Does informal care delay nursing home entry? Evidence from Dutch linked survey and administrative data

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Abstract

We assess whether informal care receipt affects the probability of transitioning to a nursing home. Available evidence points towards informal care decreasing the chance of admission but it only derives from the US, where nursing home stays are often temporary. Exploiting linked survey and administrative data on the 65+ in the Netherlands, we use the gender mix of children to retrieve plausibly exogenous variation in informal care receipt. Our results suggest that nursing home admissions within a three-year period are *reduced* with informal care for individuals with mild limitations, while they are *increased* for individuals with severe limitations. For the latter, although informal care increases formal care costs, it also results in lower post-acute care use and mortality. Therefore, policy makers should not expect that promoting informal care systematically results in lower institutionalization rate and care costs. Still, informal support can well be welfare-enhancing: a timely admission may come along with benefits in terms of well-being and survival that may outweigh additional costs.

Key-words: Long-term care, nursing home care, informal care, instrumental variables, bivariate probit.

JEL codes: C24; D12; I18; J14.

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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 2016*, 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 25$^{\text{th}}$, 2018).

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Author contributions

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1 Introduction

Nursing homes are costly. Besides, most people do not consider them the ideal place to end one's days (Nieboer *et al.*, 2010). In line with this, developed countries put emphasis on aging in place, whereby individuals can receive care at home. Delaying, or altogether preventing nursing home (NH) entry is also commonly perceived as a way of reducing long-term care (LTC) costs, although empirical evidence questions that claim (Bakx *et al.*, 2020; Werner *et al.*, 2019; Kim & Lim, 2015). Public LTC spending has been on the rise: in 2017 it amounted to 1.7% of GDP on average in the OECD countries (Hashiguchi & Llena-Nozal, 2020; OECD, 2020). To contain further increases, another policy orientation is to combine professional LTC with the provision of care by relatives, with partners and adult children being frequently in the front-line (Brunel *et al.*, 2019; Zigante, 2018). Not only informal care is expected to reduce the demand of unskilled formal home care (Bonsang, 2009), but it is also often framed as a way of preventing or delaying a NH admission (Zigante, 2018).

Is informal care effective at keeping older individuals longer out of nursing homes? From a theoretical perspective, it is not entirely clear. The risk of a NH entry increases as health and functional status deteriorate (Headen, 1993); thus, if informal care slows down the depreciation of cognitive and functional capabilities (Coe *et al.*, 2019), it can be expected to delay NH entry. For example, informal care might lead to a reduction of depressive symptoms (Barnay & Juin, 2016), the onset of which is strongly associated with the evolution of functional status (Ormel *et al.*, 2002; Taylor & Lynch, 2004). On the other hand, there may be competing channels through which receiving informal care increases the chance of a NH entry. First, if individuals can benefit from the regular help of a relative for a broad range of activities, they may 'unlearn' how to do them (Bonsang & Bordone, 2013), and hence become more likely to transition to a NH. Furthermore, such a transition may become especially likely if care provision is burdensome or has negative effects on the caregivers' health and well-being (Bom *et al.*, 2019; van den Berg *et al.*, 2014; Schmitz & Westphal, 2015; Do *et al.*, 2015), as some empirical evidence suggests that caregiver's limitations might worsen the recipient's own health (Yuda & Lee, 2016). Finally, informal caregivers may be more likely than other relatives not involved in care provision to correctly assess the frailty of their relative and – altruistically - push for a NH admission. Determining which effects predominate requires an empirical investigation.

In this paper, we assess the impact of informal care receipt for community-dwelling individuals on subsequent NH entry in the Netherlands. The Dutch LTC system has long been characterized by a high institutionalization rate, fostered by generous public funding of NH care: the share of 65+ residing in institutional care exceeded 7% in 2005 (OECD, 2020). However, in the recent years, Dutch policy makers have promoted ageing in place and encouraged informal care support. Whether the promotion of informal care contributes to containing the institutionalization rate, down to 4.2% in 2017 (OECD, 2020), depends on the extent to which informal support does affect NH admissions.

Direct evidence of the effect of informal care receipt on NH use is scarce and only available in the US context (Van Houtven & Norton, 2004; Charles & Sevak, 2005; Sasso & Johnson, 2002; Newman *et al.*, 1990). To identify a causal effect, these studies use characteristics of children as instrumental variables for informal care receipt. All in all, they find that receiving informal care reduces the probability of a NH admission and reduces the length of stays.[1] However, the US stands out among other rich countries for its specific LTC system, offering limited public coverage of LTC expenses. The validity of evidence from US data from the 1980s-1990s for other countries with a different institutional setting is debatable.

For our analysis, we leverage a 2016 health survey, with a large sample representative of the community-dwelling 65+ Dutch population. Respondents are asked whether they receive help with daily activities from their relatives. We link this survey with rich, exhaustive administrative data, so that we can track NH admissions and mortality between 2017 and 2019, as well as post-acute care use, spending on home care and health care services. In addition, population registers allow us to retrieve information on respondents' children. To address the potential endoegenity of informal care receipt in NH use, we fit a bivariate probit model. Furthermore, we exploit the randomness of the gender mix among children and use it as an instrument for informal care, thereby strengthening identification.

Our key result is the following. We find that individuals with only mild limitations do have a lower chance of a NH admission when receiving help from their relatives. By contrast, for individuals with severe limitations, we document a *positive* causal effect of informal care receipt on the probability of a NH admission within 3 years.

[1]We provide a more a detailed literature review, including indirect evidence on the link between informal care receipt and NH use in Appendix A.

At first sight, this finding contrasts with a grey literature on the benefits of informal care receipt and previous evidence from the US. We propose three explanations. First, the unexpected enhancing effect of informal care is found only when zooming in on individuals with high care needs, while previous studies derived average effects on broader populations. Second, we isolate the effect on NH admissions with an expected permanent nature, given the care needs required to trigger eligibility. By contrast, in most of the US studies (Van Houtven & Norton, 2004; Sasso & Johnson, 2002; Newman *et al.*, 1990), NH admissions include stays in post-acute care facilities with a temporary nature. Our further analyses reveal that (also) in the Netherlands informal support causally reduces the probability of using post-acute care within 2 years. Third, there are important differences between the Netherlands and the US in the public coverage of LTC (Bom, 2021). In the absence of well-funded permanent NH stays and limited availability of home care services, US informal care providers may play a role that in the Netherlands would typically be shared between informal helpers and professional caregivers.

We contribute to the existing literature in three main ways. To our knowledge, we are the first to document the causal impact of informal care on NH admissions in a European country, disentangling between expected permanent admissions and post-acute care use. The previous studies focus only on the US while NH stays in many European countries (including the Netherlands) are mostly made on a permanent basis (see e.g. Fizzala (2017); Bom (2021)) and the public coverage of LTC is more generous than in the US. By exploiting recent data from the Netherlands, we therefore expect our results to have a higher contemporaneous policy relevance for European countries than available studies. Second, we show that the effect of informal care differs with respect to the health capital at baseline, as can be expected theoretically. Third, our study adds to the literature that quantifies the spillover effects of informal care on formal LTC and health care use (Bonsang, 2009; Balia & Brau, 2014; Bolin *et al.*, 2008; Coe *et al.*, 2019). We assess how informal support affects LTC costs, both nursing home care and substitute home care services, as well as health care spending, thereby shedding light on a range of costs and benefits for the care recipient and society. For individuals with mild limitations, informal care reduces spending not only on institutional care but also on skilled home care and health care at large. For individuals with severe limitations however, informal care receipt is suggested to also increase skilled home care costs and total care costs, while reducing 3-year mortality risk.

One critical implication is that policy makers should not expect that promoting informal care will necessarily result in lower NH admissions. On the one hand, it seems an effective way of preserving the health capital of individuals with only mild limitations and achieving cost savings, prompting informal support to be encouraged well ahead of the onset of activity limitations. On the other hand, informal care leads to higher costs in the medium run for the most fragile. Our results support the interpretation that informal caregivers help to trigger a timely NH admission for individuals with high care needs as well as to get access to adequate skilled care if staying at home. The monetary and non-monetary benefits of a timely access to formal LTC may end up exceeding the extra costs. If so, informal care may still be welfare-increasing despite its cost-inflating effect.

2 Institutional background: formal care and informal care in the Netherlands

2.1 Informal care in the Netherlands

Historically, the Dutch LTC system was classified as one with generous public coverage of LTC services (Kraus *et al.*, 2011). Reliance on informal care was relatively limited, despite the availability of public support to family caregivers.[2] The role assigned to informal care has however changed somewhat in the recent years. Coming along with the fostering of ageing in place and cost containment, a 'normative reorientation' (Maarse & Jeurissen, 2016) towards a higher role of the support provided by the community has been promoted since the 2015 reform of the LTC system. More than in the past, relatives are expected to take an active role in supporting older adults, especially those whose limitations are not yet severe enough to give them access to NHs.

In 2016, one quarter of the Dutch adults provide informal care ('mantelzorg') in a broad sense (including help with activities of daily living, supervision and emotional support) to a relative or friend in the community (De Klerk *et al.*, 2017). Informal caregiving is most frequent among the 45-64 years-old, who are likely to have elderly parents(in-law) with care needs: 8% provide intensive care (more than 8 hours a week), and more than 30% provide non-

[2]For example, non-professional caregivers can benefit from advice and counselling, but also from legal entitlements to compensated leave for caregiving purposes (Zigante, 2018). Individuals eligible for LTC services can opt either for in-kind care or for LTC vouchers, which can be used to hire and pay for non-contracted care providers or the relatives involved in informal care provision.

intensive care. From the perspective of care recipients, in 2015, 6.5% of the 65+ report receiving care from their children.[3]

2.2 Publicly-subsidized long-term care

LTC in the Netherlands is financed through three different schemes, providing coverage for institutional care and home care. In what follows, we highlight what the features of the LTC system imply for the empirical study of the effect of informal care on subsequent NH entry and use of substitute formal care options.[4]

We identify six relevant features. First, a NH admission can only follow from a positive eligibility decision. Such a decision is based on a formalized needs assessment, entrusted to an independent agency. Whether someone is eligible depends on whether they have reached a certain cutoff in terms of health and functional limitations, which corresponds to a need a permanent supervision. [5] Second, having informal caregivers should not affect entitlements for such care, but may be a trigger for an application to a need assessment because they can request a need assessment on behalf of their relative. Third, the Dutch system offers well-funded alternatives to a NH admission, including post-acute care provided in institutions and skilled home care covered by the Health Insurance Act as well as social services organized by municipalities (e.g. domestic help, meals-on-wheels, house adaptation, short stays). Fourth, public coverage of formal LTC and health care is fairly generous in the Netherlands, such that the use of purely private care options is extremely limited (Tenand, Hussem & Bakx, 2020). This implies that mapping out the use of LTC and health care and the effect of informal care thereon can be achieved by leveraging information on publicly-funded care use.

Fifth, the decentralization of home-based care may generate regional differences in the trade-off between institutional and home-based care, which may correlate with differences in the availability and perception of informal care provision. Finally, the out-of-pocket costs of a NH stay relative to home-based care increase with income and wealth, creating a stronger financial incentive for richer individuals to remain in the community. These two points justify that we control for income and wealth as well as the region of residence when assessing the impact of informal care on NH entry and substitute care use.

[3] Authors' own computation based on the SHARE survey, wave 6.
[4] Appendix B provides a more extensive description of the system.
[5] See Bakx *et al.* (2020) for a detailed description.

3 Data and samples

3.1 Data sources

Our analysis relies on a large-sample health survey combined with exhaustive administrative register data. The Health Monitor (*Gezondheidsmonitor*) is a cross-sectional survey conducted every 4 years, jointly by the Municipal Health Services (*GGDs*) and Statistics Netherlands (CBS). The Health Monitor includes self-reported information on physical and mental health, chronic conditions, functional limitations and mobility restrictions, as well as sociodemographic characteristics (such as age, gender and education). Wave 2016 includes questions about informal care receipt and was conducted between September and December of 2016. One questionnaire is designed specifically for the 65+ population. The target population consists of individuals living in a private household in January 2016.

We then link the Health Monitor to several administrative datasets, based on a unique pseudomyzed individual identifier, which we further link with the identifiers of their legal parents to retrieve information on the respondents' children in the population registers. Appendix C.2 provides further details on each dataset used and its sources. An overview of the information retrieved from the Health Monitor and the administrative data is provided in Table I.

Table I: Content of datasets used

Source	Variables
Outcomes	
Administrative data	Nursing home stays (2016-2019)
	Mortality (2016-2019)
	Post-acute care costs (2015-2018)
	Health care costs (2015-2018)
	Skilled home care costs (2015-2018)
	Indicator of social care support (2015-2018)
Explanatory variables and instruments	
Survey data	Informal care receipt
	Self-assessed health
	Self-reported health issues/diseases
	Self-reported functional limitations
	Education
Administrative data	Date of birth
	Gender
	Migrant background
	Marital status (31-10-2016)
	Household composition (31-10-2016)
	Household income (2016)
	Household wealth (01-01-2016)
	Health care spending (2015)
	Number of children alive (31-10-2016)
	Gender of children
	Own address (31-10-2016) and distance to closest child (2011)
	LTC purchasing region

NOTES: 31-10-2016 is the mid-point of the survey collection period.

3.2 Informal care receipt and nursing home care use

We define a dummy variable NH_i equal to 1 if individual i stays in a NH at any point between January, 1st 2017 and December, 31st 2019. We construct this variable based on the register data, which allow to distinguish NH stays from other institutional care (e.g. palliative care, care received in handicap centers). Regarding informal care, the survey respondents are asked whether they currently receive any such care. They are provided with the following definition of informal care: 'Informal care is care that you receive from a relative or an acquaintance of yours, such as a your partner, parents, child, neighbors or friends, if you have been sick for a long time, in need of help or handicapped. This care may encompass doing house chores, grooming and dressing, keeping company, transport, arranging finances, etc. Informal care is not paid. A volunteer from a non-profit association is not considered an informal caregiver'.[6] We define a dummy IC_{i2016} equal to 1 if individual i reports informal care receipt at the time of the survey.

3.3 Additional outcomes: mortality, post-acute care use, home care use and care costs

We further investigate the effect of informal care receipt on other outcomes to shed light on the mechanisms driving its impact on NH use and assess its broader impact on formal care costs.

The second outcome we test is mortality, which is relevant for two reasons: first, it is a competing risk to that of a NH admission (Headen, 1993), such that a lower NH admission rate may arise with higher mortality. Second, potential mortality effects, all other things equal, are informative of the welfare effects of informal care receipt. We define a dummy variable indicating whether the individual died by the end of 2019. We also assess how informal care receipt affects the probability to use post-acute care in 2017 or 2018. In addition, we estimate how informal care weighs on the use of potential formal substitutes to institutional care, namely i) municipal social care[7] and ii) district nursing care (which we refer to as skilled home care), in any of the two years following the survey.

[6] Authors' translation. See Appendix C.4 for the original (Dutch) wording and additional information.

[7] Municipalities may provide *basic* social care, such as domestic help and meals-on-wheels, and tailored services, like housing adaptation and day- or temporary stays in nursing homes. Our data only allow us to infer whether individuals receive *tailored* care. Basic social care is broadly accessible, such that we expect the vast majority of individuals with limitations to be eligible for it.

Finally, we investigate the effect of informal care receipt on care costs incurred over 2017 and 2018.[8] The use of administrative records allows us to compute (i) the cost of old age institutional care, [9] (ii) skilled home care costs and (iii) health care costs, also zooming into hospital spending. This allows us to explore the effect of informal care receipt on each type of formal care but also total care costs. In doing so, we examine the claim that stimulating care providing by relatives enables cost savings on formal LTC and health care.

3.4 Control variables

We control for a rich set of individual characteristics that might correlate with both informal care receipt and care use or mortality. More details on how the variables are constructed can be found in Table II, with descriptive statistics. We include age, gender and marital status. To control for potential cultural differences relating to informal care and the propensity of formal care use, we include information about individuals' migrant background.[10]

Health status is captured by three types of variables. First, the Health Monitor provides self-assessed overall health. Second, it includes self-reported information on more objective measures of health. Third, health care costs in 2015, i.e the year before the survey, can be retrieved from the administrative data and provide additional information on the health status of the respondents.[11] We do not include costs incurred in the year of the survey because informal care receipt might also affect medical care use (Van Houtven & Norton, 2008, 2004), raising endogeneity issues.

In addition, we control for household wealth and household disposable income.[12] We also control for home-ownership by a dummy, as Dutch homeowners are less likely to move to a nursing home when old than renters, because of a stronger attachment to their residence or higher freedom to adapt their

[8] Care costs consists of both public spending and private spending (co-payments for LTC, deductible for health care) incurred on care.

[9] Old age institutional care encompasses NH care strictly speaking as well as palliative care. We compute the duration of each stay with a given care package (ZZP) with the daily national tariff for such a stay. Institutional care costs are derived summing over all stays at the individual level. We also define the costs on nursing home care as a sub-category.

[10] Appendix C.2 provides additional information on the classification of geographical origins by Statistics Netherlands.

[11] Health care costs are those incurred under the the Health Care Insurance Act (ZVW). We exclude costs on district nursing care, also funded via this Act, as we use them as a separate outcome and control in some specifications. See *infra*.

[12] We deduct the value of the main residence to the wealth variable, which is equal to all assets minus debts of the household. Income is equivalized using the OECD square root equivalence scale, which reflects an economies of scale parameter of 0.41 for a two-adult household (OECD, 2011).

house (Rouwendal & Thomese, 2013).

We also include a set of dummies indicating in which of the 32 LTC purchasing regions the individual lives, so as to capture potential differences in the supply of nursing home care beds across regions.

Finally, in our baseline analysis, we control for characteristics of the children that correlate with informal care receipt: the number of children and the distance to children 5 five years before the survey. We use a lagged distance, more likely to be exogenous to formal care use than *contemporaneous* distance (Hiedemann *et al.*, 2018).

3.5 Study samples: individuals with severe or mild limitations

The Health Monitor surveyed 242,888 individuals aged 65 or older. We focus on individuals who are potential informal care recipients, by selecting individuals reporting functional limitations or a poor health. Functional limitations are defined following the OECD 7 item list (Lafortune & Balestat, 2007), which includes 2 hearing items, 2 sight items and 3 mobility items.[13] Individuals with limitations represent 57% of the at-home 65+ Dutch population.

Less than 1% of the survey respondents cannot be retrieved in the administrative data. We also delete the few individuals who were in institutional care already during the survey collection period. Given that our empirical strategy exploits children's characteristics, we further exclude individuals with no children alive recorded in the administrative data at the time of the survey (13% of observations). Finally, we drop individuals with missing information on contemporary informal care receipt (9% of observations). After these selection steps, the sample consists of 113,386 individuals.[14]

We posit that informal care has differential impacts on subsequent health, NH admissions and care trajectories depending on initial health capital. Informal care, which is generally unskilled, may be less efficient at preserving the health capital of individuals with high care needs than that of individuals with only mild limitations. The nature of informal care may also vary with the severity of limitations, with informal support to individuals with severe limitations being more likely to take the form of personal care and assistance with activities of daily living. Empirically, the relationship between informal

[13] Additional details on the items are provided in Appendix D.2.
[14] Details on sample selection are provided in Appendix D.1, Table D.I.

and formal care receipt is found to differ according to the level of of limitations (Bonsang, 2009; Balia & Brau, 2014). Finally, we posit that an altruist caregiver would have a different attitude towards a NH admission whether their parent has severe care needs or only mild limitations.

With these hypotheses in mind, we investigate the effect of informal care receipt on two non-overlapping sub-populations: individuals with severe limitations and individuals with only mild limitations. The former are defined as individuals being unable to perform at least 1 of the 2 hearing items, 1 of the 2 sight items or 1 of the 3 mobility items reporting poor or very poor health. Mild limitations refer to any limitation among the 7 OECD items, whatever its severity.

3.6 Descriptive statistics

The descriptive statistics are displayed in Table II.[15] Column (1) provides the mean characteristics for the full sample, while Columns (3) and (4) display these statistics for the sub-samples of those who receive informal care and those who do not receive any, respectively. In addition, we show the descriptive statistics among individuals with severe and mild limitations in Columns (7) and (9) respectively, so as to provide benchmarks for the estimation results.

As Panel A suggests, a NH admission is a rare event, as only 3.4% of the non-institutionalized 65+ have been admitted by the end of 2019; this proportion is 6.2% when considering individuals with limitations (Column (7)). We also observe in Columns (3) and (5) that the admission rate is much higher among individuals who receive informal care at the time of the survey than those who do not (13.0% against 1.8%). Unconditional old-age institutional care costs represent only a small fraction of total care costs (€1,084 on average over 2017-2018, against €16,319), which justify that we assess the effect of informal care on care costs at large.

Regarding informal care receipt, 14.2% of the population declare receiving some (Panel B); this share is much higher (27.0%) among individuals with severe than with mild limitations (4.5%).

Unsurprisingly, the share of daughters is close to 50%, with substantial cross-individual variation (Panel C). The distribution of the covariates is dis-

[15] Survey weights are used to account for unequal probability sampling and correct for selective non-response, so as to make the sample representative of the target population in terms age, gender, income, migrant background, household size, marital status, urbanization, municipality and health region of residence.

played in Panel D. The figures confirm that individuals who receives informal care are older, with a more deteriorated health through the occurrence of functional limitations, chronic illness, poor self-declared health or higher health care cost. Women receive more often informal care, but this might also be due to the fact that being a widow(er) increases the chances of receiving informal care, and that widowhood is more frequent among women. On the contrary, individuals with higher income or wealth appear less likely to receive informal care.

Table II: Descriptive statistics

Sample	Full sample						With severe limitations		With mild limitations	
Sub-sample	All		With IC		Without IC		All		All	
	Mean (1)	Std. (2)	Mean (3)	Std. (4)	Mean (5)	Std. (6)	Mean (7)	Std. (8)	Mean (9)	Std. (10)
Panel A: Outcomes										
Any nursing home use (2017-2019)	0.034		0.130		0.018		0.062		0.013	
Died by the end of 2019	0.101		0.265		0.074		0.163		0.055	
Any post-acute care use (2017-2018)	0.035		0.078		0.028		0.056		0.019	
Any skilled home care use (2017-2018)	0.176		0.436		0.133		0.281		0.098	
Any social care use (2017-2018)	0.153		0.428		0.107		0.274		0.062	
Total care costs (2017-2018)	16319	28101	38031	44729	12726	22323	24567	35729	10135	18313
Costs of old-age institutional care (2017-2018)	1084	9437	4846	20046	462.0	5880	2093	13119	328.0	5047
Costs of skilled home care (2017-2018)	1941	7289	7753	14268	979.7	4660	3797	10234	550.1	3149
Health care costs (2017-2018)	13293	21137	25431	29983	11284	18534	18676	25730	9256	15728
Panel B: Informal care receipt										
Informal care receipt	0.142		1		0		0.270		0.045	
Panel C: Characteristics of chidren										
Proportion of daughters	0.492	0.352	0.507	0.341	0.489	0.354	0.493	0.351	0.491	0.352
Number of children	2.418	1.137	2.689	1.428	2.373	1.075	2.497	1.254	2.359	1.037
Closest child is co-resident	0.081		0.076		0.082		0.079		0.082	
Closest child in the same municipality	0.569		0.628		0.559		0.594		0.550	
Closest child in a different municipality	0.349		0.295		0.357		0.325		0.366	
Panel D: Covariates										
Is a woman	0.527		0.656		0.506		0.589		0.482	
Never married or separated	0.072		0.054		0.075		0.081		0.066	
Widow	0.243		0.413		0.215		0.310		0.193	
Married or in a registered partnership	0.663		0.507		0.689		0.585		0.722	

To be continued

SAMPLE and NOTES: see bottom of the Table.

Table II: Descriptive statistics

Sample	Full sample						With severe limitations		With mild limitations	
Sub-sample	All		With IC		Without IC		All		All	
	Mean (1)	Std. (2)	Mean (3)	Std. (4)	Mean (5)	Std. (6)	Mean (7)	Std. (8)	Mean (9)	Std. (10)
Age:[65-70[	0.256		0.121		0.278		0.200		0.298	
Age: [70-75[	0.252		0.154		0.268		0.214		0.281	
Age: [75-80[	0.218		0.189		0.223		0.212		0.223	
Age: [80-85[	0.160		0.231		0.148		0.194		0.135	
Age: [85-90[	0.082		0.194		0.064		0.124		0.051	
Age: [90-95[	0.025		0.089		0.014		0.045		0.009	
Age: 95+	0.003		0.018		0.001		0.008		0.000	
Origin: Dutch	0.889		0.883		0.890		0.873		0.901	
Origin: Western country	0.088		0.089		0.087		0.092		0.085	
Origin: non-Western country	0.022		0.027		0.021		0.033		0.013	
Education: none	0.035		0.058		0.031		0.055		0.020	
Education: primary/intermediate secondary	0.549		0.612		0.538		0.593		0.515	
Education: higher secondary	0.200		0.158		0.207		0.170		0.222	
Education: higher	0.160		0.105		0.169		0.113		0.195	
Education: missing	0.054		0.064		0.053		0.066		0.046	
Income: quartile 1	0.293		0.399		0.276		0.373		0.233	
Income: quartile 2	0.272		0.285		0.270		0.283		0.265	
Income: quartile 3	0.235		0.182		0.244		0.201		0.261	
Income: quartile 4	0.197		0.132		0.208		0.141		0.239	
Wealth: quartile 1	0.223		0.155		0.234		0.179		0.255	
Wealth: quartile 2	0.283		0.342		0.273		0.344		0.237	
Wealth: quartile 3	0.270		0.307		0.264		0.284		0.260	
Wealth: quartile 4	0.222		0.194		0.227		0.191		0.246	
Is a homeowner	0.602		0.471		0.624		0.502		0.677	

To be continued

SAMPLE and NOTES: see bottom of the Table.

Table II: Descriptive statistics

Sample	Full sample						With severe limitations		With mild limitations	
Sub-sample	All		With IC		Without IC		All		All	
	Mean (1)	Std. (2)	Mean (3)	Std. (4)	Mean (5)	Std. (6)	Mean (7)	Std. (8)	Mean (9)	Std. (10)
Hearing limitations: no	0.855		0.739		0.874		0.682		0.984	
Hearing limitations: yes	0.125		0.241		0.106		0.293		0	
Hearing limitation: missing	0.018		0.018		0.018		0.023		0.015	
Sight limitations: no	0.876		0.770		0.894		0.721		0.993	
Sight limitations: yes	0.114		0.217		0.097		0.266		0	
Sight limitations: missing	0.008		0.011		0.008		0.011		0.006	
Mobility limitations: no	0.693		0.272		0.763		0.297		0.990	
Mobility limitations: yes	0.298		0.720		0.228		0.696		0	
Mobility limitations: missing	0.008		0.007		0.008		0.006		0.009	
Health: poor/very poor	0.084		0.252		0.056		0.197		0	
Health: average	0.402		0.553		0.377		0.504		0.326	
Health: good/very good	0.506		0.184		0.559		0.290		0.668	
Health: missing	0.006		0.009		0.005		0.007		0.005	
Chronic illness: no	0.411		0.162		0.452		0.259		0.524	
Chronic illness: yes	0.574		0.823		0.533		0.724		0.462	
Chronic illness: missing	0.014		0.014		0.014		0.015		0.013	
Costs on GP care in 2015	215.5	141.3	283.7	209.8	204.2	122.8	245.5	169.9	192.9	110.0
Costs on drug care in 2015	665.6	2164	1276	4013	564.6	1649	955.6	3056	448.2	1039
Costs on auxiliary care in 2015	283	807.9	642.1	1330	224.7	665.7	426.2	1018	177.3	581.5
Costs on hospital care in 2015	2778	7911	5214	13453	2375	6469	3747	9938	2051	5850

SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386).
NOTES: IC stands for informal care receipt. Costs are expressed in current euros. Weighted means and standard deviations in parentheses, omitted for dummy variables.

4 Empirical approach

4.1 A recursive bivariate probit model for binary outcomes

We present our estimation method for binary outcomes, namely the probability of being admitted to a NH, mortality, any post-acute care use and home care use. We specifically present the methodology for the probability of being admitted to a NH because it our main outcome, but the same approach is used for all other binary outcomes.

We define y_i^* a latent variable capturing the propensity to use NH care in the years following the survey for individual i. We assume it can be expressed as:

$$y_i^* = X_i^y \beta_1 + \beta_2 IC_{i2016} + v_i \tag{1}$$

where IC_{i2016} is the dummy for informal care receipt. X_i is a vector of control variables. y_i^* cannot be observed, but we observe whether individuals have used NH care (y_i=1) or not (y_i=0) following the survey. We assume the following observational scheme:

$$\begin{cases} y_i = 0 & \text{if} \quad y_i^* \leq 0 \\ y_i = 1 & \text{if} \quad y_i^* > 0 \end{cases}$$

We also assume that latent variable IC_{i2016}^* captures the propensity to receive informal care and can be expressed as:

$$IC_{i2016}^* = X^{IC\prime} \gamma_1 + u_i \tag{2}$$

where X^{IC} and u_i are respectively observed and unobserved determinants of informal care receipt for individual i. We assume that:

$$\begin{cases} IC_{i2016} = 0 & \text{if} \quad IC_{i2016}^* \leq 0 \\ IC_{i2016} = 1 & \text{if} \quad IC_{i2016}^* > 0 \end{cases}$$

β_2 in Equation (1) is our main parameter of interest: it represents the effect of informal care receipt on the propensity to use NH care in the subsequent years. However, estimating Equation (1) may result in biased estimates: IC_{i2016} may be endogenous if some of the unobserved determinants of informal care receipt (included in u_i), like health issues or preferences over alternative care options, also affect the propensity to use NH care, and generate unwar-

ranted correlation between v_i and IC_{i2016} (Jones, 2000).

In order to address this endogeneity issue, we jointly estimate Equations (1) and (2) through a maximum likelihood estimation of a recursive bivariate probit model. The estimation relies on the parametric assumption that the error terms of the two equations jointly follow a bivariate normal distribution with means of 0 and a correlation denoted ρ. The average treatment effect (ATE) of informal care on NH use, which is our *treatment* parameter of interest, is defined as:

$$ATE^{bin} = E\left[P(y = 1|IC = 1, X^y)\right] - E\left[P(y = 1|IC = 0, X^y)\right] \quad (3)$$

Without exclusion restrictions, i.e. when the two sets of regressors X^y and X^{IC} perfectly overlap, the parameters β_1,β_2,γ_1 and ρ underlying the ATEs are not point identified (Mourifié & Méango, 2014; Han & Vytlacil, 2017). We ensure point identification using an exclusion restriction, i.e a variable Z_i that affects y_i^* only via their impact on informal care receipt. We will present instrument Z in Section 4.3.

4.2 A control function approach for continuous outcomes

To investigate the effect of informal care on care costs, we use a control function approach that consists of a two-stage estimation procedure (Wooldridge, 2014, 2015). Details are provided in Appendix F. We use a Poisson quasi maximum likelihood estimator (also called pseudo Poisson maximum likelihood or PPML) to model the second stage, i.e. care costs. This estimator is a consistent estimator of the average effect of informal care receipt on the expected value of the outcome and behaves well irrespective of the proportion of zeros on the outcome and the form of heteroskedasticity (Santos Silva & Tenreyro, 2011). This estimator also requires an instrumental variable to identify a causal effect.

4.3 Instrumenting informal care by the proportion of daughters

In the context of our study, an instrument must satisfy two conditions: (i) it must correlate with informal care receipt (relevance); (ii) it must affect the propensity to use care or die only via its impact on informal care receipt and

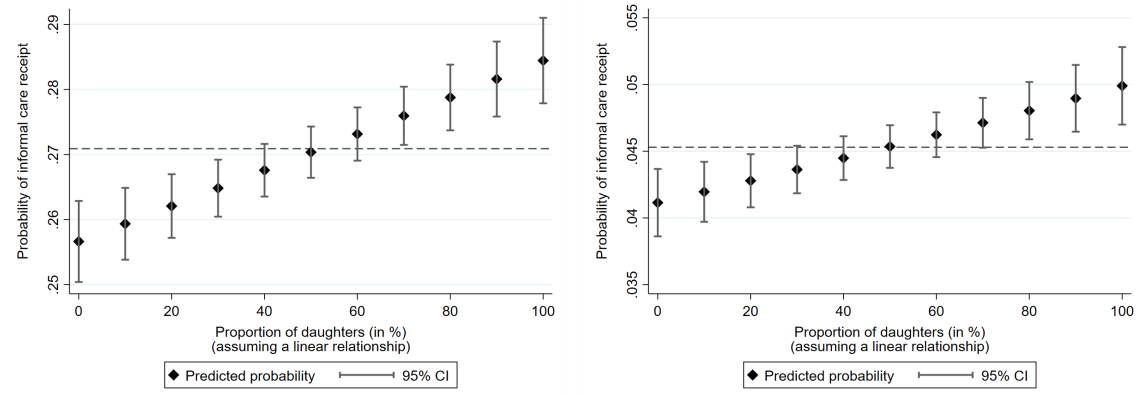
be uncorrelated with omitted variables (exogeneity). The economic literature interested in the effect of informal care on formal care use has proposed a number of instruments for informal care receipt. Drawing on previous studies (Bonsang, 2009; Van Houtven & Norton, 2004; Charles & Sevak, 2005; Sasso & Johnson, 2002), we use the gender mix of children, for two reasons. First, daughters are found to be more likely to provide informal care than sons (Byrne *et al.*, 2009; Carmichael & Charles, 2003).[16] Second, in the Netherlands there is no evidence that the gender of births could be manipulated. Conditional on the number of children, the proportion of daughters is expected to be random and have no effect on care use and mortality per se. We believe this instrument meets the exclusion restriction.

The relevance condition is supported by the positive relationship between informal care receipt and the proportion of daughters we document empirically. Panel A of Figure 1 shows that, among individuals with severe limitations, the probability of informal care receipt is predicted to be less than 26% for individuals with no daughter but to exceed 28% for those who have only daughters, when controlling for covariates. Similarly, Panel B shows a similar relationship among individuals with mild limitations.[17]

[16]The main reasons evoked in the literature are a lower opportunity cost for women (Byrne *et al.*, 2009; Carmichael & Charles, 2003), a higher effectiveness in caregiving, a lower disutilty of caregiving (Byrne *et al.*, 2009) and gender norms (Barigozzi *et al.*, 2020).

[17]Figure G.1 in Appendix G.1 confirms that the relationship holds in the study population as a whole.

Figure 1: The probability of informal care receipt increases with the proportion of daughters.



Panel A: Individuals with severe limitations.

Panel B: Individuals with mild limitations.

SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations, either severe (left panel, N=48,588) or mild (right panel, N=64,978).

NOTES: Panel A (resp. B) represents the predicted probability of informal care receipt as a function of the proportion of daughters for individuals with severe (resp. mild) limitations, as derived from a probit regression. Regressions are unweighted, include covariates and assume a linear relationship between the proportion of daughters and informal care. In Panel A (resp. B) the dashed horizontal line represents the average probability of informal care receipt in the sub-population with severe (resp. mild) limitations.

5 Results

5.1 The causal effect of informal care receipt on nursing home entry

We start by showing how informal care is predicted to affect subsequent NH care use. Table III displays the average treatment effect (ATE). Columns (1) and (2) show the ATEs for the full population with functional limitations, while Columns (3) and (4) (resp. (5) and (6)) display the ATEs for individuals with severe limitations (resp. mild limitations). For each population, two estimates are displayed. In Columns (1), (3) and (5), informal care receipt is assumed to be exogenous: technically, the correlation of unobserved heterogeneity ρ is set to 0. In Columns (2), (4) and (6), we relax this constraint and tackle the potential endogeneity of informal care by using the proportion of daughters as an instrument.

The results reveal different patterns depending on whether informal care receipt is assumed to be endogeneous or not. When assuming exogeneity, informal care receipt is predicted to *increase* NH care use whether functional limitations are severe or mild. However, in Columns (2), (4) and (6) ρ is statistically significantly different from 0 and positive, indicating that unobserved factors correlating with informal care receipt tend to be positively associated with unobserved determinants of NH care use (think about unobserved health factors). Therefore, our preferred specifications are those with informal care treated as endogenous. Looking at the full population, we find a point estimate very close to 0, but this hides striking heterogeneity. For individuals with severe limitations, informal care receipt is predicted to *increase* the probability of a NH admission by 2.9 percentage points (relative to a 6.3% mean). At the 5% we cannot rule out an ATE as low as 1.1%-pt and as high as 4.7%-pt, but we can reject it is null even at the 1% level. Turning to the sub-population with mild limitations, informal care is predicted to *decrease* the probability of a NH admission by 1.3%-pt (mean is 1.3%).

Overall, our results indicate that when limitations are moderate, informal care can prevent or postpone a NH admission, but it can hasten it when the care recipient has severe limitations. These effects are already detectable in the short-run, as for the latter group informal care is found to increase the probability to have been admitted in 2017 already (Figure H.1, Appendix H.2). These additional estimates suggest that, for both sub-populations, the effects of informal care on NH entry build up over the years.

Table III: Average treatment effect of informal care receipt on the probability to enter a nursing home, depending on the severity of limitations.

Population	Full population		Individuals with severe limitations		Individuals with mild limitations	
	(1)	(2)	(3)	(4)	(5)	(6)
IC can be endogenous	No	Yes	No	Yes	No	Yes
Instruments	-	% daughters	-	% daughters	-	% daughters
ATE	0.039***	0.002	0.058***	0.029***	0.028***	-0.013***
	(0.002)	(0.004)	(0.003)	(0.009)	(0.003)	(0.003)
ρ		0.285***		0.609***		0.139***
		(0.039)		(0.067)		(0.047)
N	113386	113386	48588	48588	64798	64798

SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386).
NOTES: ATE stands for the mean average treatment effect of informal care receipt at the time of the survey (IC) on the probability of being admitted to a nursing home between January 1st 2017 and December 31st 2019. Estimation of a bivariate probit model, including covariates, under two alternative hypotheses: in Columns (1), (3) and (5), informal care is assumed to be exogenous. In Columns (2), (4) and (6), informal care is assumed to be possibly endogenous and instrumented by the proportion of daughters.

We briefly comment on the effects of the covariates, for which we report the raw coefficients in Table H.1 (Appendix H.1). As expected, the probability of transitioning into a NH increases with age, the presence of a chronic disease and past health care expenditures, but decreases with better self-reported health. We also find that being in the top income quartile and home-ownership decrease the probability of a an admission, while wealth has a non-monotonous effect, in line with Tenand, Bakx & van Doorslaer (2020). Having an immigration background from a non-Western country decreases the probability of transitioning into a NH for individuals with severe limitations.

5.2 The effect of informal care on post-acute care use and mortality

Our finding that informal care receipt may foster a NH admission for individuals with severe functional limitations contrasts with available evidence. One hypothesis is that 'nursing home care' has a specific definition in the US context and data. The US studies capture the effect of informal care on an indicator that combines two types of stays: admissions with an expected *permanent* nature, and admissions to facilities providing post-acute and rehabilitative care, with an expected *temporary* nature.[18] With the results of Section 5.1, we provide evidence on how informal care receipt specifically affects the former.[19]

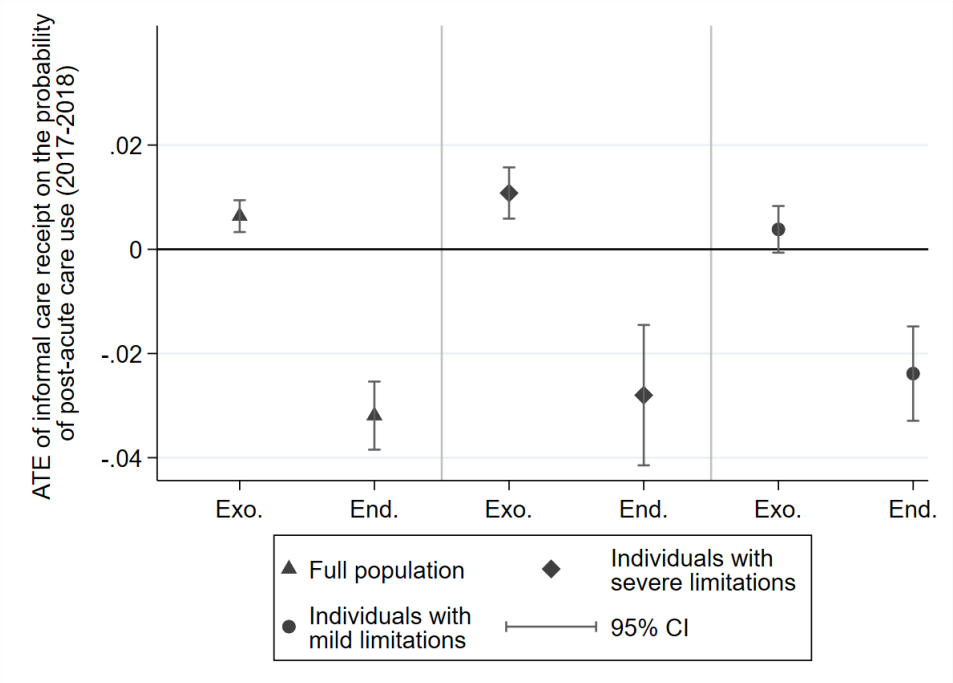
To explore the consistency of our findings with the US literature, we additionally estimate the effect of informal care on the probability of using post-acute care. Figure 2 shows the ATEs for the 3 samples, whether endogeneity of informal care in post-acute care is addressed or not. When correcting for endogeneity, informal care is predicted to *decrease* the probability of using post-acute care, by -2.4%-pt and -2.8%-pt for those with mild and severe limitations respectively (both statistically significant at the 1% level). 3.5% individuals have used post-acute care in 2017 or 2018 (2.0% among individuals with mild limitations and 5.7% among those with severe limitations; cf. Table II), such that the effect of informal care proves to be substantial.

This effect could be either due to informal care reducing the occurrence of adverse health events that necessitate post-acute care, or to informal care resulting in a lower use of such care in the occurrence of an adverse health event, if the presence of informal caregivers makes at-home recovery a more feasible option. Although we cannot disentangle between the two, whatever the prevailing mechanism we may interpret the reduction in post-acute care

[18] The definition in the Health and Retirement Survey (HRS), leveraged in Charles & Sevak (2005); Sasso & Johnson (2002); Van Houtven & Norton (2004), encompasses any overnight stay in 'a nursing home, convalescent home, or other long-term health care facility'. It is expected to include rehabilitative care and skilled nursing care facilities (SNFs), where elderly patients with a temporary health condition or discharged from a hospital stay can be admitted temporarily. Hackmann & Pohl (2018) leverage register data from four US states and document that the rate of discharges to the community for stays in SNFs is 45%. Using comparable data from the US and the Netherlands, Bom (2021) shows that the probability of *any* NH admission is higher in the US than in the Netherlands even when controlling for disability, but the probability of a prolonged stay (over 100 days) is substantially higher in the Netherlands than in the US.

[19] Appendix E.2 provides additional descriptive statistics on NH stays, showing that, in the Netherlands, only a minority of the 65+ admitted to a NH with an indication for a permanent stay are eventually discharged.

Figure 2: Average treatment effect of informal care receipt on the probability of post-acute care use, depending on the severity of limitations



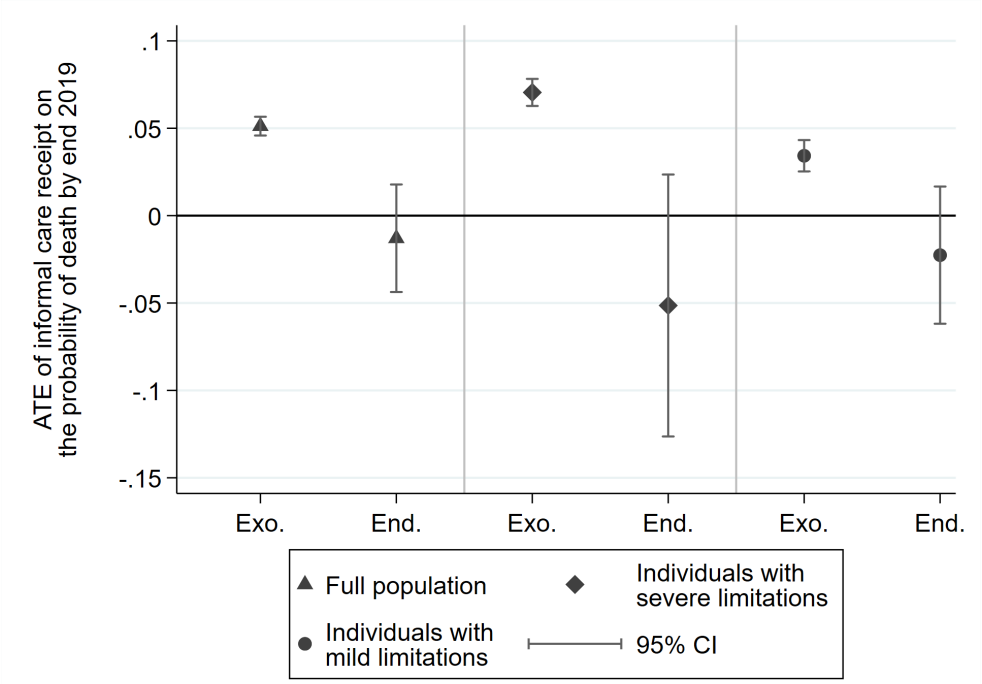
SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386), either severe (N=48,588) or mild (N=64,978).
NOTES: ATE stands for the mean average treatment effect of informal care receipt at the time of the survey (IC) on the probability of using post-acute care between 1st 2017 and December 31st 2018. Estimation of a bivariate probit model, under two alternative hypotheses: EXO.: assuming the exogeneity of informal care receipt, END.: assuming endogeneity of informal care and instrumenting it by the proportion of daughters.

use as a welfare-enhancing effect of informal care if avoidable admissions to a rehabilitation facility can prove detrimental to well-being of older patients. One condition for such an interpretation is that informal care does not translate into a higher mortality risk (in which case a reduction in post-acute care use over the period could mechanically arise, even in the absence of a decrease in post-acute care use at a given time). In addition, our finding that informal care receipt increases the probability of a NH admission for individuals with severe functional limitations raises the concern that informal care might be detrimental for the health and functional status of the recipient.

To test this hypothesis, we further estimate the causal impact of informal care on 3-year mortality (at 10.2% in the study population). As shown in Figure 3, the ATEs are quite imprecisely estimated when we address the endogeneity of informal care, such that we cannot reject a null effect even at the 10% level. However, all point estimates are negative. There is therefore

no evidence that informal care receipt results in an increase in mortality, or that the higher NH admission rate over the period for individuals with severe limitations comes at a cost in terms of medium-run survival.

Figure 3: Average treatment effect of informal care receipt on 3-year mortality, depending on the severity of limitations



SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386), either severe (N=48,588) or mild (N=64,978).
NOTES: ATE stands for the mean average treatment effect of informal care receipt at the time of the survey (IC) on the probability to have died by December 31st 2019. Estimation of a bivariate probit model, under two alternative hypotheses: EXO.: assuming the exogeneity of informal care receipt, END.: assuming endogeneity of informal care and instrumenting it by the proportion of daughters.

5.3 Informal care and formal home care

So far, our analysis has left aside the fact that individuals in the community may benefit from skilled home care as well as from social care (cf. Section 2). Formal care in the community may play a part at two levels. First, formal care use at the time of the survey (call it *contemporaneous* use) may depend on whether individuals receive help from their relatives. If informal care and home care are substitute (resp. complement), individuals who receive informal care would tend to receive less (resp. more) formal home care, which could *per se* have an impact on subsequent health and NH entry.[20] Not taking into account contemporaneous formal care might induce an omitted variable bias in our estimates. Second, access to home-based formal care in the years following the survey (call it *subsequent* use) may be one *mechanism* through which informal care causally affects NH entry. If the support of relatives induces individuals to resort e.g. to less skilled home care, this might ultimately result in a health deterioration and higher NH entry.

In order to examine these two channels, we run two analyses. For the first, we check the robustness of the baseline estimates to the inclusion of *contemporaneous* social care and skilled home care receipt. For the second, we estimate the causal effect of informal care receipt on the probability to receive *subsequent* social care or skilled home care. Detailed results are presented in Appendix I.

The point estimates are roughly unchanged when controlling for *contemporaneous* formal care. The only notable change is that the ATE for mortality among individuals with severe limitations increases in magnitude when we control for log-spending on skilled home care and statistical precision increases.[21] A downside of this test is that it does not formally address the potential endogeneity of formal home care. However, together with previous evidence showing only limited substitution between informal care and formal home care (Balia & Brau, 2014), the robustness of our results gives us confidence that we do not confound the effect of informal care with that of lower home care receipt.

When assessing the effect of informal care on *subsequent* use, we find that informal care decreases the probability of receiving skilled home care within 2

[20] Especially when limitations are severe, informal care tends to be associated with formal home care. Table E.1 in Appendix E.1 map out the combinations of informal care, skilled home care and social support in our study population.

[21] Taking into account skilled home care use might capture unobserved health issues and thus achieves higher precision.

years. For individuals with mild limitations, the decrease is of 13.4%-pt (for a benchmark, 28.2% of this population has subsequent skilled home care use). The effect for individuals with mild limitations is of a lower magnitude but also significant (-6.8%-pt, for a population mean of 9.8%). Social care receipt also decreases, but the effect is of a smaller magnitude.[22] To better understand the mechanisms at play and bring the societal perspective into the picture, we turn to examining how informal care impacts on the formal care costs.

5.4 Effect of informal care receipt on care costs

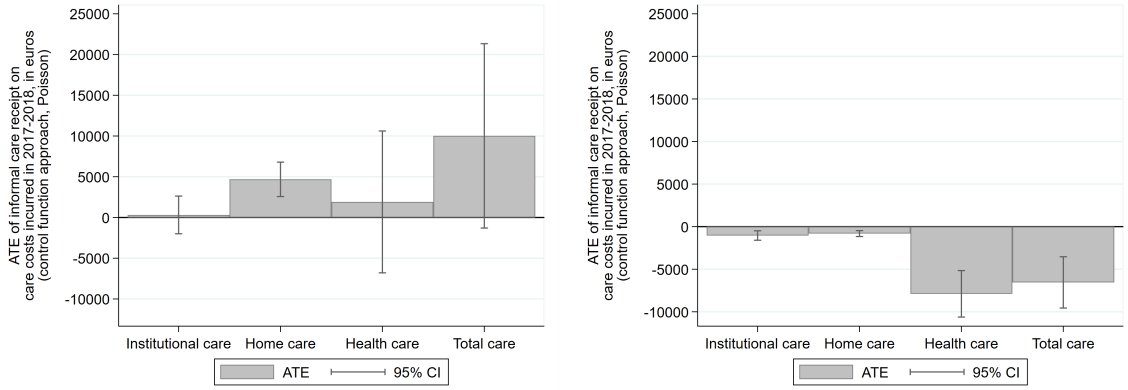
Figure 4 shows the ATEs of informal care on care costs incurred in 2017 and 2018, among individuals with severe limitations (Panel A) and individuals with mild limitations (Panel B). Total care costs are broken down into three main categories: (i) costs of old-age institutional care, (ii) skilled home care and (iii) health care. On average, care costs incurred in 2017-2018 reach €25,000 for individuals with severe limitations and 2.5 times less for individuals with mild limitations, with substantial heterogeneity within each population (cf. Panel A, Table II).

For individuals with severe limitations, informal care is predicted to increase total care costs, with a 90% confidence interval ranging from €500 to €19,500. The increment in skilled home care costs is statistically different from 0 at the 1% level: informal care receipt would increase these costs by €5,000, or 0.5 of a standard deviation for this population. We documented earlier a negative effect of informal care on skilled home care use at the *extensive* margin: the positive ATE on unconditional costs suggests that informal care increases skilled home care use at the *intensive* margin. This could be explained by the relatives involved in caregiving being able to realize the severity of the health condition of the care recipient and helping securing suitable formal care. The ATE on institutional care is very close to 0, possibly because NH residents maintain a better health when they received prior informal care.[23] While total health care costs are suggested to increase with informal care, zooming in on hospital care costs (Panel A of Figure H.3, Appendix H.3) reveals a strong negative effect of informal care, which brings further support to the hypothesis that informal care contributes to preserving the health of recipients even at

[22] When estimating the ATEs on *subsequent* social care and skilled home care use, our favorite specification includes controls for *contemporaneous* formal care receipt. See justification in Appendix I. Results remain qualitatively similar when we do not control for these variables.

[23] In a NH, unit costs are higher when the patient has lower health or functional status, cf. Appendix C.

Figure 4: Average treatment effect of informal care receipt on subsequent care costs, depending on the severity of limitations.



Panel A: Population with severe limitations (N=45,588).

Panel B: Population with mild limitations (N=64,798).

Sample: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386).
Notes: This Figure reports the average treatment effect (ATE) of informal care receipt on different costs incurred over 2017 and 2018. Costs are expressed in current euros. Estimation of a control function model combining a probit regression and a Poisson regression, instrumenting informal care receipt by the proportion of daughters. All specifications include control variables.

high level of limitations.

For individuals with mild limitations, ATEs are much more precisely estimated and allow to conclude that informal care generates across-the-board cost savings: reduction in costs on nursing home care and skilled home care are of a small magnitude (in line with the low use of such care in this population) while informal care is predicted to significantly decrease subsequent health care costs. Savings on total costs would amount to €6,500. Informal care provision to individuals with mild limitations seems to preserve their health capital, and ultimately helps reducing the use of formal LTC and health care.

6 Discussion

6.1 Contributions and policy implications

Our study provides evidence on the causal effect of informal care on NH admissions with an expected permanent nature while also assessing its effect on care costs at large and potential health responses. A back of the envelope calculation suggests that informal care contributed to 9% of the NH admissions

of the 65+ (with children) between 2017 and 2019. Had all individuals received informal care, we would have observed 10,000 *less* admissions among those with mild limitations but 14,000 *more* admissions among those with severe limitations.[24]

We add to the literature on the relationship between informal care and formal LTC use. Available studies mostly find that informal care results in a lower probability of subsequent NH admissions (Charles & Sevak, 2005; Sasso & Johnson, 2002). We offer several hypotheses for the discrepancy between these papers and some of our findings.

First, the effect of informal care on the recipient's health capital and formal care use may differ depending on initial health capital. Unlike previous studies, we are able to stratify the analysis by the severity of limitations. Our results support the assumption that informal care is critical for individuals in relatively good health, in preventing a deterioration such that round-the-clock care becomes necessary. For individuals who may already need such care, informal caregivers can instead help triggering a timely NH admission, by making them aware of their situation, claiming a needs assessment and helping with the many administrative and practical tasks involved in a permanent NH admission. Relatives may play there a critical role, especially as the Dutch needs assessment agency does not perform outreach actions towards potential beneficiaries.[25]

The second explanation is that NH in the US (literature) combines post-acute care with care for individuals with permanent round-the-clock care needs, while our data identify the latter separately. Informal care could well prevent health shocks or allow individuals to return to their home after an acute care episode, but not similarly delay permanent admissions. Consistent with this, we document that informal care substantially decreases the probability of post-acute care use, also for those with high care needs. However, this hypothesis may not explain the discrepancy between our findings and that of Charles & Sevak (2005), who find that informal care receipt reduces the probability of a stay longer than 100 days.

A third, related explanation is that the US and the Netherlands differ markedly in terms of public funding of LTC, not only for institutional care but also for home care. In the US, the coverage of home-based care services is limited, and was even more so in the 1990s, when the data used in Sasso

[24] See Appendix J. for details.

[25] The presence of informal caregivers could also play as a signal for needs assessors, of a high care need, although it is not among the official criteria taken into account for eligibility decisions in the Netherlands.

& Johnson (2002); Charles & Sevak (2005); Van Houtven & Norton (2004) were collected. In the Netherlands, as in continental and Northern European countries, public coverage on domestic help, personal care and nursing care at home is more comprehensive. It is therefore possible to read available US evidence as: 'at-home support contributes to ageing in place' while our results are indicative of how receiving support from relatives *next to* access to formal home care affect the use of institutional care at old age.[26] We believe that the latter is more informative of the current policy debates on the role of informal care in aging policies. Acknowledging the lack of medical skills of informal caregivers and the burden that intensive caregiving places on them, many countries engage in the promotion of informal care while working on improving access to high quality, skilled home care.

What should policy makers read from our results? First, informal support can slow down the health deterioration of older people, even when formal home care is accessible, and contribute to savings on formal care costs. Second, informal care should not be expected to generate similar savings in the medium run for individuals with severe limitations. However, support from relatives may remain welfare-improving. Previous studies from the Netherlands suggest that postponing a NH admission when care needs are high do not systematically generate cost savings (Bakx *et al.*, 2020), nor improve the well-being of older individuals (Bom *et al.* (2019)). The positive effect on survival and the only small increase in institutional care costs that we find support the idea that informal care helps individuals to receive adequate formal home care and fosters a timely NH admission.

6.2 Validity and robustness checks

The effect of informal care receipt differs by gender

For conciseness, we provide the results from the gender heterogeneity analysis in Appendix H.4. Our key result is that, among individuals with severe limitations, informal care significantly increases NH care use for women but has no effects for men. This could reflect that men are more likely to receive (intensive) care from a partner and stay at home, while women are more likely to be helped by children, with less hours provided. Informal care may therefore have heterogeneous effects depending on how it is provided.

[26] Or put it differently: in the absence of comprehensive and publicly-subsidized home care services, the US elderly with high care needs may have no other option but to enter a costly NH, unless they can rely on informal caregivers.

Robustness to the use of alternative instruments

We use the gender mix of children as our baseline instrument, assuming a linear relationship between the proportion of daughters and informal care receipt. We check that our results are robust to alternative functional forms for the gender mix, namely having a daughter or not and the proportion of daughters as a categorical variable. ATEs are very similar (cf. Tables I.I and I.II, Appendix I.2).

In addition, we use alternative instruments: the number of children and their geographical distance. Empirically, the more children and the closer they are, the higher the probability of informal care (see Figure G.4 in Appendix G.2). Previous literature have used these variables as instruments for informal care in studying formal home care use or NH admissions (see e.g. Bonsang (2009); Stern (1995); Charles & Sevak (2005)). We replicate the bivariate probit estimations on binary outcomes and the Poisson control function estimations on continuous outcomes with these instruments. As shown in Appendix I.1 (Figures I.1, I.2 and I.3), the ATEs are very close to the baseline.

All our instruments impose us to focus on individuals *with* children, such that our estimates should be read as ATEs among this population. We expect this not to reduce the scope of policy implications: the possibility to stimulate informal care among those *without* children (for whom spouses are the main source of care and are very often involved) is arguably limited.

Robustness of the bivariate probit estimates

Our main estimates derive from a recursive bivariate probit. A linear two-stage regression, or 2SLS, is an alternative approach that does not require any distributional assumption on the error terms u and v. However, we did not retain this estimator because of its poor performance when the probability of treatment is low (i.e inferior or equal to 10 percent). It delivers very large standard errors, as shown by Chiburis *et al.* (2012), such that statistical tests become uninformative. Even for a relatively large sample size, the 2SLS estimate remains biased Chiburis *et al.* (2012). In addition, it would provide the ATE among compliers (LATE) rather than the ATE, which in our context would have limited policy relevance (Angrist & Pischke, 2008).

Finally, the bivariate probit has been shown to be robust to a range of misspecifications. In a simulation study, Denzer (2020) find that 'the non-linear maximum likelihood recursive bivariate probit estimator dominates in

a majority of scenarios, even if the corresponding parametric assumptions are not fulfilled'. We are therefore confident that our findings are not driven by arbitrary assumptions. Out of completeness, we provide the 2SLS estimates in Table I.1, Appendix I, which show large *positive* treatment effects of informal care on NH use, with extremely wide standard errors.

Data limitations

Despite their richness, our data have three main limitations. First, the construction of our instruments leverages the linkage between a respondent's identifier and their children's identifiers. This linkage is not perfect, as explained in Appendix C.3. There can be small measurement errors on the number of children. Conditional on our rich set of control variables, we expect the measurement errors to be independent from the outcomes, and see no reason why they would correlate with the effects of informal care we are interested in. Furthermore, there is no reason why measurement errors would be more frequent for daughters than for sons, such that the proportion of daughters is unlikely to be systematically biased.

Second, in the Health Monitor survey, informal care is measured in a broad sense: it may be ADL-related care, but also keeping company or arranging finances (excluding moral support). Sasso & Johnson (2002) find that ADL-related care prevents NH admissions, but other types of informal care do not. We are not able to similarly test for heterogeneity across tasks.

Third, the costs incurred for the social care provided by municipalities could not be included in total costs. However, these costs represent 5% of the costs we are able to measure (Appendix B).[27]

7 Conclusion

Most developed countries attempt to foster aging in place and encourage care provided by relatives to reduce LTC costs. We examine the claim that informal care decreases NH admissions and ultimately results in savings on formal care. While we find this is the case when informal is provided early ahead of the disablement process, we also show that informal care *increases* NH admission and formal care costs for those with severe limitations. In setting orientations with respect to informal care and ageing in place, policy

[27] We also ignore institutional care other than elderly care, but after age 65 admissions to handicap centers and psychiatric hospitals are rare.

makers should balance these extra costs with the benefits in terms of health and well-being of an earlier admission, also taking into account the societal costs of informal care provision.

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Supplementary Material.

Does informal care delay nursing home entry? Evidence from Dutch linked survey and administrative data

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Contents

A Related literature: empirical evidence on the effect of informal care receipt on nursing home care admissions

In this Appendix, we provide a more detailed review of the economic literature that has studied the effect of informal care on nursing home (NH) care use. We can distinguish between two strands: a strand that explicitly assesses the relationship between these two variables, and a literature that provides indirect evidence on this relationship.

We start with the former. Early work from Newman *et al.* (1990) exploits the 1982 and 1984 waves from the US National Long Term Care survey. The authors focus on individuals who were ill in 1982 and monitor their NH stays longer than 90 days. They find evidence that informal care reduces the probability of a (prolonged) NH stay only when provided by a spouse or someone living less than 10 minutes away. The author argues that their result might reflect the fact that care provided by a co-resident or someone living nearby is potentially more effective, due to higher availability throughout the day and night.

This early study is however limited by the fact that it does not account for the potential endogeneity of informal care receipt, which Charles & Sevak (2005) tackle. Using US data from AHEAD/HRS survey from 1993, 1998 and 2000, they focus on individuals who were living in the community in 1993. They find that informal care receipt in 1993 *increases* the likelihood of a NH transition - over both 1993-2000 and 1998-2000 periods - when informal care is assumed to be exogenous; this effect becomes *negative* when informal care is instrumented by interactions between the gender of children, their location and their marital status. The reduction is suggested to be driven by a reduction in long stays (more than 100 days) in NH. Also using the AHAED/HRS surveys, Sasso & Johnson (2002) estimate the probability of transitioning into a NH between 1993 and 1995. They focus on individuals living in the community in 1993 with a least one child, and use children's characteristics as instruments for informal care receipt at home in 1993. ADL-related care receipt is found to reduce NH entry within three years, but informal care defined in a broader sense is not found to significantly affect the risk of a NH admission.

Van Houtven & Norton (2004) similarly use children characteristics as instruments for the total hours of informal care received from children, with data from AHEAD (1992) and HRS (1995). By contrast with Charles & Sevak (2005) and Sasso & Johnson (2002), they focus on *contemporaneous* effects. More hours of informal care decrease the probability to use NH care over a two-year recall period, while not impacting on the conditional duration of stay. Taking a different approach, Stern (1995) estimates a semi-structural model of long-term care arrangements and uses its parameters to conduct policy experiments. He

shows how the availability of potential caregivers and their geographic proximity - which increase the likelihood of using informal care - are important factors in reducing the likelihood of NH use.

In addition, a number of studies have provided more indirect empirical evidence. Gentili *et al.* (2017) study the effect of cultural norms on LTC arrangements. They exploit the difference in norms relating to family ties in Switzerland and find that, contrary to German-speaking individuals, French speakers are more likely to rely on informal care, use more home care and enter later in NH when having a poorer health. German-speaking individuals are also more likely to enter a NH from their home than the French-speaking, who are more likely to transition into a NH from another institution (e.g. a hospital). Although it provides suggestive evidence than informal care may delay NH entry, this analysis is limited by the fact that it relies on different (not linked) datasets, some containing only aggregated variables while others contains individual data. Using HRS data, Goda *et al.* (2013) find that becoming a widow increases the likelihood of NH entry and the number of institutionalized nights. As widowhood may proxy for a loss of intra-household informal care provision, their finding might reflect the fact that a reduction in informal care receipt results in an increase in NH use - although widowhood entails other negative psychological and health effects that may affect NH admissions on their own. Headen (1993) report that both the number of cohabitants and the number of children outside the household reduce the hazard of NH entry. More recently, Mommaerts (2018) finds that the presence of a Medicaid spend-down provision decreases the probability of co-residence with an adult child and increases nursing home use by 1–4 percentage points for individuals aged 80 and older. Although informal care receipt is not observed in any of these last two studies, co-residence may play as a proxy for informal care receipt.

B Additional information on the organisation of long-term care and health care in the Netherlands

In this section we provide more details in the institutional background in the Netherlands on access to nursing homes, formal home care and the out-of-pocket costs for different LTC services.

Nursing home care

The Long Term Care Act (WLZ) is a national-level social insurance covering all individuals with functional or cognitive limitations of a permanent nature. To be granted eligibility, one needs to apply for a need assessment to the independent central assessment agency (CIZ). Health care providers and family members may also apply on behalf of the individual. An assessor determines whether an individual meets the national-level eligibility criteria (the existence of physical or self-management problems that make round-the-clock supervision necessary to avoid self-injury or further deterioration of the condition of the applicant).

The eligibility decision comes with an indication for the type of institutional setting (nursing home, mental care facility, handicap center etc.) and the appropriate combination and intensity of care. Once eligible, the applicants can choose whether and when they enter an institution; alternatively, they can receive in-kind care at home or vouchers to hire their own caregivers (Hussem *et al.*, 2020). The former two options are chosen by a minority of those eligible for residential care: in 2017, among the WLZ-care recipients aged 65 or older, 83% received care in a regular nursing home .

The Dutch LTC system is often considered as a non-carer blind system, to the extent that household members are expected to provide 'usual care' for one another, i.e. daily help with house chores (Mot, 2010).[1] However, this does not apply to nursing home care: the availability of potential informal caregivers is not listed among the criteria taken into account when deciding upon eligibility (CIZ, 2015). Conditional on application, eligibility therefore depends only on whether they have reached a certain cutoff in terms of functional limitations.

Substitute home-based care

When living in the community, the Dutch can benefit from publicly-subsidized home care. Skilled home care (personal and nursing care) is financed through the Health Insurance Act (ZVW). This scheme is managed by private insurance companies, which are in

[1] See the definition from the Ministry of Health and Social Affairs in Appendix C.4.

charge of insuring the Dutch population for their health care expenditures. Contracting and provision of care is managed at the regional level by a purchasing agency, which mandates community nurses for conducting the needs assessments of applicants.

The Social Support Act (WMO) covers personal assistance, domestic help and social support for individuals living in the community. It is managed by municipalities that contract with providers and choose freely eligibility criteria and how individuals' needs are assessed. Basic services (e.g. meals-on-wheels, help with grocery) are widely available while more tailored services (e.g. domestic help, house adaptation, temporary institutional stays) are available only for individuals who are not capable of arranging enough support from their social network. This means that, if one person has some potential informal caregivers who can provide assistance, benefits can be denied.

Out-of-pocket costs of LTC

The costs of institutional care and social support are partly charged to the users through resource-dependent co-payments. The median annual co-payments paid in 2016 for nursing home care users amount to 33% of disposable income (Bakx *et al.*, 2020). Co-payments for social support are very small.[2] Skilled home care is exempt from out-of-pocket costs. Incentives to opt for home care rather than nursing home use are stronger for richer individuals, as shown in Tenand *et al.* (2020); Hussem *et al.* (2020).

Health care coverage

For health care (other than LTC), the Dutch population benefits from a mandatory health insurance coverage. In most cases, care is exempt from co-payments. However, a mandatory deductible applies yearly on the first €385 of care; in exchange of rebates on their insurance premiums, individuals can opt for a higher deductible (up to €885) (values of 2020). A unified health care system is in place, with virtually no private care supply, such that all health care use is registered in individual health insurance claims. Post-acute care use is covered under the Health Insurance Act.

Health care spending and relative size of the schemes

In 2015, total spending on health care and long-term care in the Netherlands reached 80.1 billion euros (CBS, 2021*c*).[3] Skilled home care and post-acute care (funded by the Health Insurance Act, ZVW) represented together a budget of 3.9 billion euros, while the budget of the social long-term care insurance (WLZ) amounted to 17.8 billion euros

[2]The median annual co-payments on care funded via the Social Support Act were of €267 in 2016 among 65+ recipients (Bakx *et al.*, 2020).

[3]Category 'Geneeskundige en langdurige zorg'.

(Alders & Schut (2019), Table 1). In 2014, before the decentralization of social long-term care services to municipalities, the budget of the Social Support Act (WMO) amounted to 4.4 billion euros; in 2015, after these services were added to the WMO, its budget reached 8.0 billion euros (Alders & Schut, 2019). We infer that the budget for social LTC alone was about 3.6 billion euros.[4]

[4]Social LTC funded via WO thus represents less than 5% of total health care and long-term care spending (3.6/80.1).

C Data used in the analysis: additional information

Our study leverages data from Statistics Netherlands (CBS). In these Supplementary Materials, we also leverage data from SHARE, which we use for benchmarking information on children from the CBS data. We provide below the acknowledgments for access to the SHARE data, and then turn to a detailed description of the CBS data.

C.1 Data from SHARE (benchmark)

These Supplementary Materials leverage data from the Survey of Health, Ageing and Retirement in Europe (SHARE), Wave 6 (DOI: 10.6103/SHARE.w6.710), see Börsch-Supan *et al.* (2013) for methodological details). The SHARE data collection has been funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N211909, SHARE-LEAP: GA N227822, SHARE M4: GA N261982) and Horizon 2020 (SHARE-DEV3: GA N676536, SERISS: GA N654221) and by DG Employment, Social Affairs Inclusion. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

C.2 Data from Statistics Netherlands

Micro-data provided by Statistics Netherlands

Table C.I lists all the micro-datasets (individual- or household-level data) that were used in our study.

Register data from CAK tracks the use of institutional care throughout the year. For each institutional stay, dates of admission and potential discharge as well as the type of institution and the intensity of care provided are provided. Death records allow us to monitor survival in the years following the survey. Population registers provide information about household composition and marital status. As we do not know which day precisely each survey respondent was interviewed, we link their situation as of October 31st, 2016 (mid-point of the survey collection period). We also match household income and wealth provided by the Tax Authorities and Statistics Netherlands. Information about health care use is provided by the federation of health care insurers (Vektis). We observe yearly individual health care costs falling under the National Health Insurance

Act (ZVW). The Dutch population has the obligation to insure against an extensive set of inpatient and outpatient medical care costs at a private health insurer. The Vektis data provide the costs of such medical care, including the mandatory and voluntary deductibles charged to the patient. Costs are split into several categories, such as GP care, outpatient specialist care and hospital care. The data also contain ZVW-funded costs incurred for district nursing care (which we refer to as skilled home care).

Table C.I: Content and source of datasets used (in progress).

Content	Source	Name & version of datataset[a]	Level of observation	Selected period of observation
Health Monitor	GGDs & CBS	GEMON2016	One time	September-December 2016
Use of residential care	CAK	GEBWLZ 2017 (v2), GEBWLZ 2018 (v1), GEBWLZ 2019 (v1)	Day-level	2016 to 2018
Death	Death records	GBAPOVERLIJDEN 2019 (v1)	Day-level	2017 to 2019
Date of birth, gender, migration background[b]	Population registers	GBAPERSOON 2019 (v1)	n.a.	n.a.
Household composition	Population registers	GBAHUISHOUDENSBUS 2017 (v1)	Day-level	31-10-2016
Marital status	Population registers	GBAVERBINTENISPARTNERBUS 2016 (v1)	Day-level	31-10-2016
Address	Population registers	GBAADRESOBJECTBUS 2017 (v1)	Day-level	31-10-2006; 31-10-2011; 31-10-2016
Household income	Tax Office and CBS	INPA 2016 (v3), INHA 2016 (v2)	Year-level	2016
Household wealth	Tax Office and CBS	VEH 2016 (v2)	Year-level	01-01-2016
Health care spending (per category)[b]	Vektis	ZVWZORGKOSTEN 2015 (v1), ZVWZORGKOSTEN 2016 (v1), ZVWZORGKOSTEN 2017 (v1), ZVWZORGKOSTEN 2018 (v1)	Year-level	2015 to 2018
Social care	CAK, Ministry of Health	EIGEN BIJDRAGES (v4.1)	Year-level	2016 to 2018
Linkage parent-child	Population registers	KINDEROUDER 2018 (v1)	n.a.	
Linkage address-GPS coordinates	Population registers	VSLCOORD 2018 (v1)	n.a.	
Linkage address-municipality	Address registers	VSLGWB 2019 (v3)	Address	Year

NOTES: [a]: the names and versioning of the datasets correspond to those defined by Statistics Netherlands (CBS); [b]: We also retrieve the gender of children with these datasets after we link the individuals with their children. [c]: Skilled home care is provided as a sub-category of health care spending.

Classification of origins, municipalities and regions

Each individual is linked with her or his migrant background (i.e whether s/he is a first or second generation migrant) to her or his land of origin using a dedicated bridge table.[5] Each land is classified by Statistics Netherlands into one of 7 categories: (1) the Netherlands, (2) Suriname, (3) the so-called Dutch Caribbean, (4) Morocco, (5) Turkey, (6) Western countries other than the Netherlands, (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 Morocco, Turkey, Suriname and the Dutch Caribbean with the other non-Western countries.

To retrieve the municipality in which a respondent and their children live, we use a bridge table linking each address to a municipality (VSLGWB dataset). In addition, to link each municipality to one of the CIZ regional offices and to one of the LTC purchasing regions, we also used the bridge table "GIN - Gebieden in Nederland" (2013-V1).

Information on unit care costs

In order to compute the costs of stays in old age institutional care facilities, we combine the number of days each individual spent in institutional care with a given care package (ZZP) in a given year with the daily cost of a stay for residents with this care package. In the Netherlands, the daily tariff paid to nursing homes is set at the national level by the National Health Care Authority (NZa) and varies with across care packages. There exist two tariffs per care package: one for stays (or days) including therapy (*behandeling*) and one for days that do not include therapy. CBS microdata allow us to retrieve the care package of each stay, but not whether the resident receives therapy. Therefore, instead of referring to the national tariffs set by the Health Care Authority, we use the average daily cost incurred in a given year. We compute this cost as the ratio of spending to the number of days of care use, available for each care package, up until year 2019, as provided by CBS (2021*b*). For nursing home care strictly speaking, the average daily cost varies between €167 and €319 in 2019.[6]

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

[6] As expected, for each the average daily cost falls between the national tariff without therapy and the tariff including therapy.

C.3 Bridge table between parents and children

Based on population registers, Statistics Netherlands provide a bridge table linking the pseudomyzed identifier of individuals to that of their legal parents. The linkage is however not perfect, and for methodological reasons its quality is lower for older cohorts. According to Statistics Netherlands, quality is highest for individuals who are born since January 1966. Women who gave birth to their first child in 1966 were aged 24.6 years on average (CBS, 2019). Such women were aged 77 on average in 2018. In our study sample, we therefore expect some measurement errors on the identity and, thus, characteristics of the children of the respondents. Such errors may be more frequent in older cohorts.

To gauge the quality of the linkage, we compare the percentage of individuals who have at least one child alive in the Health Monitor survey (after linkage with the administrative data) and this same percentage among the 65+ in the Survey of Health, Ageing, and Retirement in Europe (SHARE). As indicated in Table C.II, the proportion of individuals with at least a child alive is 5%-point lower in the Health Monitor sample than in the SHARE sample. The discrepancy is only slightly higher among the 80+ than among the 65-75 years-old.

It should be noted however, that the definition from Statistics Netherlands includes only the link between children and their *legal* parents, while the SHARE survey encompasses a much broader definition.[7] Even absent any linkage issues in the Dutch administrative data, we would have expected the SHARE figures to be somewhat higher than the one reported for the Health Monitor sample. Similarly, the conditional numbers of children in the SHARE survey and in the Health Monitor sample displayed in Table C.III are fairly close.

We conclude from these comparisons that we can dismiss the concern that the number of children suffers from severe measurement errors in our data.

[7] In the English main questionnaire of the SHARE survey, the question on the number of children is framed as follows: '*Now I will ask some questions about your children. How many children do you have that are still alive? Please count all natural children, fostered, adopted and stepchildren [, including those of/, including those of/, including those of/, including those of] [your husband/your wife/your partner/your partner]*'.

Table C.II: Percentage of individuals with at least one child alive: comparison of SHARE and the Health Monitor

	SHARE (2015)[a]	Health Monitor (2016)[b]
Age $\geq$ 65	91.9%	87.0%
Age $\geq$ 70	92.8%	88.0%
Age $\geq$ 75	93.9%	88.3%
Age $\geq$ 80	93.1%	87.8%
Age $\geq$ 85	91.7%	86.1%

NOTES [a]SHARE sample for the Netherlands from wave 6 (2015). [a] Health Monitor sample of the 65+ from 2016, after linkage with administrative data (including register information on legal children) was completed.

Table C.III: Average number of children alive (among individuals with at least one child): comparison of SHARE and the Health Monitor

	SHARE (2015)[a]	Health Monitor (2016)[b]
Age $\geq$ 65	2.56	2.41
Age $\geq$ 70	2.63	2.48
Age $\geq$ 75	2.80	2.60
Age $\geq$ 80	2.90	2.76
Age $\geq$ 85	3.09	2.90

NOTES [a]SHARE sample for the Netherlands from wave 6 (2015) with at least one child. [a] Health Monitor sample of the 65+ with at least one child from 2016, after linkage with administrative data (including register information on legal children) was completed.

C.4 Informal care: definition in the Health Monitor survey

The 2016 wave of the Health Monitor was the first to include questions about the receipt of informal care (*mantelzorg* in Dutch). Prior to being asked these specific questions, the respondent was provided with the following definition of informal care:

Original text (in Dutch): *Mantelzorg is de zorg die u ontvangt van een bekende uit uw omgeving, zoals uw partner, ouders, kind, buren of vrienden, als u voor langere tijd ziek, hulpbehoevend of gehandicapt bent. Deze zorg kan bestaan uit het huishouden doen, wassen en aankleden, gezelschap houden, vervoer, geldzaken regelen, enzovoorts. Mantelzorg wordt niet betaald. Een vrijwilliger vanuit een vrijwilligerscentrale is geen mantelzorger.*

Translation: Informal care is care that you receive from a relative or an acquaintance of yours, such as a your partner, parents, child, neighbors or friends, if you have been sick for a long time, in need of help or handicapped. This care may encompass doing house chores, grooming and dressing, keeping company, transport, arranging finances, etc. Informal care is not paid. A volunteer from a non-profit association is not considered an informal caregiver (*authors' translation, based on DeepL*).

In the Dutch policy context however, informal care has usually a narrower definition. The Ministry of Health and Social Affairs provide the following definition:

Original text (in Dutch): *Gebruikelijke hulp valt niet onder mantelzorg. Gebruikelijke hulp of zorg is de dagelijkse zorg die huisgenoten elkaar bieden omdat zij samen het huishouden voeren. Daar zijn zij samen verantwoordelijk voor.*

Translation: Usual help/care falls not under informal care. Usual help or care is the daily help that individuals in the same household offer each other because they run the household together. They are jointly responsible for this (*authors' translation, based on DeepL*).

It is possible that the official definition of informal care in the Dutch context plays a role in how the Health Monitor respondents answer the questions about informal care receipt. We conjecture that Dutch respondents may be less likely to report domestic help provided by household members than by relatives living outside the household. Failure - or refusal - to consider intra-household help with domestic chores as informal care is documented for other countries, but it may be even more marked in the Netherlands.

D Additional information on data treatment

D.1 Sample selection

We provide here the number of observations after each step of sample selection. Note that we keep respondents with partial non-response on the survey variables other than informal care receipt, in order to minimize sample selection. When generating the covariates from the survey (e.g. education, self-reported health), we define a separate category for a missing value on each variable (e.g. missing education, missing health).

Table D.I: Number of observations at each step of the selection procedure

Selection criteria	Number of observations
Initial sample size (65+ in the Health Monitor)	242,888
Sample size after linkage with administrative data	241,276
Sample size after dropping individuals with no limitations	143,716
Sample size after dropping those with institutional care use during survey collection period	142,193
Sample size after dropping individuals with no adult child alive	124,710
Sample size after dropping individuals with less 15 years age gap with oldest child	124,623
Sample size after dropping individuals with item non-response on current informal care receipt	113,386

D.2 Construction of variables: additional information

In this section we provide more details on some variables defined for and used in the empirical analysis.

Functional limitations

The Health Monitor includes a list of 7 items standardly used to assess functional status (e.g. by the OECD): (1) 'can follow a conversation with 3 or more people', (2) 'can engage into a conversation with 1 person', (3) 'can read small characters', (4) 'can recognize faces', (5) 'can walk 500 meters', (6) 'can drag 5 kg' and (7) 'can bend down and pick up something'. We refer to these variables to select our study population (individuals with limitations), split the population in two sub-groups (individuals with severe vs mild limitations) and, in the regression analyses, control for functional status at the time of the survey.

For each item, to the question 'Can you perform the following task?', the respondent can report: (1) 'Yes, without difficulty', (2) 'Yes, with some difficulty', (3) 'Yes, with high difficulty', (4) 'No, I cannot'. We consider an individual has *having a limitation* if answer (2), (3) or (4) is ticked.

Three dummies indicating whether the individual has severe (i) hearing limitations, (ii) sight limitations or (iii) mobility limitations, were pre-coded in the Health Monitor. Variable LGBPS203 is equal to 1 if the respondent has severe limitations or cannot perform 1 of the 2 OECD hearing items ('can follow a conversation with 3 or more people' and 'can engage into a conversation with 1 person'). We stick to the denomination used in the Health Monitor survey and call this variable 'hearing limitations'; in the interpretation of the results however, we keep in mind that the epidemiological literature has shown that these indicators can also be a sign of cognitive limitations. Variable LGBPS204 is equal to 1 when the respondent has severe limitations or cannot perform 1 of the 2 OECD sight items ('can read small characters' and 'can recognize faces'). Variable LGBPS205 is equal to 1 if the individual has severe limitations or cannot perform 1 of the 3 OECD mobility items ('can walk 500 meters', 'can drag 5 kg' and 'can bend down and pick up something').

In the control variables, we include these 3 pre-coded dummies separately because the correlation between them is fairly small, indicating each captures a different disability profile. In addition, different types of functional limitations have been shown to have a different association with activity restrictions (Cambois *et al.*, 2005). We therefore do not expect these functional limitations to be equivalent risk factors for a nursing home admission.

Dummy for social support receipt

As the Social Support Act (WMO) is decentralized to municipalities, information on the take-up of social support services is of lower quality than information on other types of care. A dataset curated by the Ministry of Health and CAK provide individual-level information on the co-payments paid for some long-term care services. In particular, for each year until 2018 it contains two variables indicating whether (i) the yearly co-payments charged for tailored social support, and (ii) the yearly co-payments charged for short stays in institution, funded under the Social Support Act. The schedule for co-payments on social support is such that even individuals on very low economic resources are charged a minimum amount for the social support services they receive. For each of year 2016, 2017 and 2018, we create a dummy indicating whether the individual has received social support in the form of tailored services or short stays, equal to 1 if one of the two variables is positive. This is the variable we use in our empirical analyses as a proxy of social support receipt. Strictly speaking, it does not reflect whether someone receives basic social support services (such as domestic help). However, such services are widely accessible, such that we expect most individuals with limitations to benefit from them. In addition, the subsidiary nature of social support mostly applies to tailored services, such that we do not expect the use of basic services to be directly influenced by the availability of informal caregivers.

Geographical distance to children

In the empirical analysis, we use geographical distance to children as a control variable in the baseline analysis and as an alternative instrument when assessing the robustness of our estimates.

After linking the respondent's identifier and that of their children (cf. Appendix C.2), we retrieve the identifier of the personal address of the respondents and each of their children, as provided by the population registers. Using a bridge table linking each address to a municipality, we are able to retrieve the municipality in which each child lives and the municipality of residence of the respondents. We therefore construct variables indicating whether children live at the same address (co-residence), live in the same municipality or live in different cities. Using the GPS coordinates for each address, we are also able to construct a continuous measure of the distance (in kms) between a respondent and each of their children.

At a given point in time, the address of one or several children can be missing in the register data. When one child's address is missing on October 31st 2011, we impute it using the first recorded address in that year. The underlying assumption we make is

that children's residential mobility is fairly limited in the course of a year, such that our imputation should induce limited measurement error. If the child had no address known in that year, we assume that the child was residing abroad, as address registration is strictly mandatory for Dutch residents.

In order to conduct the empirical analysis at the respondent-level, we refer to the distance to the geographically *closest* child.

The empirical analysis refers to distance to children as of 5 years before the survey, which is somewhat arbitrary. We also retrieved geographical distance 10 years prior to the survey (October 31st 2006). Further lagged distance also correlates negatively with informal care, but the correlation is lower, making it a less powerful candidate instrument when used to test the robustness of the baseline results to the use of alternative instruments. One interpretation is that 10 years prior to the survey, many 65+ respondents still had a child living in their household because they were still teenagers or young adults. Geographical distance to children 10 years before the survey is therefore expected to be a lower predictor of the long-run localization of children than geographical distance 5 years before the survey, and as such a lower predictor of the propensity to provide informal care at the time of the survey.

E Additional descriptive statistics

E.1 Additional descriptive statistics: Combination of informal care receipt, skilled home care and social care

Table E.I: Combinations of informal care, social support and skilled home care

Care received	Individuals with severe limitations	Individuals with mild limitations
No care	56.4%	89.8%
Informal care only	9.7%	2.8%
Social support only	7.2%	2.1%
Skilled home care only	5.4%	3.0%
Informal care and social support only	4.3%	0.5%
Social support and skilled home care only	3.9%	0.6%
Informal care and skilled home care only	6.0%	0.8%
Informal care, social support and skilled home care	7.1%	0.4%

SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations, either severe (N=48,588) or mild (N=64,798).
NOTES: Informal care receipt at the time of the survey. Skilled home care use and social support receipt in 2016.

E.2 Additional descriptive statistics: nursing home admissions generally have a permanent nature

In this Appendix, we provide additional descriptive statistics on the patterns of nursing home (NH) stays conditional on any admission between 2017 and 2019. The Table below provides summary statistics supporting the notion that admissions to nursing homes (strictly speaking) in the Netherlands have seldom a temporary nature.

A majority of users have been admitted in a NH within three years after the survey and have stayed in the same NH. 15% have 2 or more stays recorded.[8] About 8% of users were discharged from a NH towards the end of the observation period and spent 30 days or more outside of a NH. We also compute the difference between (i) the time elapsed between the first admission and the end of 2019 (or death if it occurred before) and (ii) the time spent in a NH. If the difference is positive, it means that the individual was discharged back to the community at some point. On average, this difference is less than 18 days. But for a large majority of individuals, this difference is virtually 0: for 90% of NH users, there were at maximum 2 days spent out of the NH after their first admission.

Table E.II: Descriptive statistics on stays in nursing homes

Variables	Mean	p5	p10	p50	p90	p95
	(1)	(2)	(3)	(4)	(5)	(6)
Number of different stays in a nursing home	1.14	1	1	1	2	2
Time spent in a nursing home	3266	14	28	257	751	876
Number of days before first admission	600.6	89	169	619	997	1044
More than 0 day has elapsed between last discharge from nursing home and end 2019 or death	0.09	0	0	0	0	1
More than 30 days have elapsed between last discharge from nursing home and end 2019 or death	0.08	0	0	0	0	0
Difference between (i) time elapsed between first admission and end 2019 or death. and (ii) time spent in a nursing home[a]	17.9	-1	-1	0	2	92

SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations, who have entered a nursing home between 2017 and 2019 (N=3,923).
NOTES: [a] Negative values may arise if multiple stays, as the day of discharge from one nursing home might be equal to the day of entry into another nursing home and be counted twice.

[8] These stays are not necessarily done in 2 different nursing homes: a new stay is generated in the data as soon as the patient is entitled to a new care package, e.g. because their health deteriorates.

F Additional elements on the empirical method: the control function estimation

In this section we describe the control function estimation procedure we use for the continuous outcomes.

First, we define informal care receipt as in presented in Section 4.1 for discrete outcomes and with the same observational scheme. We assume that the unobserved random term, u_i, follows a univariate normal distribution and we estimate a probit model with covariates X_i^y and instrument Z_i. Using estimates $\hat{X^y}_i$, we compute the generalized residual for each individual, denoted g_i.[9]

In the second stage, we regress y_i on IC_{i2016}, X_i^y and g_i. As explained in Wooldridge (2014, 2015), g_i acts as the control function that captures the endogeneity of informal care, such that IC_{i2016} can be considered as exogenous in the second-stage regression. Because our continuous outcomes are non-negative and potentially include many zeros, we use the Poisson quasi maximum likelihood estimator (also called pseudo Poisson maximum likelihood or PPML), such that we can write:

$$E(y_i|X_i^y, IC_{i2016}, g_i) = exp(X_i^y\beta_1 + \beta_2 IC_{i2016} + \rho g_i) \tag{1}$$

We use this estimator because it is a consistent estimator of the average effect of informal care receipt on the expected value of the outcome. In addition, Santos Silva & Tenreyro (2011) show that PPML is the estimator that behaves the best irrespective of the proportion of zeros and the form of heteroskedasticity.[10]

The average treatment effect for the continuous outcomes is given by:

$$ATE^{cont} = E(y_i|IC_{i2016} = 1, X_i^y, g_i) - E(y_i|IC_{i2016} = 0, X_i^y, g_i) \tag{2}$$

[9] g_i corresponds to the inverse Mills ratio within a probit model.

[10] In specific, Santos Silva & Tenreyro (2011) compare the PPML with the Gamma pseudo-maximum likelihood estimator, OLS estimator on the transformed $log(y_i + 1)$ and the OLS estimator when $y_i > 0$. Wooldridge (2014) also recommends the use of Poisson QMLE for non-negative outcomes.

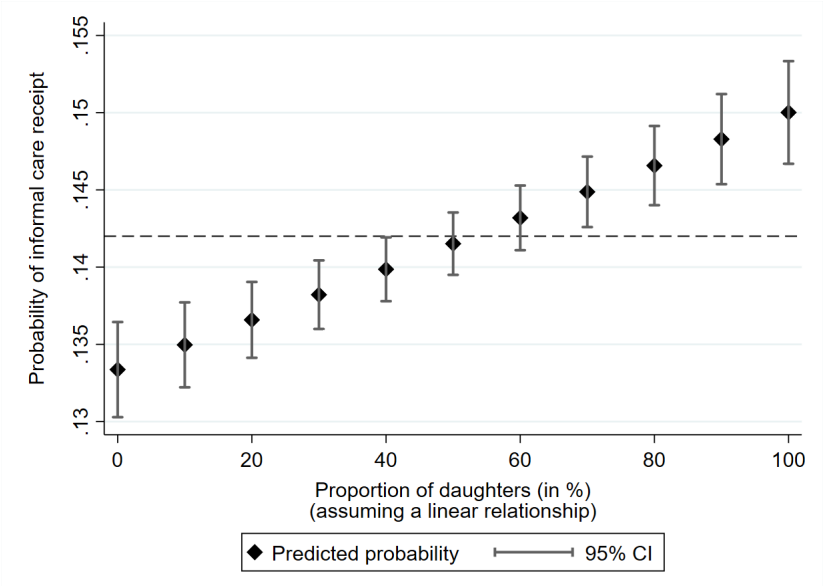
G Additional information on the instruments

In this Appendix, we provide additional information supporting the choice of our baseline instrument (gender mix of children) as well as on the additional instruments used in the robustness checks (number of children and distance).

G.1 Relationship between informal care receipt and the proportion of daughters in the full population

Figure 1 in the main text shows that, for the two sub-samples we consider, there is an increasing relationship between the proportion of daughters among a respondent's children and their probability to receive informal care, when assuming this relationship is linear. It is also confirmed for the full sample in Figure G.1.

Figure G.1: The probability of informal care receipt increases with the proportion of daughters.



SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386).
NOTES: The Figure represents the predicted probability of informal care receipt as a function of the proportion of daughters for individuals with limitations, as derived from a probit regression. Regressions are unweighted, include covariates and assume a linear relationship between the proportion of daughters and informal care. The dashed horizontal line represents the average probability of informal care receipt in the study population.

G.2 Choice of instrument: comparison of baseline with alternative instruments

In our analysis, we define our main instrument as the proportion of women among one's children and assume it as a linear effect on the probability of informal care receipt. It is however possible that the proportion of daughters predicts informal care receipt in a non-linear way, or that other functional forms for the gender mix of children would have a higher explanatory power for informal care receipt.

To choose our favorite functional form, we have taken into account the following dimensions: (i) fit to the data, and (ii) strength of the instrument. In terms of fit, we inspect visually the relationship between each functional form and the predicted probability of informal care receipt and compare the information criteria (AIC and BIC) associated with the probit estimation. For (ii), we refer to the F-statistics on the excluded instrument that is standardly computed in a 2SLS analysis. Although this F-statistics does not have the same interpretation in the context of nonlinear regressions, it provides an indication of how strongly the instrument correlates with informal care, depending on the functional form of the former and conditional on the covariates.

Here below we graphically show predicted informal care as a function of the instrument values, with alternative functional forms. We also report the information criteria and F-statistics for the various functional forms of the instrument. We provide similar information for the instruments used in the robustness checks, namely the number of children and geographical distance.

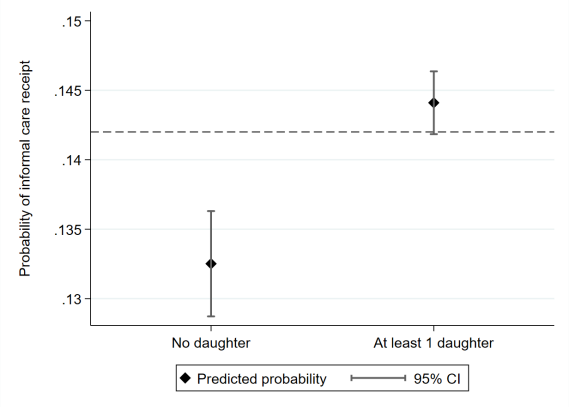
We will then show in Appendix I.2 the robustness of our estimates when using alternative functional forms or instruments.

Gender mix of children and informal care receipt

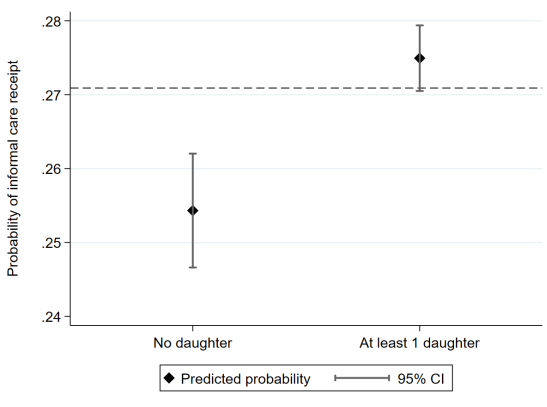
We have considered two alternative functional forms: i) having at least one daughter (which is equivalent to the proportion of daughters being strictly positive) ii) the proportion of daughters as a categorical variable with four categories (0-25%; 25-50%; 50-75%; 75-100%).

Figure G.2 displays the average predicted probability of receiving informal care with respect to the existence of a daughter, derived from a probit regression. The results show that having a daughter makes a particular difference for informal care receipt in all samples. Figure G.3 displays the average predicted probability of receiving informal care with respect to the categorical percentage of daughters. In all samples, we observe a jump in the probability to receive informal care in families where the majority of children are daughters (i.e share higher than 50%).

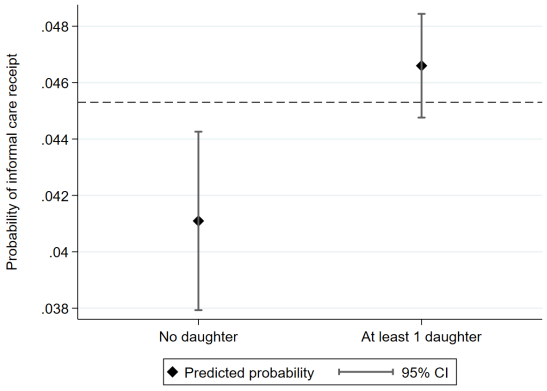
Figure G.2: Empirical relationship between having a daughter and informal care receipt.



Panel A: Full sample



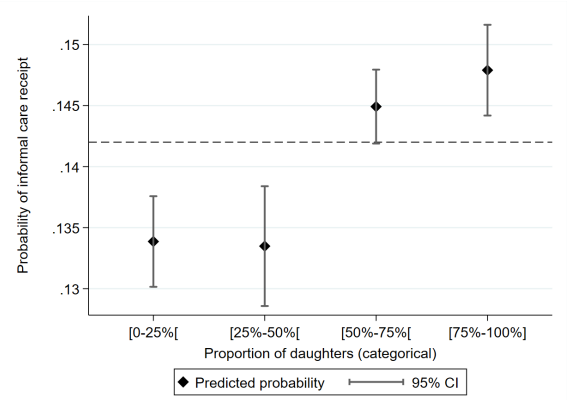
Panel B: Sub-sample with severe limitations



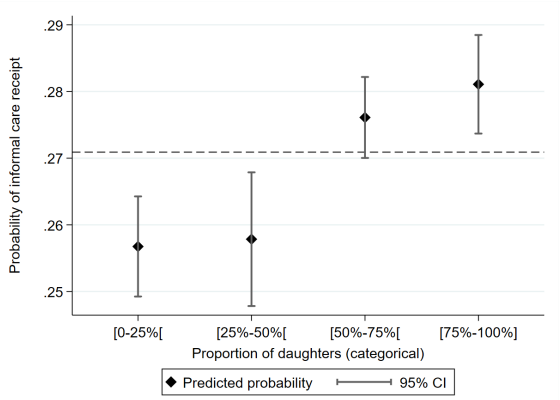
Panel C: Sub-sample with mild limitations

SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386).
NOTES: Panel A (resp. B and C) represents the predicted probability of informal care receipt as a function of the existence of a daughter for the full sample (resp. individuals with severe and mild limitations), as derived from a probit regression. All regressions include covariates. Note that the scale on the y-axis differs across panels because the average predicted probabilities are different in each sub-sample.

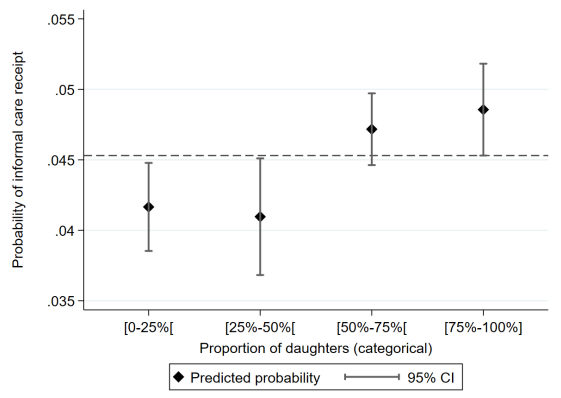
Figure G.3: Empirical relationships between the categorical percentage of daughters and informal care receipt.



Panel A: Full sample



Panel B: Sub-sample with severe limitations



Panel C: Sub-sample with mild limitations

Sample: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386).
Notes: Panel A (resp. B and C) represents the predicted probability of informal care receipt as a function of the categorical percentage of daughters for the full sample (resp. individuals with severe and mild limitations), as derived from a probit regression. All regressions include covariates. Note that the scale on the y-axis differs across panels because the average predicted probabilities are different in each sub-sample.

These patterns suggest that a nonlinear specification of the gender mix might be more appropriate. However, comparing the information criteria derived from probit regressions for these various functional forms lead to a different conclusion. In Table G.I below, Columns (1) to (3), the Bayesian information criterion (BIC) is minimized when the proportion of daughters is included as a continuous variable. The Akaike information criterion (AIC) is minimized with the categorical percentage of daughters, but the difference with the linear and continuous one regression is marginal.[11] These result suggest that assuming a linear effect for the proportion of daughters is not excessively restrictive and does not penalize the prediction of informal care receipt. Furthermore, Table G.II shows that including the proportion of daughters as a continuous and linear variable provides the highest indicator for the strength of the instrument: comparing Columns (1) with Columns (5) and (6) show that the F-statistics for the gender mix is substantially higher with our baseline functional form than when using having at least one daughter or the proportion of daughters as a categorical variable, in all three samples.

Note that our instrument is stronger among those with severe limitations than among those with mild limitations. Even in the latter though, the F-statistics associated with our favorite instrument is still beyond the usual threshold retained by empirical economists of 10 (Andrews *et al.*, 2019). Overall, our empirical investigation suggests that the proportion of daughters as a continuous and linear variable is the best suited functional form for its use as an instrument for informal care.

[11] Both information criteria penalize the addition of extra covariates in the model, but AIC and BIC incorporate a different penalizing function.

Fit of the model: Information criteria from probit regressions

Table G.I: Information criteria from probit regressions of informal care receipt for different specifications of the gender mix of children.

Specification	Continuous	Has one daughter	Categorical
(1)	(2)	(3)	
AIC	67,355	67,369	67,354
BIC	68,068	68,083	68,087
Likelihood	-33,603	-33,611	-33,601

SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive for the full sample (N=113,386).
NOTES: All regressions include covariates.

Strength of the instrument: F-statistics in a linear regression of the instrument on informal care receipt

Table G.II: F-statistics on excluded instrument(s) in the linear regression of instrument(s) and covariates on informal care receipt.

	(1)	(2)	(3)	(4)	(5)	(6)
F-stats in sample:						
Full sample	48.77	87.61	36.50	62.18	30.11	18.32
Severe limitations	31.90	69.13	21.48	42.95	23.03	11.89
Mild limitations	16.52	15.72	12.66	16.78	8.288	5.857
Instrument(s)	Gender mix	Number of children	Distance	All	Gender mix	Gender mix
Functional form for gender mix	Prop. of daughters, linear	Prop. of daughters, linear	Prop. of daughters, linear	Prop. of daughters, linear	A daughter	Prop. of daughters, cat.

SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386).
NOTES: F-statistics on the excluded instrument(s), in a linear regression of the instrument(s) and covariates on the probability of informal care receipt.

Number of children and distance to closest child as alternative instruments

The number of children is defined as a continuous variable. Distance to the closest child in 2011 is defined as a categorical variable, taking 3 values: (i) the closest child co-resides with the respondent, (ii) the closest child lives in the same municipality as the respondent (but does not co-reside), (iii) the closest child does not live in the same municipality as the respondent.[12] Co-residence with a child is relatively rare in the Netherlands, but it is common to have at least a child living in the same municipality.

Empirically, the number of children is generally associated with a higher propensity to receive informal care, seemingly because it increases the number of potential caregivers, while daughters are found to be more likely to provide informal care than sons (Byrne *et al.*, 2009; Carmichael & Charles, 2003). As a consequence, the number of children has been used as an instrument for informal care in many studies of the LTC literature (see e.g. **?**Sasso & Johnson (2002)).

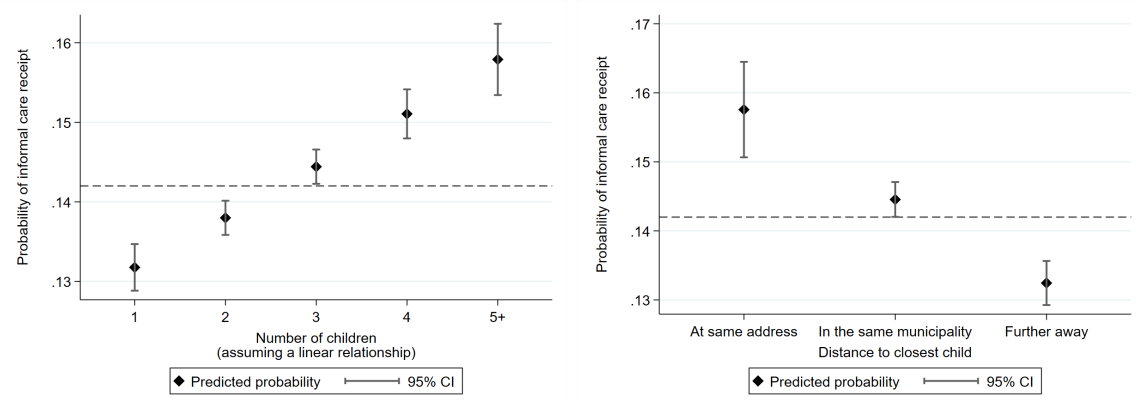
There is also a negative correlation between informal care receipt and the geographical distance to one's (closest) children, documented in several contexts (US, Europe), with data from years 1980s to 2000s. This variable has been used in several studies, including Stern (1995); Charles & Sevak (2005); Bolin *et al.* (2008); Bonsang (2009); Hiedemann *et al.* (2018). Still, geographical distance to children might not be exogenous to NH admissions if children relocate closer to their elder parents in response to, or in anticipation of a health deterioration that is also expected to influence the propensity to enter a NH. Stern (1995) and Hiedemann *et al.* (2018) provide theoretical and empirical support for such a pattern. They however argue that the endogeneity bias should be small: the strong inertia in the location of adult children, observed in both the US and in European data (e.g. Rainer & Siedler (2009) for Germany), suggest that such re-locations happen only seldom. Still, Hiedemann *et al.* (2018) recommend using the *lagged* distance instead of the *contemporaneous* distance in order to minimize endogeneity bias.[13]

[12] As for the gender mix, we tested alternative functional forms for the number of children (a categorical variable) and distance to children (quadratic distance in kilometers). We selected our favorite functional form after inspecting the association between each instrument and informal care, the fit of the probit model as provided by the AIC and BIC and the F-statistics for a linear first stage.

[13] Lagged distance could still be an issue if location decisions of adult children early in their life are made in a forward-looking way, anticipating future care needs of parents and including strategic interactions with siblings' decisions (Konrad *et al.*, 2002; Rainer & Siedler, 2009). Yet the model by Konrad *et al.* (2002) (first-born has a first-mover advantage) does not seem supported by the data (cf. Maruyama & Johar (2017) and Stern (2014)). The long-term game proposed by Rainer & Siedler (2009) is validated on German data. But, contrary to what is observed in most European countries, location decisions of a child in the Netherlands do not seem to depend on whether she has a sibling (Rainer & Siedler, 2012), making it unlikely that the model proposed would hold in this country.

The positive relationship between the number of children and informal care on one hand, and the negative relationship between distance to the closest child and informal care in our study population is displayed in Figure G.4. In addition, Table 28 (p. 28) show that the F-stats for the first stage of a linear IV with either the number of children, distance to closest children or the combination of these two instruments with our baseline instrument (Columns (2) to (4)) are above the conventional threshold of 10, for all 3 samples. These confirm the relevance for these two additional instruments.

Figure G.4: The probability of informal care receipt increases with the number of children but decreases with their geographical distance.



Panel A: Informal care and number of children.

Panel B: Informal care and distance to closest child.

SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386).
NOTES: Panel A (resp. B) represents the predicted probability of informal care receipt as a function of the number of children (resp. the distance to the closest child), as derived from a probit regression. Regressions are unweighted and include covariates. In Panel A, a linear relationship between the proportion of daughters and informal care is assumed. The dashed horizontal line represents the average probability of informal care receipt.

H Additional estimation results

H.1 Estimated coefficients: effect of informal care nursing home use between 2017 and the end of 2019

Table H.I presents the estimated raw coefficients from the bivariate probit of the main regression analysis. The average treatment effect obtained from this regression is displayed in Table III in the main text.

Table H.I: Coefficients for NH use between 2017 and 2019 on each sample.

Sample	Full sample			Sample with severe limitations			Sample with mild limitations		
Outcome	IC	NH use by 2019		IC	NH use by 2019		IC	NH use by 2019	
IC endogenous		No	Yes		No	Yes		No	Yes
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Informal care receipt		0.524***	0.027		0.590***	-0.529***		0.507***	0.272***
		(0.020)	(0.071)		(0.043)	(0.121)		(0.022)	(0.083)
Is a woman	0.209***	0.002	0.032*	0.226***	-0.019	0.047	0.207***	0.014	0.030
	(0.012)	(0.019)	(0.019)	(0.021)	(0.033)	(0.032)	(0.015)	(0.024)	(0.024)
Age 65 or more and below 70	-0.244***	-0.560***	-0.578***	-0.340***	-0.581***	-0.606***	-0.186***	-0.548***	-0.558***
ref: Age 75 or more and below 80	(0.018)	(0.036)	(0.036)	(0.030)	(0.060)	(0.056)	(0.023)	(0.046)	(0.046)
Age 70 or more and below 75	-0.154***	-0.298***	-0.310***	-0.207***	-0.315***	-0.336***	-0.120***	-0.286***	-0.292***
ref: Age 75 or more and below 80	(0.017)	(0.029)	(0.029)	(0.028)	(0.048)	(0.044)	(0.021)	(0.037)	(0.037)
Age 80 or more and below 85	0.265***	0.308***	0.337***	0.299***	0.334***	0.381***	0.245***	0.292***	0.309***
ref: Age 75 or more and below 80	(0.017)	(0.024)	(0.024)	(0.028)	(0.040)	(0.037)	(0.021)	(0.030)	(0.031)
Age 85 or more and below 90	0.582***	0.564***	0.636***	0.658***	0.631***	0.758***	0.553***	0.534***	0.575***
ref: Age 75 or more and below 80	(0.020)	(0.027)	(0.028)	(0.035)	(0.048)	(0.045)	(0.024)	(0.033)	(0.035)
Age 90 or more and below 95	0.962***	0.704***	0.836***	1.083***	0.789***	1.049***	0.932***	0.675***	0.745***
ref: Age 75 or more and below 80	(0.030)	(0.037)	(0.040)	(0.062)	(0.081)	(0.078)	(0.034)	(0.042)	(0.048)
Age 95 or more	1.313***	0.823***	1.004***	1.431***	0.856***	1.233***	1.301***	0.799***	0.895***
ref: Age 75 or more and below 80	(0.069)	(0.072)	(0.075)	(0.186)	(0.246)	(0.211)	(0.074)	(0.077)	(0.082)
Widow	0.262***	0.018	0.057	0.261***	-0.016	0.063	0.264***	0.038	0.058
ref: Never married or separated	(0.025)	(0.038)	(0.038)	(0.046)	(0.069)	(0.065)	(0.030)	(0.045)	(0.046)
Registered partnership or married	0.174***	0.001	0.028	0.102**	-0.051	-0.014	0.212***	0.031	0.047
ref: Never married or separated	(0.024)	(0.037)	(0.037)	(0.045)	(0.067)	(0.062)	(0.028)	(0.045)	(0.045)
Marital status missing	0.295***	-0.050	-0.005	0.304***	-0.152	-0.042	0.287***	-0.013	0.010
ref: Never married or separated	(0.044)	(0.066)	(0.065)	(0.078)	(0.122)	(0.114)	(0.052)	(0.079)	(0.079)
Origin: Western country	-0.003	-0.043	-0.044	0.023	-0.110*	-0.092*	-0.019	-0.018	-0.019
ref: Origin: Dutch	(0.019)	(0.030)	(0.029)	(0.033)	(0.056)	(0.051)	(0.024)	(0.036)	(0.036)
Origin: non-Western country	0.028	-0.351***	-0.344***	0.297***	-0.413**	-0.274	-0.053	-0.359***	-0.362***
									To be continued
Observations	113,386	113,386	113,386	64,798	64,798	64,798	48,588	48,588	48,588
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IC endogenous		No	Yes		No	Yes		No	Yes

SAMPLE: Individuals 65+ living in the community, with at least one child alive.

NOTES: These results are obtained with the use of the proportion of daughters an instrument.

Table H.I: Coefficients for individuals with limitations.

Sample	Full sample			Sample with severe limitations			Sample with mild limitations		
Outcome	IC	Any NH use (2017-2019)		IC	Any NH use (2017-2019)		IC	Any NH use (2017-2019	
IC endogenous		No	Yes		No	Yes		No	Yes
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ref: Origin: Dutch	(0.039)	(0.075)	(0.073)	(0.075)	(0.194)	(0.171)	(0.043)	(0.083)	(0.082)
No education	0.015	0.008	0.010	-0.047	0.003	-0.011	0.047	-0.004	-0.000
ref: Higher secondary education	(0.030)	(0.043)	(0.042)	(0.064)	(0.096)	(0.086)	(0.034)	(0.050)	(0.049)
Primary and intermediate secondary education	0.004	0.003	0.003	-0.019	0.049	0.039	0.013	-0.020	-0.019
ref: Higher secondary education	(0.015)	(0.024)	(0.024)	(0.026)	(0.040)	(0.037)	(0.019)	(0.030)	(0.030)
Higher education	0.023	-0.017	-0.013	0.017	0.009	0.014	0.037	-0.033	-0.030
ref: Higher secondary education	(0.021)	(0.033)	(0.033)	(0.033)	(0.052)	(0.048)	(0.027)	(0.043)	(0.043)
Education is missing	-0.104***	0.085**	0.066*	-0.009	0.121*	0.105*	-0.139***	0.063	0.051
ref: Higher secondary education	(0.027)	(0.038)	(0.037)	(0.047)	(0.068)	(0.062)	(0.032)	(0.046)	(0.046)
Has hearing limitations	0.193***	0.247***	0.273***				0.165***	0.253***	0.266***
ref: Has no hearing limitations	(0.015)	(0.020)	(0.020)				(0.016)	(0.022)	(0.023)
Hearing limitations is missing	-0.174***	0.116**	0.085	-0.028	0.009	-0.003	-0.252***	0.156**	0.135**
ref: Has no hearing limitations	(0.042)	(0.055)	(0.054)	(0.073)	(0.103)	(0.095)	(0.048)	(0.066)	(0.066)
Has sight limitations	0.115***	0.056**	0.075***				0.104***	0.057**	0.066***
ref: Has no sight limitations	(0.016)	(0.023)	(0.022)				(0.016)	(0.023)	(0.023)
Sight limitations is missing	0.041	0.096	0.097	0.049	0.148	0.143	0.037	0.064	0.067
ref: Has no sight limitations	(0.056)	(0.077)	(0.075)	(0.110)	(0.147)	(0.141)	(0.064)	(0.091)	(0.090)
Has mobility limitations	0.620***	0.140***	0.234***				0.580***	0.155***	0.196***
Has no mobility limitations	(0.013)	(0.021)	(0.024)				(0.019)	(0.030)	(0.033)
Mobility limitations is missing	0.159***	0.066	0.081	-0.009	-0.010	-0.013	0.287***	0.147	0.165
ref: Has mobility limitations	(0.060)	(0.089)	(0.088)	(0.087)	(0.130)	(0.118)	(0.090)	(0.129)	(0.129)
Q1 income	0.017	-0.010	-0.007	0.044	-0.017	-0.003	0.009	-0.009	-0.008
ref: Q2 income	(0.015)	(0.023)	(0.022)	(0.028)	(0.042)	(0.039)	(0.018)	(0.027)	(0.027)
Q3 income	-0.039**	0.012	0.006	-0.051*	0.042	0.022	-0.033	-0.005	-0.008
ref: Q2 income	(0.016)	(0.025)	(0.025)	(0.027)	(0.042)	(0.039)	(0.021)	(0.032)	(0.032)
Q4 income	-0.037*	-0.068**	-0.071**	-0.090***	-0.067	-0.085*	0.005	-0.066	-0.065
ref: Q2 income	(0.019)	(0.032)	(0.032)	(0.032)	(0.053)	(0.049)	(0.025)	(0.041)	(0.041)
Q1 wealth	0.034*	-0.043	-0.037	-0.040	0.012	-0.002	0.068***	-0.066*	-0.061

To be continued

Observations	113,386	113,386	113,386	64,798	64,798	64,798	48,588	48,588	48,588
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IC endogenous		No	Yes		No	Yes		No	Yes

SAMPLE: Individuals 65+ living in the community, with at least one child alive.

NOTES: These results are obtained with the use of the proportion of daughters an instrument.

Table H.I: Coefficients for individuals with limitations.

Sample	Full sample			Sample with severe limitations			Sample with mild limitations		
Outcome	IC	Any NH use (2017-2019)		IC	Any NH use (2017-2019)		IC	Any NH use (2017-2019	
IC endogenous		No	Yes		No	Yes		No	Yes
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ref: Q2 wealth	(0.019)	(0.031)	(0.031)	(0.031)	(0.053)	(0.048)	(0.024)	(0.040)	(0.040)
Q3 wealth	0.008	0.024	0.025	-0.064**	0.068*	0.044	0.036**	0.009	0.011
ref: Q2 wealth	(0.015)	(0.021)	(0.021)	(0.026)	(0.039)	(0.036)	(0.017)	(0.025)	(0.025)
Q4 wealth	0.006	-0.036	-0.035	-0.078***	0.005	-0.016	0.043**	-0.049	-0.046
ref: Q2 wealth	(0.017)	(0.026)	(0.026)	(0.029)	(0.046)	(0.043)	(0.022)	(0.032)	(0.032)
Is a homeowner	0.003	-0.107***	-0.104***	0.022	-0.106***	-0.089**	-0.006	-0.108***	-0.107***
	(0.016)	(0.023)	(0.023)	(0.028)	(0.041)	(0.038)	(0.020)	(0.029)	(0.028)
Bad health	0.448***	0.180***	0.255***				0.438***	0.188***	0.223***
ref: Average health	(0.017)	(0.025)	(0.026)				(0.017)	(0.026)	(0.028)
Good health	-0.345***	-0.263***	-0.299***	-0.414***	-0.270***	-0.359***	-0.276***	-0.248***	-0.266***
ref: Average health	(0.014)	(0.022)	(0.022)	(0.021)	(0.034)	(0.032)	(0.019)	(0.029)	(0.030)
Health is missing	0.014	0.209***	0.209***	-0.116	0.167	0.111	0.080	0.232**	0.238**
ref: Average health	(0.061)	(0.081)	(0.079)	(0.113)	(0.153)	(0.141)	(0.074)	(0.096)	(0.096)
Has a chronic illness	0.410***	-0.038*	0.016	0.369***	-0.025	0.081**	0.440***	-0.056**	-0.024
ref: Has no chronic illness	(0.014)	(0.021)	(0.022)	(0.022)	(0.034)	(0.035)	(0.019)	(0.027)	(0.029)
Chronic illness is missing	0.154***	0.004	0.017	0.076	0.014	0.028	0.198***	-0.006	0.006
ref: Has no chronic illness	(0.047)	(0.064)	(0.063)	(0.079)	(0.114)	(0.104)	(0.058)	(0.078)	(0.078)
Costs on GP care in 2015	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Costs on drug consumption care in 2015	0.000***	0.000*	0.000***	0.000***	0.000***	0.000***	0.000***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Costs on auxiliary care in 2015	0.000***	0.000	0.000***	0.000***	-0.000	0.000*	0.000***	0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Logged hospital cost in 2015	0.009***	-0.004	-0.003	0.014***	0.002	0.005	0.004	-0.009**	-0.009**
	(0.002)	(0.003)	(0.003)	(0.004)	(0.006)	(0.006)	(0.003)	(0.004)	(0.004)
Closest child is co-resident	0.077***	-0.026	-0.015	0.091**	0.082	0.096	0.069***	-0.069	-0.064
ref: Closest child in the same municipality	(0.021)	(0.038)	(0.037)	(0.037)	(0.065)	(0.059)	(0.026)	(0.045)	(0.045)
Closest child in a different municipality	-0.076***	0.071***	0.058***	-0.079***	0.051	0.023	-0.076***	0.080***	0.073***
									To be continued
Observations	113,386	113,386	113,386	64,798	64,798	64,798	48,588	48,588	48,588
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IC endogenous		No	Yes		No	Yes		No	Yes

SAMPLE: Individuals 65+ living in the community, with at least one child alive.

NOTES: These results are obtained with the use of the proportion of daughters an instrument.

Table H.I: Coefficients for individuals with limitations.

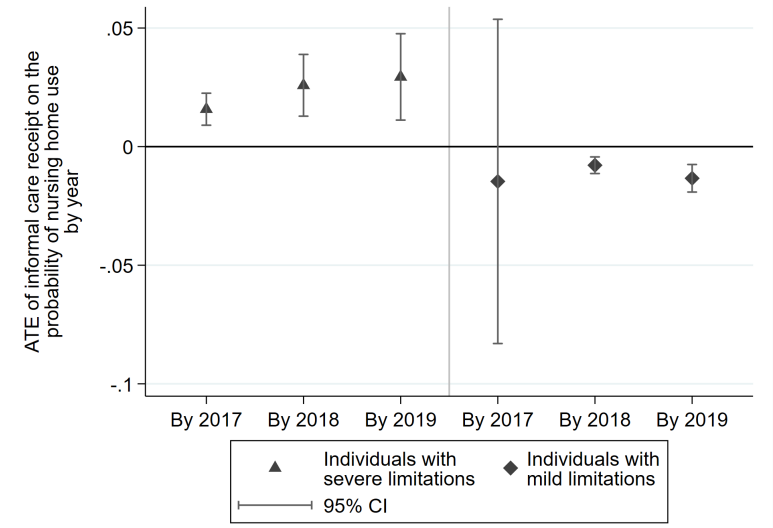
Sample	Full sample			Sample with severe limitations			Sample with mild limitations		
Outcome	IC	Any NH use (2017-2019)		IC	Any NH use (2017-2019)		IC	Any NH use (2017-2019	
IC endogenous		No	Yes		No	Yes		No	Yes
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ref: Closest child in the same municipality	(0.012)	(0.019)	(0.018)	(0.022)	(0.032)	(0.030)	(0.015)	(0.023)	(0.023)
Number of children	0.039***	0.002	0.009	0.032***	-0.011	0.001	0.045***	0.006	0.010
	(0.005)	(0.007)	(0.007)	(0.008)	(0.013)	(0.012)	(0.006)	(0.008)	(0.008)
Proportion of daughters	0.103***			0.107***			0.103***		
	(0.016)			(0.027)			(0.019)		
Constant	-2.479***	-1.950***	-2.025***	-2.321***	-2.112***	-2.098***	-2.520***	-1.867***	-1.930***
	(0.056)	(0.075)	(0.075)	(0.094)	(0.131)	(0.120)	(0.072)	(0.097)	(0.099)
ρ			0.285***			0.609***			0.139***
			(0.039)			(0.067)			(0.047)
Observations	113,386	113,386	113,386	64,798	64,798	64,798	48,588	48,588	48,588
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IC endogenous		No	Yes		No	Yes		No	Yes

SAMPLE: Individuals 65+ living in the community, with at least one child alive.

NOTES: These results are obtained with the use of the proportion of daughters an instrument.

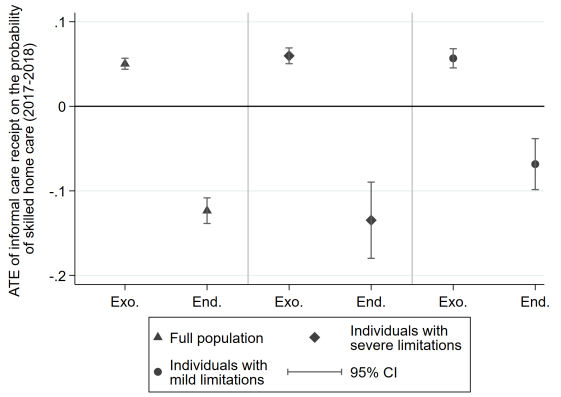
H.2 Additional results: effect of informal care on additional binary outcomes

Figure H.1: Average treatment effect of informal care receipt on nursing home entry by year, depending on the severity of limitations

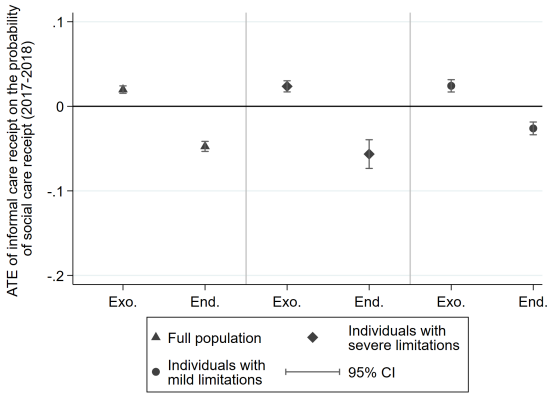


Sample: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations, either severe (N=45,588) or mild (N=64,798).
Notes: ATE stands for the mean average treatment effect of informal care receipt at the time of the survey (IC) on the probability to have been admitted to a nursing home either by the end of 2017, the end of 2018 or the end of 2019. Estimation of a bivariate probit model, assuming endogeneity of informal care and instrumenting it by the proportion of daughters.

Figure H.2: Average treatment effect of informal care receipt on subsequent formal home care receipt.



Panel A: ATE on the probability of skilled home care use (2017-2018).

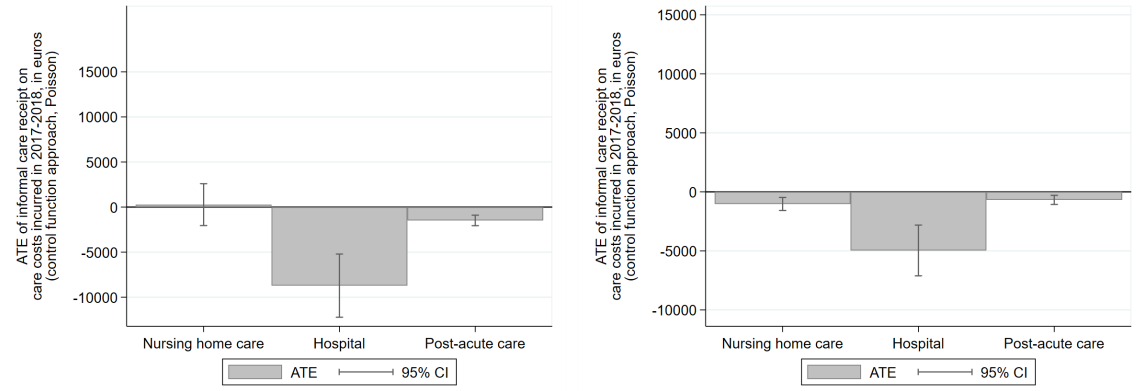


Panel B: ATE on the probability of social care receipt (2017-2018).

Sample: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386), either severe (N=45,588) or mild (N=64,798). Notes: ATE stands for the mean average treatment effect of informal care receipt at the time of the survey (IC). Estimation of a bivariate probit model, under two alternative hypotheses: EXO.: assuming the exogeneity of informal care receipt, END.: assuming endogeneity of informal care and instrumenting it by the proportion of daughters. Unlike in the favorite specifications for other outcomes, controls include here a dummy for receipt of informal care in 2016 and the log of the costs incurred on skilled home care. See Section 5.3 in the main text and Appendix XX further below for a justification.

H.3 Additional results: effect of informal care on additional care cost categories

Figure H.3: Average treatment effect of informal care receipt on subsequent care costs (additional categories), depending on the severity of limitations.



Panel A: Population with severe limitations (N=45,588).

Panel B: Population with mild limitations (N=64,798).

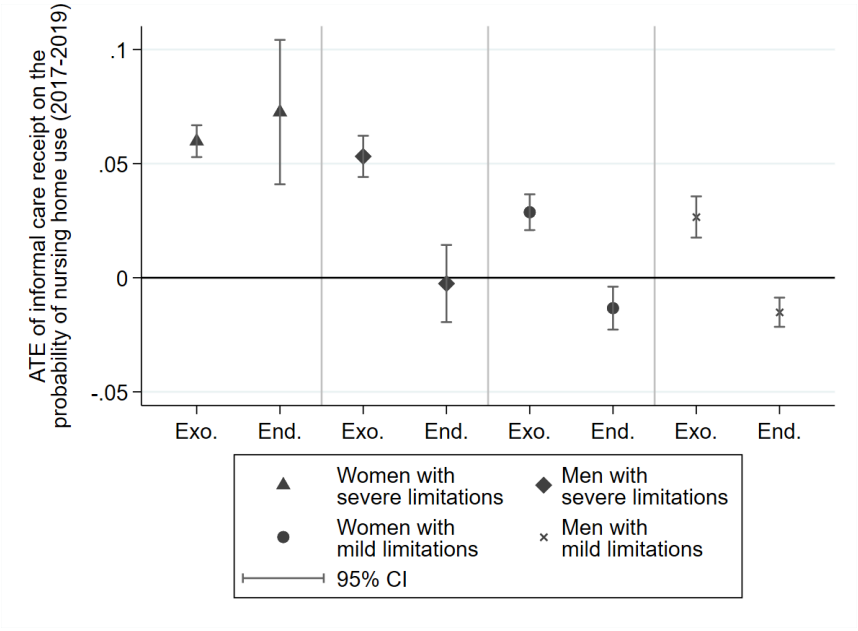
Sample: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations.
Notes: This Figure reports the average treatment effect of informal care receipt on different costs incurred over 2017 and 2018. Costs are expressed in current euros. Estimation of a control function model combining a probit regression and a Poisson regression, instrumenting informal care receipt by the proportion of daughters. All specifications include control variables.
Notes:

H.4 Additional results: heterogeneity by gender

In this Appendix, we report the results from the gender heterogeneity analysis discussed in Section 6.2. We present the ATE of informal care on nursing home care use in Figure H.4, the effect on post-acute care use mortality in Figure H.5, and care costs in Figure H.6.

We hypothesize that informal care receipt may affect health, LTC and health care use differently men and women, for example because the composition of informal care might be on average different across genders. As women at old age are more likely to be widows or have an older (less healthy) spouse than men are, women are more likely to be helped by their children, while men more often receive care from their partner (Byrne *et al.*, 2009).

Figure H.4: Average treatment effect of informal care receipt on the probability to enter a nursing home, by gender and depending on the severity of limitations.



SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386).
NOTES: ATE stands for the mean average treatment effect of informal care receipt at the time of the survey (IC) on the probability of being admitted to a nursing home between January 1st 2017 and December 31st 2019. Estimation of a bivariate probit model, under two alternative hypotheses: EXO.: assuming the exogeneity of informal care receipt, END.: assuming endogeneity of informal care and instrumenting it by the proportion of daughters.

For individuals with severe limitations, we find a strong positive effect of informal care on the probability of a NH admission among women, while we cannot rule out that the ATE is null among men (the point estimate itself is close to 0). For both genders, the probability of any post-acute care use decreases and there is no evidence that mortality

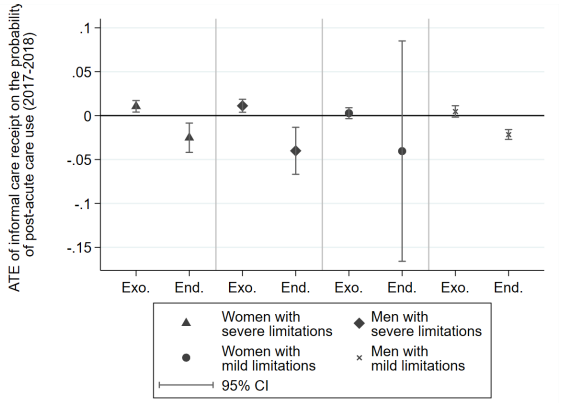
increases (Figure H.5). When looking at care costs, the picture seems also quite different for men and women: informal care receipt is predicted to increase total care costs for the latter, including skilled home care costs and health care costs (Figure H.5, Panel A). For men instead, care costs seem to decrease with informal care receipt (Figure H.6, Panel B), although statistical precision is low.

Turning to individuals with mild limitations, for both genders, the probability of any nursing home admission decreases (Figure H.4, Panel B). The same goes with post-acute care (Figure H.5, Panel A), while we find a statistically significant reduction in mortality for men only (Figure H.5, Panel B). For both genders, informal care is found to decrease future care costs, but by a much larger magnitude for men than for women (Figure H.6, Panels C and D).

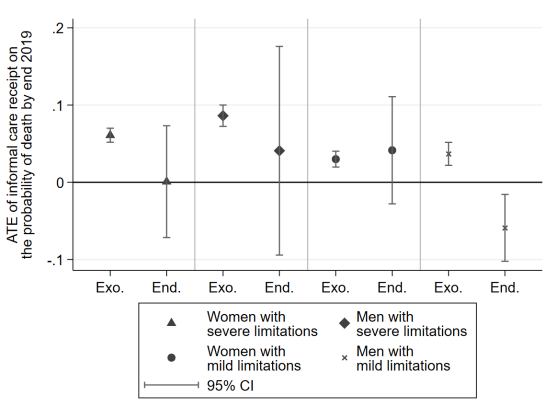
One first explanation is that men are more likely to receive intra-household informal care, which comes along with a higher volume of care received. Intra-household (intensive) informal care might become necessary at high level of limitations to stay at home. One second hypothesis is that adult children caregivers are more likely to help their elder parent to navigate the health care system, secure sufficient skilled home care and take care of the logistics of a NH admission, than an elder spouse caregiver is able to do. If so, for similar functional status and health, women (more likely to be widows) would be more likely to use formal care options than men would when they receive informal care.

At a lower level of limitations, men seem to benefit more from having informal caregivers. This may reflect differential ability to benefit from informal support, e.g. if old-age men tend to have a less healthy lifestyle (see e.g. Mollborn *et al.* (2020)), which could lead to more future health capital gains associated with informal care; or it may arise because of differential effectiveness of informal care. Results from (Byrne *et al.*, 2009) suggest that care provided *to* a father or husband is more effective than care provided to a mother or wife and also that care provided *by* a woman tends to be more effective than care provided by a man.

Figure H.5: Average treatment effect of informal care receipt on the probability of post-acute care use and 3-year mortality, by gender and depending on the severity of limitations.



Panel A: ATE on the probability of post-acute care use (2017-2018).

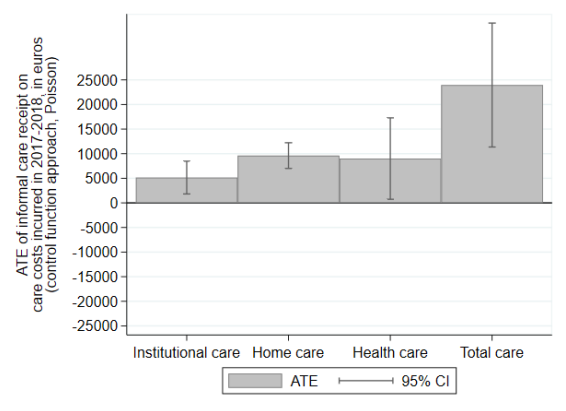


Panel B: ATE on 3-year mortality.

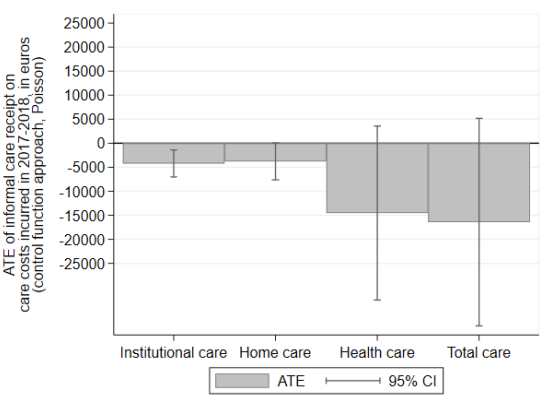
SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations, either women with severe (N=28,624), men with severe limitations (N=19,964), women with mild limitations (N=31,236) or men with mild limitations (N=33,562).

NOTES: ATE stands for the mean average treatment effect of informal care receipt at the time of the survey (IC) on the probability of using post-acute care between 1st 2017 and December 31st 2018 or have died by December 31st 2019. Estimation of a bivariate probit model, under two alternative hypotheses: EXO.: assuming the exogeneity of informal care receipt, END.: assuming endogeneity of informal care and instrumenting it by the proportion of daughters.

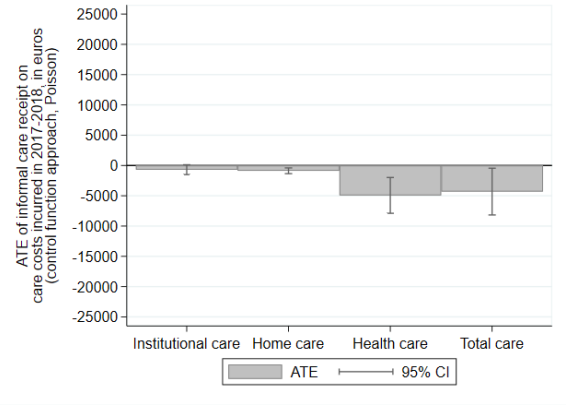
Figure H.6: Average treatment effect of informal care receipt on care costs, by gender and depending on the severity of limitations.



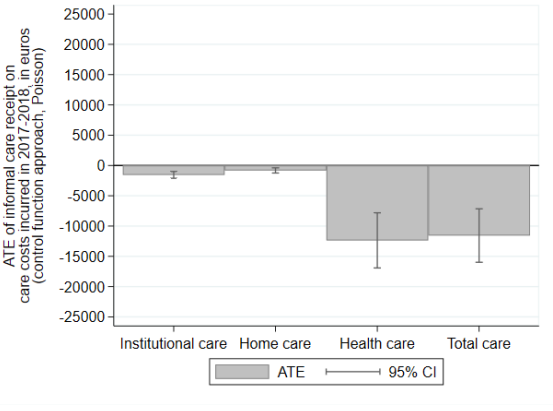
Panel A: women, severe functional limitations.



Panel B: men, severe functional limitations.



Panel C: women, severe mild limitations.



Panel D: men, severe mild limitations.

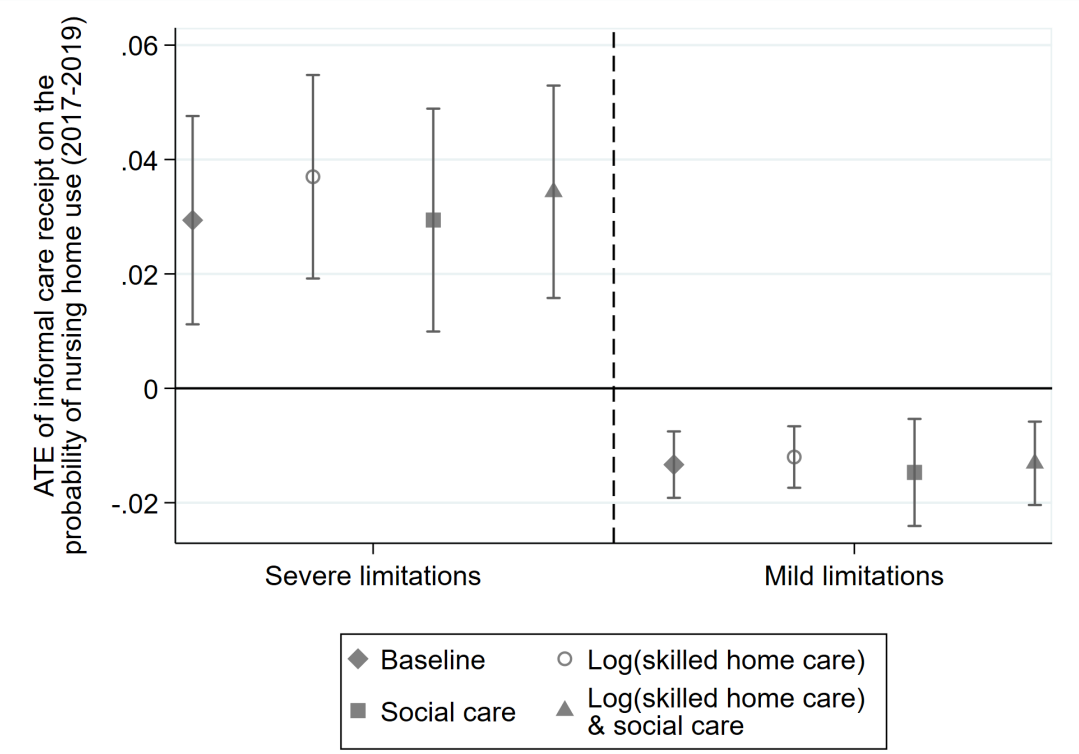
SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations, either women with severe (N=28,624), men with severe limitations (N=19,964), women with mild limitations (N=31,236) or men with mild limitations (N=33,562).

NOTES: This Figure reports the average treatment effect (ATE) of informal care receipt on different costs incurred over 2017 and 2018. Costs are expressed in current euros. Estimation of a control function model combining a probit regression and a Poisson regression, instrumenting informal care receipt by the proportion of daughters. All specifications include control variables.

I Robustness checks and alternative specifications

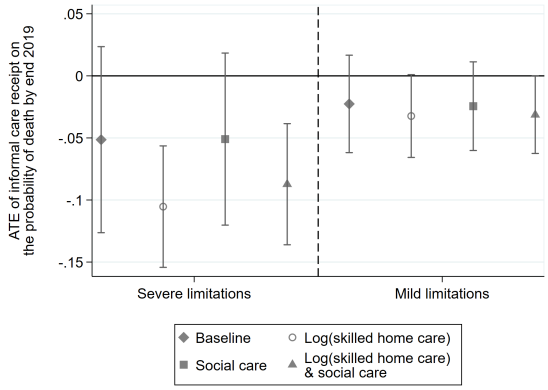
I.1 Robustness checks: Controlling for skilled home care use and social care receipt

Figure I.1: Average treatment effect of informal care on the probability of nursing home entry is robust to controlling for contemporaneous formal home care receipt.

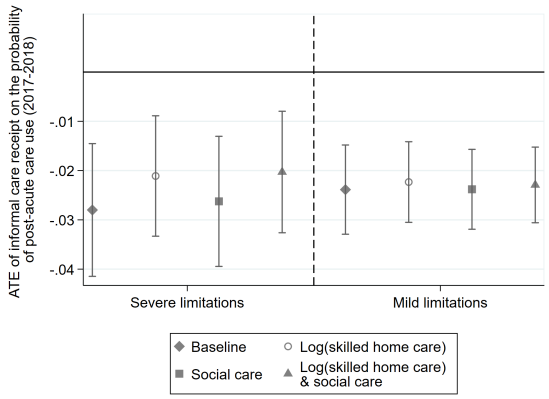


SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations, either severe (left panel, N=48,588) or mild (right panel, N=64,978).
NOTES: ATE stands for the mean average treatment effect of informal care receipt at the time of the survey (IC) on the probability of being admitted to a nursing home between January 1st2017 and December 31st2019. Estimation of a bivariate probit model, assuming endogeneity of informal care and instrumenting it by the proportion of daughters. For each sub-population, four specifications are estimated, controlling or not for home care receipt in 2016. First specification: baseline, not control for home care receipt; second specification: controls for log(spending on skilled home care+1); third specification: controls for social care receipt; fourth specification: controls for both log(costs incurred on skilled home care+1) and social care receipt.

Figure I.2: Average treatment effects of informal care on mortality and post-acute care use are robust to controlling for contemporaneous formal care receipt.



Panel A: ATE on the probability to die by the end of 2019.

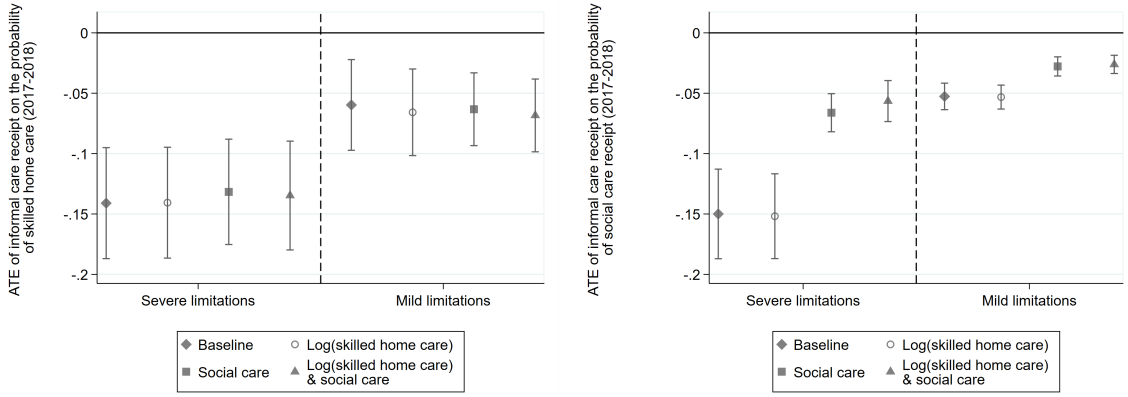


Panel B: ATE on the probability of post-acute care use (2017-2018).

Sample: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations, either severe (N=48,588) or mild (N=64,978).
Notes: ATE stands for the mean average treatment effect of informal care receipt at the time of the survey (IC). Estimation of a bivariate probit model, assuming endogeneity of informal care and instrumenting it by the proportion of daughters. For each sub-population, four specifications are estimated, controlling or not for home care receipt in 2016. First specification: baseline, not control for home care receipt; second specification: controls for log(spending on skilled home care+1);third specification: controls for social care receipt; fourth specification: controls for both log(spending on skilled home care+1) and social care receipt.

As argued in the main text, if informal care has even a small effect on *contemporaneous* access to social care given its subsidiarity nature, then the ATEs of informal care on social care could partly pick up state dependency between *contemporaneous* and subsequent social care receipt. As a matter of fact, controlling for *contemporaneous* social care receipt decreases the ATE of informal care on *subsequent* social care receipt in absolute value while controlling for *contemporaneous* skilled home care use does not affect the estimates, as shown in Figure I.3, Panel B. In addition, the ATE of informal care on *subsequent* skilled home care use is robust to controlling for *contemporaneous* receipt of social care and/or skilled home care (Figure I.3, Panel A).

Figure I.3: Average treatment effects of informal care on *subsequent* social care use are sensitive to controlling for *contemporaneous* formal care receipt, while *subsequent* skilled home care use is not.



Panel A: ATE on the probability of skilled home care use.

Panel B: ATE on the probability of social care receipt (2017-2018).

SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations, either severe (N=48,588) or mild (N=64,978).
NOTES: ATE stands for the mean average treatment effect of informal care receipt at the time of the survey (IC). Estimation of a bivariate probit model, assuming endogeneity of informal care and instrumenting it by the proportion of daughters. For each sub-population, four specifications are estimated, controlling or not for home care receipt in 2016. First specification: baseline, not control for home care receipt; second specification: controls for log(spending on skilled home care+1); third specification: controls for social care receipt; fourth specification: controls for both log(spending on skilled home care+1) and social care receipt.

I.2 Robustness checks: Estimates are robust to using alternative instruments for informal care receipt

Results are robust to using the categorical proportion of daughters or having a daughter as an instrument for informal care

Table I.I: Average treatment effect of IC receipt on binary outcomes with alternative functional forms for the instrument (gender mix of children).

	Any NH use (2017-2019) (1)	Any post-acute care use care (2017-2018)	Mortality (2017-2019)
Sample: Full sample			
Linear percentage of daughters	0.002	-0.032***	-0.013
	(0.004)	(0.003)	(0.016)
Categorical percentage of daughters	0.002	-0.031***	-0.014
	(0.004)	(0.003)	(0.016)
Has one daughter	0.002	-0.032***	-0.013
	(0.004)	(0.003)	(0.016)
Sample: Individuals with severe limitations			
Linear percentage of daughters	0.029**	-0.028***	-0.051
	(0.009)	(0.007)	(0.038)
Categorical percentage of daughters	0.029***	-0.026***	-0.055
	(0.009)	(0.007)	(0.039)
Has one daughter	0.032***	-0.028***	-0.050
	(0.009)	(0.007)	(0.040)
Sample: Individuals with mild limitations			
Linear percentage of daughters	-0.013***	-0.024***	-0.023
	(0.003)	(0.005)	(0.020)
Categorical percentage of daughters	-0.013***	-0.024***	-0.024
	(0.003)	(0.005)	(0.021)
Has one daughter	-0.014***	-0.023***	-0.026
	(0.003)	(0.005)	(0.021)

SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386).
NOTES: Estimation of a bivariate probit model, with three alternative instruments: linear percentage of daughters, categorical percentage of daughters with four categories (0-25%; 25-50%; 50-75%; 75-100%) and a dummy for having at least one daughters.

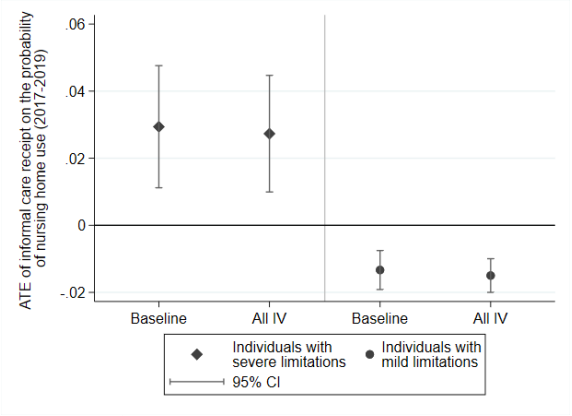
Table I.II: Average treatment effect of IC receipt on binary outcomes with alternative functional forms for the instrument (gender mix of children).

	Total cost	Cost of institutional care	Total health care cost	Home care cost
	(1)	(2)	(3)	(4)
Sample: Full sample				
Linear percentage of daughters	362.77	-1190.8***	-3749.9**	-720.41**
	(1932.3)	(444.34)	(1837.3)	(393.48)
Categorical percentage of daughters	429.12	-1189.7***	-3784.2**	-730.73*
	(1788.9)	(379.91)	(1769.6)	(381.62)
Has one daughter	350.77	-1189.7***	-3784.2**	-730.73*
	(1905.7)	(379.91)	(1769.6)	(381.62)
Sample: Individuals with severe limitations				
Linear percentage of daughters	10017.9*	312.36	1909.9	4681.0***
	(5771.1)	(1180.1)	(4441.9)	(1077.9)
Categorical percentage of daughters	10282.1*	531.81	1783.2	4765.0***
	(5611.34)	(1261.42)	(4947.9)	(1176.0)
Has one daughter	10098*	531.81	1783.2	4765.0***
	(5536.8)	(1261.42)	(4947.9)	(1176.0)
Sample: Individuals with mild limitations				
Linear percentage of daughters	-6549.9***	-1042.4***	-7890.2***	-812.48***
	(1536.8)	(283.03)	(1392.4)	(177.47)
Categorical percentage of daughters	-6628.9***	-1097.3***	-7872.9***	-833.82***
	(1702.9)	(269.12)	(1572.2)	(171.71)
Has one daughter	-6642.5***	-1097.3***	-7872.9***	-833.82
	(1931.5)	(269.11)	(1572.2)	(171.71)

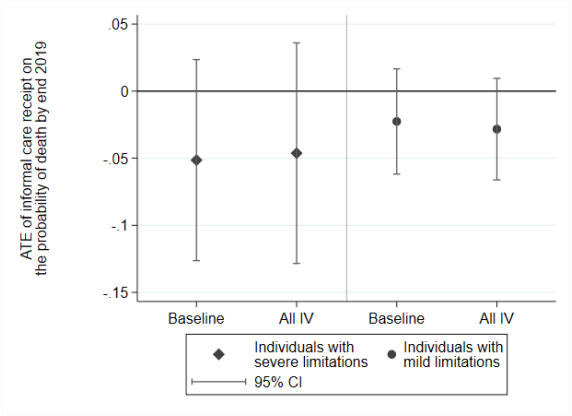
SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386).
NOTES: Estimation of a control function method, with three alternative instruments: linear percentage of daughters, categorical percentage of daughters with four categories (0-25%; 25-50%; 50-75%; 75-100%) and a dummy for having at least one daughters.

Results are robust to using distance to closest child and the number of children as instruments

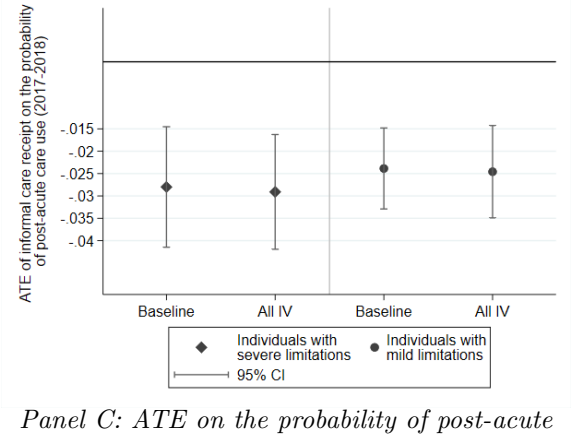
Figure I.4: Average treatment effect of informal care receipt on nursing home entry, mortality and post-acute care use, depending on the severity of limitations, with alternative instruments.



Panel A: ATE on the probability of nursing home use (2017-2019).



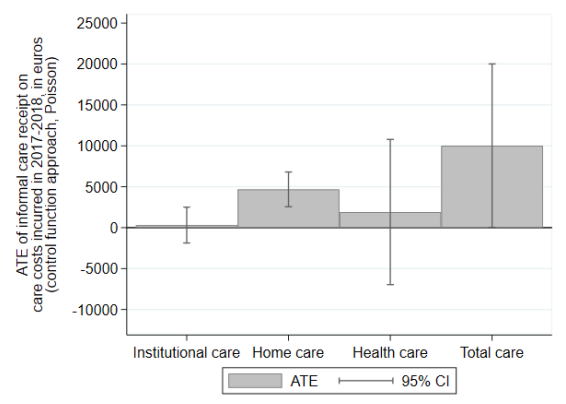
Panel B: ATE on the probability of death by end of 2019.



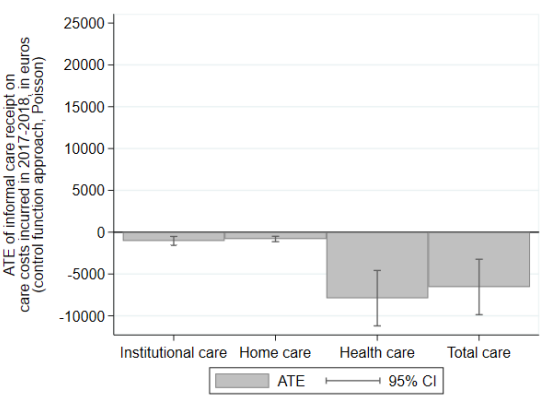
Panel C: ATE on the probability of post-acute care use (2017-2018).

Sample: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations, either severe (N=45,588) or mild (N=64,798).
Notes: This Figure reports the average treatment effect (ATE) of informal care receipt on different costs incurred over 2017 and 2018. Costs are expressed in current euros. Estimation of a bivariate probit regression, instrumenting informal care receipt either by the proportion of daughters (continuous) only ('Baseline'), or the proportion of daughters, the number of children (continuous) and the distance to the closest child (categorical) ('All IV'). All specifications include control variables.

Figure I.5: Average treatment effect of informal care receipt on subsequent care costs, depending on the severity of limitations, with alternative instruments.



Panel A: Population with severe limitations (N=45,588).



Panel B: Population with mild limitations (N=64,798).

SAMPLE: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations (N=113,386).

NOTES: This Figure reports the average treatment effect (ATE) of informal care receipt on different costs incurred over 2017 and 2018. Costs are expressed in current euros. Estimation of a control function model combining a probit regression and a Poisson regression, instrumenting informal care receipt by the proportion of daughters (continuous), the number of children (continuous) and the distance to the closest child (categorical). All specifications include control variables. See Figure 4 in the main text for a comparison with the baseline estimates (i.e. when the proportion of daughters is used as the only instrument).

I.3 Alternative specification: 2SLS estimates

Our preferred estimator, the recursive bivariate probit, imposes distributional assumptions. In this Appendix, we show estimates derived from a 2SLS estimator. Because it does not rely on any parametric assumption, the 2SLS is preferred over alter in a variety of contexts. As discussed in Section 4, in our context there are empirical and theoretical reasons to favor the bivariate probit estimator over the 2SLS. As a reminder, the bivariate probit allows to estimate a the Average Treatment Effect (ATE), while the 2SLS has been shown to produce a Local Average Treatment Effect (LATE) (Chiburis *et al.*, 2012). Furthermore, the 2SLS is suspect of not providing consistent estimates given the distribution of our variables of interest. The LATEs derived from 2SLS estimations are nonetheless provided for information, and displayed in Table I.3.

For the binary outcomes, we can observe that the coefficient estimates are larger in magnitude than those obtained with the bivariate probit. For example, in the sample with severe limitations, receiving informal care induces a 12 (resp. 6) percentage point increase in the probability to use nursing home care within 3 years with the 2SLS (resp. bivariate probit) estimator. We can also observe that, although the point estimate is larger, it is not significant because of the very low precision: standard errors are 10 times larger with the 2SLS estimator, such that the estimates are not informative. As explained in Section 4, we argue that the LATEs from the 2SLS would be biased and the standard errors biased upwards; the results comfort the choice of the bivariate probit estimator.

For continuous outcomes, we also remark a very low precision of the estimates such that the effect of informal care is never statisically significant. In addition, the linear estimator might provide a biased point estimate for the continuous variables with a high proportion of zero (no cost incurred) and highly skewed (Santos Silva & Tenreyro, 2011). We therefore have little trust in the results obtained by the 2SLS estimator in this context.

Table I.III: Estimated effect of informal care receipt on the different outcomes with a 2sls estimator

Full Sample (N=113,386)							
Outcome	Any nursing home use (2017-2019)	NH use by end 2018	NH use by end 2017	Died by end 2019	Any post-acute care use (2017-2018)	Any skilled home care use (2017-2018)	Any social care use (2017-2018)
IC	0.123	0.121*	0.022	-0.071	-0.077	-0.173	-0.136
	(0.081)	(0.066)	(0.043)	(0.135)	(0.087)	(0.167)	(0.151)
Outcome	Total care costs elderly care	Costs of old-age institutional care	Total health care costs	Costs of skilled home care	Nursing home stay cost	Cost of geriatric care	Cost of hospital care
IC	2340.134	1768.735	-1611.951	2183.350	1689.908	-2312.412	-6151.340
	(12023.141)	(4299.324)	(9414.630)	(3061.649)	(4249.473)	(1499.374)	(7183.229)
Sample with severe limitations (N=48,588)							
Outcome	Any nursing home use (2017-2019)	NH use by end 2018	NH use by end 2017	Died by end 2019	Any post-acute care use (2017-2018)	Any skilled home care use (2017-2018)	Any social care use (2017-2018)
IC	0.118	0.136	0.021	-0.051	-0.093	-0.234	-0.080
	(0.100)	(0.083)	(0.056)	(0.154)	(0.103)	(0.192)	(0.175)
Outcome	Total care costs elderly care	Costs of old-age institutional care	Total health care costs	Costs of skilled home care	Nursing home stay cost	Cost of geriatric care	Cost of hospital care
IC	1882.578	1316.346	246.294	319.938	1158.937	-2625.029	-1042.806
	(14630.959)	(5521.026)	(10927.461)	(4131.518)	(5451.946)	(1830.639)	(8111.490)
Sample with mild imitations (N=64,798)							
Outcome	Any nursing home use (2017-2019)	NH use by end 2018	NH use by end 2017	Died by end 2019	Any post-acute care use (2017-2018)	Any skilled home care use (2017-2018)	Any social care use (2017-2018)
IC	0.100	0.058	0.007	-0.210	-0.056	-0.066	-0.285
	(0.142)	(0.105)	(0.063)	(0.285)	(0.171)	(0.351)	(0.300)
Outcome	Total care costs elderly care	Costs of old-age institutional care	Total health care costs	Costs of skilled home care	Nursing home stay cost	Cost of geriatric care	Cost of hospital care
IC	1678.357	775.496	-4775.096	5677.956	938.835	-1923.728	-16717.457
	(21913.243)	(6669.501)	(19036.065)	(3714.375)	(6624.343)	(2761.962)	(15530.822)

Sample: Health Monitor 65+ respondents living in the community, with at least one child alive and functional limitations.

Notes: These results are obtained using a 2SLS estimator and represented the estimated coefficient for informal care receipt on the different outcomes. The percentage of daughters is used as an instrument. All regressions include covariates. Robust standard errors are presented in parentheses. *** p<0.01, ** p<0.05, * p<0.1

J How many less admissions with informal care? A back on the envelope calculation

Our estimation strategy allows us to derive the average treatment effect of informal care on the probability of a NH admission within 3 years. In this Appendix, we propose a simple calculation to gauge the magnitude of the effects we find. We compute the differential of NH admissions that would have been observed if (i) no individual had received informal care, or (ii) all individuals had received such care.

We start by deriving the total number of individuals with limitations among the 65+ Dutch population at home and with children alive. This is the population for which the ATE was derived. As shown in Table J.I, there were about 1.5 million such individuals in 2016, 55% of whom reporting severe limitations.

We then split the population by the severity of its limitation in Table J.II, and compute for each sub-population the number of individuals who receive informal care (based on the probability of informal care receipt reported in the survey). Among individuals with mild limitations, we estimate that receiving informal care would decrease the probability of informal care receipt by 1.3 percentage points, all other things equal (Column (1)). Given that 37,092 individuals receive informal care in this sub-population, we infer that there would have been 482 admissions over the period 2017-2019, had no informal care been provided to these individuals (1.3% $\times$ 37,092). Similarly, for individuals with severe limitations (Columns (2)), we estimate that there would have been 5,280 admissions less, would no informal care have been provided. As a benchmark, we report the number of total admissions, about 53,000 over 2017-2019 in the study population. Informal care is estimated to have contributed to 9% of these admissions (5,280-482, divided by 53,000).

Another way to look at it is to compute the counterfactual number of additional admissions, would everyone had benefited from informal care. We estimate this number to be 10,233 admissions less among individuals with mild limitations, counteracted by 14,277 admissions more among individuals with severe limitations.

These numbers should be taken with caution, as they are computed based on the point estimates and not taking into account statistical uncertainty around them. In addition, the relatively large magnitude of the ATE may be due to unobserved heterogeneity, which cannot - by definition - be reflected in our calculations.

Table J.I: Computing the number of individuals with mild and severe limitations, within the 65+ population at home and with children alive.

	Figure	Source
Population in 2016	16.98 million	CBS (2021*a*)
Share of the 65% in 2016	18.2%	CBS (2017)
65+ population in 2016	3,090,360	Own computation
65+ in institutions in 2016	136,125	OECD (2020)
65+ at home in 2016	2,954,235	
Share of the 65+ at home with children	89%	Appendix C, Table C.II[a]
65+ population at home with children	2,629,269	Own computation
Share with limitations	57%	Health Monitor, own computation (cf. Section 3.5)
65+ population at home, with children and limitations	1,498,683	Own computations
Share with mild limitations	55%	Health Monitor, own computation
Individuals with mild limitations	824,275	Own computation
Individuals with severe limitations	674,408	Own computation

NOTES: [a]: We take the mid-point between the Health Monitor and the SHARE estimates.

Table J.II: Computing the number of additional admissions if informal care was scaled down or scaled up.

	Individuals with mild limitations	Individuals with severe limitations	
	(1)	(2)	
Probability of IC receipt	4.5%	27.0%	Table II
Number of IC recipients	37,092	182,090	Own computation
ATE of IC on NH admission	-1.3%-pt	2.9%-pt	Table III
Number of additional admissions if no one had received IC	482	-5,280	Own computation
Number of additional admissions if everyone one had received IC	-10,233	14,277	Own computation
Probability of a NH admission	1.3%	6.3%	Table II
Number of NH admissions	10,715	42,487	Own computation

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