is a feature of responsibility-sensitive egalitarianism ([Fleurbaey and Schokkaert, 2011](#))

Overall, our findings are at odds with the common view that universal access and generous coverage in the Dutch public LTC insurance results in those with equal needs receiving similar LTC. Other countries that look at the Dutch model when expanding public LTC insurance should then not simply assume that inequity in access will no longer be an issue. Data availability and the features of the Dutch LTC system make our analysis unique, in that we do not rely on any arbitrary assumption nor statistical analysis to adjust the distribution of LTC use for the distribution of needs. It paves the way for original studies on the allocation of LTC in countries where administrative data on the entitlements to publicly-subsidized LTC are available.

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APPENDICES

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A National tariffs and price caps in the Dutch long-term care public insurance

The monetary costs of LTC services funded through the public insurance system (AWBZ)¹ are computed using a national grid of tariffs, presented in Table A.1.

LTC institutions (nursing homes and residential care homes), which are public in the Netherlands, receive funding in accordance with this grid. Providers of home care services are mostly private; those covered by the public LTC insurance contract with the regional authorities and agree on hourly prices that should not exceed the national tariffs reported below.

Table A.1: Tariffs of LTC services by the Dutch public LTC insurance (AWBZ) in 2012

Home care services		Nursing and residential care homes	
Type of care	Tariff/hour	Level of services (ZZP package)	Tariff/day
Personal care	€49.81	Level 1	€63.03
Guidance	€57.75	Level 2	€80.44
Nursing care	€71.52	Level 3	€98.07
		Level 4	€113.117
		Level 5	€174.32
		Level 6	€168.28
		Level 7	€210.35
		Level 8	€239.14
		Level 9	€211.21
		Level 10	€259.72

SOURCES: Nederlandse Zorgautoriteit (2011b,a).

NOTES: In the Netherlands, domestic help is not funded by the public LTC insurance. The ZZP packages we refer to correspond to institutional care of type *Verpleging en verzorging* (stays in a nursing home, residential care home, rehabilitation center or palliative care center).

When individuals are eligible for institutional care but they choose to stay in the community and receive home care services instead, the package of services they would have received in an institutional setting is converted into a certain package of home care services, following the grid presented in Table A.2.

Table A.2 also provides a comparison between the monetary value of an institutional stay and the monetary value of the equivalent package of home care services. The absolute difference between monetary values, as a function of the level of services (thus, roughly as a function of the severity of disability), is U-shaped. The difference exceeds a hundred euros per week for low levels of disability; it decreases until the two living arrangements are equally costly (for ZZP package 7), before increasing again for the most severe disability levels. Individuals who opt for home care when they are eligible for institutional care

¹We refer to the LTC system as of 2012.

with low and high levels of LTC services have thus a lower value of LTC use than similar individuals opting for a stay in an institution.

Table A.2: Correspondence between institutional care and home care: Official conversion grid and comparison of costs

	Hours of home care services, per week			Monetary value, per week		
	Personal care	Nursing care	Guidance	Cost of home care equivalent	Difference institutional care – home care	Ratio of home care cost /institutional care cost
Level of services (ZZP package)	(1)	(2)	(3)	(a)	(b)	(c)
Level 1	1	1.5	3	€330	€110	74.9%
Level 2	5.5	1.5	1	€440	€123	78.1%
Level 3	8.5	1.5	1	€589	€97	85.8%
Level 4	5.5	1.5	5.5	€699	€92	88.3%
Level 5	5.5	5.5	8.5	€1,158	€61	95.0%
Level 6	8.5	5.5	5.5	€1,135	€42	96.4%
Level 7	8.5	5.5	11.5	€1,481	-€9	100.6%
Level 8	11.5	5.5	11.5	€1,631	€42	97.5%
Level 9	8.5	5.5	8.5	€1,308	€170	88.5%
Level 10	14.5	8.5	5.5	€1,649	€168	90.7%

SOURCE: College voor Zorgverzekeringen (2012); Nederlandse Zorgautoriteit (2011b,a). Authors' computations of weekly monetary values.

READING: An individual made eligible for institutional care with a ZZP package of level 1 will be equivalently entitled to receive 1 hour of personal care, 1.5 hour of nursing care and 3 hours of guidance per week. The monetary value of home care services equivalent to the level of services the individual would receive in institution represents 74.9% of the monetary value of the institutional care she is entitled to.

NOTES: The ZZP packages we refer to correspond to institutional care of type *Verpleging en verzorging* (stays in a nursing home, residential care home, rehabilitation center or palliative care center).

Individuals eligible for either home or institutional care can also opt for LTC vouchers (or a combination of vouchers and in-kind care). If the individual is eligible for institutional care, her entitlements are first converted into a package of home care services (grid in Table A.2). The value of the LTC vouchers is equal to the monetary value of the package of home care services, computed using the tariffs of Table A.1, minus a 25% discount.

B Decomposition of the Horizontal Inequity index

B.1 Formula

We use a decomposition technique to highlight the individual characteristics that correlate most strongly with both income and LTC use (Wagstaff et al., 2003; O’Donnell et al., 2012). Following the literature, we call a “non-need factor” a variable z_k that is considered to be an illegitimate determinant of the use of LTC. We can break the total income-related inequality in use down in the following way:

$$CI(y) = \frac{\bar{x}}{\bar{y}} CI(x) + \sum_{k=1}^K \left[(\beta_k^{NN} \frac{\bar{z}^k}{\bar{y}}) CI(z^k) \right] + \frac{2cov(\epsilon, r^I)}{\bar{y}} \quad (1)$$

$$= C^N(y) + C^{NN}(y) + \frac{2cov(\epsilon, r^I)}{\bar{y}} \quad (2)$$

$$= C^N(y) + HI(y) \quad (3)$$

where y is the value of LTC used in the year, x CIZ-assessed needs, r^I the fractional rank in the income distribution. \bar{y} (respectively \bar{x} and \bar{z}^k) denotes the population-average of variable y (resp. of x and z^k). The β_k^{NN} , $k = 1, \dots, K$, are the coefficients from a linear regression of the use of LTC, y_i , on the needs x_i and the K non-need factors z_i^k :

$$y_i = \beta_0 + 1.x_i + \sum_{k=1}^K \beta_k^{NN} z_i^k + \epsilon_i \quad (4)$$

with ϵ being the error term.²

In the decomposition, $C^{NN}(y)$ represents the total contribution of the observable non-need determinants of care to the concentration index of LTC use; $2cov(\epsilon, r^I)/\bar{y}$ is the generalized concentration index of the error term and captures the degree of correlation between LTC use and the income rank that is not explained by neither needs nor non-need factors. The contribution of a given factor to inequality is all the larger as its partial correlation with LTC use is high and that is is unequally distributed across the income distribution.

As it derives from a linear regression without ruling out all sources of endogeneity, the contribution of each variable needs not be causal (Fleurbaey and Schokkaert, 2011; van Doorslaer and van Ourti, 2011). Yet such a decomposition can provide some useful insights into the potential sources of inequity and guide further investigation.³ We thus use

²The coefficient of needs is constrained to be equal to 1, so that the contribution of needs $C^N(y)$ is exactly equal to the concentration index of CIZ-assessed needs times \bar{x}/\bar{y} .

³In particular, one potential concern is that income and wealth could be lowered by a high use of LTC services. We believe there is little scope for a reverse causality bias here: income being mostly made of

the available socio-demographic information as non-need factors to perform the regression underlying the decomposition. By doing so, we do not assume that age and gender, in particular, are not legitimate determinants of LTC use: given that we control for needs in the regression, we instead take that age and gender (and all the other non-need factors) should not weigh in the use of LTC services *above and beyond* the assessment done by CIZ.

In order to interpret the contribution of a variable z_k , one must combine the descriptive statistics to get \bar{z}_k , the estimates of the OLS regression Table B.1 to get $\hat{\beta}_k^{NN}$, and the concentration index $CI(z_k)$ of the variable provided in Table B.2.

B.2 OLS estimates

Table B.1 reports the estimates $\hat{\beta}_k^{NN}$. Column (1) reports the estimates obtained on the entire sample, while Columns (2) and (3) report the estimates obtained on the subgroup eligible for home care and institutional care respectively.

For better readability, we report the coefficients associated with the income, wealth and regional dummies separately (Figures B.1 to B.9).

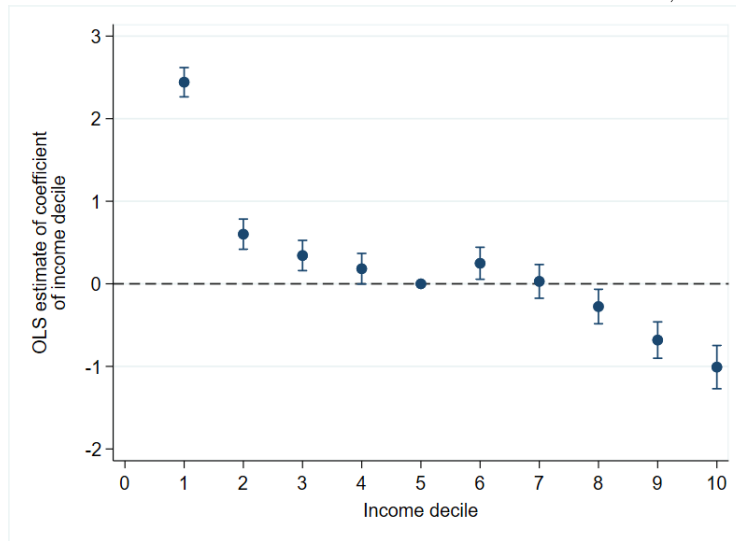
pensions, it is independent from the disability status of the individuals. As individual co-payments are capped, the medium-run impact of intensive LTC use on wealth is limited. We also exclude individuals with mental health issues and handicaps, which may affect life-time earnings.

Table B.1: Model of LTC use: OLS regression results, for the entire sample and by subgroups.

	Dependent variable: value of LTC use			
	<i>Eligible for:</i>	Entire sample	Home care	Institutional care
		(1)	(2)	(3)
CIZ-assessed LTC needs		1.000	1.000	1.000
		(.)	(.)	(.)
Age: 60-69		-1.929***	-1.808***	-2.762***
		(0.095)	(0.112)	(0.128)
Age: 70-79		-0.856***	-0.633***	-1.368***
		(0.067)	(0.081)	(0.081)
Age: 85-89		0.268***	-0.182*	0.602***
		(0.063)	(0.084)	(0.069)
Age: 90+		0.598***	-1.381***	1.360***
		(0.070)	(0.113)	(0.070)
Gender: woman		0.662***	1.574***	-0.634***
		(0.053)	(0.070)	(0.059)
Married				-0.794***
				(0.064)
Having a partner in the household		-2.932***	-1.579***	
		(0.066)	(0.059)	
Number of household members		1.099***	0.179***	-0.450***
		(0.051)	(0.073)	
Origin: foreign Western country		-0.759***	-1.065***	-0.084
		(0.088)	(0.115)	(0.096)
Origin: Turkey		-5.978***	-5.093***	-3.649***
		(0.308)	(0.322)	(0.727)
Origin: Morocco		-3.926***	-3.373***	-4.186***
		(0.396)	(0.416)	(0.900)
Origin: Suriname		-4.461***	-5.906***	-0.150
		(0.295)	(0.362)	(0.373)
Origin: Dutch Caribbean		-1.870***	-1.740*	-0.414
		(0.558)	(0.704)	(0.611)
Origin: foreign non-Western country		-4.957***	-5.495***	-1.833***
		(0.374)	(0.455)	(0.481)
Owner of main residence		-0.452***	0.498***	-1.370***
		(0.086)	(0.117)	(0.094)
Dummies for LTC contracting regions		$p < 0.01$	$p < 0.01$	$p < 0.01$
Dummies for income deciles		$p < 0.01$	$p < 0.01$	$p < 0.01$
Dummies for wealth deciles		$p < 0.01$	$p < 0.01$	$p < 0.01$
Constant		-9.493***	-7.488***	-8.217***
		(0.236)	(0.332)	(0.254)
Observations		616934	401262	287932

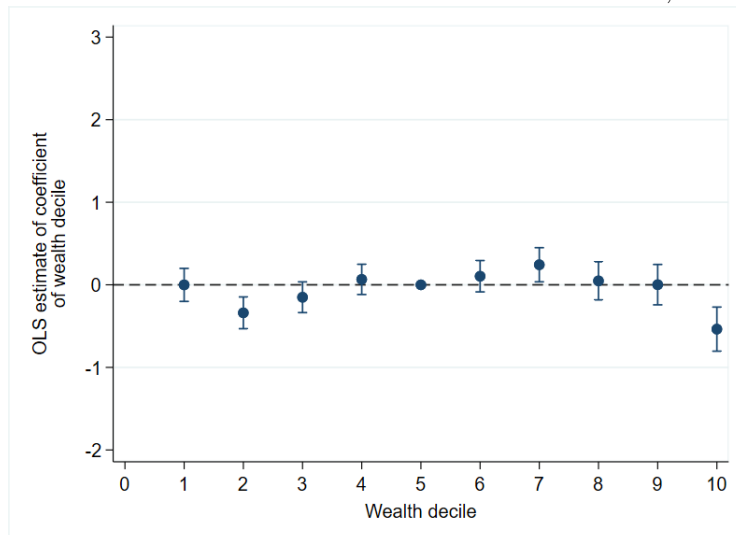
NOTES: Huber-White robust standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The monetary value of LTC use and CIZ-assessed needs, income and wealth are expressed in thousands euros.

Figure B.1: Estimates of the coefficients of income deciles, entire sample.



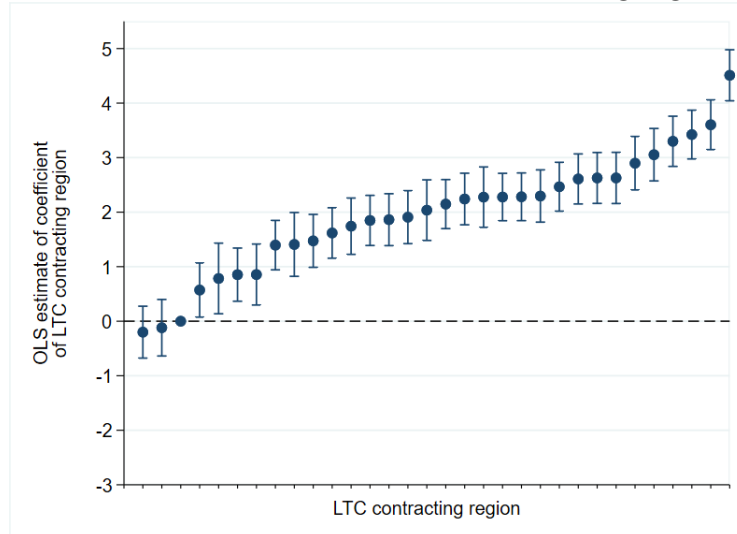
NOTES: For each coefficient, the 5% confidence interval is depicted (computed using the Huber-White robust standard errors). LTC use is expressed in monetary value, in thousands euros per year. Individuals are ranked by their 2011 disposable income. Estimates from the OLS regression (Equation (4) and Column (1) of Table B.1).
 READING: Being in the 2nd bottom income decile is associated with a higher use of LTC by €2,500, compared to belonging to the 5th income decile.

Figure B.2: Estimates of the coefficients of wealth deciles, entire sample.



NOTES: For each coefficient, the 5% confidence interval is depicted (computed using the Huber-White robust standard errors). LTC use is expressed in monetary value, in thousands euros per year. Individuals are ranked by their 2011 per capita household wealth. Estimates from the OLS regression (Equation (4) and Column (1) of Table B.1).
 READING: Being in the 10th wealth decile is associated with a lower use of LTC by €500, compared to belonging to the 5th wealth decile.

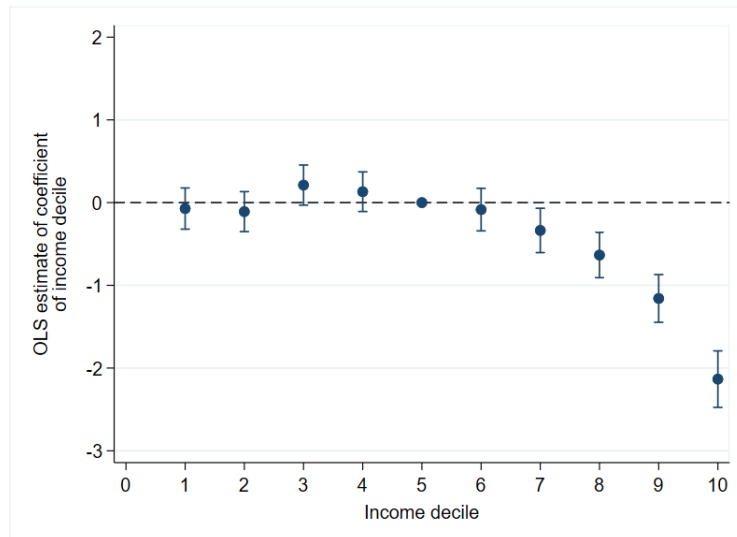
Figure B.3: Estimates of the coefficients of LTC contracting regions, entire sample.



NOTES: For each coefficient, the 5% confidence interval is depicted (computed using the Huber-White robust standard errors). LTC use is expressed in monetary value, in thousands euros per year. Ranking of regions from the left to the right is made according to the value of their coefficient. Estimates from the OLS regression (Equation (4) and Column (1) of Table B.1).

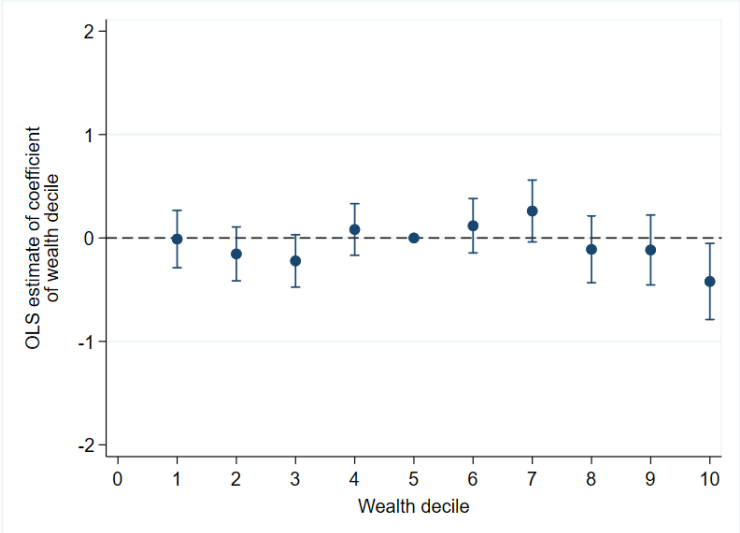
READING: Living in the region ranked eight from the left is associated with a higher LTC use of about €1,500, compared to living in the region ranked first from the left.

Figure B.4: Estimates of the coefficients of income deciles, subgroup eligible for home care.



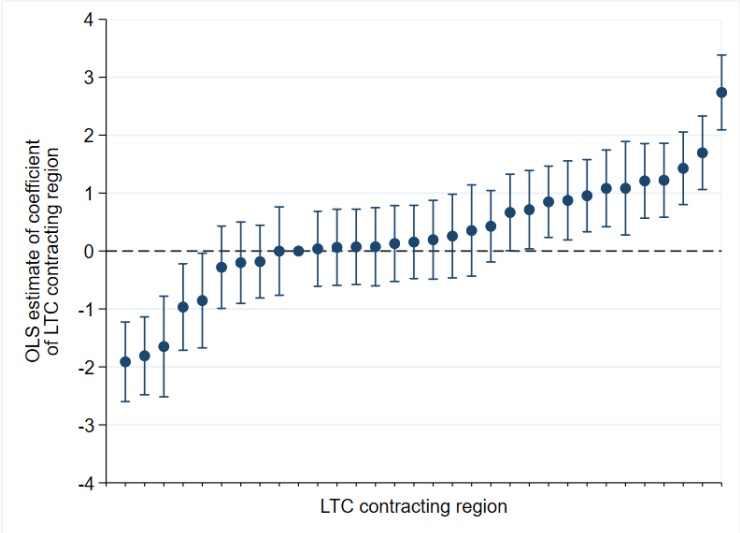
NOTES: For each coefficient, the 5% confidence interval is depicted (computed using the Huber-White robust standard errors). LTC use is expressed in monetary value, in thousands euros per year. Individuals are ranked by their 2011 disposable income. Estimates from the OLS regression (Equation (4) and Column (2) of Table B.1).

Figure B.5: Estimates of the coefficients of wealth deciles, subgroup eligible for home care.



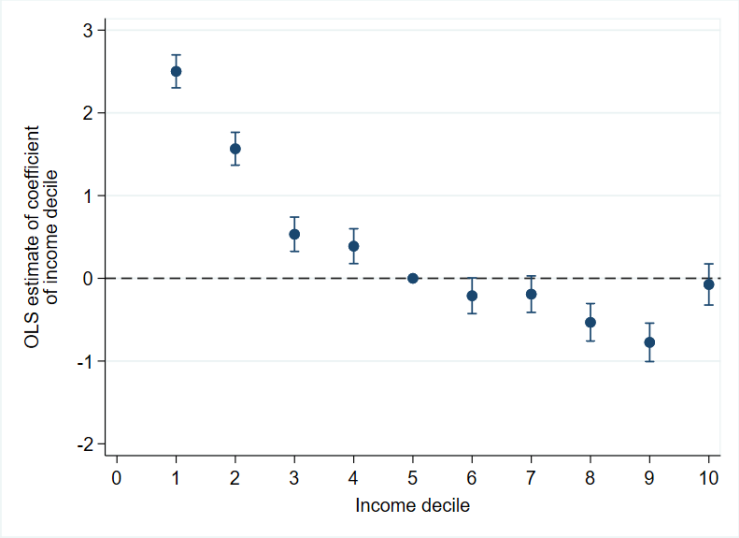
NOTES: For each coefficient, the 5% confidence interval is depicted (computed using the Huber-White robust standard errors). LTC use is expressed in monetary value, in thousands euros per year. Individuals are ranked by their 2011 per capita household wealth. Estimates from the OLS regression (Equation (4) and Column (2) of Table B.1).

Figure B.6: Estimates of the coefficients of LTC contracting regions, subgroup eligible for home care.



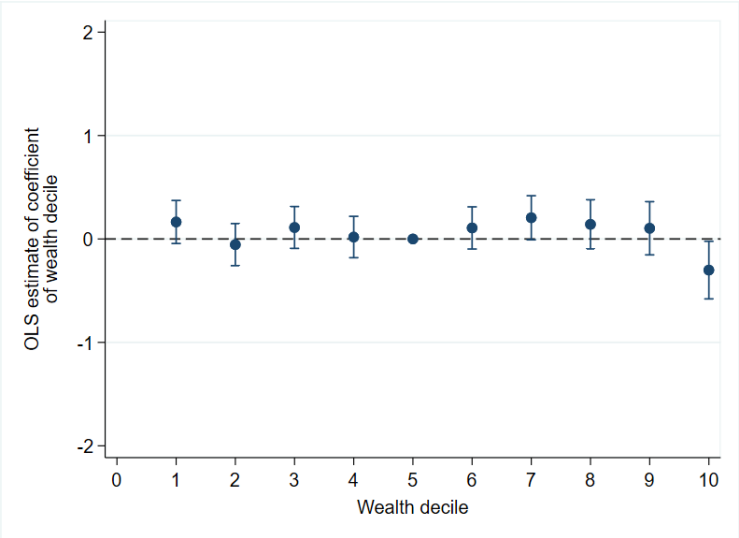
NOTES: For each coefficient, the 5% confidence interval is depicted (computed using the Huber-White robust standard errors). LTC use is expressed in monetary value, in thousands euros per year. Ranking of regions from the left to the right is made according to the value of their coefficient. Estimates from the OLS regression (Equation (4) and Column (2) of Table B.1).

Figure B.7: Estimates of the coefficients of income deciles, subgroup eligible for institutional care.



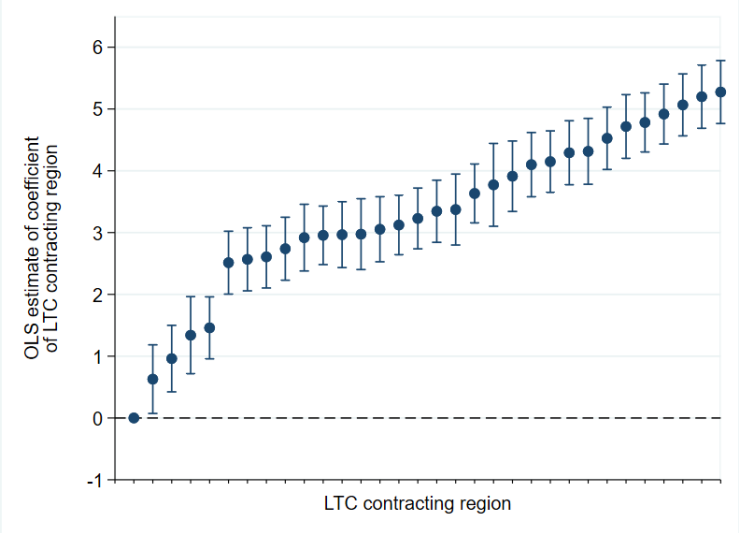
NOTES: For each coefficient, the 5% confidence interval is depicted (computed using the Huber-White robust standard errors). LTC use is expressed in monetary value, in thousands euros per year. Individuals are ranked by their 2011 disposable income. Estimates from the OLS regression (Equation (4) and Column (3) of Table B.1).

Figure B.8: Estimates of the coefficients of wealth deciles, subgroup eligible for institutional care.



NOTES: For each coefficient, the 5% confidence interval is depicted (computed using the Huber-White robust standard errors). LTC use is expressed in monetary value, in thousands euros per year. Individuals are ranked by their 2011 per capita household wealth. Estimates from the OLS regression (Equation (4) and Column (3) of Table B.1).

Figure B.9: Estimates of the coefficients of LTC contracting regions, subgroup eligible for institutional care.



NOTES: For each coefficient, the 5% confidence interval is depicted (computed using the Huber-White robust standard errors). LTC use is expressed in monetary value, in thousands euros per year. Ranking of regions from the left to the right is made according to the value of their coefficient. Estimates from the OLS regression (Equation (4) and Column (3) of Table B.1).

B.3 Concentration indexes of CIZ-assessed needs and non-need factors

Table B.2: Concentration indexes of CIZ-assessed needs and non-need factors.

	Entire sample	Eligible for:	
	(1)	Home care (2)	Institutional care (3)
CIZ-assessed LTC needs	-0.0358	0.0136	-0.0260
Age	-0.0134	-0.0123	-0.0088
Woman	-0.0728	-0.0777	-0.0599
Having a partner in the household	0.0263	0.2443	–
Number of household members	0.1307	0.1218	–
Married	–	–	0.1843
Origin: foreign Western country	0.0434	0.0385	0.0498
Origin: Turkey	-0.1407	-0.2033	-0.0990
Origin: Morocco	-0.0868	-0.1581	-0.0231
Origin: Suriname	-0.2603	-0.2834	-0.2782
Origin: Dutch Caribbean	-0.2706	-0.2758	-0.3101
Origin: other non-Western country	-0.2177	-0.2602	-0.2048
Disposable income	0.3215	0.3120	0.3228
Per capita household wealth	0.4459	0.4314	0.4585
Home owner	0.3264	0.2759	0.3771

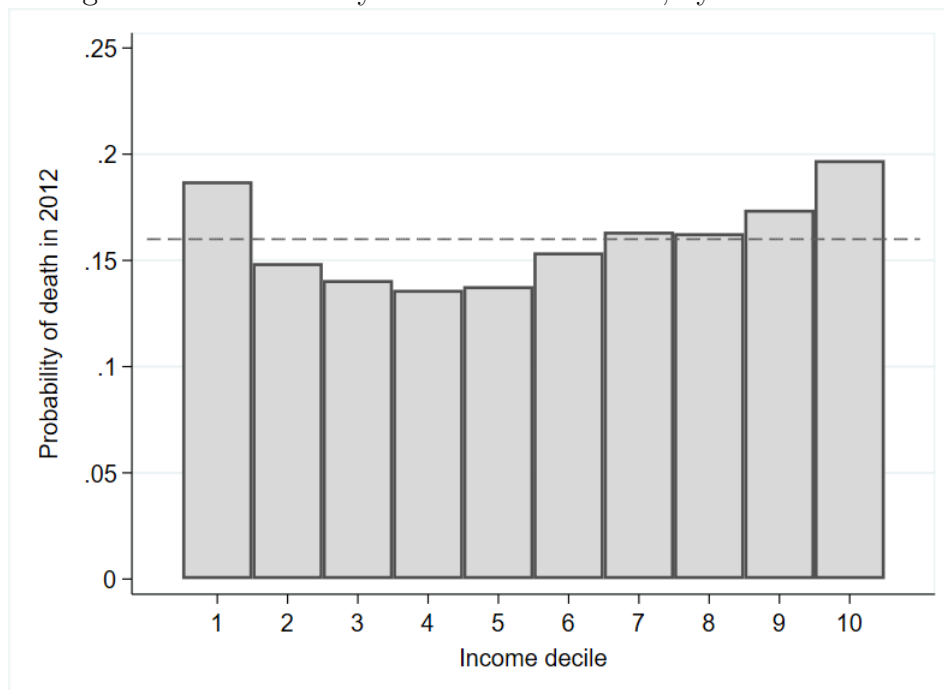
NOTES: When estimating the model of LTC use on the subgroup of individuals eligible for institutional care, we do not include the household composition as a control variable. In addition, we replace the dummy “having a partner in the house” by the marital status.

A negative (positive) concentration index indicates that the characteristic is relatively more (less) widespread among the income-poor than among the rich. For example, Table B.2 indicates that women and non-Western migrants tend to be poorer, while home owners and individuals with a partner tend to be richer.

C Robustness

C.1 Excluding individuals who died in 2012

Figure C.1: Probability to have died in 2012, by income decile.



SAMPLE: Individuals 60 and older eligible for public home care in the Netherlands in 2012 due to a somatic or psycho-geriatric condition (N=616,934).

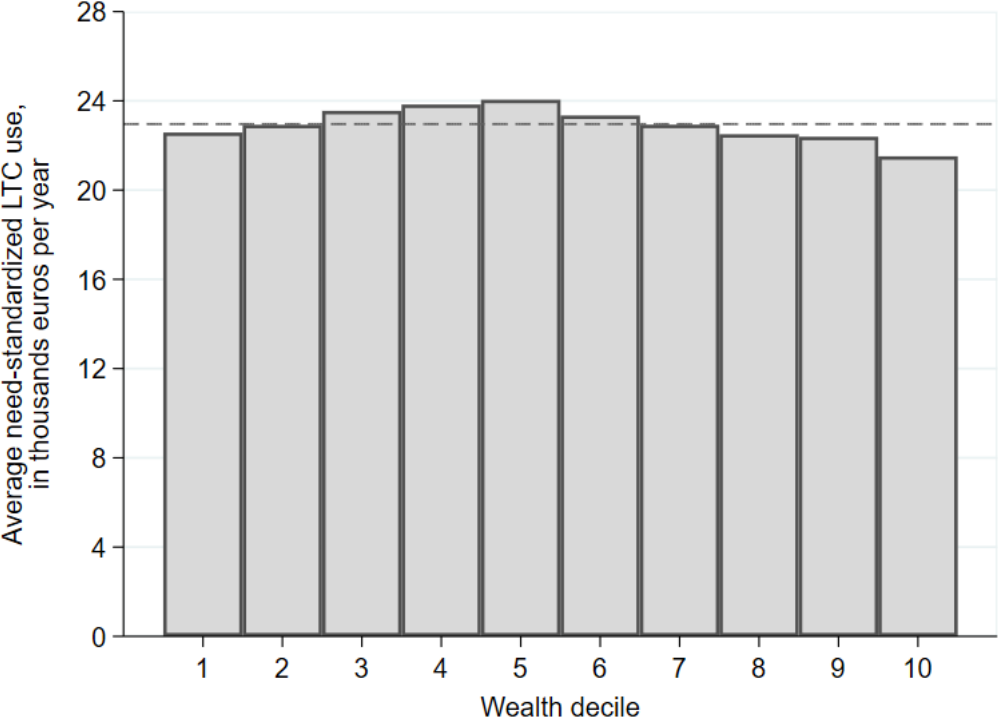
NOTES: The dashed horizontal line indicates the sample one-year mortality rate.

Table C.1: Concentration and horizontal inequity indexes: Excluding the deceased (entire sample)

	CI (1)	C^N (2)	HI (3)	N
<i>Entire sample</i>				
Baseline	-0.0853***	-0.0485***	-0.0368***	616,934
Excluding the dead	-0.0941***	-0.0609***	-0.0332***	518,097
<i>Eligible for home care</i>				
Baseline	-0.0358***	0.0254***	-0.0612***	401,262
Excluding the dead	-0.0530***	-0.0079***	-0.0450***	348,702
<i>Eligible for institutional care</i>				
Baseline	-0.0453***	-0.0238***	-0.0214***	287,932
Excluding the dead	-0.0493***	-0.0246***	-0.0246***	227,251

C.2 Wealth-related inequalities in LTC use

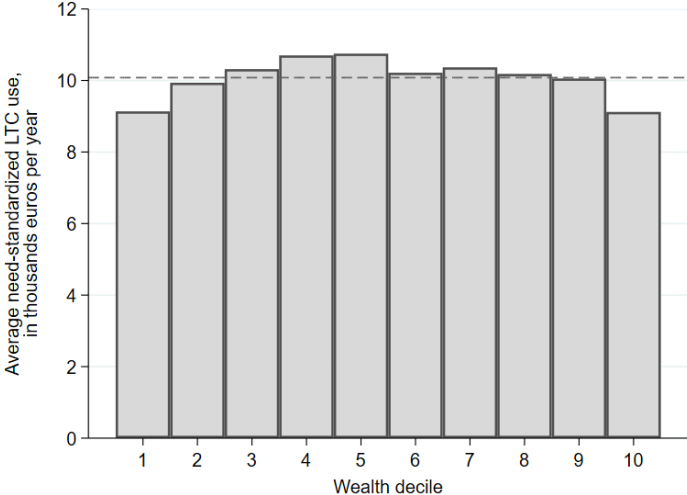
Figure C.2: Distribution of need-standardized LTC use across wealth deciles: Entire population



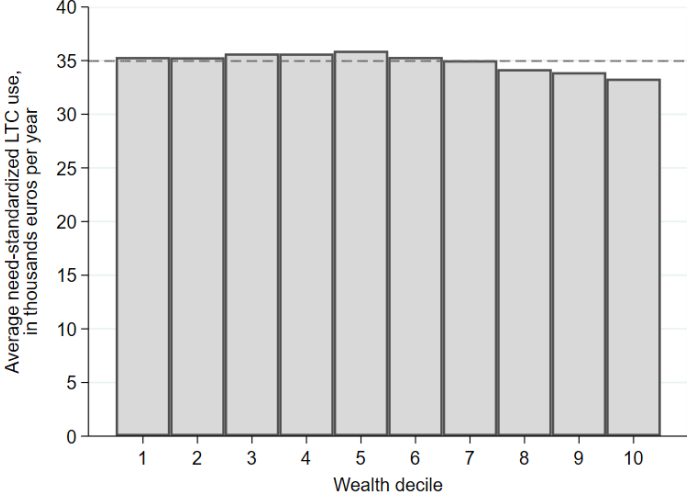
SAMPLE: Individuals 60 and older eligible for public LTC in the Netherlands in 2012 due to a somatic or psycho-geriatric condition (N=616,934).

NOTES: LTC use is expressed in annual monetary value, in thousands euros. The dashed horizontal line represents the average value of LTC use in the sample. Individuals are ranked by their per capita 2011 household wealth.

Figure C.3: Distribution of need-standardized LTC use across wealth deciles, by subgroup.



Panel A (top): Individuals eligible for home care.



Panel B (bottom): Individuals eligible for institutional care.

SAMPLES: Individuals 60 and older eligible for either public home care (Panel A; N=401,262) or institutional care (Panel B; N=287,932) in the Netherlands in 2012 due to a somatic or psycho-geriatric condition.

NOTES: LTC use is expressed in annual monetary value. LTC use is expressed in annual monetary value. In Panel A, it is the sum of the value of home care services used in kind and of the imputed value of LTC vouchers granted while the individual was eligible for home care in 2012. In Panel B, it is the sum of the value of home care services used in kind, of the value of LTC vouchers granted and of elderly institutional care received in 2012. Individuals are ranked by their per capita 2011 household wealth.

D Inference

Standard error of the concentration index of use

In order to derive standard errors on $CI(y)$, we use the convenient regression (O'Donnell et al., 2008). The convenient regression (Kakwani et al., 1997) allows to derive the concentration index directly from the estimation of the regression of a transformation of the LTC use variable on the fractional rank in the income distribution. The convenient regression corresponds to the following specification:

$$2\sigma_r^2(y_i/\mu) = \alpha + \delta r_i^I + \epsilon_i \quad (5)$$

where σ_r^2 is the variance of the fractional rank. The OLS estimate of δ corresponds to the concentration index of y .

However, the standard error associated to δ does not incorporate the sampling variability of the dependent variable in Equation 5 (which contains an estimate of the population mean of LTC use, μ). The solution is to regress the un-transformed outcome, y , on the fractional rank, then transform the coefficient on the fractional rank, and apply a delta method to derive a correct standard error:

$$y_i = \alpha_1 + \delta_1 r_i^I + u_i \quad (6)$$

The estimate of the concentration index CI is then equal to:

$$\hat{\delta} = \left(\frac{2\sigma_r^2}{\mu} \right) \hat{\delta}_1$$

This expression can be rewritten as:⁴

$$\hat{\delta} = \left(\frac{2\sigma_r^2}{\hat{\alpha}_1 + \hat{\delta}_1/2} \right) \hat{\delta}_1$$

The estimate of the concentration index is now written as a function of the regression coefficients from Equation 6; we can then apply the delta method to derive the standard error of the concentration index.⁵

⁴Using the fact that the sample mean OLS predicted value of the outcome is by construction equal to the mean of the outcome, μ , and that it is also equal to the predicted outcome at the sample mean of the fractional rank. The sample mean of the fractional rank is simply equal to 0.5.

⁵In Stata, this can be done using the command `nlcom` (O'Donnell et al., 2008).

Standard error of the concentration of needs

We have used the convenient regression approach to derive the standard error of $C^N(y)$, by replacing y_i by x_i in Equation (6).

Standard error of the horizontal inequity index

We can derive the horizontal inequity index as the concentration index of the (indirectly) need-standardized LTC use, y_i^{IS} (cf. Section 3 of the paper). The standard error of $HI(y)$ is obtained again by using the convenient regression approach: we replace y_i by $y_i^{IS} = y_i - x_i + \bar{x}$ in Equation (6).

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The present list mentions only the references quoted in the Appendices.