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Abstract

We study horizontal inequity in home care use in the Netherlands, where a social insurance scheme aims to allocate long-term care according to care needs. Whether the system reaches its goal depends on whether eligible individuals have equal access to care, but also on whether entitlements for care reflect needs, irrespective of socio-economic status and other characteristics. We assess and decompose total inequity into inequity in: (i) entitlements for home care, and (ii) the conversion of these entitlements into actual use. This distinction is original and important, because inequity calls for different policy responses depending on the stage at which it arises. Linking survey and administrative data on the 65+, we find higher-income elderly to receive less home care than poorer elderly with similar needs. While lower-income elderly tend to make greater use of their entitlements, need-standardized entitlements are similar across income, education and wealth levels. However, both use and entitlements vary by origin and place of residence. The Dutch need assessment seems effective at restricting socio-economic inequity in home care use but may not fully prevent inequity along other dimensions. Low financial barriers and universal eligibility rules may help to achieve equity in access but are not sufficient conditions.

JEL: J14; I14; D63

Keywords: Home care; Population ageing; Horizontal equity; Socio-economic inequality; Eligibility.

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Access to and use of individual-level data

The results presented in this article are based on calculations by the authors using non-public microdata from Statistics Netherlands (CBS). The datasets used include the *Gezondheidsmonitor Volwassenen en Ouderen* 2012, provided by the GGDs, CBS and RIVM. Under certain conditions and a confidentiality agreement, these microdata are accessible for statistical and scientific research. For further information: microdata@cbs.nl. Exploitation of the data and publication of the results are made in compliance with the European privacy legislation (GDPR, May 25th, 2018).

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Declaration of interests

The authors have no conflict of interests to declare.

1. INTRODUCTION

Limiting inequalities in access to long-term care (LTC) seems a widely accepted policy objective, in particular in Europe where "the right to affordable long-term care" is enshrined in the European Pillar of Social Rights (European Commission, 2017). Yet in many countries, public coverage for LTC is limited, especially for those with moderate needs and for community-based care provision (Muir, 2017); low-income elderly are often exposed to a substantial risk of unmet needs, poverty or involuntary reliance on informal care (OECD, 2017).

The Netherlands has put in place a comprehensive and generous LTC system that aims to ensure that LTC use is based only on care needs. We aim to answer the question whether this has ensured horizontal equity in home care use by Dutch elderly. The horizontal equity principle requires that people in equal need should receive equal care, irrespective of other irrelevant characteristics. Our focus is primarily on *socio-economic* inequity: as LTC is extremely costly, ensuring that access to these services does not depend on the elderly's and their families' ability to pay is a primary policy concern in ageing countries. Additionally, we document inequity in LTC access along other socio-demographic factors as well as place of residence. The unfair access to care of some segments of the population is of policy interest per se; in addition, it can contribute to inequalities in LTC use by socio-economic status.

We combine administrative data and survey data from 2012 to decompose total horizontal inequity in home care use into two components: (1) inequity in the granting of entitlements for home care, and (2) inequity in the conversion of these entitlements into actual use. This distinction is important because inequity remedies will be different depending on the stage at which it arises. Inequity in LTC use may not only be due to high out-of-pocket costs, but also to the way in which access to benefits and provision of LTC are organized; thus, it may also occur in systems with very low-cost or even entirely free care to users. In general, inequity in *health care* access may arise in each of three stages : i) the decision to consult a health care provider for a certain health issue, ii) the diagnosis and the prescription of a treatment by the provider, and iii) the uptake or provision of the treatment. However, very often stages (ii) and (iii) cannot be assessed separately because the diagnosis, the choice of a treatment and the provision of care are all decisions made by the same professional. In the case of LTC, however, in many countries stage (ii) is organized as a separate eligibility assessment and delegated to agents who are not the care providers.

We focus on the Netherlands for three main reasons. First, the Netherlands is fairly unique in offering very comprehensive public LTC coverage and collecting extensive and precise data

on eligibility and use of publicly funded LTC. As private LTC is virtually non-existent, we capture most inequalities in home care access by focusing on administratively recorded home care use. Second, in 2012 the same needs assessment was followed for all LTC except for domestic help; this makes it particularly relevant to identify inequity arising at the stage of granting LTC entitlements, as any such inequity will have implications for equity in use for (almost) all home care and institutional care. Third, the institutional setting provides us with a measure of all LTC entitlements that can be used empirically to test whether (i) those with the same needs receive the same entitlements, and (ii) those with the same entitlements use the same care. The Netherlands has entrusted needs assessments to a central independent agency rather than LTC providers, mainly to ensure an equitable assessment. However, it is difficult to *a priori* rule out disparities in entitlements between subpopulations. As there is no systematic screening of the elderly population, some population groups (e.g. low-educated or isolated elderly) may be less likely to navigate the system, and to apply and to receive benefits. In addition, Bakx *et al*. (2018) have shown that some Dutch assessors are more lenient than others in their decision to entitle elderly applicants to a nursing home stay; differing degrees of leniency might lead to eligibility decisions being more favorable to some groups.[1]

Most prior research has measured *overall* inequity in LTC use in one or more European countries, either focusing on socio-economic inequity (García-Gómez *et al.* 2015; Carrieri *et al.* 2017; Ilinca *et al.* 2017; Rodrigues *et al*. 2018) or on disparities across municipalities, in the context of the decentralized LTC provision of Nordic countries (e.g. Davey *et al*., 2006). All of these studies rely on data that do not contain information on the entitlements for publicly subsidized LTC; thus, they could not shed any light on which stage generates inequity in LTC access. To our knowledge, there are three exceptions. Duell *et al.* (2017) and Duell *et al.* (2019) investigate into regional disparities in access to *nursing home* care in the Netherlands. Duell *et al.* (2019) document substantially larger practice variation in the conversion of entitlements for nursing home care into use. Also focusing on the stage of the conversion of entitlements into care use in the Netherlands, Tenand *et al.* (2020) assess socio-economic inequity in LTC use, encompassing both home care and nursing home care. They conclude that poorer individuals tend to use more, or higher-cost, LTC (more often nursing home care) than richer elderly, given similar needs. But these results will only translate in pro-poor horizontal inequity in LTC use

[1] However, the fact that cases are assigned to assessors randomly – within one of the 10 regional offices – limits the possibility that a certain type of applicants has a higher chance to be paired with a lenient assessor. Bakx *et al.* (2018) show that there is no empirical correlation between the leniency of the assessor and the applicant's background characteristics collected in the application.

if there is no countervailing pro-rich inequity in the other stages, i.e. if entitlements for publicly subsidized LTC appropriately reflect the legitimate needs for LTC. Regarding nursing home care, Duell *et al.* (2017) report that after standardizing on the case-mix of applicants, the average probability that assessors grant entitlements ranges from 28% to 31% across the regional offices of the assessment agency – a fairly limited spread.

Like Duell *et al.* (2019), we separate inequality in entitlements from inequality in use. Yet, we add to the understanding of the Dutch context and to the international literature in four important ways. First, we investigate into access to *home care* instead of nursing home care. Second, while Duell *et al.* (2019) specifically aim at documenting regional disparities, we document horizontal inequity along multiple dimensions, focusing primarily on income-related inequity. Third, our study population is the full (non-institutionalized) elderly population; by contrast, the Duell *et al*. (2019) study assesses inequality *conditional on application* (i.e. within the group of applicants). This implies that inequity caused by differences in the propensity to apply would not be picked up, while it is potentially an important driver of inequity even in wealthy countries (Hernanz *et al.* 2004). Finally, Duell *et al*. (2019) rely on information recorded in the application files by assessors; instead, we complement background information with rich survey information on health and functional status collected independently from the LTC eligibility assessment process, which we believe is critical to unveil potential unequal treatments of similar cases.

Our empirical approach identifies which factors are associated with lower access to home care, at each of the two stages, after systematic differences in needs have been controlled for using a regression-based indirect standardization method (O'Donnell *et al*., 2012). Thus, we separate the contribution of need variables to inequality in home care from the contribution of potentially correlated illegitimate drivers of inequality.

We report four main findings. First, there is moderate pro-poor socio-economic horizontal inequity in home care use overall. Second, we find no evidence that eligibility assessment procedures systematically favor the elderly with higher income. Third, lower-income elderly tend to use more home care for given needs primarily because they convert more of their home care entitlements into actual use. Fourth, we find evidence of horizontal inequity along other dimensions than income. In particular, even though the social insurance for LTC is a national scheme in the Netherlands, and in spite of the central agency's efforts to implement a uniform needs assessment procedure, substantial regional disparities are observed.

2. ELIGIBILITY FOR LONG-TERM CARE AND USE OF CARE SERVICES IN THE NETHERLANDS

The Dutch public LTC insurance provides universal and fairly comprehensive coverage of LTC expenses. Until 2015, this was realized through a unified public LTC insurance programme (AWBZ).[2] Eligibility for publicly-financed LTC is determined by the Dutch LTC assessment agency (*Centrum Indicatiestelling Zorg* – CIZ), which is independent from the bodies funding and organizing public LTC provision. Although a centralized agency, CIZ has 10 regional offices. A needs assessment can be requested either by the person with care needs, or by someone on their behalf, including a relative or a health care professional.

The assessor decides on the type and volume of care that the applicant is eligible for. Applicants with a more severe condition and a less supporting environment may become eligible for nursing home care (30% of applicants in 2012; Duell *et al*. (2017)); others are eligible for home care, which encompasses nursing care, personal care, individual guidance and group guidance.

Extensive guidelines from the Ministry of Health describe the information that may be collected and used by assessors (RMO, 2010). Decisions should be based on the functional limitations of the applicant, her health status, and a limited number of background characteristics. Those criteria exclude the applicant's income or wealth, but they include the presence of relatives: able household members are expected to provide some personal care and assistance in the activities of daily living to their disabled relatives (Mot, 2010).

Beneficiaries most often receive in-kind care, but they can also opt for vouchers to pay their own professional caregivers or informal caregivers. Elderly eligible for nursing home care may choose to stay at home and receive an equivalent package of home care services. The provision of care is organized at a regional level: 32 regional purchasing agencies (*zorgkantoren*) contract with providers.

The bulk of LTC is publicly financed and, within this system, only 8% of LTC expenditures (2012 level) is financed through cost-sharing (Maarse & Jeurissen, 2016).[3] Co-payments increase with income and vary by type of care. They are capped: the monthly fee is lower than €20 for beneficiaries with lowest incomes, while pocket allowances and various deductions ensure that the richest beneficiaries retain about 60% of their income after paying for nursing

[2] Between 2013 and 2015, the Dutch LTC system went through a substantial reform (van Ginneken and Kroneman, 2015). We describe the system as it stood in 2012, as we assess the pre-reform situation.
[3] The remainder is paid for by mandatory social security contributions and general government revenue (Schut *et al.*, 2013)

home costs (Muir, 2017). Financial barriers in LTC access are thus limited, and the needs assessment is not based on financial information.

Yet, disparities in LTC access might still arise for a variety of reasons. First, some individuals may be less likely to apply for LTC benefits or less able to navigate the bureaucracy (e.g. low-educated individuals, non-Dutch speakers). Second, certain groups might be less willing or able to substitute informal care for formal home care (e.g. women *versus* men, as the former are less likely to have a spouse alive when they experience functional limitations). Third, assessors could make decisions more favorable to some categories of the population.[4] The conversion of information into entitlements is still a human decision, not a standardized algorithm. Moreover, entitlements do not automatically translate into the receipt of home care services, which may be postponed or delayed by demand or supply factors. For example, some groups might have better information about care delivery, or they could receive priority from providers.

[4] In sociology, empirical studies of decision-making by *street-level bureaucrats* have documented that background circumstances of applicants can considerably influence entitlements for social benefits (see e.g. Scott (1997)). Furthermore, the "representative theory agency" posits that case workers will advocate the case of culturally similar patients more strongly (see e.g. Meier *et al.* (2001)).

3. Data and study sample

3.1. Survey information on health and functional status

We use the 2012 wave of the Dutch Health Monitor (*Gezondheidsmonitor*), a cross-sectional, individual-level survey. It collects self-reported information on health status, chronic diseases and depression, physical, cognitive and sensory functional limitations as well as indicators of mobility restrictions. It thus provides a rich set of proxies for LTC needs. Survey weights make the sample representative of the population aged 65 and older living in a private household in January 2012.

3.2. Linked administrative data

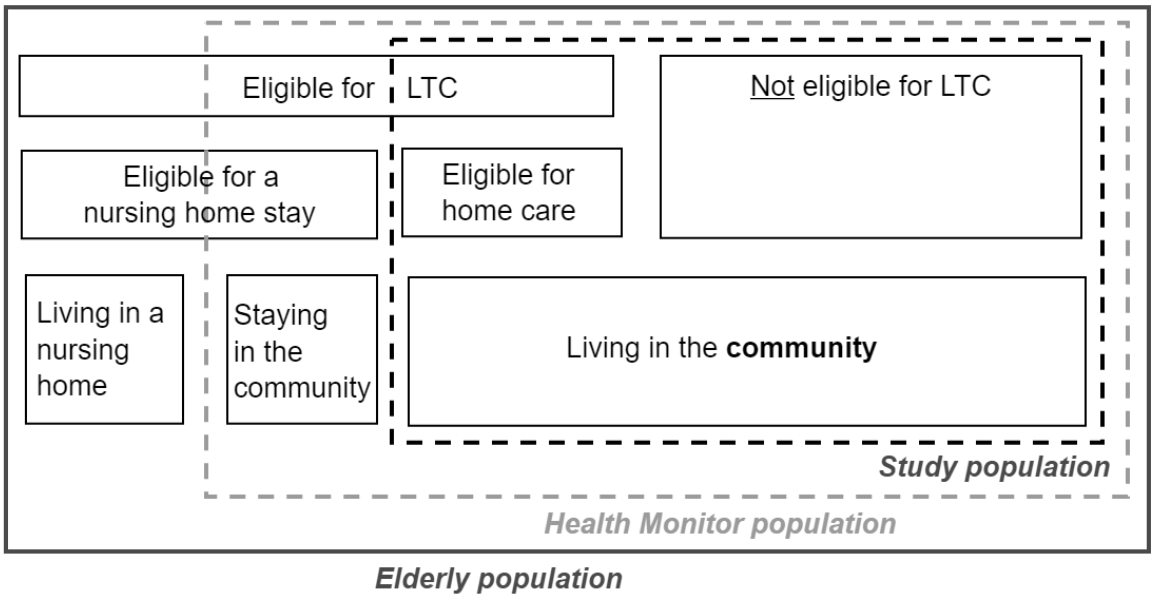
We link the Health Monitor with administrative data from Statistics Netherlands available for the entire Dutch population, based on a unique pseudomyzed individual identifier. Four types of data are linked. First, we use data from CIZ on eligibility for publicly-subsidized home care or nursing home care as well as on the use of in-kind LTC services data from the Central Administration Office of the LTC insurance scheme (*Centraal Administratie Kantoor*, or CAK) and the take-up of cash benefits from the health insurance information system (Vektis). Second, we link data from the Tax Office on household income and wealth for 2011. Third, we add socio-demographic information on migrant background (whether the elderly himself or herself, or a parent was born abroad), number of children alive and the municipality of residence taken from population registers (*Basisregistratie Personen*, or BRP).[5] Fourth, we link the 2011 claims data from mandatory health insurance and indicators of outpatient drug use for 84 categories of pharmaceuticals, according to the 2nd level categories (pharmacological or therapeutic subgroup) of the Anatomical Therapeutic Chemical (ATC) classification established by the World Health Organization, as of January 1st, 2011.

[5] Reference day: October 15th, 2012 (the mid-point of the survey collection period).

3.2. Study population and sample

Starting from a sample of 164,988 individuals, representative of the non-institutionalized 65+ population, we select the study sample in 2 steps (Figure 1). First, we drop individuals who were eligible for nursing home care in 2012. This group includes both the elderly living in a LTC institution at the time of the survey (September-November 2012),[6] as well as 3,607 respondents (2.1% of initial sample) who decided *not to take up* institutional care (yet) while they were eligible for it. This prevents the sample from being selected on the basis of respondents' *decision to use* certain LTC services. This first step delimits our study population, as depicted in Figure 1, and explains the focus on home care. Second, we drop individuals with missing information for any of the linked administrative variables (5,122 individuals). The final sample consists of 154,709 individuals (93.7% of initial sample).

Figure 1: Definition of the study population



4. METHODS

4.1. Three nested analyses

[6] Although the survey targeted individuals living in the community as of January 1st, 2012, some respondents had entered an institution by the time of the survey and filled in the questionnaire. There are 1,550 such respondents aged 65 or older. Furthermore, we discard the few individuals who were found to be in any other type of institutional setting (e.g. mental health care facility or center for the handicapped) in the administrative data.

We run three nested analyses, described in Table I. In Analysis A, we assess overall socio-economic horizontal inequity in home care use as inequality in home care use across different population groups (in particular, across socio-economic status (SES)) after controlling for differences in home care needs. In Analysis B, we focus on horizontal equity in *entitlements* for home care, by assessing whether individuals with similar needs receive similar entitlements. Finally, Analysis C focuses on individuals eligible for home care and measures inequalities in the conversion of entitlements into actual use differs.

Table I: The three stages of the empirical analysis

Analysis	*Outcome*	*Sample*	*Standardized outcome*
Analysis A: Horizontal Inequity (HI) in home care use	Value of home care use	Entire sample *N=154,709*	Outcome standardized on needs. Derived from a regression of the outcome on need and non-need factors (cf. Section 4.3)
Analysis B: HI in home care entitlements	Value of home care entitlements		
Analysis C: HI in the conversion of entitlements into home care use	Value of home care use	Sample eligible for home care *N=14,138*	Care use standardized on entitlements (cf. Section 4.3)

4.2. Definition of long-term care use and entitlements

Home care entitlements are computed as the monetary value of home care services covered by the LTC social insurance (AWBZ) that the individual was entitled to receive for a somatic or a psycho-geriatric condition. The definition of home care does not include domestic help, which is financed through a separate scheme (Wmo). Home care entitlements are defined as a range of hours per week. We take the mid-point of the range when computing the values of entitlements and use.

Home care use is defined as the monetary value of all in-kind home care services, plus the imputed value of LTC vouchers, that the individual received in 2012. For in-kind services, we multiply quantities used by the price cap set by the Dutch Healthcare Authority (NZA). If individuals opt for vouchers rather than in-kind care, we only observe whether they take up the vouchers - not the amount spent. In this case, we impute the monetary value of home care received by exploiting the official matrix used to convert home care entitlements into vouchers.[7]

[7] The cash equivalent of in-kind services represents about 75% of the national tariff of these services (see Tenand *et al*. (2020). Beneficiaries use on average 89.5% of the value of vouchers granted (Statistics Netherlands, 2018). Thus, the value of a voucher for an individual is imputed as 89.5% times 75% times the monetary value of the equivalent in-kind care.

4.3. Need-standardized outcomes

The egalitarian principle of horizontal equity requires that people with equal needs are treated equally by the LTC system. We measure the degree of *inequity* as the degree of *inequality* that remains after controlling for differences in the factors considered to legitimate greater LTC use. We use an indirect standardization method (O'Donnell *et al*., 2012).

We start by determining the *need-predicted* outcomes. For each individual i, $\hat{U}_i^A$ and $\hat{E}_i^B$ correspond to the values of home care use and entitlements that would have been observed if home care use and entitlements only reflected care needs. In order to derive $\hat{U}_i^A$ and $\hat{E}_i^B$, we first estimate the following equations using OLS:

$$U_i = \alpha_0 + X_i'\alpha^X + Z_i'\alpha^Z + u_i \qquad (1.A)$$

$$E_i = \beta_0 + X_i'\beta^X + Z_i'\beta^Z + \varepsilon_i \qquad (1.B)$$

where U_i is home care use, E_i indicates home care entitlements, X_i is the vector of care need factors, Z_i is the vector of other observable determinants of home care use, called non-need factors. u_i and ε_i are error terms.

We use the estimates from Equations (1.A) and (1.B) to construct need-*predicted* outcomes as:

$$\hat{U}_i^A = \hat{\alpha}_0 + X_i'\hat{\alpha}^X + \bar{Z}'\hat{\alpha}^Z \qquad (2.A)$$

$$\hat{E}_i^B = \hat{\beta}_0 + X_i'\hat{\beta}^X + \bar{Z}'\hat{\beta}^Z \qquad (2.B)$$

where $\bar{Z}$ is the vector of non-need factors averaged over the study population.[8]

Finally, we compute need-*standardized* use $\tilde{U}_i^A$ and entitlements $\tilde{E}_i^B$ as:

$$\tilde{U}_i^A = U_i - \hat{U}_i^A + \bar{U} \qquad (3.A)$$

$$\tilde{E}_i^B = E_i - \hat{E}_i^B + \bar{E} \qquad (3.B)$$

[8] Population averages are computed using the survey weights.

Inter-individual differences in need-*standardized* use and in need-*standardized* entitlements reflect the differences that *cannot* be explained by observed differences in needs; as such, they provide a measure of horizontal inequity, or illegitimate inequality.

For Analysis C, we derive the value of home care use *standardized for LTC entitlements*, $\widetilde{U}_i^C$, so as to capture the inter-individual variations in use that cannot be explained by individuals having different levels of home care entitlements.

$$\widetilde{U}_i^C = U_i - (\bar{U}^{elig}/\bar{E}^{elig})E_i + \bar{U}^{elig} \qquad (3.C)$$

where $\bar{U}^{elig}$ and $\bar{E}^{elig}$ are respectively home care use and entitlements averaged over the sub-population eligible for home care. With this standardization, we measure horizontal inequity in relative terms, as the deviation from a situation in which all individuals with the same needs have the same home care use ('equal care for equal needs''), but in which average care use can possibly differ from average entitlements. Horizontal equity in care use is achieved whenever: $\mathrm{U_i} = (\bar{\mathrm{U}}^{\mathrm{elig}}/\bar{\mathrm{E}}^{\mathrm{elig}})\mathrm{E_i}$ for all individuals, even if $\bar{\mathrm{U}}^{\mathrm{elig}}/\bar{\mathrm{E}}^{\mathrm{elig}}$ is significantly below 1 (as it is the case here; cf. Section 4). Note that contrary to Analyses A and B, the standardized outcome of Analysis C is not regression-based: in the latter case, we observe entitlements, while in the former case we statistically derive a measure of needs.

4.4. Concentration index and horizontal inequity index

This paper focuses primarily on *socio-economic* inequity in LTC access. We use the horizontal inequity index as a synthetic measure of this dimension of inequity (van Doorslaer and Van Ourti, 2011) for each of Analyses A, B and C. Formally, indexes HI^A, HI^B and HI^C are equal to:

$$HI^A = CI(U) - CI\left(\widehat{U}^A\right) = CI(\widetilde{U}^A) \qquad (4.A)$$

$$HI^B = CI(E) - CI\left(\widehat{E}^B\right) = CI(\widetilde{E}^B) \qquad (4.B)$$

$$HI^C = CI(U)^{elig} - CI(E)^{elig} = CI(\widetilde{U}^C) \qquad (4.C)$$

with the concentration index over SES of a continuous variable Y, $CI(Y)$, computed as:

$$CI(Y) = 2cov(Y, r^{SES})/\bar{Y} \qquad (5)$$

where r_i^{SES} is the weighted fractional rank of individual *i* in the distribution of SES, and $\bar{Y}$ the population average of Y.[9] [10] The concentration index varies from -1 (maximum pro-poor inequality in the distribution of the outcome) to +1 (maximum pro-rich inequality). If it is equal to 0, outcome Y is equally distributed across income levels *on balance*.

4.5. Income as indicator of socio-economic status

We proxy SES by disposable household income adjusted for household size,[11] for three main reasons. First, income is a continuous ranking variable, unlike e.g. education. Second, income includes the flow of pension and other benefits - a major economic resource for the elderly - whereas administrative data on wealth do not include Social Security wealth. We therefore believe that ranking the elderly based on their income better captures the potential importance of economic resources in LTC access. Third, income is the most common variable used by policy makers to monitor SES disparities in the access to public services and social benefits.

4.6. Horizontal inequity along other dimensions than income

In the empirical analysis, we additionally test for systematic differences in average standardized use or entitlements across population groups (e.g. males *versus* females, or the low-educated *versus* the high-educated) in order to assess horizontal inequity along dimensions other than income.

4.7. Classification of need and non-need factors

[9] For the individual ranking *i*-th in the distribution from lowest to highest SES, $r_i^{SES} = \sum_{j=0}^{i-1} w_j + (w_i/2)$, where w_j is the sample weight (re-scaled to sum to 1) and $w_0 = 0$ (O'Donnell *et al.*, 2008).

[10] The difference between $CI(U)$ in Equation (4.A) and $CI(U)^{elig}$ in Equation (4.B) is that the former measures the concentration of home care use *in the full study population*, while the latter measures the concentration of home care use *among the elderly eligible for home care*. A similar distinction applies for the difference between $CI(E)$ in Equation (4.B) and $CI(E)^{elig}$ in Equation (4.C).

[11] We use the OECD square root equivalence scale (OECD, 2011).

The findings from Analyses A and B, in terms of inequity along income and other dimensions, will critically depend on which variables are included in Equations (1.A) and (1.B). Their selection is based on two criteria.

First, we follow the perspective of the Ministry of Health and of CIZ to define the legitimate sources of inequalities in LTC use. We use survey measures of health, chronic conditions, functional limitations, depression and loneliness. Additional need variables include health care costs and drug use in the previous year. Since in the Netherlands household members are expected to provide some informal care to a disabled relative, we include a dummy for the presence of a partner as a need-reducing factor. As an exception, we also include age as a need variable even though it is not a criterion for access to (more) home care: we posit that age predominantly captures a condition of frailty that is not entirely reflected by self-reported health and health care use (Sirven & Rapp, 2017).

Given the large number of need variables identified, we run the risk of over-fitting the model when estimating Equations (1.A) and (1.B) and of obtaining imprecise estimates of need-predicted outcomes (cf. Equations (2.A) and (2.B)). In order to narrow down the list of need variables, we implement a Lasso procedure[12] (described in Online Appendix A) instead of hand-picking a subset of variables.

Secondly, non-need factors encompass all illegitimate determinants of home care entitlements or use that may correlate with needs. Failing to include such variables may result in biased estimates of α^X and β^X (Gravelle, 2003), which will in turn bias need-standardized outcomes.[13] Therefore, instead of shrinking down the number of non-need factors, we include the richest possible set of such variables: gender, per capita household wealth (in deciles), home ownership, migrant background, education, size of city of residence, the CIZ regional office as well as the LTC purchasing region the respondent lives in.[14] As family characteristics beyond household composition are not supposed to be taken into account by CIZ, the number of children, number of daughters, geographical proximity of children are part of the list of non-need factors.

[12] Lasso (*least absolute shrinkage and selection operator*) is a regression-based statistical method that can be used for variable selection and to enhance prediction accuracy.
[13] Our methodology thus differs from Duell *et al.* (2019) who, following the practice variation literature, do not take into account non-need factors when standardizing use and entitlements on need variables.
[14] We group these 32 regions into 8 groups, to avoid technical issues when performing Bootstrap inference (see Online Appendix C).

5. RESULTS

5.1. Descriptive statistics

Summary statistics of the study population are provided in Table II, in Column (1) for the entire study population and in Column (2) for the 9.7% individuals who were eligible for home care at some point in 2012. In the entire population, the prevalence of mobility and sensory limitations, other functional limitations and self-reported chronic conditions is high, which is in line with the high average age (73.7 years). Poor health and functional limitations are more prevalent in the sub-population entitled to home care, which also tends to be older and more often single. These statistics confirm that home care entitlements are, on average, targeted towards the elderly with higher needs. Elderly eligible for home care are also more likely to be women, to have children living in their municipality of residence and to have lower education, wealth and income.

[Table II about here; to be found on the following pages]

Table II: Summary descriptive Statistics (1/2)

	Entire weighted sample	Eligible for home care
	(1)	(2)
A. Demographic characteristics		
Women	53.6%	66.5%
Age	73.7	80.0
Deceased in 2012	0.2%	1.4%
Of Dutch descent	86.1%	84.8%
Spouse alive	63.0%	37.0%
Number of children alive	2.1	2.3
No child	13.2%	15.1%
Closest child lives at the same address	4.9%	5.0%
Closest child lives in the same city (but different address)	51.9%	55.0%
Closest child lives in a different city	30.0%	25.0%
Lives in a municipality with less than 10,000 inhabitants	1.6%	1.2%
Lives in a city with 10,001 to 50,000 inhabitants	50.9%	50.0%
Lives in a city with 50,001 to 150,000 inhabitants	29.2%	28.9%
Lives in a city with more than 150,000 inhabitants	18.4%	19.9%
B. Socio-economic status		
Education level: elementary	60.8%	71.2%
Education level: secondary or unknown	21.9%	20.3%
Education level: tertiary	17.3%	8.5%
Disposable income	€30,780	€24,608
Wealth (per capita)	€162,333	€128,343
C. LTC eligibility and use in 2012		
Eligible for home care (*yes/no*)	9.7%	100.0%
Entitlements to home care (*value)* if entitled	€14,788	€14,788
Home care (in kind) (*yes/no*)	8.1%	83.4%
Personal budget (*yes/no*)	0.4%	4.6%
LTC use (*value)* if using	€8,690	€8,690
D. Functional limitations		
Any functional limitation	59.2%	87.3%
a) Difficulties to follow a conversation	32.2%	51.1%
b) Difficulties to get involved into a conversation	11.3%	25.4%
c) Can read small characters	23.0%	42.1%
d) Difficulties to recognize faces in the street	12.0%	27.0%
e) Difficulties to lift shopping bags	30.9%	73.1%
f) Difficulties to bend and lift some weight	28.9%	75.0%
g) Difficulties to walk short distances	28.6%	66.8%
Any mobility or sensory limitations	28.1%	68.1%
a) Hearing limitations	7.6%	18.7%
b) Sight limitations	8.1%	20.3%
c) Mobility limitations	21.1%	62.3%

Continued on the following page

Table II: Summary descriptive Statistics (2/2)

	Entire weighted sample	Eligible for home care
	(1)	(2)
Continued from the previous page		
E. Self-assessed health (SAH)		
SAH: good	60.8%	25.4%
SAH: average	34.0%	54.7%
SAH: bad	5.2%	19.9%
Has a chronic condition	79.1%	89.3%
Number of chronic conditions, conditional on having any	2.4	3.9
Feels lonely (moderately to seriously)	44.3%	71.5%
Feels anxious/depressed	37.1%	65.0%
F. Health care costs and drug use in 2011		
Total health care costs (covered by mandatory insurance)	€3,586	€8,026
General Practitioner care costs	194€	€288
Any pharmaceutical use	5.1%	12.5%
Population size (estimated)	2,600,000	297,000
Sample size	154,709	14,138

Notes: Values of eligibility, use and income are expressed in euros per year. Figures are weighted by survey weights.

5.2. Income-related horizontal inequity

In terms of descriptive statistics, while 16% of the elderly in the bottom income decile received in-kind home care or LTC vouchers in 2012, this figure is less than 4% in the top decile. The income-gradient in eligibility is almost equally marked: 14% of the 10% poorest elderly are entitled to home care, but only 3% of the top decile.

The estimates of the concentration indices and horizontal inequity indices in Table III confirm a strong *pro-poor* concentration of home care use (-0.341 in the entire population). But the value of home care entitlements also exhibits a highly negative concentration index (-0.288): entitlements are on balance higher for lower-income elderly, also among those entitled to home care (-0.041). [15]

[Table III about here; to be found on the following page]

Analysis A shows that the pro-poor concentration of needs (-0.305) does not entirely offset the unequal distribution of home care use: this results in a negative HI (-0.036). HI for Analysis B is also negative (-0.015), but not statistically significantly different from 0. Our bootstrapped

[15] That *CI(U)* is smaller in Analysis C than in Analysis A is expected, as only a minority of the sub-population eligible for home care has zero use. Same remark applies for *CI(E)* in Analysis B compared with Analysis C.

95% confidence interval suggests that there is a 95% chance that HI is lower than 0.005: our findings reject the hypothesis of *pro-rich* inequity at the stage of home care eligibility. Pro-poor horizontal inequity in home care use is thus not due to poorer elderly receiving greater home care entitlements.

Table III: CI and HI for Analyses A, B and C

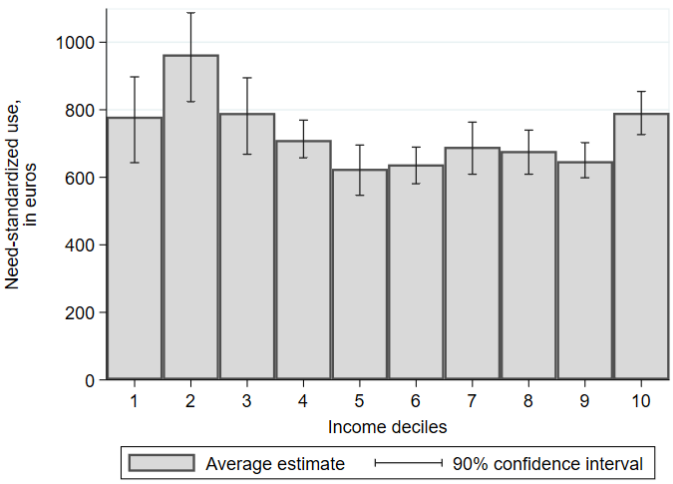
	CI(outcome)	*CI(need-predicted outcome)*	*HI(outcome)*	*N*
Analysis:	(1)	(2)	(3)=(1)-(2)	
A. Home care use (equity overall)	-0.340*** [-0.361;-0.315]	-0.304*** [-0.318;-0.292]	-0.036*** [-0.057;-0.010]	154,709
B. Home care entitlements (equity at eligibility stage)	-0.288*** [-0.311;-0.267]	-0.272*** [-0.286;-0.261]	-0.016n.s. [-0.036;0.005]	154,709
C. Conversion of entitlements into use (equity at use stage)	-0.095*** [-0.113;-0.071]	-0.040*** [-0.056;-0.022]	-0.054*** [-0.065;-0.040]	14,138

Notes: The figures in brackets show asymmetric 95% confidence intervals, computed using a bootstrap approach (1,000 replications; see Online Appendix D). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$, n.s. $p \geq 0.10$.

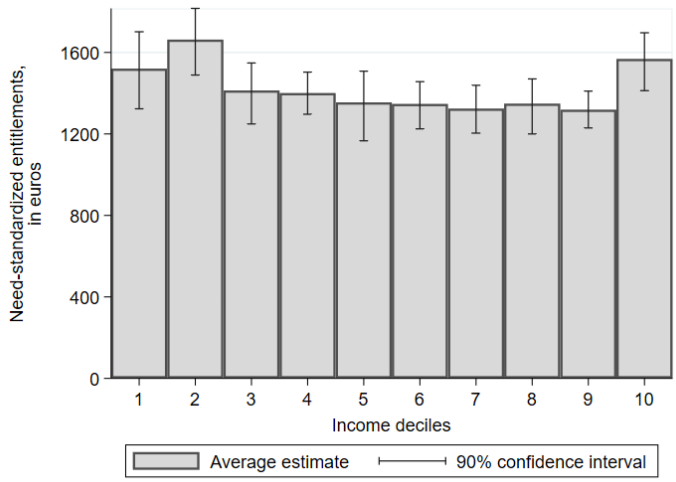
From Analysis C, it seems that inequity in home care use stems mainly from the conversion of entitlements into actual use: among those eligible for home care, the pro-poor distribution of entitlements (-0.041) does not suffice to explain the pro-poor distribution of LTC use: HI is markedly negative (-0.054).

To ease interpretation of the magnitude of income-related horizontal inequity, Figure 2 compares average standardized outcomes across income deciles. Panel A reveals that the 30% poorest elderly use on average 27% more home care (in value) than the elderly in the middle-top of the income distribution (deciles 4 to 9), when needs are controlled for. The 10% richest elderly, however, show somewhat higher use. The close-to-zero HI of Analysis B is the result of care entitlements being similar for deciles 3 to 9, while the poorest (deciles 1 and 2) but also the richest (decile 10) receive 17% higher entitlements, for given needs (Panel B). Instead, at the stage of the conversion of entitlements into use, Panel C shows a roughly monotonous and markedly negative income-gradient. The eligible elderly among the 10% poorest use 36% more home care than the elderly in the top decile, for given entitlements. In other words: the poorest convert one third more of their entitlements into use than the richest.

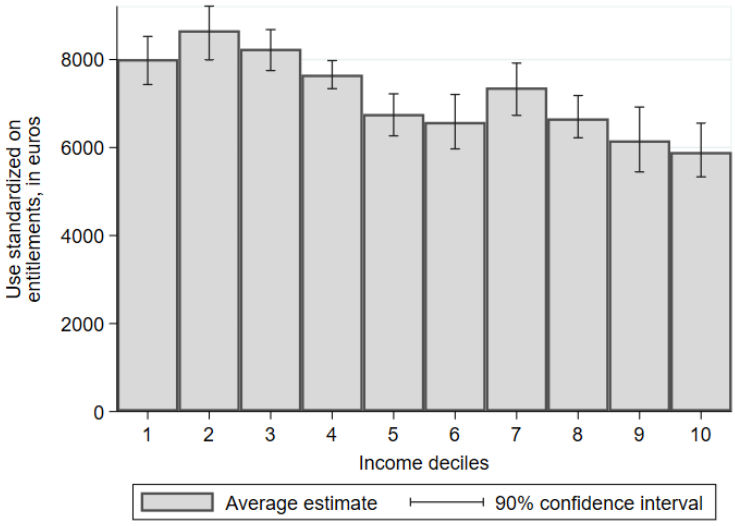
Figure 2: Average standardized outcomes, by income decile (Analyses A, B and C)



Panel A: Average need-standardized use by income decile (Analysis A)



Panel B: Average need-standardized entitlements by income decile (Analysis B)



Panel C: Average use standardized for entitlements by income decile (Analysis C)

Samples: Weighted study sample (Panels A and B); weighted subsample eligible for home care (Panel C).

Notes: Need-standardized use and entitlements (Analysis A and B) and use standardized for entitlements (Analysis C) are defined in Equations (3.A) to (3.B). Asymmetric 90%-level confidence interval based on 1,000 Bootstrap replications (see Online Appendix C). Values expressed in euros over 2012.

5.3. Further dimensions of horizontal inequity in home care access

We now assess several other dimensions of horizontal inequity in home care use, again decomposing into inequity arising at the stage of eligibility and inequity at the stage of entitlements conversion. Figure 3 displays need-standardized home care use (Panel A) and need-standardized entitlements (Panel B) averaged within the study population among subgroups defined by non-need characteristics; Panel C presents home care use averaged over the same groups but within the sub-population eligible for home care. To save space, standardized outcomes across wealth deciles and regions are reported in Figures B.1 to B.3, Online Appendix B.

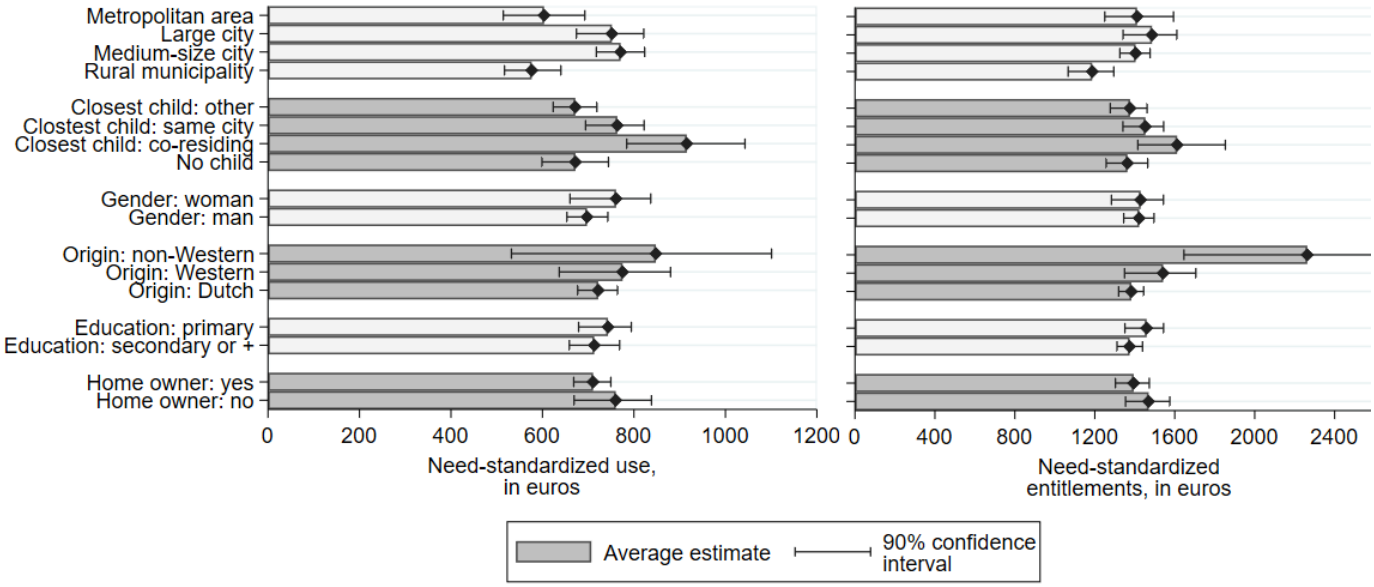
[Figure 3 about here; to be found on the following pages]

What can explain why a population group has lower home care use, after controlling for its needs? There are two potential channels: (i) belonging to this group (e.g. having a low education level) is *per se* associated with lower use when other non-need factors are controlled for, on top of care needs; or (ii) the *composition* of this group (e.g. the low-educated) in terms of socio-economic, demographic and geographic characteristics leads to its lower use of care. The coefficient estimates of Equations (1.A) and (1.B) reflect the partial correlation between each of the non-need factors of either home care use or entitlements when controlling for need variables – and the other non-need factors. As such, they help to understand the channels underlying horizontal inequity; they are reported in Columns (1) and (3) of Table IV. [16] Similarly, for Analysis C, Column (5) of Table IV provides the partial correlation between each of the non-need factors and home care use, when controlling for entitlements and other non-need factors.

[Table IV about here; to be found on the following pages]

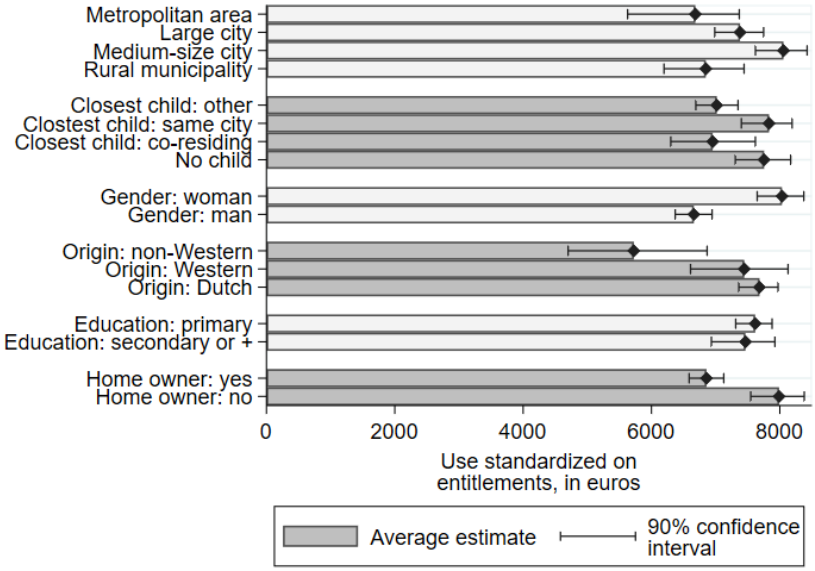
[16] Suppose that we read from Figure 3 that need-standardized use is lower for group X than for group Z. If the coefficient of the dummy for group X in Table B.III (Column (1)) were *not* statistically nor practically significant, we would conclude that horizontal inequity between groups X and Y stems from the socio-economic and demographic *composition* of the two groups beyond their difference in education levels.

Figure 3: Average standardized outcomes, by different groups (Analyses A, B and C)



Panel A: Average need-standardized use for different groups (Analysis A)

Panel B: Average need-standardized entitlements for different groups (Analysis B)



Panel C: Average use standardized for entitlements for different groups (Analysis C)

Samples: Weighted study sample (Panels A and B); weighted subsample eligible for home care (Panel C).

Notes: Need-standardized use and entitlements (Analysis A and B) and use standardized for entitlements (Analysis C) are defined in Equations (3.A) to (3.C). Asymmetric 90%-level confidence interval based on 1,000 Bootstrap replications (see Online Appendix C). Values expressed in euros over 2012.

Table IV: Regression estimates for non-need factors - Analyses A, B and C

	Analysis A		**Analysis B**		**Analysis C**	
Outcome:	*LTC use (value)*		*LTC entitlements (value)*		*LTC use (value)*	
	Coef.	Std-error	Coef.	Std-error	Coef.	Std-error
	(1)	(2)	(3)	(4)	(5)	(6)
Need variables	Yes		Yes		No	
Home care entitlements	No		No		0.512	-
Non-need factors						
Income decile: 1	147.8*	80.5	45.5	124.3	1354.2**	618.3
Income decile: 2	306.5***	101.1	237.6	183.6	1662.7***	474.6
Income decile: 3	136.8	100.5	15.0	179.2	1128.2***	369.8
Income decile: 4	70.4	77.3	26.7	169.4	635.0	385.7
Income decile: 5	*Ref.*	-	*Ref.*	-	*Ref.*	-
Income decile: 6	21.1	52.4	11.2	126.9	-436.4	632.3
Income decile: 7	76.3	54.8	-3.7	110.9	451.4	602.7
Income decile: 8	79.7	53.4	37.6	83.0	-300.3	390.0
Income decile: 9	57.4	58.3	23.2	135.8	-869.9	605.1
Income decile: 10	242.0***	82.3	300.7*	162.5	-749.6	524.0
Wealth decile: 1	-347.1***	100.7	-271.2*	152.3	-1973.7***	512.8
Wealth decile: 2	-85.5	110.6	-188.1	168.4	-248.9	423.5
Wealth decile: 3	-52.6	100.0	-35.2	149.0	-796.8	496.7
Wealth decile: 4	128.9	160.9	-11.0	188.0	655.5	587.0
Wealth decile: 5	*Ref.*	-	*Ref.*	-	*Ref.*	-
Wealth decile: 6	-25.7	67.6	72.7	142.7	-1353.9***	475.8
Wealth decile: 7	81.5	88.0	130.5	145.2	247.8	475.5
Wealth decile: 8	-1.6	60.5	10.5	103.3	294.8	469.2
Wealth decile: 9	9.4	58.5	43.6	98.3	591.4	489.1
Wealth decile: 10	-5.2	68.7	193.4	129.6	-143.3	628.2
Homeowner	-157.4	82.7	-243.2**	101.0	-1561.3***	416.1
Female	45.6	79.8	72.7	142.7	1073.0***	247.5
Origin: Dutch	*Ref.*	-	*Ref.*	-	*Ref.*	-
Origin: Western country, Dutch Indies	74.1	94.6	167.5	122.9	-219.0	573.8
Origin: non-Western country	264.5	164.5	940.7**	422.0	-1548.9**	648.4
Education: primary	-2.3	54.0	86.0	68.0	-900.3*	516.4
Education: secondary	8.9	45.6	-24.5	82.9	-182.6	453.5
Education: tertiary	*Ref.*	-	*Ref*	-	*Ref.*	-
Education: unknown	165.5	210.9	172.3	201.8	220.9	869.7
Number of children	41.5*	24.7	113.9**	45.5	-129.1	100.8
Number of daughters	8.6	25.4	19.0	50.8	34.8	139.8
No child	-116.6	98.8	160.1	219.0	-1445.0***	510.8
Closest child: at the same address	*Ref.*	-	*Ref.*	-	*Ref.*	-
Closest child: same municipality	-155.0	101.9	-55.6	206.8	-1084.1**	487.7
Closest child: different municipality	-209.7**	82.8	-36.9	215.3	-1753.4***	541.8
Municipality of residence: small city/rural	-109.9**	50.8	-191.2*	111.0	-365.2	497.1
Municipality of residence: medium city	-24.3	37.2	-142.4	91.5	493.3	349.9
Municipality of residence: large city	*Ref.*	-	*Ref.*	-	*Ref.*	-
Municipality of residence: metropole	-74.8	52.7	26.5	96.7	-543.6	500.3
Dummies for CIZ regional office	Yes	p=0.000	Yes	p=0.000	Yes	p=0.006
Dummies for group of purchasing regions	Yes	p=0.000	Yes	p=0.000	Yes	p=0.105
Constant	-281.8	260.4	-23.7	560.9	No	-
N	154,646		154,646		14,136	
R^2	0.158		0.166		-	

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$, $^{n.s.}$ $p \geq 0.10$. Outcomes are expressed in euros over year 2012. Weighted linear estimations of Equations (1.A) for Columns (1) and (2) and (1.B) for Columns (3) and (4) (defined in Section 3). Columns (5) and (6) show the estimates of a weighted linear regression of home care use on entitlements and non-need factors. The estimations take into account the clustered design of the sample (335 primary sampling units). When performing the estimations, a few observations for which the primary sampling unit is missing have to be dropped. The p-values of a Fisher test for joint statistical significance of the dummies for CIZ regional offices and for LTC purchasing regions respectively. Estimates of the need variables of Analyses A and B are reported in Table B.I, Online Appendix B. For Analysis C, a constrained linear MLE is performed: the coefficient of entitlements is constrained to the value $\bar{U}^{elig}/\bar{E}^{elig}$ (see Equation (1.C) in Online Appendix D.2).

Starting with socio-economic characteristics, Figure 3 reveals that homeowners use 12% less home care for given entitlements (Panel C), possibly because they can more easily substitute home adaptation for human assistance than renters. Differences in entitlements across education levels are limited; however, having a primary education only is associated with sizably less home care use, for all other non-need factors equal and given entitlements (Table IV, Column (5)). Conditional on needs, elderly with little wealth do not appear to be at a systematic (dis)advantage in terms of home care use or entitlements. However, when further conditioning on other non-need factors, being among the 10% elderly with the lowest wealth is associated with lower entitlements and use (Table IV, Columns (1) and (3)).

Those with a non-Western migrant background receive 60% *more* home care entitlements for given needs (Figure 3, Panel B). However, for given entitlements, they use 25% *less* care (Panel C). This explains that the elderly with a non-Western migrant background have slightly *higher* use for given needs (Panel A), although the difference is not statistically significant at the 10% level. The gap in entitlements, which persists when we control for socio-economic, demographic and geographical characteristics, possibly occurs because CIZ assessors consider the (to us unobserved) social circumstances of migrant elderly to be less supportive due to weaker ties with the local community and public services. Other potential reasons why our analysis might under-estimate care needs for the elderly with a migrant background is that self-reported indicators of functional status may be sensitive to cultural differences, or that language barriers might hamper contacts with physicians. The lower use of home care may also stem from cultural differences with respect to care use or in the propensity to call on substitute care from relatives.

Elderly with a co-residing child receive more home care for given needs than those with no child or a child living outside the household (Figure 3, Panel A). Other things equal, they convert more of their entitlements into care use (Table IV, Column (5)). Given that these elderly are more likely to receive (daily) informal care than the elderly without children, or with

children who live further away, this result runs counter to the hypothesis that having a co-residing child fosters the substitution of informal care for formal care. It is however in line with informal caregivers playing a key role in the activation of entitlements, by performing tasks complementary to the ones done by professional caregivers (Bonsang, 2009) and facilitating coordination among providers.

Women receive 20% more home care than males for given entitlements (Figure 3, Panel C). The gender gap persists when we control for other non-need factors (Table IV, Column (5)). In order to better understand how gender plays, we re-run the regressions from Analyses A, B and to C including not only gender and a dummy for living with one's partner, but also the interaction between the two.[17] When singles, women use more formal care than men for given entitlements. As (single) elderly women may be more likely to receive support from their network than elderly men (see e.g. Andrew, 2005), their higher care use may be in line with the idea that informal support may be a catalyst for formal care use (cf. Schmidt 2017).

However, when they have a partner, women have lower entitlements and use less home care than their male counterparts, for given needs (negative interaction terms in Columns (2A) and (2B) of Table B.III). For men instead, having a partner is not found to be an entitlement-reducing factor (Column (2B)). These patterns are at odds with earlier studies, which report that (in different contexts) women with a partner are more likely to receive professional home care than men with a partner, as the latter resort more to spousal informal care than the former (Arber & Ginn, 1991; Schmidt, 2017). We are unable to uncover whether, in the Netherlands, women are less likely to apply for home care when they have a partner at home, or whether there is some unequal treatment of non-single applicants, depending on their gender.

Turning to geographical disparities, the largest difference in need-standardized use between two of the 10 CIZ offices is €560 (compared with an average use of €683), as shown in Figure B.2 (Online Appendix B). There are also sizeable differences between CIZ regional offices in need-standardized *entitlements*, which range from €1,104 to €2,023. These differences are also visible in the point estimates for use (Table IV), meaning that they do not merely reflect composition effects. Under the assumption that no major need-factor is left unobserved, this pattern is suggestive of substantial variation in the eligibility process across CIZ regional offices in spite of the centralization of the agency. Furthermore, differences across CIZ offices at the stage of the *conversion of entitlements into use* are also observed and do not disappear when

[17] Results are reported in Table B.III, Online Appendix B.

we control for socio-economic and demographic factors and for LTC purchasing region. As CIZ regional offices do not correspond to any political or administrative entity that could influence the supply of care, the disparities across offices might well pick up local variation in local norms or preferences regarding elderly care.[18] Finally, need-standardized use varies with the size of the municipality of residence (Figure 3), but such variation is explained by systematic differences in the populations of these areas use (Table IV). We still observe entitlements to be €191 lower for elderly in rural areas, even though applications for a need assessment are made online or by mail - meaning that the elderly living further away from CIZ regional offices do not incur higher application costs.

[18] Comparing need-standardized use and entitlements across the 32 LTC purchasing regions (Figure B.3, Online Appendix B) also points to sizeable variation. Although statistical precision is low, this result echoes the findings from Duell *et al*. (2019) for nursing home care use.

6. Robustness checks and discussion

6.1. Robustness checks

For Analyses A and B, the estimation of horizontal inequity relies on a statistical derivation of needs. We perform two main checks to gauge the robustness of our baseline estimates.

[Table V about here; to be found on the following page]

Table V: CI and HI for Analyses A and B – robustness checks

	Variant	*CI(outcome)*	*HI(outcome)*
Analysis:		(1)	(2)
A. Home care use (equity overall)	Baseline		-0.036*** [-0.057;-0.010]
	Check 1: having a partner is a non-need factor	-0.340*** [-0.361;-0.315]	-0.058*** [-0.066;-0.017]
	Check 2: no administrative data on health care use		-0.043*** [-0.077;-0.035]
B. Home care entitlements (equity at eligibility stage)	Baseline		-0.016$^{n.s.}$ [-0.036;0.005]
	Check 1: having a partner is a non-need factor	-0.288*** [-0.311;-0.267]	-0.025* [-0.041;0.000]
	Check 2: no administrative data on health care use		-0.020** [-0.045;-0.005]

Notes: Asymmetric 95% confidence intervals in brackets, computed using a cluster-bootstrap approach (1,000 replications; see Online Appendix C). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$, $^{n.s.}$ $p \geq 0.10$.

First, we take an alternative normative stance about intra-household informal caregiving: we no longer consider it a legitimate substitute for formal home care. When replicating the analysis considering household size, having a co-residing partner as well as the interaction between gender and having a partner as non-need factors rather than need variables, point estimates for HI become more negative (Table V, 'Check 1'). According to the baseline regression estimates of Analysis B, for given needs and non-need factors, elderly with a partner receive €385 (25%) lower entitlements than single living elderly (Table B.I, Column (3)). These estimates suggest that the lower use of home care by the elderly with a partner alive in the Netherlands is partly due to their lower home care entitlements, as hypothesized by Bakx *et al.* (2015). If this difference between singles and non-singles is re-classified as inequitable, pro-poor horizontal inequity at the stage of LTC eligibility will be larger, as single-living elderly, and in particular single women, have a *lower* income.[19] Similarly, for Analysis A, the lower

[19] On the other hand, the elderly living in larger households have *higher* disposable income while receiving lower entitlements and care (Table B.I). The pro-rich effect of including household size as a

care use of the elderly with a partner explains why considering household composition as need variables attenuates pro-poor inequity.

Second, we replicate Analyses A and B excluding the dummies for pharmaceuticals use and the costs incurred for different types of health care from the list of need factors before running the Lasso selection procedure. Indicators of health care use might indeed already reflect some inequalities in health care use, which may be correlated with inequalities in LTC use, and thus filter out some of the differences that we aim to explain. The estimates ('Check 2') are similar to the baseline analysis, and not statistically different from them.

Four additional robustness checks are provided in Online Appendix E (Table E.I). Check 3 (in which the Lasso procedure is used to select both need and non-need variables), Check 4 (in which unobserved factors correlating with income are assumed to be need, rather than non-need, factors) and Check 5 (in which household income is equivalized using a different scale) deliver estimates of HI very close to baseline results. In a last variant, we relax the assumption that income is shared equally within the household. Based on estimates from Cherchye *et al.* (2012), we allocate 63% of the couple's income to women. Entitlements remain equitably allocated along the income distribution, but the gradient in the conversion of entitlements into use becomes slightly pro-rich. This is because women, who were found to convert more of their entitlements into use than men on average, are re-ranked higher in the distribution of income. We take the results from this last scenario with caution, as its underlying assumptions may not be valid in our context.[20] Still, it provides a relevant illustration of how a revision of income ranking (here, of men *vs* women and widows *vs* couples) may affect our estimates of socio-economic inequity in care access. More generally, one additional interest of the estimates of inequity along dimensions other than income (cf. Section 5.3) is that they allow to gauge how SES inequity would shift if the economic resources of some groups were to be revised.

need variable does not however offset the pro-poor effect of taking the presence of the spouse also as a need variable.

[20] See Online Appendix E.I. for a more details.

6.2. Discussion of limitations and interpretation

Our study has two data-related limitations. First, we are not able to look separately at the probability of requesting eligibility and at the need assessment itself: we cannot rule out that income-related differences in the propensity to request an assessment are offset by differential treatment of applicants through the need assessment.

Second, we can only study home care use: we are unable to unveil potential inequity in nursing home use because the survey does not include the institutionalized population. In the Netherlands, home care users represent about 2/3 of the 65+ population receiving LTC, but nursing home care still accounts for 70% of LTC spending (Muir, 2017). Moreover, the focus on home care might induce a selection bias if non-need factors influence eligibility for institutional care after need factors are controlled for. To shed light on whether this may be the case, we enrich our dataset with register data on eligibility for institutional care in 2013. We find evidence that a low income, having children (nearby) and education correlate with the probability to have become eligible for institutional care in January 2013, conditional on needs.[21] If lower income elderly are more likely to be selected out of our sample, the pro-poor gradient in home care use, conditional on needs, may be under-estimated.

However, differential probability to be eligible for nursing home will result in a selection bias only if the unobserved determinants of (non)eligibility for institutional care correlate with unobserved determinants of home care use. Our analysis controls for a very rich set of variables relating to health and functional status, arguably limiting the scope for unobserved health determinants of eligibility and use. Given the way the needs assessment is organized in the Netherlands, we also expect preferences for some type of care not to play a role in the decision to make an applicant eligible for home care rather than for institutional care.

Another form of sample selection may be induced by differential mortality across population groups, which could theoretically bias our equity estimates. In particular, low-income individuals and men have a lower life expectancy, on average. The economic literature has come up with methods to correct income inequality estimates for 'the missing poor' problem (Lefebvre *et al*., 2013). In the case of equity in care use, however, we are not aware of any method allowing to adjust for differential mortality. Even speculating about the direction of the bias it might induce would require making a series of (heroic) assumptions regarding the

[21] Recall that the survey was conducted in the Fall 2012.

relationship between care needs and mortality, and how such relationship might differ across income, gender, etc.

Our analysis focuses on publicly subsidized home care. It includes informal care, in two indirect ways. First, by considering the partial correlation between household composition and entitlements as a legitimate source of inequality in home care access, our baseline analysis incorporates the usual care expected from household members. Second, LTC vouchers in the Netherlands can be used to hire either non-contracted providers or relatives. As such, compensated informal care is considered a legitimate substitute for formal care, and is included in our measure of home care use. Inclusion is implicitly based on the assumption that compensated informal care has a value as high as that of professional home care. If it were not the case (e.g. because informal caregivers might be unskilled), the value of home care received by voucher recipients would be overestimated. How this would affect our (socio-economic) inequity estimates depends on which (income) groups are more likely to use vouchers to compensate relatives in the Netherlands, on which we have no insight.[22]

Our study does not include uncompensated informal care receipt, for which we have no data. The normative premise underlying the Dutch LTC system in 2012 was that access to publicly subsidized care should be independent from the provision of uncompensated informal care beyond 'usual care' availability. As such, ignoring uncompensated informal care does not come as a limitation, given our objective to assess equity in access to home care in the context of the social insurance scheme. Documenting the joint receipt of informal care and formal care would however contribute to understanding disparities in home care use by showing which sub-populations substitute formal care with voluntary informal care.

[22] We have checked that our main result – of a negative gradient in home care use, conditional on needs and entitlements – is robust to assuming that all vouchers are used to compensate informal with imputed value set to 0. This is because vouchers represent a limited share of publicly financed home care use (11% in the bottom income decile, 20% in the top decile).

7. CONCLUSION

When public insurance coverage is limited, LTC use risks being very pro-rich distributed. The Netherlands has tried to overcome this risk by making such coverage compulsory and comprehensive and by formalizing the needs-based allocation of care. We examine the extent to which this attempt has proven successful. Combining survey information and administrative register data, we test for horizontal inequity in home care access in the Netherlands. In addition, we disentangle inequalities in two stages: when home care eligibility decisions are made and when care entitlements are converted into actual use.

We find clear evidence of a pro-poor gradient in home care use after controlling for care needs. The main reason for this pattern is that poorer elderly convert a larger share of their entitlements into actual use, consistent with Tenand *et al.* (2020). Assuming no supply constraints, the negative income gradient in home care use would likely be caused by differences in individuals' choices. One such explanation might be a non-zero price elasticity of home care demand (Non, 2017; Roquebert & Tenand, 2017), as the copayment schedule translates into a marginal price of home care higher for richer beneficiaries. However, available evidence does not allow to conclude whether the lower use of home care by higher-income elderly results from user behavior or from the functioning of the LTC system.

The critical finding of our study is that the need assessment dampens inequity in access by socio-economic status. We do not find any evidence that higher income, wealthier or higher-educated elderly are able to better navigate the needs assessments procedure. Those elderly are not more likely to claim – or to be granted – home care entitlements at an earlier stage of the disablement process.

Still, we find some inequity in entitlements along other dimensions, as some population groups receive higher or lower home care entitlements given needs. Elderly with a non-Western migrant background seem to receive more home care entitlements but use less of them. Finally, quite large differences across CIZ regional offices in the entitlements for given needs and in the conversion of these entitlements into use are observed, despite the Dutch need assessment agency being theoretically centralized. We are unable to unravel whether this reflects local differences in preferences or in the provision of informal care, systematic variation in the supply of home care across municipalities, or differences in practices across CIZ offices.

The relevance of our study extends beyond home care in the Netherlands: horizontal equity in access to virtually all LTC services and medical care depends on 1) whether population

groups have equal access to diagnosis and 'treatment' decisions, and 2) whether they receive the same treatment for a given diagnosis. Usually, these two cannot be separated in empirical studies but the Dutch context and data make it an ideal case to identify the stage(s) at which inequity occurs.

Furthermore, the Dutch example is of specific interest for other countries aiming to distribute LTC according to needs such as Germany, France, Spain, but also South Korea and Japan (OECD, 2020). These countries vary in both "the *criteria* under which a given individual is deemed eligible for publicly funded support for long-term care" and "the *process* involved in selecting from the general population those who receive this support and determining for how much support each person is eligible" (Eleftheriades and Wittenberg, 2013). There is little empirical evidence available on what types of procedures do favor equity in access. Based on our results from the Netherlands, we speculate that entrusting the needs assessment to an independent agency, in which assessors rely on extensive guidelines and do not collect income or wealth information, is effective in limiting socio-economic inequity in LTC access.

Distinguishing between equity in eligibility and equity in entitlements however shows that setting equitable eligibility rules for LTC is not a sufficient condition for equitable use, as uptake of benefits is not guaranteed. The Dutch case illustrates that, even in a comprehensive public system in which financial barriers to access are limited, the distribution of LTC use may deviate from the distribution of needs. A better understanding of the sources of inequalities helps identifying any need for corrective policies and their appropriate design.

Although our analysis suggests that the Dutch LTC system was fairly successful in allocating home care services independently from the ability to pay for such services in 2012, the situation may have changed since the system was profoundly reformed in 2015. Home care is now funded under different schemes: eligibility for and financing of community-based nursing care is the responsibility of regional health insurers, while other home care services are entrusted to municipalities, which can set their own eligibility criteria. This setting may not only increase geographical and socio-economic inequity in home care entitlements, but it also implies that administrative data on eligibility decisions are no longer available, making it impossible to replicate our analysis for the post-reform period. Additionally, whether the recent removal of (income-dependent) co-payments on home care has fostered a higher use among richer beneficiaries is a question for future research. Despite all these reforms, equity in LTC use remains an important policy goal and a better understanding of how decisions on the use of LTC come about remains crucial in achieving it.

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Supplementary Material

Appendix A: implementation of the Lasso procedure

A.1. Selection of need variables and of and non-need factors prior to the baseline estimation of HI for Analyses A and B

The computation of the horizontal inequity indexes in Analyses A and B relies on linear predictions from regression analyses (Equations (1.A) and (1.B)). The statistical precision of the estimates of HI will in turn depend on the statistical precision of the regression estimates. Our dataset contains a very large number of (potentially highly correlated) need variables that may be included as regressors in Equations (1.A) and (1.B). In order to maximize statistical efficiency, we implement a data-driven method to select a subset of need variables to be included in the regression analyses.

We implement a Lasso procedure similar to the one performed by Bakx *et al.* (2018),[23] following the methodology proposed by Tibshirani (1996). The Lasso aims at selecting covariates in a regression model so that the model achieves a balance between low bias and high statistical efficiency. The Lasso consists in a procedure of shrinkage, whereby coefficients of covariates that are not, or weakly, associated with the outcome variable are shrunk towards zero and eliminated from the regression analysis. It relies on the minimization of an objective function that penalizes the absolute size of the regression coefficients. As the penalizing factor increases, the coefficients of all covariates shrink further towards zero; as it decreases, the procedure is more lenient towards covariates with a small partial correlation with the outcome.[24]

We apply the Lasso procedure separately to the following variants of Equations (1.A) and (1.B):

$$U_i = \tilde{\alpha}_0 + \tilde{X}_i' \tilde{\alpha}^X + \tilde{\varepsilon}_i \qquad (A.A.1)$$

$$E_i = \tilde{\beta}_0 + \tilde{X}_i' \tilde{\beta}^X + \tilde{u}_i \qquad (A.B.1)$$

[23] A more detailed description of the procedure can be found in Appendix C of Bakx *et al.* (2018).
[24] See Bakx *et al.* (2018) for additional details. We follow their choice of using the objective function and penalization proposed in Belloni *et al.* (2012). For all 3 analyses we have performed the Lasso selection without taking into account the survey structure. To the best of our knowledge, no specific adjustment of the standard Lasso procedure to complex sampling design survey data has been well established so far.

where $\tilde{X}_i$ is a vector containing the full list of the need variables prior to performing the Lasso selection, for individual i.

The outcome of the Lasso procedures that we apply to Equations (A.A.1) and (A.B.1) is made of two sub-lists of need variables (two sub-vectors of $\tilde{X}$). As there is no theoretical ground for the legitimate needs for home care entitlements and the needs for home care use to be different, we define our final list of need variables as the *union* of the variables selected by the Lasso procedures in Analysis A and Analysis B.

Table A.I provides the list of the variables that were included as need factors in the Lasso procedures. It also indicates which of these variables were selected and included in the regression analyses implemented to derive the horizontal inequity indexes.

A.2. Selection of need variables and of and non-need factors prior to the baseline estimation of HI for Analyses A and B

In a robustness check, we use a Lasso to select both a subset of need variables and a subset of non-need factors. We apply the Lasso procedure separately to the following variants of Equations (1.A) and (1.B):

$$U_i = \tilde{\alpha}_0 + \tilde{X}_i'\tilde{\alpha}^X + Z_i'\alpha^Z + \tilde{\varepsilon}_i \qquad (A.A.3)$$

$$E_i = \tilde{\beta}_0 + \tilde{X}_i'\tilde{\beta}^X + Z_i'\beta^Z + \tilde{u}_i \qquad (A.B.4)$$

In this robustness check, the outcome of the Lasso procedures applied to Equations (A.A.1) and (A.B.1) is made of two times two sub-lists (two sub-vectors of $\tilde{X}$ and two sub-vectors of Z). We define our final list of need variables as the *union* of the variables selected by the Lasso procedures in Analysis A and Analysis B.[25]

[25] The list of variables selected is available on request.

Table A.I: Need variables in the Lasso procedure (1/2)

Variables used as inputs in the Lasso procedure:	Variables selected by the Lasso procedure: *(A) LTC use*	*(B) LTC entitlements*
	(1)	(2)
Socio-demographic characteristics		
Age (5-year categories)	Yes	Yes
Having a partner in the household	Yes	Yes
Number of additional household members	Yes	No
Functional limitations[a,c]		
Follow a conversation with 3 persons or more	Yes	Yes
Engage into a conversation with 1 person	Yes	Yes
Read the small characters in the newspaper	No	Yes
Recognize someone from a 4 meter distance	Yes	Yes
Carry an object of 5 kilos over 10 meters	Yes	Yes
Bend to reach for something on the ground	Yes	Yes
Walk 400 meters without resting	Yes	Yes
Hearing problems	Yes	Yes
Sight problems	Yes	Yes
Mobility problems	No	No
Self-reported health and mental health[c]		
Self-reported health: bad, average or good	Yes	Yes
Loneliness (no, moderately, severely, very severely)	No	No
Feeling depressed	No	No
Anxiety or depression (low *versus* moderate to high)	No	Yes
Chronic condition [b,c]		
Chronic disease: diabetes	No	No
Chronic disease: cardiovascular (currently or ever)	No	No
Chronic disease: heart failure or other heart disease (currently or ever)	No	No
Chronic disease: cancer (currently or ever)	No	No
Chronic disease: high blood pressure or small vessels	Yes	Yes
Chronic disease: COPD	No	No
Chronic disease: bowel disorder or incontinence	Yes	Yes
Chronic disease: arthrosis or arthritis	Yes	Yes
Chronic disease: hernia or back issues	Yes	Yes
Chronic disease: neck, shoulder, wrist or hand issues	No	No
Chronic disease: eczema or psoriasis	No	No
Chronic disease: migraine	No	No
Chronic disease: dizziness	Yes	Yes
Chronic disease: other	No	Yes

Notes: [a] for each activity, the respondent could answer: no difficulty, some difficulties, major difficulties, cannot do.

[b] for each condition, the respondent could answer: yes or no.

[c] missing values were coded as an additional category for each of the functional limitations and self-reported chronic diseases.

Table A.I: Need variables in the Lasso procedure (2/2)

Variables used as inputs in the Lasso procedure:	Variables selected by the Lasso procedure: *(A) LTC use*	*(B) LTC entitlements*
	(1)	(2)
Health care costs incurred in 2011		
GP costs	Yes	Yes
Pharmacy costs	Yes	Yes
Paramedical costs	Yes	Yes
Dental care costs	No	No
Hospital care costs	No	No
Health care costs incurred abroad	No	No
Costs for first-line psychological care	No	No
Mental health care costs	No	No
Geriatric care costs	No	No
Costs on assistive devices (*hulpmiddel*)	Yes	Yes
Other health care costs	No	No
Total health care costs	No	Yes
Drug use in 2011[d]		
ATC A06 (Drugs for constipation)	Yes	Yes
ATC A12 (Mineral supplements)	No	Yes
ATC B01 (Antithrombotic agents)	Yes	Yes
ATC B03 (Anti-anemic preparations)	No	Yes
ATC C03 (Diuretics)	Yes	Yes
ATC D02 (Emollients and protectives)	Yes	Yes
ATC J06 (Immune sera and immoglobulins)	Yes	Yes
ATC M01 (Anti-inflammatory and anti-rheumatic products)	Yes	Yes
ATC N05 (Psycholeptics)	Yes	Yes
ATC N06 (Psychoanaleptics)	Yes	Yes
ATC R01 (Nasal preparations)	Yes	Yes
ATC Y (ATC code not filled in)	Yes	Yes

Notes: [d] There exists additional ATC codes that are not reported, as they were never selected by the Lasso procedure. The full list of ATC provided in Bakx *et al.* (2018).

Table A.II: Non-need factors in the regression analysis (Analyses A, B and C)

Socio-economic status	
Education	(1) primary education
	(2) secondary education
	(3) higher education
	(4) unknown
Disposable income	10 deciles
Per capita wealth	10 deciles
Homeownership	(1) no
	(2) yes
Demographic characteristics	
Gender	(1) woman
	(2) man
Origin (*born in a foreign country or having a parent born in a foreign country)*	(1) Netherlands
	(2) other Western country or Dutch Indies
	(3) other non-Western country
Place of residence	
Size of the municipality of residence	(1) Less than 10,000 inhabitants
	(2) between 10,001 and 50,000 inhabitants
	(3) between 50,001 and 150,000 inhabitants
	(4) more than 150,000 inhabitants
CIZ region	1 of the 10 administrative regions defined for needs assessments
LTC purchasing region	1 of the 8 groups of the 32 administrative regions in charge of the provision of LTC[a]
Family characteristics	
Number of children	Continuous variables
Number of daughters	Continuous variables
Closest child	(1) no child
	(2) co-resides
	(3) lives in the same municipality
	(4) lives in a different municipality

Notes: [a] see Online Appendix C, section C.2 for explanations regarding the grouping of the regions.

Appendix B: Additional results

Table B.I: Regression estimates for Analyses A and B (1/3)

	Analysis A		Analysis B	
Outcome:	*LTC use (value)*		*LTC entitlements (value)*	
	Coef.	Std. error	Coef.	Std. error
	(1)	**(2)**	**(3)**	**(4)**
Need variables				
Age: 65-69	-129.9*	77.0	-397.3**	154.9
Age: 70-74	-268.7***	76.1	-579.1***	146.2
Age: 75-79	-236.5***	76.1	-436.1***	125.6
Age: 80-84	*Ref.*	-	*Ref.*	-
Age: 85-89	827.6***	178.0	1410.6***	241.8
Age: 90-94	2384.7***	419.1	3822.1***	700.1
Age: 95+	5773.9***	1092.8	7495.0***	1483.1
Partner in the household	-213.1***	62.5	-384.9	236.0
Number of additional household members	-99.1*	52.5	20.8	213.8
Follow a conversation: no difficulty	28.3***	55.2	-30.0	98.5
Follow a conversation: slight to moderate difficulty	*Ref.*	-	*Ref.*	-
Follow a conversation: serious difficulty	1239.5***	347.5	1901.2***	462.7
Engage into a conversation: no difficulty	-303.8***	110.2	-536.0***	179.9
Engage into a conversation: moderate difficulty	2414.8***	889.3	3888.9***	1476.4
Engage into a conversation: slight or serious difficulty	*Ref.*	-	*Ref.*	-
Recognize someone from a distance: no difficulty	-213.4	173.1	-236.6	249.5
Recognize someone from a distance: slight to serious difficulty	*Ref.*	-	*Ref.*	-
Read the small characters: no to moderate difficulty	*Ref.*	-	*Ref.*	-
Read the small characters: serious difficulty	735.7***	217.7	1081.6	414.2
Carry an object of 5 kg: no or moderate difficulty	*Ref.*	-	*Ref.*	-
Carry an object of 5 kg: slight difficulty	-306.6***	96.3	-341.8***	127.1
Carry an object of 5 kg: serious difficulty	894.6***	172.6	1593.1***	278.5
Bend to reach the ground: no difficulty	-380.9**	152.2	-617.0**	295.8
Bend to reach the ground: slight difficulty	-371.7**	172.8	-555.3*	313.1
Bend to reach the ground: moderate difficulty	*Ref.*	-	*Ref.*	-
Bend to reach the ground: serious difficulty	2423.0***	458.5	3956.0***	740.1
Walk 400 meters: no difficulty	112.9	89.9	-91.0	131.2
Walk 400 meters: slight to moderate difficulty	*Ref.*	-	*Ref.*	-
Walk 400 meters: serious difficulty	704.8***	217.5	1155.7***	288.5
Hearing limitations: no or unknown	*Ref.*	-	*Ref.*	-
Hearing limitations: yes	233.0	236.1	457.1	420.9
Sight limitations: no	-37.9	237.1	20.3	305.0
Sight limitations: yes or unknown	*Ref.*	-	*Ref.*	-
Self-reported health: v. good/good/average	*Ref.*	-	*Ref.*	-
Self-reported health: v. bad/bad	957.1***	181.6	1637.0***	264.1
Anxiety or depression: low chance	69.9	38.0	17.0	81.0
Anxiety or depression: low chance or unknown	*Ref.*	-	*Ref.*	-

Continued on next page

Table B.I: Regression estimates for Analyses A and B (2/3)

	Analysis A		**Analysis B**	
Outcome:	*LTC use (value)*		*LTC entitlements (value)*	
	Coef.	Std. error	Coef.	Std. error
	(1)	**(2)**	**(3)**	**(4)**
Continued from previous page				
Blood disease: no	326.7***	60.6	507.9***	72.3
Bowel disorders or incontinence: no	-266.3***	59.3	-552.5***	106.3
Arthritis or arthrosis: no	242.8***	61.7	449.2***	95.6
Hernia: no	100.6	109.4	148.7	198.4
Hernia: yes	-358.4***	102.7	-729.0***	191.6
Hernia: unknown	*Ref.*	-	*Ref.*	-
Dizziness: yes	371.2***	131.3	662.5***	227.0
Chronic disease: other (miscellanea)[a]	42.0	90.1	220.6	126.0
GP costs[b]	3911.3***	1100.9	5859.0***	1068.5
Pharmacy costs[b]	82.2***	21.4	101.0**	30.8
Paramedical costs[b]	1046.3***	254.9	1408.0***	237.6
Costs on medical devices[b]	799.4***	155.1	991.6***	129.2
Total health care costs[b]	-12.3	7.8	3.2	16.9
ATC A06 (Constipation treatments)	224.8***	76.3	359.9***	108.8
ATC A12 (Mineral supplements)	115.6	152.2	310.4	227.2
ATC B01 (Antithrombotic agents)	-2.2	58.4	92.3	92.6
ATC B03 (Anti-anemic preparations)	67.9	182.6	420.8*	253.5
ATC C03 (Diuretics)	93.9	50.2	63.1	90.5
ATC D02 (Emollients and protectives)	416.4***	116.2	470.2***	157.8
ATC J06 (Immune sera and immoglobulins)	-2646.2***	513.7	-3661.2***	954.9
ATC M01 (Anti-inflammatory and anti-rheumatic products)	-294.6***	86.1	-433.4***	116.6
ATC N05 (Psycholeptics)	371.4	259.1	1327.5***	385.0
ATC N06 (Psychoanaleptics)	674.6***	98.0	1338.2***	170.9
ATC R01 (Nasal preparations)	-341.8***	90.6	-527.8***	116.7
ATC Y (ATC code not filled in)	1855.7**	778.6	5286.1***	1594.4
Non-need factors *(see Table IV and B.II)*	Yes		Yes	
Constant	-281.8	260.4	-23.7	560.9
N	154,646		154,646	
R^2	0.158		0.166	

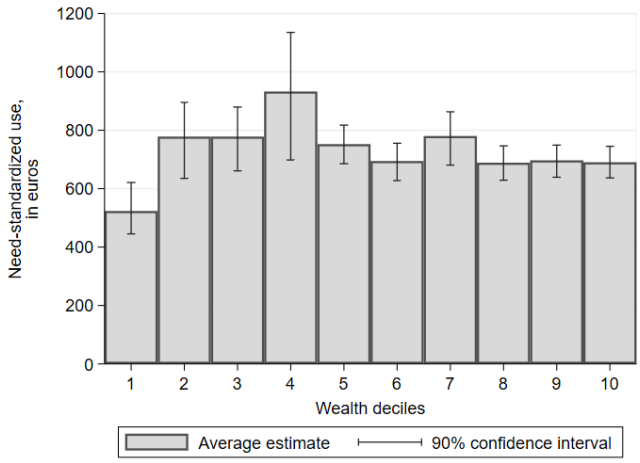
Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$, n.s. $p \geq 0.10$. [a]The full list of need variables and their coding before the Lasso selection is displayed in Table A.I (Appendix A). [b]Health care costs are expressed in thousands euros. Outcomes are expressed in euros over year 2012. Weighted linear estimations of Equations (1.A) for Columns (1) and (2) and (1.B) for Columns (3) and (4) (defined in Section 3). The estimations take into account the clustered design of the sample (335 primary sampling units). When performing the estimations, a few observations for which the primary sampling unit is missing have to be dropped.

Table B.II: Regression estimates for long-term care regions - Analyses A, B and C

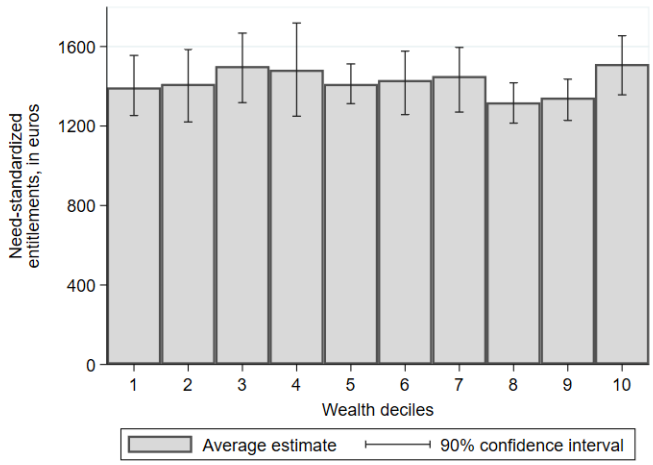
	Analysis A		**Analysis B**		**Analysis C**	
Outcome:	*LTC use (value)*		*LTC entitlements (value)*		*LTC use (value)*	
	Coef.	Std-error	Coef.	Std-error	Coef.	Std-error
	(1)	(2)	(3)	(4)	(5)	(6)
CIZ regional office 1	*Ref.*	-	*Ref.*	-	*Ref.*	-
CIZ regional office 2	179.1***	53.1	34.5	90.1	1854.0***	440.2
CIZ regional office 3	51.1	51.5	-237.0**	129.1	1864.4**	784.0
CIZ regional office 4	-32.7	62.3	-282.8**	144.1	1110.0*	579.7
CIZ regional office 5	-0.4	51.3	-228.5**	99.1	1129.2**	480.2
CIZ regional office 6	-71.1	57.9	-311.2***	117.2	876.8*	490.5
CIZ regional office 7	458.9***	150.4	424.4*	217.2	1228.8*	668.7
CIZ regional office 8	816.9***	262.9	756.0**	330.8	2490.8**	999.4
CIZ regional office 9	310.3**	122.9	359.2**	159.2	1222.7	751.9
CIZ regional office 10	-74.2	68.6	-218.9	133.6	762.6	518.1
Group of purchasing regions 1 (lowest use)	*Ref.*	-	*Ref.*	-	*Ref.*	-
Group of purchasing regions 2	127.2	169.4	-19.5	257.3	-372.8	699.6
Group of purchasing regions 3	198.1	171.1	60.9	262.2	-306.5	776.0
Group of purchasing regions 4	321.3*	165.6	271.9	257.8	251.9	784.9
Group of purchasing regions 5	401.8**	164.2	414.9	258.3	397.7	766.8
Group of purchasing regions 6	475.0***	162.1	587.0**	226.1	440.0	697.0
Group of purchasing regions 7	603.5***	184.3	719.8***	264.6	1049.8	727.1
Group of purchasing regions 8 (highest use)	729.3***	176.8	912.4***	261.0	1153.2	800.0
Other non-need factors *(see Table IV)*	Yes		Yes		Yes	
Need factors *(see Table B.I)*	Yes		Yes		No	
Home care entitlements *(see Table IV)*	No		No		Yes	
N	154,646		154,646		14,136	

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$, $^{n.s.}$ $p \geq 0.10$. Outcomes are expressed in euros over year 2012. Weighted linear estimations of Equations (1.A) for Columns (1) and (2) and (1.B) for Columns (3) and (4) (defined in Section 3). The estimations take into account the clustered design of the sample (335 primary sampling units). When performing the estimations, a few observations for which the primary sampling unit is missing have to be dropped.

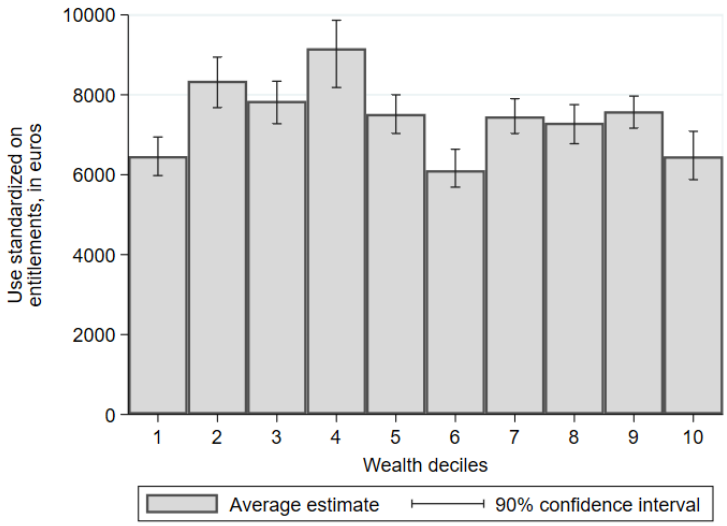
Figure B.1: Average standardized outcomes, by wealth decile (Analyses A, B and C)



Panel A: Average need-standardized use by wealth decile (Analysis A)



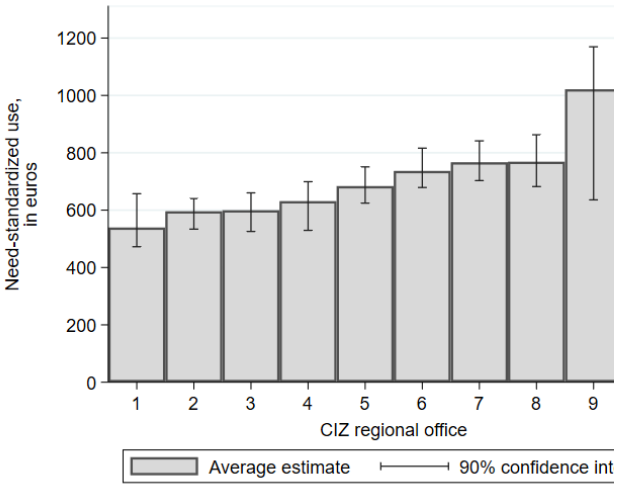
Panel B: Average need-standardized entitlements by wealth decile (Analysis B)



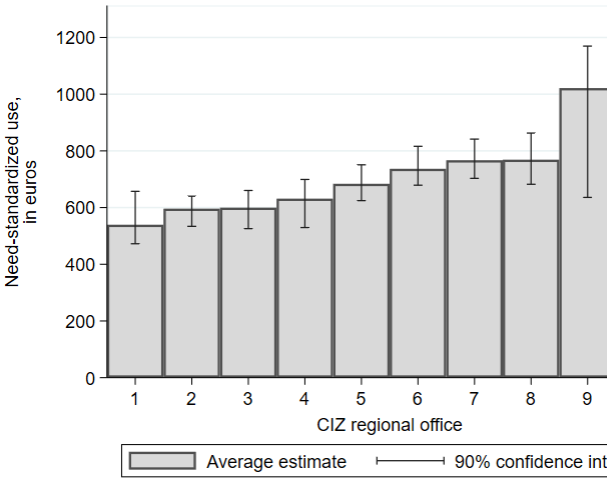
Panel C: Average use standardized for entitlements by wealth decile (Analysis C)

Notes: Need-standardized use and entitlements (Analyses A and B) and use standardized for entitlements (Analysis C) are defined in Equations (3.A) to (3.B). Asymmetric 90%-level confidence interval based on 1,000 Bootstrap replications (see Online Appendix C). Values expressed in euros over 2012.

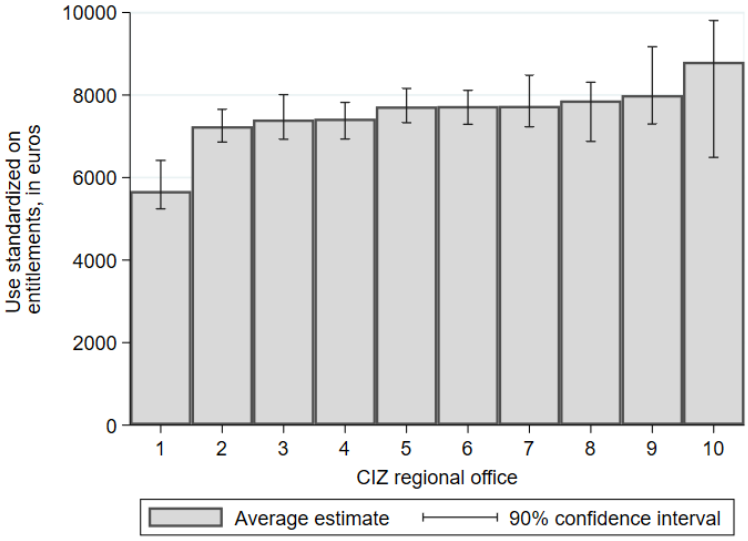
Figure B.2: Average standardized outcomes, by CIZ regional office (Analyses A, B and C)



Panel A: Average need-standardized use by CIZ regional office (Analysis A)



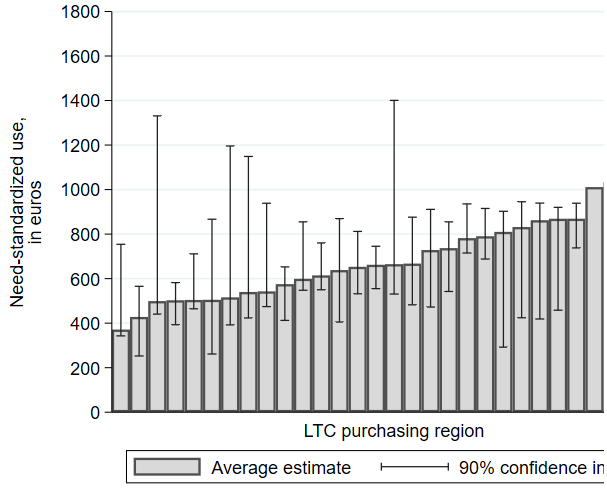
Panel B: Average need-standardized entitlements by CIZ regional office (Analysis B)



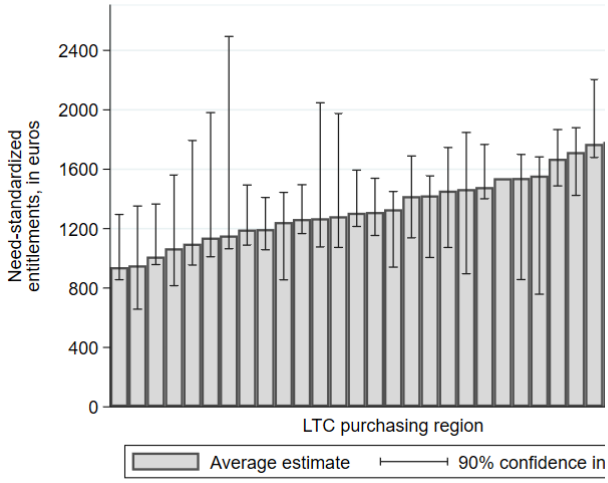
Panel C: Average use standardized for entitlements by CIZ regional office (Analysis C)

Notes: Need-standardized use and entitlements (Analyses A and B) and use standardized for entitlements (Analysis C) are defined in Equations (3.A) to (3.B). Asymmetric 90%-level confidence interval based on 1,000 Bootstrap replications (see Online Appendix C). Values expressed in euros over 2012.

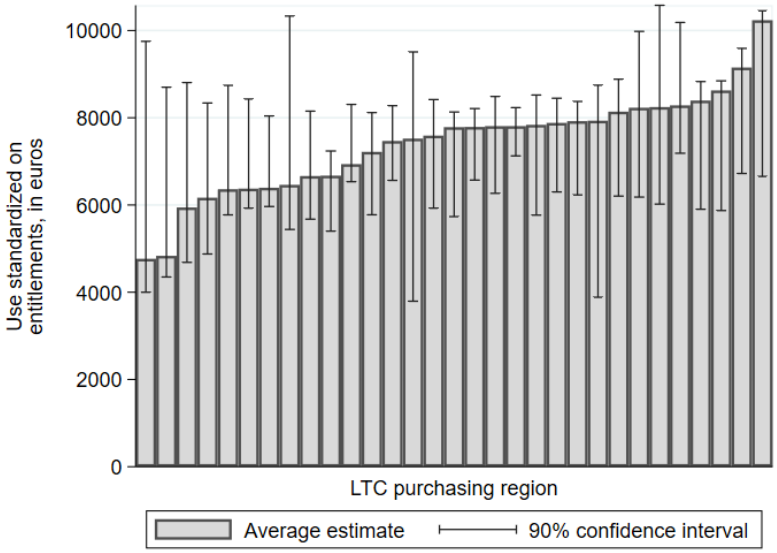
Figure B.3: Average standardized outcomes, by LTC purchasing regions (Analyses A, B and C)



Panel A: Average need-standardized use by LTC purchasing region (Analysis A)



Panel B: Average need-standardized entitlements by LTC purchasing region (Analysis B)



Panel C: Average use standardized for entitlements by LTC purchasing region (Analysis C)

Notes: Need-standardized use and entitlements (Analyses A and B) and use standardized for entitlements (Analysis C) are defined in Equations (3.A) to (3.B). Asymmetric 90%-level confidence interval based on 1,000 Bootstrap replications (see Online Appendix C). Values expressed in euros over 2012. The confidence intervals for region 27 (Panel A) and for region 28 (Panel B) being extremely large, they are not displayed for better readability of the graphs.

Table B.III: Estimates for gender and household composition

	Analysis A		**Analysis B**		**Analysis C**	
	(1A)	*(2A)*	*(1B)*	*(2B)*	*(1C)*	*(2C)*
Woman	45.6	190.1*	-29.9	173.1	1073.7***	778.7**
	(79.8)	(104.0)	(119.9)	(154.3)	(241.2)	(371.0)
Partner	-213.3***	-87.5	-384.9	-210.5		-431.5
	(62.2)	(69.2)	(236.0)	(253.9)		(741.3)
Woman x Partner		-213.3***		-304.0**		-167.9
		(77.6)		(133.0)		(550.8)
Number of household members	-99.1*	-85.0	20.8	37.1		-1071.8***
	(52.5)	(53.8)	(213.8)	(214.4)		(391.7)
N	154,646	154,646	154,646	154,646	14,136	14,136

Notes: *** $p < 0.01$, ** $p < 0.05$, $^{*}p < 0.10$. Standard errors in brackets. Estimates from the regression of home care use (Analysis A) or home care entitlements (Analysis B) over 2012 on need variables and non-need factors; estimates from a constrained linear regression of home care use over 2012 on entitlements and non-need factors. In the baseline analysis, gender is a non-need factor but having a partner and number of household members are need variables (Columns (1A) and (1B); there are no need variables in Analysis C); in a complementary analysis, all these 3 variables are treated as non-need factors (Columns (2A), (2B) and (2C)).

Appendix C: Inference on concentration and horizontal inequity indexes

C.1. Standard error of the concentration index of LTC use and LTC entitlements

Inference on a concentration index derived from microdata was derived in Kakwani *et al.* (1997).[26] The standard error of the concentration index of a variable can be obtained using a "convenient regression" and can accommodate survey weights.

For outcome Y, denoting r_i^{SES} is the weighted fractional rank of individual i in the distribution of SES, we can derive an estimate of the concentration index by estimating by OLS following regression:

$$Y_i = \theta_0 + \theta_1 r_i^{SES} + \epsilon_i \qquad \text{(C.1.)}$$

The estimate of $CI(Y)$ is given by:

$$\hat{\theta} = \frac{2\sigma_r^2}{\hat{\mu}} . \hat{\theta}_1 \qquad \text{(C.2.)}$$

Where σ_r^2 is the variance of the (weighted) fractional rank and $\hat{\mu}$ is an estimate of the population-average of Y. Given that the weighted OLS predicted value of Y is equal to the population average of Y, and that the mean of the weighted fractional rank is 0.5, we can rewrite:

$$\hat{\theta} = \frac{2\sigma_r^2}{\hat{\theta}_0 + \hat{\theta}_1/2} . \hat{\theta}_1 \qquad \text{(C.3.)}$$

Given that the estimate of $CI(Y)$ has been rewritten as a function of the regression coefficients, a standard error can be derived applying the delta method. In Stata, we use the `nlcom` command, which supports probability weights. In addition, this command allows us to take into account the clustered sampling design of the Dutch Health Monitor survey, by correcting the standard error for within-cluster correlation.[27]

Using this approach, we can derive standard errors associated with the concentration of LTC use in Analysis A, the concentration of LTC needs in Analysis B and the concentration of LTC use among the elderly eligible for home care in Analysis C. However, in our Tables of results,

[26] We also refer to the manual by O'Donnell *et al.* (2008), which provides an extensive presentation of the formulas for the concentration and horizontal inequity indexes and the computation of their standard errors.

[27] See O'Donnell *et al.* (2008), pp. 103-104, for more details.

we have provided confidence intervals derived using an alternative method, i.e. a cluster-bootstrap approach (cf. *infra*). Inference based on the delta method (available on demand) and inference based on the bootstrap approach lead to the same conclusions regarding the statistical significance of the concentration indices of use and entitlements at the conventional thresholds of 1%, 5% and 10% levels.

C.2. Standard error of the concentration of needs, the horizontal inequity index and the contributions of non-need factors

One way of obtaining standard errors for the concentration index of the need-predicted outcome and for the horizontal inequity index is to apply the convenient regression approach described here-above to the need-predicted outcome and the need-standardized outcome respectively, instead of applying to the raw outcome. However, this approach would not take into the fact that there is sampling variability in the need-predicted and need-standardized outcomes for Analyses A and B, as they are derived from the OLS regression predictions. We therefore conduct inference based on a bootstrap procedure.[28]

The standard assumption for a bootstrap procedure is that the observed sample is a random sample of the underlying population and that observations within the sample are independent (van Doorslaer *et al*., 2004). As the Health Monitor survey is based on a two-stage sampling design with unequal sampling probability, the standard assumption does not hold. We therefore implement a cluster bootstrap while taking into account the unequal sampling probability design.

[28] Bootstrap is a resampling method for estimating the sampling variability of sample estimates by randomly drawing multiple samples with replacement from the original sample.

We proceed in three steps:

a. We draw a random subsample *b* (with replacement) of the 335 primary sampling units (PSUs);[29]
b. In sample *b*, we adjust the survey weights in the following way: for individual *i*, we compute the share of the study population it originally represented, $p_i = \frac{w_i}{\sum_{j=1}^{N} w_j}$, where *N* is the original sample size and w_i the probability weight for individual *i*. The adjusted probability weight for individual *i* in sample *b* is computed as: $\tilde{p}_i = p_i . \frac{\sum_{j=1}^{N^b} w_j}{n_i}$, where N^b is the size of sample *b* and n_i is the number of times individuals *i* was drawn in sample *b* (as the random is drawn with replacement, one cluster and thus one individual may show up several times in a given bootstrap sample). This adjustment ensures that the relative weighting of individuals who are selected in sample *b* is the same as in the original population.[30]
c. We use sample *b* to replicate our core analysis: we run the OLS regressions, derive the concentration and horizontal inequity indexes, as well as the contributions of non-need factors, while taking into account the clustered nature of the bootstrap sample and the weights.

We replicate steps 2 to 4 *B*=1,000 times, so that we obtain *B* different samples, with *B* values of our statistics of interest (e.g. concentration index). Finally, for each statistics of interest *S*, we draw the distribution of its value over the *b*=1,…, *B* samples. The upper bound of the 0.5% and of the 99.5% (respectively of the 2.5% and of the 97.5%, and of the 5% and of the 95%) smallest values provide a bootstrapped 99% level (respectively a 95% level and 90% level) confidence interval for statistics *S*.

Note that the Lasso procedure itself is not bootstrapped, as this would result in excessive computational time. In addition, because of the bootstrap analysis, we have to regroup the LTC purchasing regions for a technical reason: several of the 32 regions are relatively small (less than 2,500 elderly from our entire study sample, and many less when we focus on the subsample

[29] For this (bootstrap) sample *b*, the sample size N^b depends on the number of observations in the selected clusters.

[30] This approach is yet not ideal as it is not possible to take into account the individuals who are not selected in sample *b* in the reweighting process. Another possible approach would be to expand the sample by multiplying each observation by its survey weight, such that we obtain a final sample, of size *N'* where all observations have a probability sampling weight equal to 1. However, given the large sample size and the fairly large dispersion of weights, expansion would result in a dataset too large to be handled with Stata®.

eligible for home care in Analysis C). This implies that some of the bootstrap subsamples do not include any individual from these small regions, and estimates of the coefficients of the LTC purchasing regions cannot be systematically derived.

To circumvent this issue, we have grouped the 32 regions into 8 groups in a data-driven way. We have run a regression of home care use on need variables and the non-need factors (Equation (1.A), Section 4). We have retrieved the estimates of the coefficients of the 32 regions (the coefficient for the reference region being set to 0). We have then ordered the 32 regions from the one with the lowest coefficient to the one with the highest. Finally, we have divided the regions into 8 groups of 4, from the lowest-use regions to the highest-use group.

Table C.I: Grouping of the LTC purchasing regions for the econometric analysis

	Group 1	**Group 2**	**Group 3**	**Group 4**
Regions	6, 8, 9 and 32	2,5, 11 and 28	1, 3, 13 and 15	12, 20, 21 and 26
N	*5,304*	*12,969*	*6,203*	*20,528*
	Group 5	**Group 6**	**Group 7**	**Group 8**
Regions	10, 23, 24 and 29	7, 14, 25 and 30	4, 16, 18 and 31	17, 19, 22 and 27
N	*29,724*	*27,251*	*29,569*	*23,161*

Notes: The number identifying each region is the one used by Statistics Netherlands.

Appendix D: Deriving and decomposing the horizontal inequity index

The aim of this Appendix is twofold: first, we aim at motivating the 'conservative' approach to the horizontal inequity index for Analyses A and B that we adopt in our fourth robustness check (provided in Online Appendix E). This approach relies on a decomposition of income-related inequalities proposed by Wagstaff et *al.* (2003). Second, we show how the standardization for entitlements that we propose in Analysis C can be made consistent with a decomposition of HI into the contributions of non-need factors, which in turn motivates the estimation of a constrained linear regression analysis when testing for the sources of horizontal inequity at the stage of the conversion of entitlements into care use (Section 5.3 and Table B.II in Online Appendix B).

D.1. Decomposition of HI^A and HI^B

Following Wagstaff et *al.* (2003), we can decompose CI^A into:

$$CI^A = \sum_{k=1}^{K} \frac{\bar{x}^k}{\bar{U}} \hat{\alpha}^k CI(x^k) + \sum_{l=1}^{L} \frac{\bar{z}^l}{\bar{U}} \hat{\alpha}^l CI(z^l) + CGE^A(u) \qquad (D.1.A)$$

$$= CI(\hat{U}^A) + HI^A$$

Where $\bar{x}^k$ (resp. $\bar{z}^l$) is the population-average of the need factor x^k (resp. non-need factor z^l), and $CI(x^k)$ (resp. $CI(z^l)$) is the concentration index of variable x^k (resp. z^l). $CGE^A(u)$ is called the generalized residual and equals the concentration index of the residual term from the estimation of Equation (1.A), rescaled by $\bar{\hat{u}}/\bar{U}$:

$$CGE^A(u) = 2cov(\hat{u}, r^{SES})/\bar{U} \qquad (5)$$

HI^A is conventionally defined as: $\sum_{l=1}^{L} \frac{\bar{z}^l}{\bar{U}} \hat{\alpha}^l CI(z^l)) + CGE^A(u)$. A more conservative approach would be to consider that unobserved determinants of LTC access are also (unobserved) need factors. In such a case, the generalized residual in Equation (D.1.A) would be subtracted from HI^A and the 'conservative' horizontal inequity index for Analyses A writes:

$$HI^{cons,A} = \sum_{l=1}^{L} \frac{\bar{z}^l}{\bar{U}} \hat{\alpha}^l CI(z^l) \qquad (D.2.A)$$

while $CI(\widehat{U}^A) + CGE^A$ measures the concentration of both observed and unobserved needs across the income distribution.[31]

Similarly, for Analysis B, we can write:

$$CI^B = \sum_{k=1}^{K} \frac{\bar{x}^k}{\bar{E}} \hat{\beta}^k CI(x^k) + \sum_{l=1}^{L} \frac{\bar{z}^l}{\bar{E}} \hat{\beta}^l CI(z^l) + CGE^B(\varepsilon) \qquad (D.1.B)$$

$$= CI(\widehat{U}^B) + HI^B$$

$$HI^{cons,B} = \sum_{l=1}^{L} \frac{\bar{z}^l}{\bar{E}} \hat{\beta}^l CI(z^l) \qquad (D.2.B)$$

The estimates of $HI^{cons,A}$ and $HI^{cons,B}$ are provided as a robustness check ('Check 4') in Online appendix E, Table E.I.

D.2. Decomposition of HI^C

The derivation of HI^C is different from what we do in Analyses A and B, to the extent that in Analysis C use is standardized on a readily available measure of entitlements (we do not need to rely on a regression-based derivation of needs). Still, we can use a similar framework to decompose HI^C into the contribution of non-need factors; in addition, a regression can be used to test for any partial correlation between a non-need factor and home care use, when entitlements are controlled for. Regression estimates can then be used to better understand what drives the differences in care use standardized for entitlements across population groups (i.e. horizontal inequity) that we report in Section 5.3.

For Analysis C, we estimate the following constrained linear regression on the subsample of the elderly eligible for some home care:

[31] According to Wagstaff et *al.* (2003), $\frac{\bar{z}^l}{\bar{U}} \hat{\alpha}^l CI(z^l)$ can be thought as the (non-causal) contribution of non-need factor z^l to income-related inequality in care use; as such, HI can be expressed as the sum of the contributions of non-need factors plus the generalized residual. Our empirical analysis does not rely this interpretation, which has been discussed by several recent developments of the equity literature (see Erreygers & Kessels (2013) and Heckley *et al.* (2016)). Whatever the interpretation of $\sum_{l=1}^{L} \frac{\bar{z}^l}{\bar{U}} \hat{\alpha}^l CI(z^l)$, it remains true that the horizontal inequity index, in its conventional definition, equals this term plus the (rescaled) concentration index of the residuals.

$$U_i = (\bar{U}^{elig}/\bar{E}^{elig})E_i + Z_i'\gamma^Z + v_i \qquad (1.C)$$

The coefficient of entitlements is constrained to be equal to the ratio of population averages $(\bar{U}^{elig}/\bar{E}^{elig})$. This ensures that we use the vector of estimates of parameters γ^Z and residuals v to decompose income-related inequality in care use as:

$$CI^C = \left(\frac{\bar{U}^{elig}}{\bar{E}^{elig}}\right).\left(\frac{\bar{E}^{elig}}{\bar{U}^{elig}}\right).CI(E)^{elig} + \sum_{l=1}^{L}\frac{\bar{z}^{l,elig}}{\bar{E}^{elig}}\hat{\gamma}^l CI(z^l) + CGE^C(v) \qquad (D.C)$$

$$= CI(E)^{elig} + HI^C$$

Where $\bar{z}^{j,elig}$ is the average of non-need factor z^j in the population eligible for home care. Consistently, HI^C is simply equal to the difference between the concentration index of use and the concentration index of entitlements among the individuals eligible for home care $(CI(U)^{elig} - CI(E)^{elig})$.

In the case of Analysis C, there is no conservative approach to inequity analogous to the one considered for Analyses A and B: when assessing inequity in the conversion of entitlements into actual care use, we standardize use for entitlements, which are perfectly observed. In this setting, the error term v necessarily captures unobserved non-need factors, and $CGE^C(v)$ reflects the concentration of these unobserved *illegitimate* determinants of home care use.

Appendix E: Additional robustness checks

In the main text, we have included two robustness checks for the baseline estimates income-related inequity. This Appendix provides four additional robustness checks, whose results are displayed in Table E.I ('Check 3' to 'Check 6'). For better readability, we have reproduced the estimates from the baseline analysis and the first two robustness checks.

[Table E.I. on the following page]

As a third robustness check, we use the Lasso to select *both* the need variables and the non-need factors to be included in the regressions. On the one hand, including as control variables as many non-need factors as available reduces the risk that the correlation between need variables and income rank (which defines fair income-related inequalities in access to care) actually captures a correlation between the income rank and the non-need factors, in the case the latter are correlated with need variables. On the other hand, not submitting the non-need factors to the Lasso selection procedure may lead to exclude some need variables that are highly correlated with some non-need factors. This might distort our estimates of legitimate needs and of their distribution across income levels. We have replicated Analyses A and B using the Lasso to statistically select simultaneously a subset of need variables and a subset of non-need factors. The point estimates for HI (Table E.I, 'Check 3') are very close to our baseline estimates.

Table E.I: CI and HI for Analyses A and B – additional robustness checks

	Variant	*CI(outcome)*	*HI(outcome)*
Analysis:		(1)	(2)
A. LTC use (equity overall)	Baseline		-0.036*** [-0.057;-0.010]
	Check 1: having a partner is a non-need factor		-0.058*** [-0.066;-0.017]
	Check 2: no administrative data on health care use	-0.340*** [-0.361;-0.315]	-0.043*** [-0.077;-0.035]
	Check 3: both need variables and non-need factors are selected with Lasso		-0.029*** [-0.044;-0.011]
	Check 4: unobserved factors correlating with income are need variables		-0.037*** [-0.059;-0.011]
	Check 5: OECD modified equivalence scale & equal sharing within couples	-0.313*** [-0.335;-0.288]	-0.035*** [-0.055;-0.009]
	Check 6: OECD square root scale & sharing rule "63% to women"	0.020** [0.004;0.040]	0.001$^{n.s}$ [-0.016;0.016]
B. LTC entitlements (equity at eligibility stage)	Baseline		-0.016$^{n.s.}$ [-0.036;0.005]
	Check 1: having a partner is a non-need factor		-0.025* [-0.041;0.000]
	Check 2: no administrative data on health care use	-0.288*** [-0.311;-0.267]	-0.020** [-0.045;-0.005]
	Check 3: both need variables and non-need factors are selected with Lasso		-0.011$^{n.s}$ [-0.026;0.004]
	Check 4: unobserved factors correlating with income are need variables		-0.018$^{n.s}$ [-0.038;0.004]
	Check 5: OECD modified equivalence scale & equal sharing within couples	-0.268*** [-0.291;-0.247]	-0.015$^{n.s}$ [-0.034;0.006]
	Check 6: OECD square root scale & sharing rule "63% to women"	0.002$^{n.s.}$ [-0.017;0.022]	-0.000$^{n.s}$ [-0.014;0.013]
C. LTC use (equity at use stage)	Baseline	-0.095*** [-0.113;-0.071]	-0.054*** [-0.065;-0.040]
	Check 5: OECD modified equivalence scale & equal sharing within couples	-0.086*** [-0.104;-0.061]	-0.046*** [-0.057;-0.033]
	Check 6: OECD square root scale & sharing rule "63% to women"	-0.015* [-0.029;0.022]	0.015** [0.002;0.031]

Notes: Standard errors in brackets, computed using the convenient formula approach supporting survey weights (O'Donnell *et al.*, 2008); 95% confidence intervals in parentheses; a cluster-bootstrap approach (1,000 replications) is used to construct confidence intervals (see Online Appendix C).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$, $^{n.s.}$ $p \geq 0.10$.

Getting to our fourth robustness check, our baseline analysis relies on the - standard - assumption that the unobserved determinants correlating with the income rank are *illegitimate*

determinants of care use. But what if, in spite of our extensive set of health-related information, we fail to observe some (pro-poor distributed) dimensions of needs that are known to CIZ assessors? In particular, an adapted house can improve the capacity of the elderly with functional limitations to perform the activities of daily living without human assistance (Hoenig *et al*., 2003); a more accessible dwelling can also delay nursing home entry (Diepstraten *et al*., 2019). If lower-income elderly are less likely to have adapted houses – which we do not know from our data but is suggested by Diepstraten *et al*. (2019) -, their legitimate care needs would be higher than our estimates indicate. To check that the finding of no pro-rich horizontal inequity in home care access is not driven by our implicit assumption that the unobserved factors co-determining use are *need-related*, in a third robustness check we relax this assumption. With this more 'conservative' approach (Bago d'Uva *et al*., 2009), estimates point to an absence of income-related horizontal inequity at both the eligibility stage and overall: HI is now extremely close to zero for both Analyses A and B.[32]

Our analysis of income-related inequity in care use relies on the assumptions that: (i) the OECD square root equivalence scale correctly reflects economies of scale for (household-level) expenditures, and (ii) economic resources are shared equally in the household (between spouses).

If (i) is incorrect, the ranking in the income distribution of singles relative to that of the elderly with a spouse would be incorrect. If (ii) is untrue, then the ranking of men with a spouse relative to that of women with a spouse is incorrect. Given that the share of singles (mostly widows) is higher among women, a sharing rule of household resources unfavorable to women would also imply that relatively more women are over-ranked in the distribution of income, relative to men. As both spousal status and gender exhibit practically and statistically significant partial correlation with home care use and/or entitlements (holding other needs and non-need factors fixed), violation of (i) and/or (ii) could bias our assessment of income-related inequity in care use.

Estimates of economies of scale and sharing rules in couples are available for the Dutch 65+ population. Using consumption survey data, Cherchye *et al.* (2012) estimate an economies of scale parameter of 0.32. They also estimate a sharing rule that is *more* beneficial to women (average of 0.63 and standard deviation of 0.03 among couples).

[32] This robustness check is based on the decomposition formula provided in Wagstaff *et al.* (2003); it amounts to computing HI as the difference between CI and the sum of the concentration of need variables and the generalized residual (formula provided in Online Appendix D.1).

The OECD-square root equivalence scale we use in our baseline analysis reflects an economies of scale parameter of 0.41 for a two-person household. The OECD modified scale, which was standardly used until the 2000s, reflects an economies of scale parameter of 0.33. We therefore run two additional robustness checks: first, we re-compute equivalized income using the OECD modified scale; second, we assume that women in a couple receive 63% of the household income, after economies of scale have been taken into account.

Changing the equivalence scale is innocuous; however, assigning more resources to women somewhat affects the results. Like in the baseline analysis, there is no evidence of socio-economic inequity in entitlements for home care; but the pro-poor gradient in the conversion of entitlements into use fades out and even becomes slightly pro-rich. This is consistent with the fact that women were found to convert more of their entitlements on average, and robustness check #6 makes women relatively richer. This scenario may over-estimate the pro-richness of the distribution of home care use, for given entitlements. The intra-household sharing rule estimated by Cherchye *et al.* (2012) used data from 1978 to 2004 and their results suggest that resource sharing became more equal over the period. Re-allocating 63% of the household resources to women among the 65+ population in 2012 may thus make women with a partner artificially richer, relative to men with a partner and single individuals. Furthermore, Cherchye *et al.* (2012) find substantial heterogeneity in the sharing rule across households. We thus take the results from ‘Check 6’ with caution.

Appendix F: List of datasets used

This research relies on data from Statistics Netherlands (CBS) and the Municipal Health Services (GGDs). It has been registered in the Gezondheids monitors repository as part of project 'Financial and health risks: household decisions and government intervention'.

To facilitate the reproducibility of our results, we provide in Table F.I the list of the datasets that we linked together, together with their name in the CBS environment and the version that was used.

Table F.I: List of datasets used in the analysis

Dataset	Content	Version
GEMON	Health Monitor survey (wave 2012)	2012
GBAPERSOONTAB	Population registers (age, gender and migrant background)	2017 – V1
GBAOVERLIJDENTAB	Death records	2017 – V1
GBAHUISHOUDENSBUS	Household composition	2017 – V1
GBAVERBINTENIS-PARTNERBUS	Formal unions	2014 – V1
GBAADRESOBJECTBUS	Address identifiers (main)	2017 – V1
VSLGWTAB	Location of addresses (main)	
NIETVSLGWTAB	Location of addresses (complementary)	2018 – V4
KINDOUDERTAB		2012 – V1
INDICAWBZTAB	CIZ eligibility indications	2012 – V1
GEBZZVTAB	Use of AWVZ-funded home care	2012 – V2
ZORGMVTAB	Use of AWBZ-funded institutional care	2012 – V1
PGBAWBZTAB	Use of AWVZ-funded LTC vouchers	2012 – V1
MEDICIJNTAB	Drug use	2011 – V1
ZVWZORGKOSTENTAB	Health care costs	2011 – V1
Integraal Huishoudens Inkomen	Household income (tailor-made from dataset IHI)	2012
Integraal Vermogen	Household wealth (tailor-made from dataset VEHTAB)	2012

Notes: The description of these datasets is provided by Statistics Netherlands at https://www.cbs.nl/en-gb/our-services/customised-services-microdata/microdata-conducting-your-own-research/microdata-catalogue.

To link each municipality to one of the CIZ regional offices and to one of the LTC purchasing regions, we also used the table of correspondence "GIN - Gebieden in Nederland" (2013-V1).

Finally, we link each individual with a migrant background (first or second generation migrant) to her or his land of origin using a dedicated table of correspondence.[33] Each land is classified

[33] File "120123 omrekentabel land naar herkomstgroepering.xls" in the CBS remote environment, folder "metadata/Utilities/Code_Listings/Landen- en nationaliteitscodes".

by Statistics Netherlands into one of 7 categories: (1) the Netherlands, (2) Suriname, (3) the so-called *Dutch Caribbean, (4) Morocco, (5) Turkey, (7) Western countries other than the Netherlands and (7) other* non-Western countries. Categories (4) and (5) correspond to the countries from which the highest proportion of individuals living in the Netherlands but with a migrant background come from; categories (2) and (3) encompass countries that used to be Dutch colonies, with the exception of Indonesia (which is classified by Statistics Netherlands in the category of the Western countries). In our empirical analysis, we group together categories (2), (3), (4), (5) and (7).

Additional References

This list provides the references mentioned in the Supplementary Material and not provided in the list of references of the main text.

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