Does subsidized long-term care at home improve mental health and wellbeing? New evidence on causal effects from the Survey of Health, Ageing and Retirement in Europe

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1. INTRODUCTION

An increasingly common policy response to the rising fraction of older people with functional limitations is to encourage 'ageing-in-place'. This approach is defined as 'remaining living in the community, with some level of independence, rather than in residential care" (Davey, Nana, de Joux, & Arcus, 2004, p. 133). As a result, most European countries have introduced some form of subsidized home-based Long Term Care (LTC) programme (1) that renders older people with functional limitations eligible to home-based LTC services, thus increasing the probability that they remain at home.

The assumption behind this policy is that home-based care improves the health and wellbeing of older people; yet, there is almost no evidence on whether receiving care at home has a causal impact on the wellbeing of older people. Addressing this question is critical: If long-term care at home substantially improves the health and functioning of older people, we would expect ageing in place policies to increase disability-free life expectancy, while at the same time reducing the burden of care on partners, adult children and other family members. By contrast, if home care services do not address the needs of frail older people and does not improve their wellbeing, governments may need to consider alternative approaches to caring for people in older age.

We examine the impact of home-based care on mental health, particularly on the prevalence of depressive symptoms in older age. Depressive symptoms are common among older people with functional limitations (2), leading to significantly higher costs for medical and non-medical services.(3) The overall costs of mental ill-health are estimated at around 4% of GDP in OECD countries.(4) Depressive symptoms have been linked to declines in cognitive and physical functioning through mutually reinforcing pathways.(5) As governments are downsizing the public budget for formal care while encouraging informal care provision(6), understanding how care-use impacts mental health would contribute to a broader evaluation of the societal benefits of LTC systems.(6)

From a theoretical perspective, the impact of domiciliary formal and informal LTC on mental health is ambiguous. On the one hand, home-care is often seen as preferable to older people as it enables them to maintain independence, autonomy and close relationships with family and friends (7), which we would expect would lead to improvements in mental wellbeing.(8) Home-based care may also reduce or prevent functional decline (1), which could indirectly reduce the risk of decline in mental wellbeing and improve life satisfaction. On the other hand, home-care LTC may reduce self-sufficiency and increase dependency at home, thus increasing vulnerability and emotional distress.(9) Home-care may also be a substitute for informal care, thus potentially reducing support from close family and friends. This may increase social isolation and loneliness at home, leading to higher risk of depressive symptoms in older age.

Availability of home-care has been linked to reductions in hospitalizations and increased survival, particularly among individuals with a moderate level of LTC needs.(10-12) However, only a small number of studies has empirically estimated the causal impact of home care on mental health. Surprisingly, these studies find no consistent evidence that receiving formal or informal support at home has a causal effect on mental health.(13, 14) This might reflect the methodological difficulties in addressing this question, raised by the endogeneity of care-use,(13) i.e., older people with limitations are more likely to receive home-based care than those without limitations.

This requires a source of exogenous variation to identify a causal effect. While several instruments have been proposed for informal care use, the literature has struggled to identify instruments for formal-care.(13)

Based on an extensive analysis of national and regional legislation in a selection of European countries with clear-cut eligibility rules, we constructed an instrument that strongly predicts the probability of formal-care use and is exogenous to mental health. In essence, our identification approach exploits variation in eligibility rules for publicly-funded domiciliary long-term-care to identify the effect of home-based care on depression. Eligibility for LTC in Europe is determined by an assessment of an older person's functional, mobility and cognitive impairments. Rules differ substantially across countries, so that two individuals with similar clinical profiles but in different countries may differ in their eligibility for home-based care, by virtue of different eligibility criteria.(15) Over time, eligibility to home-based care changes as an individual becomes older and develops new limitations, which may trigger eligibility for home-based care. We exploit this interaction between individual health trajectories and country specific legislation for causal identification. We build an individual-level variable identifying respondents who are eligible for public formal home-care, based on legislations in their area, and link it to microdata. We estimate an instrumental variable model, which also controls for informal-care using information on children's characteristics as instruments.

2. METHODS

2.1 Econometric model and the instrumental variable

In order to estimate the effect of formal-care use on depression, we start from the following basic model estimated through OLS-random effects, for individual *i* in region *r*.

$$MH_{i,r} = \gamma_0 + \gamma_1\ FC_{i,r} + \gamma_2\ IC_{i,r} + \gamma_3' HS_{i,r} + \gamma_4' X_{i,r} + \gamma_5 R_r + \varepsilon_{i,r}$$

where *MH* is depression score, *FC* and *IC* are binary indicators for formal- and informal-care use respectively, *HS* is a vector of health variables, *X* is a vector of socioeconomic covariates, and *R* is a vector of regional dummies at NUTS1 level. Estimating this model poses important identification challenges, as the care-variables are likely endogenous because of reverse causality, unobserved factors affecting both care-use and depression, and measurement error.(13, 16)

We contribute to the existing literature by exploiting novel individual-specific information on eligibility status for local subsidized programmes of home-based care, as instrument for formal-care use. Access to formal home-care is largely not discretionary for older adults in Europe, with several legislations defining eligibility by comparing an applicant's "clinical profile assessment" with a given eligibility index (15). The legislation-based eligibility index often consists in a non-linear aggregation of health information where the main components are functional (e.g., ADL and iADL tasks) and cognitive limitations, yet excluding depressive symptoms. Crucially, algorithms differ across countries and, as a consequence, the same clinical profile may render an individual eligible in one country, but ineligible in another.(15) Our instrumental variable is therefore individual-specific binary index, identifying individuals fulfilling the eligibility thresholds of any LTC programme implemented in their region or country. To our knowledge, only Kim and Lim (17) and Carrino, Orso and Pasini (18) adopted a similar strategy in the field of LTC, albeit looking at unrelated questions. This improves on previously proposed instruments for formal care which exploited variability at the macro-level only (e.g., expenditure or coverage rates of LTC programs).(13, 14)

Regarding informal care utilisation, we follow the relevant literature and adopt information on children characteristics as instrumental variables, namely the number of children and the fraction of daughters (results are robust to using only fraction-of-daughters as instrument)(13, 16, 19). We thus consistently restrict the definition of informal care to assistance from respondent's offspring.

Instrument validity and identification

Our identification approach exploits the fact that while the probability of receiving care increases with the number of functional (and cognitive) limitations in all countries, each legislation has unique criteria for eligibility status using a non-linear and non-additive combination of health characteristics.(15) For example, a person with three limitations in instrumental Activities of Daily Living (iADL) and two in Activities of Daily Living (ADL) - a common profile for the European older population – may be eligible in Belgium or in Germany only, depending on the specific combination of iADL and ADL limitations (Appendix *Table 4*). Hence, once controlling for the set of

health conditions comparable to those included in the legislations, and for regional dummies, the eligibility instrument captures the exogenous increase in the probability of receiving care due to the functional form of the eligibility algorithm. In order to guarantee the informativeness of the instrument, our analysis can only include countries where eligibility rules are clearly and objectively stated in the legislation. Similarly, we cannot include countries where LTC programs only provide cash benefits that are unmonitored and not targeted at home care use.

The exogeneity of the instrument comes from its legislation-based nature: the way a legislation evaluates a specific combination of health-outcomes should not directly affect a respondent's depressive symptoms, except through its impact on the probability of receiving home-based care. Importantly, depression plays no role in the eligibility algorithms.(15) In addition to individual covariates, we include a full set of regional dummies to account for unobservable effects common to individuals from the same region, including systematic deviation of medical evaluators from the region-specific LTC regulation.(18)

We implement a 2 stage least squares instrumental variable [2SLS IV] approach, using a random-effects estimator, where the outcome variable is the continuous depression score, and the endogenous variables are use of formal- and informal-care (from children). We use eligibility rules for public home-LTC as instrument for formal-care, and number of children and fraction of daughters as instruments for informal-care.(16, 19) We control for health and sociodemographic characteristics, wave and NUTS1 regional dummies. The standard errors are clustered at NUTS1 regional level. In some analyses, we include individual fixed effects that exploit the longitudinal nature of the data and control for all time-invariant confounders. Models are run using the command xtivreg in Stata 15.

2.2 Data

Data comes from waves 1 (2004), 2 (2007), 5 (2013) 6 (2015) and 7 (2017) of the Survey of Health, Ageing and Retirement in Europe [SHARE], a large cohort study representative of populations aged 50 and older in 27 European countries.(20) We do not use Waves 3 and 4 as they lack information on formal-care use. Our country selection includes Belgium, France, Germany and Spain as these countries had in place clear-cut LTC legislation for home-care use eligibility. We exclude the remaining countries because either their LTC programs do not provide benefits specifically targeted at home-care use (they provide unmonitored and untargeted benefits); or care-eligibility is determined without clear-cut rules and through a more subjective evaluation of an assessment team. Details on the legislation are available elsewhere.(15) We exclude countries which do not appear in at least one regular wave of SHARE. We consider non-institutionalized individuals aged 65 and older, with children (because we focus on informal care from children). Our analytical sample includes 12,872 individuals (24,857 observations).

Mental Health

Depressive symptoms are measured using the continuous Euro-D score, ranging from 0 to 12, which was designed for use among older Europeans.(21) We also examine impacts on quality of life and loneliness as possible mechanisms, using a continuous index of Quality of Life (QoL) in older age, the CASP-12, a reduced version of the widely-used CASP-19 scale.(22, 23) As no clinically validated threshold has been proposed, we generate a binary indicator for being above or below the average CASP score in our sample (37.9). We measure loneliness (Waves 5 and 6 only) using the 3 item University of California Los Angeles Loneliness Scale, and a threshold of 6 (out of a maximum of 9) for caseness of loneliness (24).

Care utilization

SHARE participants are asked about the utilization of formal and informal domiciliary help in the previous 12 months due to health problems. We define formal care as the receipt of professional or paid personal/nursing care or meals on wheels as has been done in recent studies.(18) Respondents are specifically asked about the identity of their informal caregivers. Thus, we can specifically focus on informal care from children, both from inside and outside the recipient's household (16).

Sociodemographic, regional, and health controls

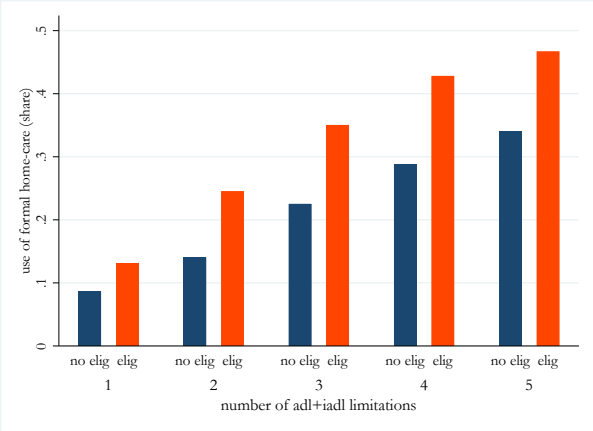
We control for the following variables: age, age squared, gender, marital status/cohabitation, highest education attainment, residential area (urban vs rural), household income quintiles, NUTS1 region of residence, and wave. Crucially, we control for individual health using self-reported health, number of chronic diseases, number of ADL, IADL, and mobility limitations, and cognitive function.

3. PRELIMINARY RESULTS

Do eligibility rules influence the probability of receiving home-based care?

Building on the work of Carrino et al (18), we assign the eligibility index by simulating the implementation of local legislation on self-reported information on respondents' mobility restrictions, cognitive impairment, other health conditions, and limitations in the ADL and iADL. On average, 10% of the sample is eligible for formal LTC. Figure 1 shows that the likelihood of receiving formal-care increases with the extent of functional limitations; at any level of limitations, being eligible for LTC substantially increases the probability of receiving formal-care.

Figure 1, proportion of respondents receiving formal home-care, by number of ADL/iADL limitations and by LTC eligibility status



The causal impact of receiving home-based care on mental wellbeing

Columns 1 and 2 in Table 1 show results from the first stage models for formal- and informal-care use. The LTC eligibility index is a strong predictor of formal care use, increasing probability of take up by 10 percentage points (F-test=30). The instruments for informal care are similarly informative. The Angrist–Pischke (AP) multivariate F-test significantly rejects weak identification of formal and informal care.

Table 1, effect of receiving home-care on depression.

	(1) any formal home-care	(2) any informal care (from children)	(3) EURO-D *OLS*	(4) EURO-D *IV*
Any formal home care	-	-	0.155***	-2.264**
			(0.041)	*(0.904)*
Any informal care (children)	-	-	0.111**	-1.18
			(0.020)	*(1.315)*
Eligible to home-care	0.103***	0.015	-	-
	(0.019)	*(0.016)*		
F-test	*30.1*	*1*		
Fraction of daughters	-0.0001*	0.001***	-	-
	(0.0000)	*(0.0001)*		
F-test	*2.5*	*10.6*		
Number of children	0.005	0.009***	-	-
	(0.001)	*(0.001)*		
F-test	*0.2*	*25.4*		
AP F-test for instruments	16.4***	24.5***		
N	24,857	24,857	24,857	24,857
Sample Average	0.092	0.13	2.642	2.642

Note: we report results for the first-stage (columns 1, 2) and the OLS and IV models for EURO-D scores (columns 3, 4). Sample: individuals aged 65+, with children, in SHARE waves 1,2,5-7 in Belgium, France, Germany and Spain. Controls: age (quadratic), gender, living arrangements, education, living area, self-reported health, ADL-, iADL-, mobility-, cognitive limitations, household income, waves and regions. Standard errors clustered by regions (57).

Results for the instrumented models are shown in column 4, while in column 3 we show estimates from OLS models that ignore the endogeneity of care use. In the OLS estimates, use of formal care is associated with higher depression. However, once endogeneity is accounted for, formal care use reduces the EURO-D score by 2.3 points. This partially contrasts with previous findings where formal care was not found to affect depression.(13) Compared to an average of 2.7 points, with a standard deviation of 2.3, the estimated effect is substantial and well above the common thresholds for *minimally important effects*.(25). The use of informal care is found to reduce depression, but this effect is not statistically significant.

In Table 2, we estimate that the use of formal care reduces the risk of depression (defined as a Euro-D score of 4 or more (18)) by 14 percentage points (column 1). Informal-care use reduces it by 7 percentage points, consistent with previous evidence.(13) In addition, the use of formal care increases the probability of having a quality-of-life score above the average by roughly 16 percentage points, with a similar finding for informal care. Importantly, receiving either formal care or informal care reduces the likelihood of loneliness by 6.5 and 8.3 percentage points, respectively (column 4).

Table 2, effect of receiving home-care on depression.

	(1) EURO-D caseness *IV*	(2) CASP *IV*	(3) CASP caseness *IV*	(4) Loneliness caseness *IV*
Any formal home care	-0.140***	1.949	0.161***	-0.065***
	(0.034)	*(2.220)*	*(0.044)*	*(0.025)*
Any informal care (children)	-0.068*	1.132	0.145***	-0.083**
	(0.031)	*(4.437)*	*(0.045)*	*(0.033)*
AP F-test instruments for FC	17.5	19.3	20.17	26.75
AP F-test instruments for IC	26.4	12.3	14.38	11.27
N	24,857	22,273	22,273	17,524
Sample Average	0.303	38	0.5	0.12

Note: Sample: individuals aged 65+, with 1+children, in SHARE waves 1,2,5-7 in Belgium, France, Germany and Spain. Controls: age (quadratic), gender, living arrangements, education, living area, self-reported health, ADL limitations, iADL limitations, mobility limitations, cognitive health, fixed effects for household income (quintiles), waves and NUTS-1 regions. Standard errors are clustered by regions (57).

Conclusion

We find that national legislation has an important impact on the probability of receiving care. Exploiting this variation for identification, we show that receiving home-based care reduces the probability of depression and loneliness, and increases quality of life. These findings suggest that policies that support older people's independence, autonomy and social support, by enabling them to age in place while receiving home-based care, are likely to substantially improve the mental wellbeing of older people with declining physical health. This may result in substantial improvements in disability-free life expectancy, compression of morbidity, and reductions in later-life care costs. On the other hand, results suggest that recent reforms that have reduced formal-care coverage and expenditure on long-term care (6) might have detrimental effects on older people's mental health. Countries should consider the potential negative consequences of these reforms for the mental wellbeing and quality of life of older people, as well as for health care costs associated with mental disorders in later life.

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APPENDIX

Table 3, LTC eligibility rules in selected SHARE countries

Country	Program	ADL	IADL	Others	Eligibility threshold	Main ADL	Main non-ADL
Belgium	APA	p	p	C	7 points out of 18	equal weight	equal weight
Belgium	INAMI/RIZIV (BESADL)	✓		C	bathing + dressing + moving or using WC / cognition + bathing + dressing	Bathing, dressing	cognition
Belgium: Flanders	Vlaamse zorgverzekering (BEL profielschaal)	✓	✓	C	35 points out of 81	-	housework, cognition
Germany	Pflegeversicherung	✓	✓	C, S	90m die° / cognition	bathing, eating, continence	cognition
Spain	SAAD	✓	✓	C	25 points out of 100	eating, WC	-
France	APA (AGGIR)	✓i		C	2 ADL / cognition	-	cognition
France	Aide ménagère (AGGIR)	✓i	p	C	bathing / cooking / housework	Bathing	cooking, housework

C = cognitive limitations; p = included partially; S = advanced medication for post-surgical conditions; i = Incontinence not included; ° Germany: out of the 90m of need, at least 45m must come from ADL limitations. Adapted from Brugiavini, Carrino, Orso and Pasini (15).

Table 4, clinical profiles evaluated under the eligibility rules of Belgium and Germany

Profile A	**Profile B**	**Profile C**	**Profile D**
Limited in 2 ADL, 3 iADL	*Limited in 2 ADL, 3 iADL*	*Limited in 2 ADL, 3 iADL*	*Limited in 3 ADL, 3 iADL*
Age: 74	**Age**: 85	**Age**: 74	**Age**: 84
Limitations in ADL: Dressing, Bathing	**Limitations in ADL**: Dressing, Transferring	**Limitations in ADL**: Incontinence, Bathing	**Limitations in ADL**: Bathing, eating, using WC
Limitations in iADL: Outdoor mobility, Using the telephone, Managing money	**Limitations in iADL**: Shopping for groceries, Meal preparation, Houseworks	**Limitations in iADL**: Outdoor mobility, Shopping for groceries, Houseworks	**Limitations in iADL**: Shopping for groceries, Houseworks, Managing money
Cognitive limitations: yes	**Cognitive limitations**: no	**Cognitive limitations**: no	**Cognitive limitations**: no
Eligibility status: ELIGIBLE ONLY IN BELGIUM	**Eligibility status**: ELIGIBLE ONLY IN BELGIUM	**Eligibility status**: ELIGIBLE ONLY IN GERMANY	**Eligibility status**: ELIGIBLE ONLY IN GERMANY

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