Statistisk sentralbyrå
Statistics Norway

Family composition and transitions into long-term care services among the elderly

TALL SOM FORTELLER
DISCUSSION PAPERS
954

Astri Syse, Alyona Artamonova, Michael Thomas and Marijke Veenstra

Discussion Papers No. 954, May 2021
Statistics Norway, Research Department

Astri Syse, Alyona Artamonova,
Michael Thomas and Marijke Veenstra

Family composition and transitions into long-term care services among the elderly

Abstract:
Elderly's use of long-term care (LTC) services are likely to be influenced by family members, but there is scarce research on the role played by partners and/or adult children, especially taking geographic proximity into account. We thus examine how partners and adult children influence elderly's LTC use, taking regional differences into account. We employ logistic discrete-time hazard regression models on linked registry data for complete cohorts of elderly individuals (65+ years), their partners, their adult children, residing in Norway in the period 2010-2016 (N=820 000). We also include municipal characteristics.

One's own, partner's and child(ren)'s characteristics are all associated with elderly individuals' LTC use. Partners' resources matter the most, but those of adult children are relevant when partners are less resourceful or absent. Childless elderly use more LTC services than elderly with children, and elderly with resourceful children living nearby use the least LTC services. The trends are similar across municipalities, but the magnitudes vary slightly depending on their geographic location and sociodemographic and economic resources. Future demographic and economic changes warrant a better understanding of the role played by family members for elderly's use of LTC services.

Keywords: Care use, Family, Formal care, Geographic, Informal care, Long-term care (LTC)

JEL classification: I10, I12, I18, J10, H41

Acknowledgements: We are grateful for valuable comments from K. Wiik and E. Holmøy at SSB, and seminar participants at the Maryland Population Research Center. This study was supported by a grant from the Norwegian Research Council (#256678, HELSEVEL) and the European Research Council under the Horizon 2020 research and innovation program (#740113, FamilyTies).

Address: Astri Syse, Statistics Norway, Research Department. E-mail: sya@ssb.no

Alyona Artamonova, University of Groningen, Faculty of Spatial Sciences. E-mail: a.artamonova@rug.nl

Michael Thomas, Statistics Norway, Research Department. E-mail: mjt@ssb.no

Marijke Veenstra, OsloMet, NOVA. E-mail: mveen@oslomet.no

Discussion Papers comprise research papers intended for international journals or books. A preprint of a Discussion Paper may be longer and more elaborate than a standard journal article, as it may include intermediate calculations and background material etc.

Abstracts with downloadable Discussion Papers
in PDF are available on the Internet:
http://www.ssb.no/en/forskning/discussion-papers
http://ideas.repec.org/s/ssb/dispap.html

ISSN 1892-753X (electronic)

Sammendrag

Eldres bruk av kommunale pleie- og omsorgstjenester avhenger dels av egen helse og egne ressurser, men kan også påvirkes av ressurser til nære familiemedlemmer. Det er imidlertid lite forskning på betydningen av ressursene til partnere og voksne barn, spesielt med tanke på geografisk nærhet. I denne artikkelen undersøker vi betydningen av anerkjente sosiodemografiske kjennetegn som alder, utdanning, og familiesituasjon for bruk av pleie- og omsorgstjenester, men ser også på i hvilken grad geografisk avstand mellom eldre og deres voksne barn inngår i et utvidet ressursbegrep. Videre undersøker vi om det er regionale forskjeller i bruk av slike tjenester, gitt sosiodemografiske kjennetegn hos de eldre selv, deres nærmeste og kommunen de eldre er bosatt i.

Vi har koblet registerdata for komplette kohorter av eldre personer (65+ år) med data om deres partnere og deres voksne barn, bosatt i Norge i perioden 2009-2016 (N = 820 000 individer, 4,0 millioner person-år, gjennomsnittlig observasjonstid 4,8 år). I tillegg til sosiodemografiske kjennetegn har vi også IPLOS-data om eldres bruk av kommunale pleie- og omsorgstjenester, informasjon fra KOSTRA om kommunene eldre er bosatt i, samt informasjon om eldres geografiske nærhet til sine voksne barn. Vi benytter logistiske regresjonsmodeller for å undersøke samvariasjon mellom bruk av kommunale pleie- og omsorgstjenester og sosiodemografiske kjennetegn for eldre, deres partnere og deres barn, samt regionale kjennetegn.

Til sammen hadde 68 prosent av de eldre en partner (gift eller samboer), mens 88 prosent hadde ett eller flere barn. Rundt en fjerdedel brukte kommunale pleie- og omsorgstjenester. Både eldres egne, deres partneres og deres barns sosiodemografiske kjennetegn var assosiert med eldres bruk av tjenester. Ressursene til voksne barn hadde størst betydning for eldre som ikke (lenger) hadde en partner eller eldre med en mindre ressurssterk partner. Eldre uten barn brukte mer omsorgstjenester enn eldre med barn, og eldre med barn i nærområdet brukte omsorgstjenester minst av alle. Trendene var relativt like også i et regionalt perspektiv, men omfanget av tjenestebruk varierte noe avhengig av geografisk beliggenhet og sosiodemografiske og økonomiske ressurser i den enkelte kommune.

I denne studien er vi ikke i stand til å vise årsakssammenhenger, og vi kan heller ikke skille mellom seleksjon og sosiale støttemekanismer. Kanskje er det slik at eldre med ressurssterke partnere og/eller voksne barn (i nærheten) er friskere og dermed i større grad unngår helseproblemer som fordrer bruk av pleie- og omsorgstjenester i eldre år? Eller kan det være at de får mer støtte og oppfølging fra sine nærmeste, og dermed har et reelt lavere behov for tjenester? Framtidige demografiske og fiskale endringer, som for eksempel aldring, flere eldre med komplekse familiekonstellasjoner, sentralisering og et forverret økonomisk og ressursmessig handlingsrom innenfor helse, pleie og omsorg, fordrer mer forskning på familiemedlemmers rolle for eldres helse og forbruk av pleie- og omsorgstjenester.

1 Introduction

In modern societies, the health, care and well-being of elderly is typically a shared responsibility between the family and the welfare state, with supportive efforts from other parties, such as friends, neighbors and volunteers (WHO 2002). Norway is facing rapid populating ageing: Whereas elderly aged 65 or over comprise 18 percent of the population today, they are projected to comprise 28 percent by 2060, according to the main alternative in Statistics Norways population projections (Syse et al. 2020a). More specifically, the population aged 65 or older has risen from near 600 000 persons in 1980, to 940 000 today, and is expected to increase further to around 1.7 million by 2060. The rise of elderly aged 80 or over will be even greater and increase more than threefold, from 230 000 today to 720 000 by 2060. The number of persons in their 90s and 100s will increase nearly fivefold, from 45 000 to 210 000. Population ageing may thus both lead to a greater demand for labor-intensive long-term care provided by municipalities, as well as challenge the intergenerational solidarity within the family (Muir 2017). Ultimately, this is likely to influence the sustainability of the welfare state (Lorenzoni et al. 2019, OECD 2019).

The use of old-age care services is driven by elderly's health and welfare needs, the availability of such services, but also by the availability of informal care. Most of the informal old-age care today is provided either by a partner or by adult children (OECD 2019). Increased geographic mobility, declining family size, changing family structures, extended working lives and rising female labor market participation might imply that fewer people will be willing or able to provide informal care in the future (Tonnessen 2017, Blix et al. 2021).

The availability of both formal and informal care is relevant for elderly's health and well-being. As such, the presence or absence of family members as well as their characteristics is important. However, there is relatively scarce research on how partners' characteristics affect elderly companions' health and long-term care use. There is even less research on the role played by adult children, especially taking geographic proximity into account. In this paper we aim to examine the role played by cohabiting or marital partners, as well as that of adult children, for elderly's use of formal long-term care services. A particular focus will be directed at geographic closeness to children.

Elderly individuals clearly benefit from being healthy and independent (WHO 2002). However, having a healthy and independent elderly population is also significant for the health and care burden of a society, and thus its sustainability. As such, it is important to understand how family members may contribute to keep older generations healthy and independent, and thus help ensure active ageing at an individual level. In Norway, adult children have no legal obligation to contribute to informal old-

age care (Kjonstad et al. 2017). Nevertheless, the overall situation is typically considered when determining the type and level of long-term care services to be provided (Jakobsson et al. 2015).

1.1 Background and motivation

Previous research has shown that elderly's health is associated with marital status, with partnered persons reporting better health and living longer (Waite & Lehrer 2003, Kravdal et al. 2012). Similar findings have also been observed for parenthood (Kravdal et al. 2012). Some evidence suggests that this primarily stems from selection mechanisms, i.e. that healthy or resourceful individuals select one another for partnership and/or parenthood (e.g. Goldman 1993, Wiik & Dommermuth 2014). Other literature suggests, however, that protection mechanisms play an important role, i.e. that individuals with partners and/or children may have healthier lifestyles and behaviors, and therefore better general health (e.g. Lillard & Panis 1996, Waite & Lehrer 2003, Lindström 2009). Having a partner and/or children may also promote earlier contact with health personnel and/or help ensure more optimal treatment and follow-up care (Kravdal 2000, DiMatteo 2004, Seo & Lee 2010). Importantly, all these suggested mechanisms invoke the mere presence of partners and/or children and do not consider the partners' or children's characteristics that are indirectly or directly relevant for elderly's health, and thus possibly function as a predictor for old-age care uptake. Few studies have looked at the importance of family resources for old-age care use (see Section 1.4), and we have not been able to identify studies that simultaneously account for characteristics of married and cohabiting partners and adult children, as well as the geographic proximity to adult children. In this study we thus expand the family perspective to include also adult children residing outside the household of elderly parents. We assess only the actual uptake of formal long-term care services. However, we argue that the need for formal care may be proxied by its actual use. Along the same lines, we have no measure of informal care in our data, albeit previous reports show that it comprises close to around 100 000 man-years annually in Norway (Otnes 2013, Hjemaas et al. 2019). Although a partner is generally considered the major provider of support and company (Cantor 1991) and living close to family is associated with the frequency of contacts (Bordone 2009, Hank 2007) and exchange of support (Knijn & Liefbroer 2006, Mulder & van der Meer 2009), the presence of partners and the geographic proximity of children might of course proxy also other factors such as the underlying quality of the parent-child relationship or the general resourcefulness of children or elderly, but that is beyond the scope of this article. Our contribution to the literature is thus threefold: First, we examine differences in long-term care use by elderly and their partners resources. Second, we account also for adult children's possible contribution, focusing particularly on geographic proximity. Lastly, we assess the importance of local contexts and regional variation, as long-term care is provided at the municipal level in Norway.

1.2 The Norwegian setting

Norway is a welfare state, and around a quarter of Norway's population of 5.4 million rely in part on welfare benefits as a means of a living.[1] The National Insurance Scheme ensures free or highly subsidized health care regardless of age, contrary to many other systems worldwide, and health care accounts for more than 10 percent of the GDP in Norway (Statistics Norway 2020a). This measure includes also long-term care services for elderly, hereafter abbreviated LTC, which include among others home health care, nursing homes, other LTC living facilities, as well as social measures such as day-time activities. These services are embedded in a universalist system with extensive service provision and universal citizen rights (Oien et al. 2012, Kjonstad et al. 2017). They are predominantly publicly financed through general taxation and rationed according to health needs, as is the case in most OECD countries (Colombo et al. 2011). In total, Norway spends around 3.3 percent of its GDP on such services, only surpassed by the Netherlands and closely followed by Sweden (OECD 2019). Public opinion supports the predominant role of the public sector in this context (Daatland & Herlofson 2003). Demand for old-age care services is expected to rise, primarily due to ageing populations and increasing prevalence of long-term conditions such as dementia. Although Norway has comparatively fewer elderly aged 65 and above with functional limitations (15 percent) and in suboptimal health (32 percent) than that of many other OECD countries, population ageing has outpaced the growth of old-age care supply for elderly in Norway (OECD 2019).

Norway is a relatively small, but long-stretched, country. There were 428 municipalities in Norway in 2016, ranging in size from around only 200 to more than 600 000 inhabitants. The average number of inhabitants per square kilometer is only around 14. However, the majority of the population resides in urbanized areas, and only 12 percent reside in what may be defined as 'rural' areas.[2] As in most other countries, there is an ongoing centralization in Norway, primarily driven by younger generations leaving rural communities and relocating to more centralized areas, resulting in a pronounced ageing of rural municipalities (Syse et al. 2018a). One possible consequence is that the number and/or share

[1] Welfare benefits account for around one third of the government budget. Norwegian pensions are generous and universally available, and retirement is not associated with a pronounced increase in povery risk, see https://www.oecd.org/els/public-pensions/PAG2017-country-profile-Norway.pdf. Before 2011, age 67 was the default retirement age. From 2011, a pension reform established age 62-70 as a general and flexible pension period. Consequently, the vast majority (94%, cf. Table 1) of the elderly included in this study receive some form for pension and/or other welfare benefit.

[2] Rural areas are defined as the two lowest centralization categories, see https://www.ssb.no/en/klass/klassifikasjoner/128/versjon/969. In short, centrality is a measure of a municipality's geographical position in relation to a centre where higher-order services are available (banks, post offices, etc.). We distinguish between rural (which normally have populations of less than 15 000 and do not fulfil the function of a regional centre) and urbanized municipalities (all other).

of elderly in rural areas without children nearby might increase in the years to come, with implications for informal care provision.

Norwegian municipalities are not fully autonomous units, but exercise autonomy within the framework determined by the Parliament. To counteract differences in the service provision between the municipalities, the state provides guidelines and adopt common laws and regulations which, among other things, require municipalities to organize and ensure the provision of welfare services, including primary sector health care and old-age care services (LTC), in compliance with certain predefined minimum standards.[3] Residents are not entitled to specific services. Their rights are determined by need, and anyone in need has a right to necessary health care. Consequently, municipalities decide which service, and the scope of the service, that is warranted to meet the corresponding individual needs of their residents (Oien et al. 2012, Kjonstad et al. 2017). They are, however, restricted to allocating services according to need and irrespective of sociodemographic characteristics, unless these characteristics modify the need. All inhabitants in a municipality are thus entitled to health and care services should they need it, irrespective of their living arrangements and/or the specific geographic location of their home, and also irrespective of the resource situation in the municipality. In line with the active ageing framework, the proportion of LTC recipients living at home instead of in care facilities has increased over the past decade, in Norway as in most other OECD countries (OECD 2019).

Altogether, 7 percent of the Norwegian population used LTC in 2016, and the number of unique users has increased substantially from 2009 (Mork et al. 2017). Women use more services than men, and the proportion of the population receiving services increase with age: In 2016, LTC were used by 13 percent in the age group 65-79 years, near half in the age group 80-89 years, and around 90 percent among those 90 years and older. Nevertheless, every fourth recipient was below 50 years. Many recipients received more than one service during the year, and elderly aged 90 and over have the greatest needs for assistance. Around 70 percent of users of LTC live in ordinary community housing, including around a quarter of recipients with extensive needs. In 2016, 42 percent of all LTC recipients also received some form of unpaid private help, but this figure has declined somewhat over time (Mork et al. 2017).

[3] Individuals, or any person acting on behalf of an individual, must submit an application to the municipality to receive LTC. The applications are generally sent via the individual's general practitioner. The allocation of care is then determined after reviews of applications. The evaluation should only consider the situation of the applicant, but research has shown that also other factors appear to play a role, such as the presence of a social support network which most commonly comprises either a partner or adult children (Jakobsson et al. 2015).

1.3 Theoretical background

Two main mechanisms can be distinguished in describing how family members, both in terms of their mere presence and their characteristics, may postpone, reduce or altogether avoid elderly's use of long-term care services. First, by ensuring that good health is maintained also in late life and by postponing the onset of illness and disease. Second, by providing informal care and support.

1.3.1 Health promotion

Differentials in elderly's health and welfare by individuals' family situations have been hypothesized to stem from either selection or protection, or a combination of the two. Being in a co-residential union implies certain obligations, expectations and responsibilities, which lead to a certain level of protection. This implies that having partners and/or children may result in a different lifestyle, for instance by reducing risky or unhealthy behaviors and by increasing means for social integration (Lillard & Panis 1996, Monden et al. 2003, Waite & Lehrer 2003, Lindström 2009). It may also promote earlier contact with health personnel (Seo & Lee 2010) and help ensure more optimal treatment and follow-up care, should the need arise (Kravdal 2000, DiMatteo 2004).

The positive health effects of having a partner and/or children may also reflect selection effects. For example, the selection of marriage theory suggests that the physically and psychologically unhealthy less likely to be chosen for marital or cohabitating unions (Goldman 1993, Wiik & Dommermuth 2014), with links to fertility, although in a causally complex way (Syse et al. 2020b). However, also less healthy individuals in partnerships have lower fertility (Barclay & Kolk 2020). Furthermore, while the health of a partner is obviously a determinant of widowhood and linked to the health of the person under study (Jin & Christiakis 2013), separation and divorce risks may also be influenced (Teachman 2010). Existing studies are fairly consistent in that they identify an association between partners' and children's resources and the health outcome studied, but the magnitude of effects differ depending on the outcome variable examined (e.g. all-cause mortality, cause-specific mortality, self-rated health, disease outcomes or transfers to LTC facilities), the explanatory variables assessed, and the setting (especially country and age) (see e.g. Monden et al. 2003, Grundy & Jitlala 2007, Torssander & Erikson 2009, Torssander 2014, Syse & Lyngstad 2017). More research is currently emerging on elderly's health and mortality, accounting also for partners' and children's characteristics. However, few studies have looked at the importance of the joint resources of partners and children.

1.3.2 Informal care provision

In countries with a developed welfare state, older people can receive necessary assistance from both formal sources as well as from family members (Connidis & Barnett 2018). How the assistance tasks

are divided might depend on the availability of care services funded by the state, the legal obligation to support relatives in need, and opinions about whether the state or family members should be responsible for the care of older people (Haberkern & Szydlik 2010). In Norway, people tend to place greater responsibility on the state than on the family in providing care for older people (Daatland & Veenstra 2012). Substitution among the providers of old-age care originally indicated a process whereby the state 'takes over' what families used to do. In an earlier Norwegian study, Lingsom (1997) failed to find substantial support for this thesis that public services have 'taken over' family care. Rather, with ongoing pressures and cutbacks in LTC, a 'reverse' substitution is taking place in many countries in Europe, with family members stepping in to counteract the decline of public services (cf. Lingsom 1997, van Houtven & Norton 2004, Bremer et al. 2017, Zigante et al. 2021), especially in care for older people with less complex care needs (Bonsang 2009). Since the midt 1990s, there are fewer elderly in nursing homes in Norway, and fewer who receive home care services (Daatland & Veentra 2012). However, relatively more older people have access to assisted housing. In addition, there has been a development towards prioritizing those with the greatest care needs. Needs for practical assistance have to a large extent become the responsibility of older people themselves and their families.

Daatland and Herlofson (2003) have shown that in the Nordic welfare states, professional providers often perform the medically demanding care, while the family is more likely to provide the less demanding, spontaneous help, as well as oversee and coordinate the formal care. This is also observed internationally (Bonsang 2009). Among married elderly persons, spouses typically bear the primary responsibility for their partner's care (Hayward et al. 2004, Szinovacz & Davey 2008). Prior research suggests a gender difference, in that husbands tend to receive more spousal care than wives (Katz et al. 2000), over longer time periods and at greater levels of disability (Freedman et al. 1994). Consequently, married women are more likely to become institutionalized than married men (Szinovacz & Davey 2008). Along the same lines, there is also gender variation in husbands' and wives' relative reliance on care from a spouse versus that of adult children: Husbands rely heavily on their wives for care and relatively little on adult children, while wives receive a substantial proportion of their care also from adult children. In general, daughters are more often caregivers than sons (e.g. Kotsadam 2011, Bauer & Sousa-Poza 2015, Grigoryeva 2017).

While there exists a solid literature on informal care giving, in particular in relation to ageing (see e.g. van Groenou & De Boer 2016), little is known how family member's resources are associated with formal LTC use in older people. Having resourceful partners and/or children increases the availability of informal care (Chappel & Blandsford 1991, OECD 2019) and may thus to some extent serve as a

substitution for scarce formal care services. On the other hand, it may result in a more favorable interaction with the formal health and care system. Resourceful partners and/or adult children of elderly parents may be better at negotiating a fairly complex health care system, in particular in municipal out-patient settings where user-provider communication is key (Bago d'Uva & Jones 2009).

Theoretically, having children nearby might proxy many different aspects, for instance the underlying quality of the parent-child relationship with close families opting to reside close to one another (Seltzer et al. 2013) or the general resourcefulness of children, since less resourceful children are less likely to move away for education and/or employment (Zhang et al. 2013).

In the current paper, we initially operationalized 'resourcefulness' in terms of partners' younger age, higher education, higher relative income as compared to other partners, and good health, the latter proxied by partners not using formal LTC. For children, we also included geographic proximity, gender, being partnered (married/cohabiting) and good health (i.e., no uptake of health benefits), in addition to education and income. In the reverse case, children's unfavorable labor market attachment, unfavorable economic situation and poor health may proxy fewer resources. Below, we briefly review the empirical and theoretical importance of these characteristics.

1.4 Existing studies

Our review of existing studies is limited to the uptake of formal LTC. On this topic, there is relatively scarce research that accounts for the role played by family members and their resources, and most research examines transitions to institutions or other long-term care facilities rather than the uptake of home health care.

1.4.1 Characteristics of elderly and uptake of LTC

Associations between individual sociodemographic characteristics and either health, morbidity, LTC uptake or mortality are well-established, with younger age, partnership, parenthood, and a higher level of socioeconomic status generally predicting better health, lower LTC uptake and a reduced risk for institutionalization (Grundy & Jitlala 2007).[4] Patient-provider communication and use of health care is known to vary with for instance education (see e.g. Bago d'Uva & Jones 2009, Smith et al. 2009, Marks et al. 2010, Fiva et al. 2014). It may thus be argued that more resourceful persons have a better understanding of the healthcare system, and thus are better at navigating their way through the health

[4] In Norway, as in many other developed countries, immigrant status is generally associated with lower mortality and better health, primarily thought to reflect selection, i.e. the 'healthy immigrant effect' (Syse et al. 2018b).

bureaucracy, claiming their rights, acquiring relevant information, and communicating their symptoms.

Some studies, however, report counterintuitive results for LTC uptake: Larsson et al. (2006) find for instance that a high level of education increases the risk of institutionalization. Furthermore, they find that informal extra-residential care increases the risk of both home health and institutionalization in Sweden, and that predisposing factors such as age and gender are of importance only for people living alone (ibid). They thus conclude that elderly care resources are not provided solely according to need. This is also observed by Nöell-Miller (2010), who find that neither a high education nor a high income predicts transitions to nursing homes, which they state is in line with previous studies.

1.4.2 Elderly with and without partners and partners' characteristics

Existing studies on LTC use suggest that elderly who live alone use more hours of formal home care than those who live with for instance a spouse or an adult child (Hayward et al. 2004, Dohl et al. 2016). Whereas the Canadian study finds no gender differences (Hayward et al. 2004), the Norwegian study finds that among elderly living with a partner, less care is provided to men than to women (Dohl et al. 2016). Living alone is also associated with a higher likelihood of institutionalization (Grundy & Jitlal 2007, McCann et al. 2011). The reverse is also true, i.e. that older people with a spouse at home are less likely to utilize institutionalized care (Greene & Monahan 1987, Grundy & Jitlal 2007, Van der Pers et al. 2015a). Studies find, however, somewhat inconsistent results when the *reason* for living without a partner is considered: Thomeer et al. (2016) find that widowed, divorced, and never married adults have the highest risks of long-term care admission, while remarried and partnered adults are as likely to be institutionalized as the continuously married, whereas McCann et al. (2011) find that those living alone have the highest likelihood of admission, but that there is little difference between the never-married and the previously married.

In terms of gender differences, Pezzin et al. (2013) report that widowhood leads to the same increased risk for institutionalization for men and women, while the findings of Noël-Miller (2010) suggest that the risk of nursing home entry is doubled for men following spousal death but remains unchanged for women. Van der Pers et al. (2015a) report that for women, widowhood and separation is closely related to moves to a care institution, whereas for men, the risk is equally increased irrespective of the cause of having an absent partner. Pezzin et al. (2016) find that among divorced elderly, there is an increased risk of institutionalization among men only. Thomeer et al. (2016) observe a gender difference in the risk of institutionalization for both partnered and unpartnered elderly, with the difference being more

pronounced for men than women, and thus conclude that relationship status is most important for men. In contrast, McCann et al. (2011) report no gender differences for elderly living alone.

Empirical studies on the role of partner characteristics for elderly's LTC use are rare. One study indicates a positive association between the likelihood of men's institutionalization and the partner's age, indicating that older wives might have a limited capacity to reduce their husband's risk of nursing home admission (Noël-Miller 2010). In addition, younger partners may be better at seeking information and navigating the healthcare system and thus gain access to better treatment and care for their partner. A similar association can be expected for partners with a high level of education (Cutler & Lleras-Muney 2010). Further, having a partner with a higher income, also net of education, has been shown to have a positive influence on health and mortality (Brown et al. 2014, Syse & Lyngstad 2017). Having a partner in poor health is not likely to be a resource. It may indicate a reverse situation in that older persons might need to provide informal care for their partner rather than be at the receiving end themselves. However, studies on this topic are rare, and Noël-Miller 2010 does not find an association between a spouse's self-reported health or disability status and the companion's risk of moving to an institutionalized care facility.

1.4.3 Elderly with and without children and children's characteristics

Childless women are at higher risk for being in institutionalized care than women with children, irrespective of partnership status (Grundy & Jitlal 2007, Pezzin et al. 2013). The risk is further increased for childless women after the loss of a partner (van der Pers et al. 2015a). Grundy and Jitlal (2007) find that having adult children buffer husbands' risk of nursing home entry only after the death of their wife, when spousal assistance is no longer available.

Whereas one study finds that among married partners, each additional child diminishes wives' risk of nursing home use, while there is no effect for husbands (Grundy & Jitlal 2007), a study including also unpartnered elderly finds a similar gender pattern (Thomeer et al. 2016). A more recent study, however, does not reveal an association between the number of children and the likelihood of institutionalization, for neither elderly men nor women (Artamonova et al. 2021).

In terms of co-residence, living with an adult child appears to offer a similar protection as that of living with a partner (McCann et al. 2011). However, the presence of children reduces admissions especially for married couples, and more so for men than women (ibid). Furthermore, van der Pers et al. (2015a) find that recently widowed women with co-residing children are more likely to move to a care institution, whereas the reverse is true for men who had recently become widowed or otherwise lost

their partner. This might imply that in the absence of a partner, co-resident children are less able to meet the increased need for the assistance of their mothers than of their fathers (van der Pers et al. 2015a).

Having children living nearby (for example, in the same neighborhood or municipality) appears to buffer transfers to a care institution (van der Pers et al. 2015a, Artamonova et al. 2021). The protective effect of children's proximity is found to be stronger for mothers than fathers (Artamonova et al. 2021). The presence of nearby children might, however, proxy many different aspects, for instance the underlying quality of the parent-child relationship with close families opting to reside close to one another (Seltzer et al. 2013).

Previous studies have shown that daughters are more likely than sons to provide informal care for their elderly parents (Haberkern & Szydlik 2010, Colombo et al. 2011). Some studies also suggest that children are more likely to provide informal care for a parent of the same gender (Lee et al. 1993, Leopold et al. 2014). The gender gap is remarkably robust across European countries (Haberkern & Szydlik 2010), even though there are large differences in old-age care policies and in gendered norms of family care (Kotsadam 2011). For elderly with nearby children, having a daughter nearby might increase the availability of informal care more than having a son nearby, thus resulting in less need for formal care (Jakobsson et al. 2015). A Norwegian study among case managers suggested that municipal care allocation may depend on the gender of a nearby child, i.e. that if an elderly woman had a daughter instead of a son, she would on average receive about a third less formal care per week (Jakobsson et al. 2015). This is in line with results suggesting that having a greater number of daughters diminishes women's, but not men's, risk of institutionalization following spousal loss (Noël-Miller 2010), and that in sibling groups with sons, children seem to be more likely to leave care responsibilities to professional carers (Haberkern et al. 2015). A recent Swedish study, however, did not find evidence of a differential effect of having a daughter as compared to a son as the closest child on the likelihood of institutionalization (Artamonova et al. 2021).

Children's level of educational attainment may be important for older people's LTC use as, in the case of higher educated partners, educated children may have a better understanding of the LTC system, and thus be better at navigating their way through the health bureaucracy, claiming their parents' rights, acquiring relevant information, and communicating their parents' needs. Whether or not such resources would be applied to provide informal care or to 'push' the system for more formal care is, however, not clear (Hanaoka & Norton 2008). Having at least one adult child with high income is associated with a higher propensity of mothers to be institutionalized (Artamonova et al. 2021). Additionally, the older the closest child, the more likely a parent is to relocate to residential care (ibid). Women who were living with a never-married child had a reduced chance of being institutionalized

relative to women living alone (Grundy & Jitlal 2007). However, those who lived in complex households, predominantly with married children, have similar risks of institutionalization as those living alone, suggesting that never-married children are able or willing to give more care to a parent than married children with competing responsibilities (Grundy & Jitlal 2007). The authors state, however, that this might also reflect a higher level of disability among those who had already made a move to living with a married child (ibid).

1.5 Hypotheses

Our hypotheses are outlined from both the theoretical framework and existing findings. First, we expect that elderly with neither a partner nor nearby adult children are the most likely to use formal LTC (*Hypothesis i*), both because their health might be hypothesized to be worse (due to both selection and protection mechanisms), and because they are likely to have access to less informal care. Consequently, they might also be more likely to receive more extensive services, such as institutionalized care.

For elderly with partners and/or adult children nearby, the sociodemographic resources of partners and adult children emerge as a factor that may influence and/or modify elderly's LTC usage.[5] Partners are different and bring varying amounts of resources into a household. These resources may contribute to differentials in LTC use, net of the elderly individual's own resources. We thus hypothesize that having a resourceful partner might increase the availability of informal care, and thus reduce the need for formal care, either at home or in institutions (*Hypothesis ii*). We hypothesize that this might apply particularly to men, as female partners are more likely to care for their partners than vice versa (*Hypothesis iii*).

Adult children might also contribute to elderly households, and perhaps especially if they live nearby. Nevertheless, for LTC uptake, we expect resourceful partners to be of greater relevance than resourceful children, and we consequently hypothesize that having resourceful partners will contribute to reduce LTC uptake more than children (*Hypothesis iv*). However, if there are no partners or the partners are less resourceful, we hypothesize that having nearby resourceful children is likely to be advantageous in that it might reduce the LTC uptake (*Hypothesis v*). At the same time, we hypothesize that it may be disadvantageous to have disadvantaged children nearby, i.e. that it is less likely to contribute to reduce LTC uptake (*Hypothesis vi*). Perhaps even the care burden may be reversed, so

[5] 'Resourcefulness' is defined in detail in Section 2.1.2. It pertains in general to general socioeconomic and sociodemographich resources.

that having disadvantaged children nearby might actually increase the uptake of formal LTC as opposed to having disadvantaged children further away?

The above hypotheses rely to a large extent on the assumption that resourceful partners and/or children are likely to provide informal care and thus substitute and/or complement formal LTC uptake. However, resourceful partners and/or children could also be hypothesized to facilitate earlier and further contact with the municipal care system, should the need arise.

Pronounced regional variations in LTC demands and spending have been reported both internationally (see e.g. Hayward et al. 2004) and for Norway (Langorgen 2004, Otnes & Haugstveit 2015, Forland & Rostad 2019, Statistics Norway 2020b). Although Norwegian municipalities are obligated to organize and ensure the provision of old-age care services irrespective of the resource situation in the municipality (Kjonstad et al. 2017), it has been shown that the municipal demographic situation, its resources and constraints, as well as chosen set-up for the organization of such services influence the type and scope of LTC provision (Langorgen 2004, Otnes & Haugstveit 2015). More specifically, geographic characteristics such as population size, the relative number of elderly, the general health of the local population and the focus on home health versus institutionalized care may bear some relevance for the provision of LTC, net of individual factors and perhaps also net of the characteristics of family members. Consequently, we expect there to be differences in the influence of partners and children on uptake across rural and urbanized areas, although the needs of elderly should be met irrespective of place of residence (*Hypothesis vii*).

2 Data and methods

2.1 Data

Our analysis draws on population register data provided by Statistics Norway, covering all resident individuals aged 65 or older (i.e. elderly) during the period January 1st 2010 to December 31st 2016 (N=820 000).[6] The data were structured into person-years (N=3.96 million person-years, average follow-up time 4.8 years), with new individuals joining the analytical sample each year when they turned 65 or immigrated to Norway and were aged 65 or over. Records were censored at December 31st 2016, upon death, emigration or transition into LTC, whichever came first. For the analyses focusing on institutionalizations, the data were recoded to look explicitly at transfers into care

[6] In practice, we ran observations from 2009 onwards, to be able to exclude persons who already were enrolled in LTC from our data. As such, no individuals included in these analyses were registered as LTC users in January 2010.

facilities, and observations were thus left in the sample until this event occurred even though they may have taken up home health nursing, practical assistance or other LTC.[7]

A licensure to link sociodemographic data to information from the pseudonymized municipal care use registry (IPLOS) was provided by the National Data Inspectorate in Norway after ethical review by the Norwegian Board of Medical Ethics. Annual data were linked by means of a unique personal ID number assigned to all residents in Norway, following a standard encryption protocol.[8] Referring to the elderly individual's situation at January 1st of each year, these linked data included information on age, sex, partnership status, number of children, educational attainment, employment status and immigrant status (i.e. whether the individual was Norwegian or foreign born). Similar socio-demographic and economic information on co-residential partners and the three oldest children were linked through unique family ID numbers. As only information on the three oldest children was available, all elderly individuals with four or more children were dropped from our analysis, resulting in the exclusion of 14 percent of the original sample. Annual data on elderly's LTC uptake was retrieved from the IPLOS registry, and refers to use throughout the year until December 31, or until date of death or emigration.

KOSTRA is a national information system that provides aggregate information on municipal activities, including elderdare services (Statistics Norway 2020b). From this database we extracted characteristics of the elderly's residential municipality. The data were obtained for 2015, but changes over time can be assumed to be negligible during our relatively short observation window.[9]

2.1.1 Dependent variables

Information on our dependent variables were retrieved from the IPLOS registry, which contains individual level information on persons receiving LTC, including the type of services provided. The IPLOS registry data include 26 different categories of service provision, ranging from in-home safety alarms to full-time institutionalized care (Mork et al. 2017). To ensure robust numbers, we utilize a dummy indicator for the use of 'any service' or not, as well as indicators for: i) overnight institutionalized care (short- and long-term); ii) home health nursing; iii) practical assistance; and iv)

[7] This results in a larger sample, comprising 4.7 million person-years.

[8] The agency responsible for the encryption and the data linkage informed us <1% of the observations were excluded before delivery. This was either due to invalid identification numbers preventing linkage of 0.2% of the individuals and/or their partners, or because combinations of different sociodemographic variables for around 0.2% of the annual observations resulted in potential identifiable data (defined as <5 similar observations). However, for all practical purposes the resulting data set may be considered complete and representative of the elderly Norwegian population.

[9] Municipal ID numbers were substituted prior to the delivery of data to help ensure anonymization. However, random identifiers grouping individuals into different municipalities were left in the file to enable tests of variation in uptake in different (types of) locations.

'other services'. 'Other services' is a residual category, comprising any services not included in the aforementioned categories. This is in line with the standardized groupings and coding used in official statstics by Statistics Norway (Mork et al. 2017). Since some individuals receive services across these indicators, we also created a variable where individuals were categorized into mutually exclusive groups according to their highest level of care, i.e. in the order listed above. Our primary outcome of interest is the *transition* into LTC use, irrespective of the type of service used. We observed around 215 000 transitions to LTC for the full sample (both elderly men and women), corresponding to around 26.3 percent of individuals and 5.4 percent of the total person-years (Table 1). In terms of services rendered, home health nursing was most commonly awarded, followed by short-term institutionalized care. The patterns of use were a bit different for men and women: Women were more likely to use practical assistance, home health nursing and 'other services', whereas men were more likely to receive institutionalized care. If we look at 'ranked use', i.e. use categorized into mutually exclusive groups ranking from the highest to the lowest level of use (no use), we see that the pattern remains similar.

Table 1. Descriptive long-term care services statistics of three samples. In percent of total person-years, 2010-2016.[a]

	Full sample			Partnered sample			Sample with children		
	All	Men	Women	All	Men	Women	All	Men	Women
Person-years (N)	3 956 903	1 949 549	2 007 354	2 692 385	1 504 132	1 188 253	3 491 642	1 696 151	1 795 491
Municipal care services									
Received no services[b]	94.6	95.0	94.1	95.9	95.9	96.0	94.8	95.4	94.3
Received any services	5.4	5.0	5.9	4.1	4.1	4.0	5.2	4.6	5.7
Practical assistance	1.2	0.9	1.6	0.6	0.4	0.9	1.1	0.7	1.5
Home health nursing	3.2	3.0	3.3	2.4	2.5	2.3	3.0	2.8	3.2
Institutionalized care	1.5	1.6	1.5	1.2	1.3	1.0	1.4	1.5	1.4
Short-term	1.5	1.5	1.4	1.2	1.3	0.1	1.4	1.4	1.4
Long-term	0.2	0.2	0.2	0.2	0.2	1.0	0.2	0.2	0.2
Other services	1.1	0.9	1.3	0.8	0.8	0.8	1.1	0.9	1.3
Ranked use of LTC services									
Institutionalized care	1.5	1.6	1.5	1.2	1.3	1.0	1.4	1.5	1.4
Home health nursing	2.3	2.2	2.5	1.8	1.8	1.8	2.2	2.0	2.4
Practical assisstance	0.5	0.3	0.7	0.3	0.2	0.4	0.5	0.3	0.6
Other services	1.1	0.9	1.3	0.8	0.8	0.8	1.1	0.9	1.3

[a]Altogether 215 338 individuals (26.3%) received LTC services, 118 602 (28.4%) women and 96 736 (24.0%) men. Altogether, 60 137 (7.3%) were institutionalized, 124 961 (15.2%) received home health nursing, 48 701 (5.9%) received practical assistance and 44 655 (5.4%) received 'other services'. Since many used multiple services at the onset of care use, the sum of users of individual services exceeds the overall number of LTC users.

Beyond our general focus on the transition to all forms of LTC, we perform additional subanalyses on transitions into institutionalized care, irrespective of previous uptake of any other LTC. In this sample, there is an overweight of women (54 percent), and a larger share of institutionalizations (3.8 percent, N=176 254) than what is portrayed in Table 1. Furthermore, the uptake is higher among women (4.2 percent) than among men (3.2 percent).

2.1.2 Independent variables

For the elderly, we collected data on age, calendar year, gender, partnership status (married/cohabiting vs single), the number of children they have had (0, 1, 2+), educational attainment (degree-level education or not), personal income (in quartiles by age, sex and year) and immigrant status (Norwegian born or foreign born).[10] For elderly persons' partners we collected information on educational attainment (degree-level education or not), personal income (above or below median income by age, sex and year), employment status (employed or non-employed), and use LTC (defined as any uptake).[11] For the children of the elderly focal persons, we collected gender, partnership status (married/cohabiting vs single), educational attainment (degree-level education or not), employment status (employed or non-employed), uptake of social assistance benefits and health status (defined by the uptake of health-related benefits, e.g. sick pay and disability pay). The distance between the focal elderly person and their three oldest children was also obtained, wherein we defined a child as 'near' when living within 10 kilometers of their parent and 'far' when living more than 10 kilometers from their parent.

The above variables were then used to define family networks that contain partners and children with 'advantaged' characteristics and then family networks that contain partners and children with 'disadvantaged' characteristics. Partners are defined as advantaged when they are employed, have a degree-level education, an above median income and are not using LTC. Partners are defined as disadvantaged when they are non-employed, do not have a degree-level education, have an income below the medium income and are LTC users.[12] We refer to advantaged children when one of the three oldest children has a degree-level education,[13] while having a disadvantaged child refers to one of the three oldest children being non-employed, or in receipt of social assistance benefits, or in poor health.[14] We then incorporated children's geographical proximity to their parent to form four mutually exclusive groups for the comparison of advantaged children: i) near and advantaged; ii) near and not advantaged; iii) far and advantaged; and iv) far and not advantaged. Likewise, four mutually exclusive groups for disadvantaged children were formed: i) near and disadvantaged; ii) near and not

[10] Although immigrants comprise only a small share of the data (5%), their pattern of use of LTC and their family situations may differ from that of elderly natives.

[11] Of the partnered elderly individuals, more than 99% had a valid partner identifier. Partnered elderly without a connectable partner were not included.

[12] Initially, we also included partners' younger and older age, respectively. However, as there is much homogamy in age between partners, and since age is strongly related to employment, we opted not to include it in the final classifications.

[13] Preliminary models using a more detailed measurement of advantage, also including employment status, partnership status, health, income and gender failed to converge due to issues of collinearity. When children's gender was included separately, the odds ratio was statisticially non-significant.

[14] Initially, we also included children's age and the number of dependent children in the household. While the effects of these variables were statististically significant, they were closely linked to the age of the parent and were thus not included in the final classifications.

disadvantaged; iii) far and disadvantaged; and iv) far and not disadvantaged). The end-result is two composite variables of 'advantaged' and 'disadvantaged' family networks, representing our main predictors of interest. Summary statistics for the composite variables are displayed in Table 2, whereas more detailed descriptives are shown in Appendix Table A1.

Table 2. Descriptive statistics of the main explanatory variables for the main sample. In percent of total person-years.

Advantaged composite variable[a]			Disadvantaged composite variable[b]		
	Men	Women		Men	Women
Advantaged composite variable [a]			*Disadvantaged composite variable* [b]		
No partner, no child	7	7	No partner, no child	7	7
No partner, child near and advantaged	4	10	No partner, child near and disadvantaged	5	12
No partner, child near and not advantaged	4	11	No partner, child near and not disadvantaged	5	12
No partner, child far and advantaged	4	8	No partner, child far and disadvantaged	3	4
No partner, child far and not advantaged	3	4	No partner, child far and not disadvantaged	3	5
Partner not advantaged, no child	5	3	Partner not disadvantaged, no child	5	3
Partner not advantaged, child near and advantaged	22	17	Partner not disadvantaged, child near and disadvantaged	20	17
Partner not advantaged, child near and not advantaged	18	14	Partner not disadvantaged, child near and not disadvantaged	24	20
Partner not advantaged, child far and advantaged	18	14	Partner not disadvantaged, child far and disadvantaged	9	7
Partner not advantaged, child far and not advantaged	7	4	Partner not disadvantaged, child far and not disadvantaged	10	8
Partner advantaged, no child	1	1	Partner disadvantaged, no child	1	1
Partner advantaged, child near and advantaged	3	3	Partner disadvantaged, child near and disadvantaged	3	1
Partner advantaged, child near and not advantaged	1	1	Partner disadvantaged, child near and not disadvantaged	3	1
Partner advantaged, child far and advantaged	2	2	Partner disadvantaged, child far and disadvantaged	1	1
Partner advantaged, child far and not advantaged	1	1	Partner disadvantaged, child far and not disadvantaged	1	1

[a]The groups are mutually exclusive. Near is defined as < 10 km. The variable is coded so that first we check if there is at least 1 child near that is advantaged, next we check if there is child(ren) near that are not advantaged. Then we check if there is at least 1 child further away that is advantaged, before we check if there is child(ren) far that are not advantaged. [b]The groups are mutually exclusive. Near is defined as < 10 km. The variable is coded so that first we check if there is at least 1 child near that is disadvantaged, next we check if there is child(ren) near that are not disadvantaged. Then we check if there is at least 1 child further away that is disadvantaged, before we check if there is child(ren) far that are not disadvantaged.

Characteristics of the elderly's residential municipality in terms of their relative location on the urban-rural hierarchy as well as their demography, finances, health and care spending, and the availability and set-up of LTC were also included, and descriptive statistics are portrayed in Appendix Table D1.

2.2 Methods

We use discrete-time logistic hazard regression models (Allison 1995) on annual observations (N=3.96 million, with an average follow-up time of 4.8 years) to assess transitions to LTC use. More specifically, we examine the relative importance of partners' and adult children's resources by separately estimating LTC uptake for elderly persons with 'advantaged' (Table 3) and 'disadvantaged' (Table 4) family networks. This study is purely descriptive, and no causal relationships have been explored. Consequently, the term 'effect' is used as a technical term to denote statistical associations.

As LTC varies considerably according to elderly persons' gender (cf. Table 1), we estimate separate models for elderly men and elderly women. However, when testing the hypothesis that elderly men with resourceful partners may have lower transitions to LTC than elderly women with resourceful partners (Hypothesis iii), we derive the relevant predicted probabilities from interaction terms between gender and the main explanatory variables of interest, using a model based on the full (two-sex) sample (cf. Figure 1 for 'advantaged' family network and Figure 2 for 'disadvantaged' family

network).[15] The same modelling approach was used to assess the associations between the same explanatory variables and the risk of transitions into institutionalized care (Table 5).[16] Finally, we assessed the impact of regional differences by including municipal characteristics in multivariate models with robust standard errors clustered at the municipality level. More specifically, we assessed the potential for interactions between individual and municipal characteristics and estimated stratified models across rural and urban areas (Table 6).[17] When the interaction terms suggested statistical significance, predicted probabilities and average marginal effects of LTC use were calculated and plotted to facilitate comparisons across models (Mood 2010, Williams 2012). In general, the discretionary choices of parameterizations of the independent variables had minor impact on our conclusions. The statistical significance level was set at 5 percent.

3 Results

We begin with a presentation of results from multivariate models for the risk of transitions to LTC, followed by the risk of transitions to institutionalized care. Thereafter, we present results from models examining the role of regional characteristics.

3.1 The importance of family members' resources for any LTC uptake

Tables 3 and 4 present our main models, where we have created composite variables identifying the effect of having an advantaged partner and an advantaged child nearby (or not) (Table 3), and similarly, the effect of having a disadvantaged partner and a disadvantaged child nearby (or not) (Table 4).[18] The reference category is elderly with neither a partner nor a child. From Table 3 we see that elderly with both an advantaged partner (i.e., employed, degree-level education, above median income, not using LTC) and an advantaged child (i.e., degree-level education) nearby are least likely to use LTC (odds ratio (OR) 0.34 for men and 0.31 for women). Male elderly persons with neither partners nor children, and female elderly persons without a partner and only children who are not advantaged and live further away are most likely to use LTC (OR 1.00 and 1.05, respectively).

---

[15] Although the observed effects are consistent in the separately estimated models presented in Tables 3 and 4.

[16] Appendix Table C1 and Appendix Figures C1-C3 show estimates from an additional multinomial model where we ranked service uptake from the most extensive (institutionalization) to least extensive (no services), with home health nursing, practical assistance and 'other services' in between.

[17] A preliminary variance component model (i.e. a null multilevel model) suggested that just 0.3% of the variation in the risk of transitions to LTC existed at the municipality level (intra-class correlation coefficient = 0.003). The estimated effects and standard errors from multilevel models are thus very similar to those presented in Table 6 and Figure 4 and thus we choose not to present them here.

[18] Appendix Figure B1 portrays average marginal effects (AMEs) with 95% confidence intervals for the uptake of any LTC, for the composite advantaged (upper panel) and disadvantaged (lower panel) variables for men and women combined, and largely confirm the general pattern portrayed in Tables 3 and 4, respectively.

Furthermore, having an advantaged partner is more important than having an advantaged child, although the latter also matters, and it appears that having an advantaged child is more important than the relative closeness of a child when a partner is present.

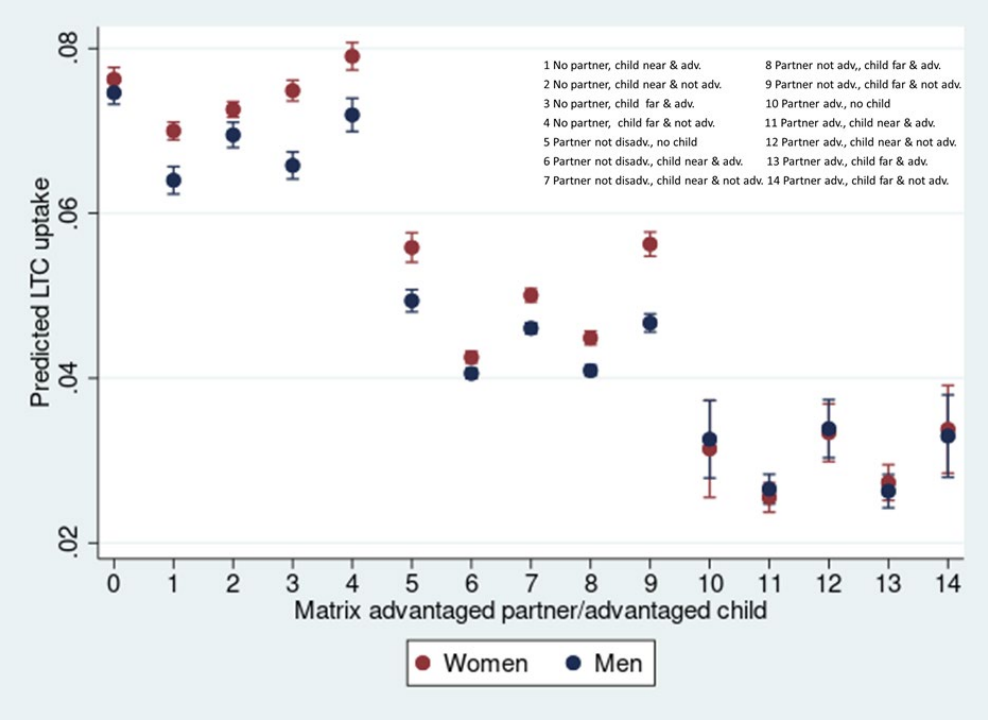
While Table 3 presents the estimates from separate models for men and women, Figure 1 presents the estimates of a joint model including an interaction term between gender and the advantaged partner/advantaged child composite variable. Figure 1 largely confirms the findings from Table 3 and shows that there are gender differences across most categories where there is no partner (categories 0-4) or a partner who is not advantaged (categories 5-9), with women being more likely than men to use LTC. There are no statistically significant gender differences if an advantaged partner is present (categories 10-14). While the most likely uptake is observed for unpartnered women with a child who is neither advantaged nor lives nearby (category 4), the estimate is not significantly different from that of the unpartnered and childless (category 0). For unpartnered women, having a child nearby appears more important than the socioeconomic characteristics of the child. For men, the relative geographic closeness to the child appears to matter less. The same applies to both men and women with partners who are not advantaged, i.e. the socioeconomic resources of the child appear to matter more than the relative closeness of the child.

Table 3. Modeled estimates of the impact of joint advantaged characteristics of partners and children on the risk of any long-term care (LTC) uptake, net of characteristics of the elderly individual.[a]

	Male elderly		Female elderly	
	OR[b]	**95% CI**[c]	**OR**	**95% CI**
Main explanatory variable[d]				
No partner, no child	1	ref	1	ref
No partner, child near and advantaged	0.86	0.82-0.89	0.90	0.87-0.93
No partner, child near and not advantaged	0.92	0.89-0.95	0.95	0.93-0.98
No partner, child far and advantaged	0.88	0.84-0.91	**0.97**	0.94-1.00
No partner, child far and not advantaged	0.96	0.92-0.99	1.05	1.01-1.08
Partner not advantaged, no child	0.64	0.62-0.66	0.71	0.69-0.74
Partner not advantaged, child near and advantaged	0.52	0.51-0.54	0.53	0.52-0.55
Partner not advantaged, child near and not advantaged	0.59	0.57-0.60	0.64	0.62-0.66
Partner not advantaged, child far and advantaged	0.52	0.51-0.54	0.57	0.55-0.58
Partner not advantaged, child far and not advantaged	0.60	0.58-0.62	0.73	0.70-0.75
Partner advantaged, no child	0.41	0.36-0.48	0.38	0.31-0.46
Partner advantaged, child near and advantaged	0.34	0.32-0.37	0.31	0.28-0.33
Partner advantaged, child near and not advantaged	0.43	0.38-0.48	0.41	0.37-0.46
Partner advantaged, child far and advantaged	0.34	0.31-0.37	0.33	0.31-0.36
Partner advantaged, child far and not advantaged	0.42	0.36-0.50	0.41	0.35-0.49
Covariates				
2+ children (ref=1 child)	0.94	0.92-0.96	0.92	0.91-0.94
Elderly immigrant (ref=not an immigrant)	0.80	0.78-0.83	0.78	0.76-0.81
Elderly high education (ref=low education)	0.93	0.92-0.94	0.90	0.88-0.91
Lowest income quartile	1	ref	1	ref
2nd lowest income quartile	0.93	0.91-0.94	0.96	0.94-0.98
2nd highest income quartile	0.77	0.75-0.78	0.90	0.89-0.92
Highest income quartile	0.52	0.50-0.53	0.69	0.67-0.70

[a]This table portrays estimates from two fully adjusted models, one for males and one for females. In addition to the estimates shown, the models were also adjusted for age group and year. [b]Odds ratio. Estimates not in bold are statistically significant at the 5% level. [c]Confidence interval. [d]The groups are mutually exclusive. Near is defined as < 10 km. The variable is coded so that first we check if there is at least 1 child near that is advantaged, next we check if there is child(ren) near that are not advantaged. Then we check if there is at least 1 child further away that is advantaged, before we check if there is child(ren) far that are not advantaged.

Figure 1. Predictive margins for the uptake of any LTC for the advantaged composite variable for men and women, respectively.



Note: The categories are mutually exclusive. The 0-category refers to no partner/no child. The margins were calculated by including an interaction term between the composite variable and gender using the full two-sex sample. As such, the portrayed effects are net of averaged covariates. 95% confidence intervals are shown at the predicted values.

Next, we consider the effect of having a disadvantaged partner and/or child. Table 4 shows that childless elderly with a disadvantaged partner (i.e., non-employed, below degree-level education, below median income, using LTC have the highest risk of transitioning into LTC (OR 1.16 for men and 1.73 for women). Indeed, their risk is even greater than that observed for elderly persons without a partner (OR range 0.85-1.10). Elderly persons with neither a partner nor a child who is disadvantaged have the lowest risks of transitioning to LTC, irrespective of the geographical proximity of the child, and the risk is about 50 percent lower than that of unpartnered, childless elderly. For female elderly without partners, there appears to be no protection in having a disadvantaged child (i.e., non-employed, receiving social assistance benefits, in poor health) near (OR 1.00). If the disadvantaged child lives further away, the risk of transitioning into LTC is higher (OR 1.10). Men as well as unpartnered women have lower risks of transitioning into LTC if they have a child who is not disadvantaged and nearby. For male elderly persons without partners, having a child nearby reduces the risks of LTC use, irrespective of whether they are disadvantaged (OR 0.96) or not (OR 0.85). Having a disadvantaged partner appears to matter a lot, especially for women, but if we compare the estimates of disadvantaged and not disadvantaged children across similar partner categories, having children who are not disadvantaged reduces the risk of transitioning into LTC.

Table 4. Modeled estimates of the impact of joint disadvantaged characteristics of partners and children on the risk of any long-term care (LTC) uptake, net of characteristics of the elderly individual.[a]

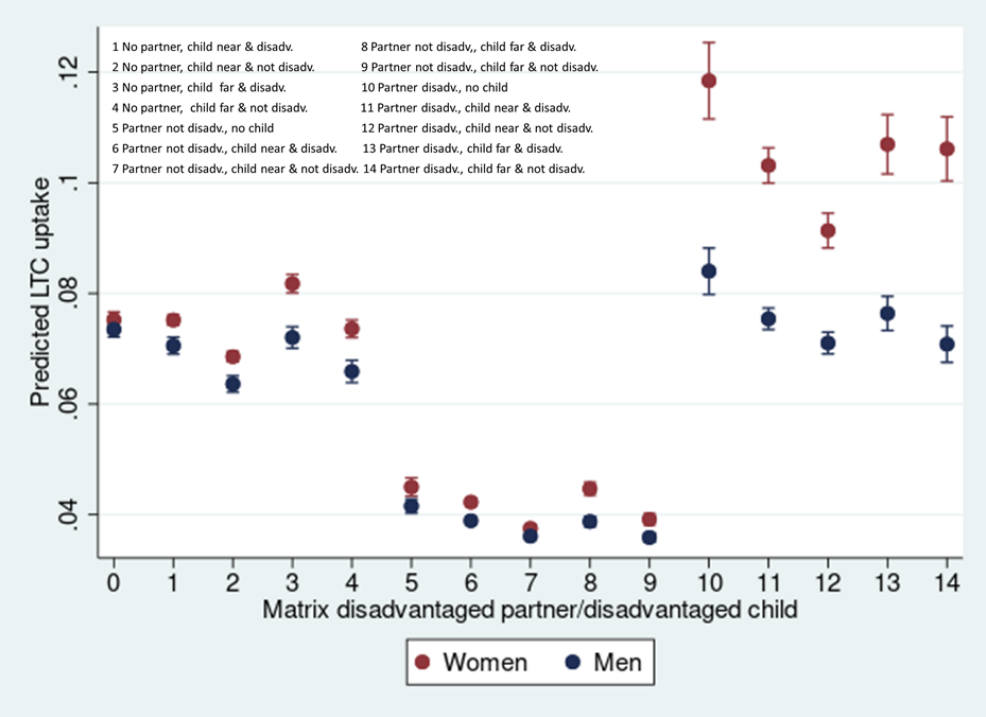
	Male elderly		Female elderly	
	OR[b]	**95% CI**[c]	**OR**	**95% CI**
Main explanatory variable[d]				
No partner, no child	1	ref	1	ref
No partner, child near and disadvantaged	0.96	0.92-0.99	**1.00**	0.98-1.03
No partner, child near and not disadvantaged	0.85	0.82-0.89	0.90	0.88-0.93
No partner, child far and disadvantaged	**0.98**	0.94-1.02	1.10	1.06-1.13
No partner, child far and not disadvantaged	0.89	0.85-0.93	**0.97**	0.94-1.01
Partner not disadvantaged, no child	0.54	0.52-0.56	0.57	0.55-0.59
Partner not disadvantaged, child near and disadvantaged	0.50	0.49-0.52	0.54	0.52-0.56
Partner not disadvantaged, child near and not disadvantaged	0.46	0.45-0.48	0.47	0.46-0.49
Partner not disadvantaged, child far and disadvantaged	0.50	0.48-0.52	0.57	0.55-0.59
Partner not disadvantaged, child far and not disadvantaged	0.46	0.45-0.48	0.49	0.48-0.51
Partner disadvantaged, no child	1.16	1.09-1.23	1.73	1.61-1.85
Partner disadvantaged, child near and disadvantaged	**1.02**	0.99-1.06	1.48	1.42-1.55
Partner disadvantaged, child near and not disadvantaged	0.96	0.92-0.99	1.29	1.23-1.35
Partner disadvantaged, child far and disadvantaged	**1.04**	0.99-1.10	1.54	1.45-1.64
Partner disadvantaged, child far and not disadvantaged	**0.95**	0.90-1.01	1.52	1.43-1.63
Covariates				
2+ children (ref=1 child)	0.91	0.90-0.93	0.90	0.88-0.91
Elderly immigrant (ref=not an immigrant)	0.81	0.78-0.84	0.78	0.76-0.81
Elderly high education (ref=low education)	0.94	0.93-0.95	0.90	0.89-0.92
Lowest income quartile	1	ref	1	ref
2nd lowest income quartile	0.93	0.91-0.95	0.96	0.94-0.97
2nd highest income quartile	0.78	0.76-0.79	0.90	0.88-0.92
Highest income quartile	0.52	0.51-0.54	0.68	0.66-0.69

[a]This table portrays estimates from two fully adjusted models, one for males and one for females. In addition to the estimates shown, the models were also adjusted for age group and year. [b]Odds ratio. Estimates not in bold are statistically significant at the 5% level. [c]Confidence interval. [d]The groups are mutually exclusive. Near is defined as < 10 km. The variable is coded so that first we check if there is at least 1 child near that is disadvantaged, next we check if there is child(ren) near that are not disadvantaged. Then we check if there is at least 1 child further away that is disadvantaged, before we check if there is child(ren) far that are not disadvantaged.

Figure 2 presents the predicted probabilities derived from an interaction between gender and the disadvantaged partner/disadvantaged child composite variable, using the full (two-sex) sample. It is clear from Figure 2 that the differences in general are greater when studying disadvantaged family networks than advantaged family networks (cf. Figure 1). As is also the case in the separate estimates presented in Table 4, we observe gender differences across most categories of the composite variable. Both childless women and men with a disadvantaged partner (categories 10-14) have the highest risks

of transitioning into LTC, albeit with a higher uptake among women than men. The gender differences appear most pronounced when a disadvantaged partner is present. For women with a disadvantaged partner, there appears to be some protection in having a nearby child who is not disadvantaged (category 12). For men in a similar situation, there are minor and mostly nonsignificant differences across children's characteristics.

Figure 2. Predictive margins for the uptake of any LTC for the disadvantaged composite variable for men and women, respectively.



Note: The categories are mutually exclusive. The 0-category refers to no partner/no child. The margins were calculated by including an interaction term between the composite variable and gender using the full (two-sex) sample. As such, the portrayed effects are net of averaged covariates. 95% confidence intervals are shown at the predicted values.

3.2 The importance of family members' resources for institutionalization

Table 5 presents the estimates for the risk of transitions into institutionalized care. Only the main explanatory variables are shown, but the magnitude of the estimates of the other covariates are similar to those portrayed in Tables 3 and 4.

Table 5. Modeled estimates of the impact of joint i) advantaged and ii) disadvantaged characteristics of partners and children on the risk of institutionalization, net of characteristics of the elderly individual.[a]

	Male elderly		Female elderly	
	OR[b]	95% CI[c]	**OR**	95% CI
i) Matrix advantaged partner, advantaged child[d]				
No partner, no child	1	ref	1	ref
No partner, child near and advantaged	0.92	0.88-0.96	0.90	0.88-0.93
No partner, child near and not advantaged	**0.97**	0.93-1.00	0.97	0.94-0.99
No partner, child far and advantaged	0.92	0.88-0.96	0.91	0.88-0.94
No partner, child far and not advantaged	0.96	0.92-0.99	**0.99**	0.97-1.03
Partner not advantaged, no child	0.69	0.66-0.71	0.75	0.72-0.79
Partner not advantaged, child near and advantaged	0.59	0.57-0.61	0.57	0.55-0.59
Partner not advantaged, child near and not advantaged	0.65	0.63-0.67	0.71	0.69-0.74
Partner not advantaged, child far and advantaged	0.58	0.56-0.60	0.58	0.56-0.60
Partner not advantaged, child far and not advantaged	0.65	0.62-0.67	0.75	0.72-0.78
Partner advantaged, no child	0.33	0.26-0.44	0.38	0.27-0.52
Partner advantaged, child near and advantaged	0.35	0.31-0.39	0.33	0.29-0.37
Partner advantaged, child near and not advantaged	0.50	0.43-0.59	0.43	0.36-0.52
Partner advantaged, child far and advantaged	0.34	0.30-0.39	0.31	0.57-0.36
Partner advantaged, child far and not advantaged	0.38	0.29-0.49	0.42	0.31-0.55
ii) Matrix disadvantaged partner, disadvantaged child[e]				
No partner, no child	1	ref	1	ref
No partner, child near and disadvantaged	**0.99**	0.96-1.04	**1.00**	0.98-1.03
No partner, child near and not disadvantaged	0.92	0.89-0.96	0.92	0.89-0.94
No partner, child far and disadvantaged	**0.97**	0.93-1.01	**1.01**	0.98-1.04
No partner, child far and not disadvantaged	0.93	0.89-0.97	0.93	0.90-0.96
Partner not disadvantaged, no child	0.57	0.54-0.59	0.58	0.56-0.62
Partner not disadvantaged, child near and disadvantaged	0.53	0.52-0.55	0.56	0.54-0.58
Partner not disadvantaged, child near and not disadvantaged	0.50	0.48-0.51	0.50	0.49-0.52
Partner not disadvantaged, child far and disadvantaged	0.52	0.50-0.54	0.57	0.54-0.59
Partner not disadvantaged, child far and not disadvantaged	0.48	0.46-0.50	0.50	0.48-0.52
Partner disadvantaged, no child	1.07	1.00-1.14	1.34	1.24-1.45
Partner disadvantaged, child near and disadvantaged	**1.03**	0.99-1.08	1.28	1.22-1.34
Partner disadvantaged, child near and not disadvantaged	**0.99**	0.95-1.04	1.14	1.08-1.20
Partner disadvantaged, child far and disadvantaged	**1.03**	0.97-1.09	1.27	1.19-1.36
Partner disadvantaged, child far and not disadvantaged	**1.03**	0.97-1.09	1.19	1.10-1.28

[a]This table portrays estimates from four fully adjusted models, i.e. i) and ii) for males and females, respectively. In addition to the estimates shown, the models were also adjusted for age group, year, and elderly's immigrant status, education, income, number of children and gender. Altogether, there were 4.7 million observations and 176 254 institutionalizations (3.8%). [b]Odds ratio. Estimates not in bold are statistically significant at the 5% level. [c]Confidence interval. [d]The groups are mutually exclusive. Near is defined as < 10 km. The variable is coded so that first we check if there is at least 1 child near that is advantaged, next we check if there is child(ren) near that are not advantaged. Then we check if there is at least 1 child further away that is advantaged, before we check if there is child(ren) far that are not advantaged. [e]The groups are mutually exclusive. Near is defined as < 10 km. The variable is coded so that first we check if there is at least 1 child near that is disadvantaged, next we check if there is child(ren) near that are not disadvantaged. Then we check if there is at least 1 child further away that is disadvantaged, before we check if there is child(ren) far that are not disadvantaged.

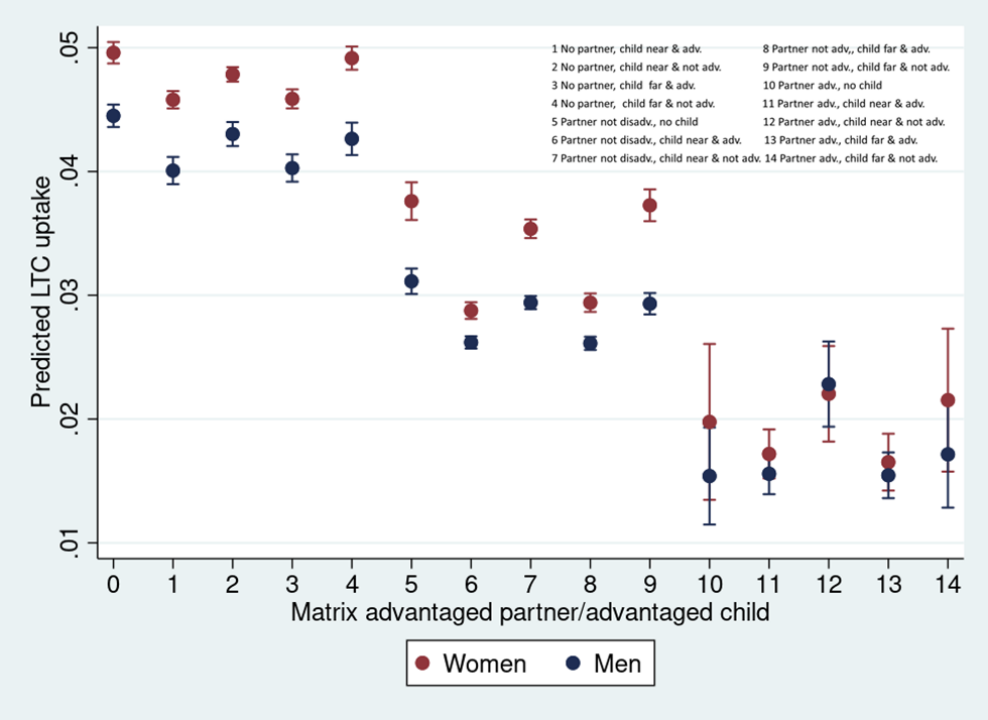
In terms of advantaged partners and children, having an advantaged partner reduces the risk of transfers to institutionalized care most markedly. When we look at the reverse situation, i.e. the disadvantaged composite variable, a visual inspection reveals similar estimates for the transition to any care versus institutionalization for male elderly. For instance, there is virtually no association between

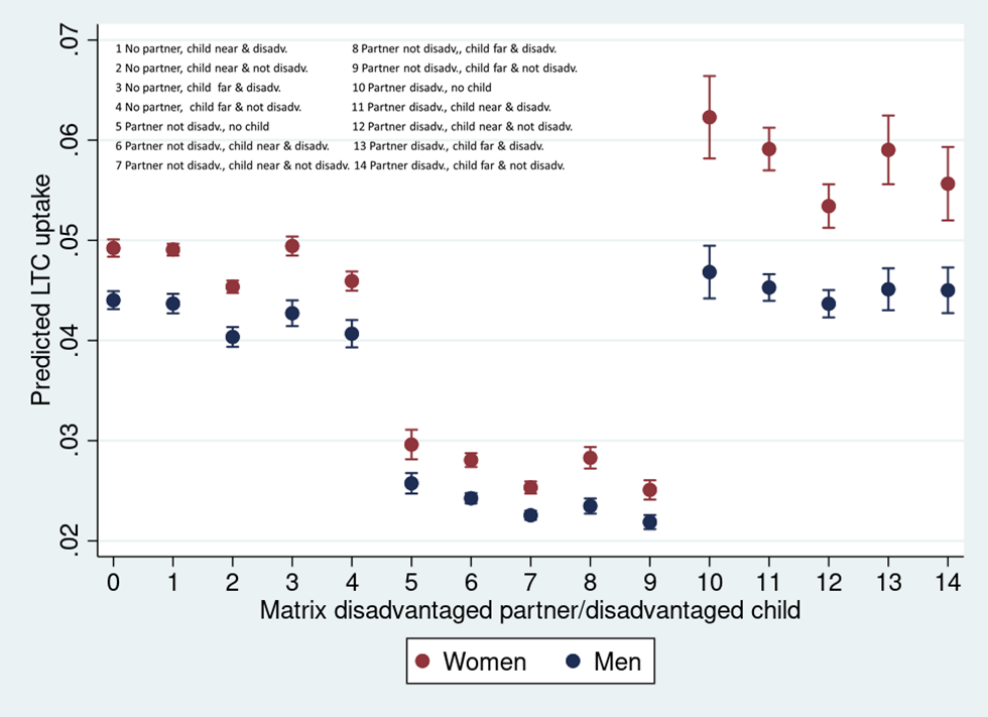
having a disadvantaged partner and the transition to institutionalized care for male elderly as compared to not having a partner, which is in line with what we observed for any LTC uptake. For female elderly with disadvantaged partners, the estimates appear less pronounced for institutionalization than for any LTC uptake, but in both cases, there is a statistically significant increased risk of uptake. For both men and unpartnered women, having a child who is not disadvantaged reduced the risk of transition to institutions, irrespective of whether the child lives nearby or further away. For those with partners who are not disadvantaged, having children who are not disadvantaged only marginally reduces the risk of institutionalization. Meanwhile, as compared to those without children, having disadvantaged children also appears to play little role in increasing the risk of transitions into institutionalized care.

Figure 3 provides an overview of the differences across gender, with estimates again derived from the use of an interaction term on the full (two-sex) sample. The upper panel portrays estimates from a model including an interaction term between gender and the advantaged composite variable, whereas the lower panel portrays similar estimates resulting from the disadvantaged composite variable. The findings from Table 5 are largely confirmed. The upper panel shows statistically significant gender differences across all categories, except for those including an advantaged partner (categories 10-14). Having an advantaged partner is clearly associated with a reduced risk of institutionalization, irrespective of the children's resources or geographic closeness. As such, these associations appear to be similar for elderly men and women.

With that said, a statistically significant difference in the risk for institutionalization between unpartnered and childless men and women is found (categories 0-4), with women having a higher risk of institutionalization than men. A comparison between the upper and lower panels in Figure 3 shows that the differences in general are greater for the disadvantaged than for the advantaged composite variable, in line with the results in Figures 1 and 2. Furthermore, the lower panel shows that there are statistically significant gender differences in the risk for institutionalization across *all* categories of the disadvantaged variable, with women being more likely to be institutionalized than men. The risk for institutionalization is greatest for men and women with disadvantaged partners (categories 10-14), while gender differences appear most pronounced when a disadvantaged partner is present. It should be noted, however, that the uncertainty is also greater across these categories, as shown by the relatively wide confidence intervals. Men and women with partners who are not disadvantaged (categories 5-9) have the lowest risk of institutionalization, irrespective of the geographic proximity and/or the resources of the child. In general, the overall trend as well as the patterns of institutionalization across gender are very similar to those observed for any LTC uptake.

Figure 3. Predictive margins for institutionalization for the advantaged (upper panel) and disadvantaged (lower panel) composite variables for men and women, respectively.





Note: The categories are mutually exclusive. The 0-category refers to no partner/no child. The margins were calculated by including an interaction term between the composite variable and gender using the full two-sex sample (Table 5). As such, the portrayed effects are net of averaged covariates. 95% confidence intervals are shown at the predicted values.

3.3 The relevance of place

In Table 6, we account for the influence of place characteristics (Model A) and present stratified analyses of differences in LTC uptake in rural (Model B) and urban (Model C) areas. Model A shows that the asociations between characteristics of partners and children and LTC uptake are remarkably stable, even when municipal characteristics are accounted for. Comparing estimates from Models B and C, we further see that the influence of partners and children appears fairly stable across rural and urbanized areas. Consequently, the effects of having partners and/or children who are either advantaged or disadvantaged appear to be consistent across geographical contexts.

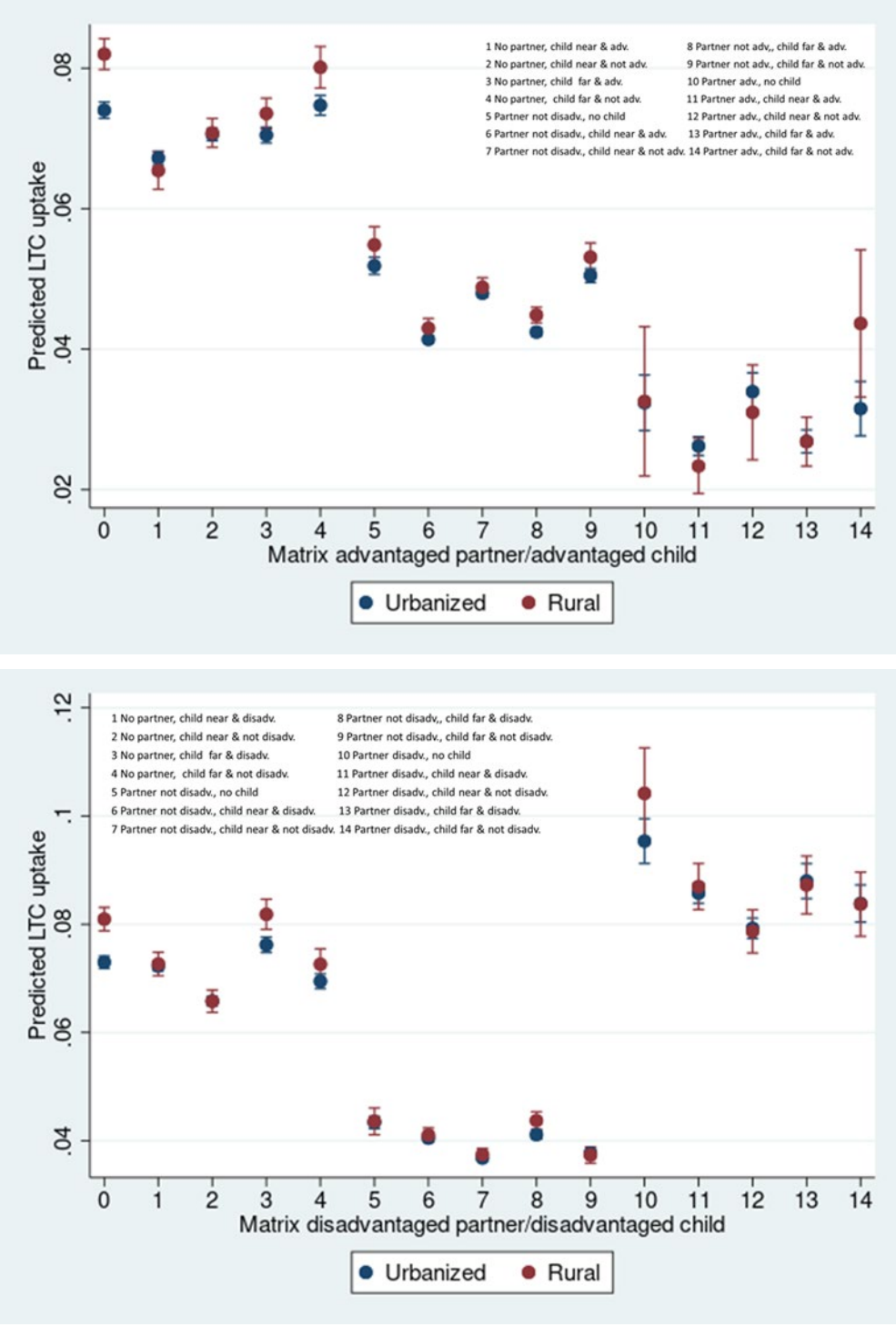
Table 6. Modeled estimates of the impact of joint i)advantaged and ii) disadvantaged characteristics of partners and children on the risk of any long-term care (LTC) uptake, net of characteristics of the elderly individual.[a]

	Model A (adjusted for municipal charact.)				Model B (rural areas)				Model C (urbanized areas)			
	Male elderly		Female elderly		Male elderly		Female elderly		Male elderly		Female elderly	
	OR[b]	95% CI[c]	OR	95% CI	OR[b]	95% CI[c]	OR	95% CI	OR[b]	95% CI[c]	OR	95% CI
i) Matrix advantaged partner, advantaged child[d]												
No partner, no child	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref
No partner, child near and advantaged	0.85	0.82-0.88	0.90	0.88-0.93	0.83	0.74-0.92	0.78	0.72-0.85	0.86	0.82-0.90	0.92	0.89-0.95
No partner, child near and not advantaged	0.91	0.88-0.95	0.96	0.93-0.98	0.86	0.79-0.94	0.87	0.81.0.93	0.93	0.90-0.97	**0.97**	**0.94-1.00**
No partner, child far and advantaged	0.88	0.84-0.91	**0.97**	0.94-1.00	0.92	0.85-0.99	0.90	0.84-0.97	0.87	0.84-0.91	**0.99**	0.95-1.02
No partner, child far and not advantaged	0.96	0.92-0.99	1.05	1.01-1.08	**1.01**	0.93-1.10	**0.98**	0.90-1.05	0.95	0.91-0.98	1.06	1.02-1.10
Partner not advantaged, no child	0.64	0.91-0.66	0.71	0.69-0.74	0.61	0.56-0.65	0.68	0.62-0.75	0.64	0.62-0.67	0.72	0.69-0.75
Partner not advantaged, child near and advantaged	0.52	0.50-0.53	0.54	0.52-0.55	0.51	0.47-0.55	0.49	0.45-0.54	0.52	0.50-0.54	0.54	0.53-0.56
Partner not advantaged, child near and not advantaged	0.58	0.57-0.60	0.65	0.63-0.67	0.57	0.54-0.62	0.57	0.53-0.61	0.59	0.57-0.61	0.66	0.64-0.68
Partner not advantaged, child far and advantaged	0.52	0.51-0.54	0.57	0.55-0.58	0.53	0.50-0.57	0.52	0.48-0.56	0.53	0.51-0.54	0.57	0.55-0.59
Partner not advantaged, child far and not advantaged	0.60	0.58-0.62	0.73	0.70-0.75	0.60	0.55-0.64	0.67	0.61-0.73	0.60	0.58-0.62	0.74	0.71-0.77
Partner advantaged, no child	0.41	0.35-0.48	0.38	0.31-0.46	0.36	0.23-0-54	0.36	0.20-0.66	0.43	0.36-0.50	0.38	0.31-0.47
Partner advantaged, child near and advantaged	0.34	0.31-0.37	0.31	0.28-0.33	0.28	0.22-0.36	0.24	0.18-0.31	0.35	0.32-0.38	0.32	0.29-0.34
Partner advantaged, child near and not advantaged	0.43	0.38-0.48	0.41	0.37-0.46	0.38	0.28-0.51	0.31	0.48-0.56	0.44	0.39-0.50	0.43	0.38-0.48
Partner advantaged, child far and advantaged	0.34	0.31-0.37	0.33	0.30-0.36	0.31	0.25-0.37	0.30	0.24-0.37	0.35	0.31-0.38	0.33	0.30-0.37
Partner advantaged, child far and not advantaged	0.42	0.36-0.49	0.41	0.35-0.49	0.52	0.37-0.74	0.47	0.32-0.70	0.40	0.33-0.48	0.40	0.33-0.48
ii) Matrix disadvantaged partner, disadvantaged child[e]												
No partner, no child	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref
No partner, child near and disadvantaged	0.95	0.91-0.98	**1.01**	0.98-1.03	**0.95**	0.87-1.03	**0.90**	0.84-0.97	0.96	0.92-0.99	**1.02**	0.99-1.05
No partner, child near and not disadvantaged	0.85	0.81-0.88	0.90	0.88-0.93	0.82	0.75.0.90	0.81	0.76-0.87	0.86	0.83-0.90	0.92	0.89-0.95
No partner, child far and disadvantaged	**0.98**	0.94-1.02	1.10	1.06-1.13	**1.07**	0.98-1.16	**1.02**	0.95-1.11	**0.96**	0.92-1.00	1.11	1.07-1.15
No partner, child far and not disadvantaged	0.89	0.85-0.92	**0.97**	0.94-1.01	0.90	0.82-0.98	0.91	0.84-0.98	0.89	0.74-0.93	**0.99**	0.95-1.02
Partner not disadvantaged, no child	0.54	0.52-0.56	0.57	0.55-0.60	0.49	0.45-0.53	0.51	0.46-0.57	0.55	0.53-0.57	0.58	0.55-0.61
Partner not disadvantaged, child near and disadvantaged	0.50	0.48-0.51	0.54	0.52-0.56	0.50	0.46-0.54	0.46	0.43-0.50	0.50	0.49-0.52	0.55	0.54-0.57
Partner not disadvantaged, child near and not disadvantaged	0.46	0.45-0.48	0.48	0.46-0.49	0.45	0.42-0.48	0.42	0.39-0.46	0.47	0.45-0.48	0.48	0.47-0.50
Partner not disadvantaged, child far and disadvantaged	0.50	0.48-0.52	0.57	0.55-0.59	0.53	0.49-0.57	0.51	0.46-0.55	0.50	0.48-0.52	0.58	0.56-0.61
Partner not disadvantaged, child far and not disadvantaged	0.46	0.45-0.48	0.49	0.48-0.51	0.45	0.41-0.49	0.42	0.39-0.46	0.47	0.45-0.49	0.51	0.49-0.53
Partner disadvantaged, no child	1.16	1.09-1.23	1.73	1.60-1.86	**1.12**	0.99-1.28	1.79	1.52-2.10	1.17	1.09-1.25	1.70	1.56-1.84
Partner disadvantaged, child near and disadvantaged	**1.02**	0.98-1.06	1.49	1.42-4.55	**1.01**	0.92-1.11	1.31	1.17-1.46	**1.03**	0.99-1.07	1.52	1.45-1.59
Partner disadvantaged, child near and not disadvantaged	0.95	0.82-0.99	1.29	1.23-1.35	**0.93**	0.84-1.02	**1.12**	1.00-1.25	**0.97**	0.92-1.01	1.32	1.26-1.39
Partner disadvantaged, child far and disadvantaged	**1.04**	0.99-1.10	1.53	1.44-1.64	**0.99**	0.89-1.11	1.37	1.20-1.56	1.06	1.00-1.13	1.57	1.46-1.70
Partner disadvantaged, child far and not disadvantaged	**0.96**	0.90-1.01	1.53	1.42-1.63	**0.90**	0.80-1.01	1.36	1.19-1.56	**0.98**	0.92-1.05	1.56	1.44-1.69

[a]This table portrays estimates from 12 fully adjusted models, i.e. Ai-Ci) and Aii-Cii) for males and females, respectively. In addition to the estimates shown, the models were also adjusted for age group, year, and elderly's immigrant status, education, income, number of children and gender. In addition, Model A includes the following statistically signifificant variables describing municipalities: rural status (associated with a 3% reduction in uptake across models), share of elderly aged 67+ (increasing shares associated with a 3-10% increase in uptake across models), index of economic capacity (associated with a 24-36% increase in uptake across models), and index of economic workload (associated with a 23-3% reduction in uptake across models). The other variables from Table A1 did not reach statistical significance and were thus not included in Model A. [b]Odds ratio. Estimates not in bold are statistically significant at the 5% level. [c]Confidence interval. [d]The groups are mutually exclusive. Near is defined as < 10 km. The variable is coded so that first we check if there is at least 1 child near that is advantaged, next we check if there is child(ren) near that are not advantaged. Then we check if there is at least 1 child further away that is advantaged, before we check if there is child(ren) far that are not advantaged. [e]The groups are mutually exclusive. Near is defined as < 10 km. The variable is coded so that first we check if there is at least 1 child near that is disadvantaged, next we check if there is child(ren) near that are not disadvantaged. Then we check if there is at least 1 child further away that is disadvantaged, before we check if there is child(ren) far that are not disadvantaged.

Figure 4 presents estimates from joint models which include interaction terms between the advantaged partner/advantaged child composite variable (upper panel) and the disadvantaged partner/disadvantaged child (lower panel) and rurality.

Figure 4. Predictive margins for the uptake of any LTC for the advantaged (upper panel) and disadvantaged (lower panel) composite variables by rurality for both genders



Note: The categories are mutually exclusive. The 0-category refers to no partner/no child. The margins were calculated by including an interaction term between the composite variable and rurality in the fully adjusted model (Model A, Table 6). As such, the portrayed effects are net of averaged covariates. 95% confidence intervals are shown at the predicted values.

Although Figure 4 largely confirms the findings from Table 6, some differences are worth noting. The upper panel shows that uptake is generally higher among elderly in rural areas, but in most cases the

estimates overlap. An exception is noted for unpartnered, childless elderly in rural areas (category 0), who have a significantly higher risk of transitioning into LTC than their counterparts in urbanized areas. Similar associations are observed for unpartnered elderly in rural areas without a nearby or advantaged child (categories 3 and 4). The lower panel shows estimates for joint models including an interaction term between the disadvantaged composite variable and rurality, and we see that the relative differences in risk by the different partner and children characteristics are fairly minor between urban and rural areas. Indeed, only for unpartnered, childless elderly (category 0) and for unpartnered elderly with a disadvantaged child not living in the vicinity (category 3) do we see an appreciable difference. In these instances, the elderly in rural areas have a statistically higher uptake than the elderly in urban areas.[19] Appendix Figures D2 and D3 also show little difference between urban and rural areas in terms of the risk of uptake of different forms of LTC for each given family configuration.

3.3 Summary of main results

We find that having a partner and having children matters for elderly's LTC use and their risk for institutionalization. Furthermore, we find that the *characteristics* of partners and/or children matter, net of elderly's own resources. Having an 'a*dvantaged*' partner appears more important than having resourceful children, albeit the resources of adult children do play a role, and especially for elderly without a partner. However, not having a '*disadvantaged*' partner appears more important than having an '*advantaged*' partner. The same picture appears, albeit less pronounced, also for children, although the importance of the relative geographical proximity of children depends in part on whether we consider children who are advantaged or disadvantaged. In summary, although Norwegian municipalities are responsible for rationing LTC among eligible residents according to need, we find that partners' and child(ren)'s characteristics are also associated with transitions into LTC among elderly, and that their effect is over and above that of the elderly's own characteristics. Based on these findings, we thus infer that partners and children contribute to modify care needs.

4 Discussion

4.1 Findings in light of the research background and hypotheses

For the sociodemographic characteristics of the elderly individuals themselves, we confirmed well-established associations between partnership, parenthood, higher education, higher income and

[19] Appendix Figure D1 shows the same panels, but with an interaction term also including gender. Very slight differences are observed, and relevant findings are commented upon in Appendix D.

immigrant status (cf. Appendix B) as deterrents for LTC uptake. The counterintuitive results reported by some, i.e. an increased LCT uptake among more resourceful elderly likely to be in better health (e.g. Larsson et al. 2006, Nöell-Miller 2010), might suggest that actual uptake reflects a combination of both poor health and valuable resources to obtain formal care. This warrants further study, although survey data on elderly people are often affected by selection bias, i.e. only the healthiest participate (Banack et al. 2018). Moreover, studies including other health proxies, such as general practitioner visits or hospital admissions often represent a mixture of health, health care needs and individual tendencies towards service use (NASEM 2018), which may complicate our ability to make confident inferences on health itself.

In terms of characteristics of family members, our findings are only partly in line with *Hypothesis i*, i.e. that elderly with neither a partner nor nearby adult children are the most likely to use formal LTC, and most likely to experience institutionalizations. We found this to be true only when we look at elderly with resourceful partners (i.e. advantaged versus not advantaged partners). In this set-up, we observe a reduced uptake of both any formal care and for institutionalized care, in line with *Hypothesis ii*. However, elderly persons with disadvantaged partners were more likely than elderly persons without partners to use LTC, including institutionalized care. In our design we cannot determine whether this reflects worse health or an increased propensity to rely on or be awarded formal LTC provision. In term of gender, we expected men to benefit the most from being partnered, and especially to a resourceful partner (*Hypothesis iii*). This was not confirmed, as there were hardly any differences between men and women with advantaged partners (Figure 1). However, men who had partners who were 'not advantaged', were less likely to use LTC than women with such partners. Whether this is because these female partners are more family-oriented and thus more likely to provide informal care or less able to assert their right to formal care, cannot be assessed with our data but should be explored in future studies. Furthermore, unpartnered women had a higher uptake of LTC than men in similar situations. On the other hand, we found men with disadvantaged partners had a much lower uptake of LTC than women in similar situations, and this tendency was also observed for unpartnered men and men with partners who were not disadvantages, though the differences were much smaller (Figure 2).

When we examine the impact of children's characteristics (*Hypotheses iv-vi*), we confirm *Hypothesis iv*, that having a resourceful partner is more important than having resourceful children, even when these children are in close vicinity (Figure 1). In the absence of partners, however, having an advantageous child nearby is of greater importance, as it is associated with a reduced uptake of formal care (Figure 1), in line with *Hypothesis v*. These findings are in line with research that suggests that

partners are preferred carers and companions, but that children step in when partners are unavailable or unable to provide informal care (Cantor 1991).

If we only consider institutionalizations (Figure 3, upper panel), having an advantageous child nearby is of greater importance in the absence of partners, and reduces the risk of transfers to institutionalized care, for both men and women. This also appears to be the case when a partner is present but not advantaged, albeit in these instances the association with distance to the advantaged child is less strong. According to *Hypothesis vi*, having a disadvantaged child nearby might provide less opportunities for informal care, thus increasing the uptake of formal care. This was not confirmed, however, as having a disadvantaged child further away is associated with an increased LTC uptake for women, but not men (Figure 2). For institutionalizations, however, unpartnered men and women having a nearby disadvantaged child have the same risk of transfers as that of unpartnered, childless elderly. Otherwise, the importance of disadvantage characteristics of children appeared in general to matter more than their geographic location. Consequently, *Hypothesis vi* was not confirmed.

Few studies exist that account for the role played by family members in the uptake of LTC in general, but our findings are in line with those of Hayward et al. (2004) and Dohl et al. (2016), who report that elderly who live alone use more hours of formal home care than those who do not live alone. However, when we compare our findings to existing studies of transfers to institutionalized care, we see that our findings largely support and expand on what is already known. Elderly with neither a partner nor nearby adult children are more likely to use extensive services, such as institutionalized care, in line with the findings of others (Grundy & Jitlal 2007, McCann et al. 2011, Van der Pers et al. 2015a). However, this appears to be even more true for elderly with disadvantaged partners, and for women especially, and we have not seen this reported previously. Consequently, *who* you are partnered with does matter for the uptake of formal LTC.

Taken together, our findings might suggest that available support, proxied by the presence and characteristics of family members, are taken into account when allocation of care decisions are made. Had we found the opposite, i.e. that elderly with resourceful family members have a higher uptake, it could have implied that resourceful family members instead are offered or (successfully) push for additional receipt of formal services. However, this does not seem to be the case for Norway. On the other hand, our results cannot examine the extent to which elderly with resourceful partners and/or children are able to make better use of what is offered, i.e. adhere more closely to recommendations for follow-up care, and this warrants further study. Municipal out-patient settings are becoming increasingly complex and user-provider communication is key. It is likely that this will put elderly in favorable situations ahead, unless attention is paid to this issue at the provider side. Along the same

lines, resourceful partners with for instance a higher education may provide a manifold of resources where some are directly available, such as more knowledge and higher social status, and some indirectly available through the partner's own social network. People with educated partners have been shown to be healthier in general, and to engage in fewer negative health behaviors, such as smoking (Monden et al. 2003). The mechanisms described above, all apply to education and/or knowledge. However, as was shown, our results also varied by income, net of education and other sociodemographic resources that have been found to be associated with health. This stands in contrast to the fact that old-age care is publicly run and heavily subsidized (Kjonstad et al. 2017).[20] Social support or pressure from a resourceful partner, economic advantages from sharing a household with a resourceful partner, and increased knowledge may lead to a healthier lifestyle, with for instance better nutrition, less smoking and less alcohol (Lillard & Panis 1996, Waite & Lehrer 2003, Lindström 2009, Kickbusch et al. 2013). A naive perspective of only considering the presence of partners may thus conceal important differences in LTC use.

In terms of gender inequality, our study does not suggest that women receive less formal care than men, in line with the findings of Hayward et al. (2004) and Dohl et al. (2016) but contrary to the findings of others (e.g. Parker 2009). On the one hand, the increased uptake of LTC among women that we observe may result from a higher level of needs among women. Women have in general more (self-reported) health problems than men over the whole life course (Malmusi et al. 2011), and as men tend to die earlier and in general have a shorter period in need of personal care before death, elderly women tend to need more and prolonged care towards the end of life (Romoren 2003). As women are also more often widowed, they tend to have less partner support and consequently, more needs for services and/or help from children. Our analyses that look at the type of care provided (Figure C3) might suggest that men are assumed to be less self-sufficient, and therefore given priority for institutionalized care, under otherwise equal circumstances. On the other hand, our findings appear to lend some support to the notion that female informal care is regarded as a substitute to formal care services (e.g. Stark 2005), since we find that women with disadvantaged partners have a higher uptake of LTC and institutionalized care than their male counterparts (Figures 2 and 3), albeit there is no difference among men and women with advantaged partners (Figures 1 and 3). As this might suggests an insufficient provision of formal care to husbands, further exploration is warranted.

[20] Users are charged with user fees (usually around 15%), but these are means tested (Langorgen 2004). However, since nursing home placements are expensive, significant costs may nevertheless incur, and may comprise a large share of elderly's pension benefits.

When we turn to the importance of children, an existing study from Sweden suggests that older mothers whose closest child lived in the same neighborhood, transfer to institutions primarily when care needs become substantial before death (Artamonova et al. 2021). In these circumstances, children living far away might be unable to provide sufficient care, and this might be what is portrayed in Figure 3, but primarily evident if the child living near is advantaged, or at least not disadvantaged, and there is no advantaged partner present. However, as we do not know the time of death, we are not able to assert the suggested underlying mechansim.

The same study (Artamonova et al. 2021) further observed that in Sweden, having nearby children appeares to matter more for institutionalization of mothers than fathers, perhaps because fathers in general tend to have a more peripheral role in family life in this setting. A tendency towards a similar finding is shown in the upper panel of Figure 3, i.e. that there are larger differences across children's categories (especially 5-9) in terms of distance and advantage for women than men. Research from the US shows that support to mothers in good health is more common than support to fathers, even in poor health (Silverstein et al. 2006). However, as we find smaller differences for any uptake (Figures 1 and 2) than for institutionalization (Figure 3), we find little support for this in our study.

Somewhat surprisingly, in supplementary analyses (Appendix Table B1) we found no differences in parents' use of LTC across the gender of children, contrary to what has been suggested in earlier studies from Norway and Sweden, where care managers have been found to discriminate elderly with daughters when assessing needs for formal care (Szebehely 2000, Jakobsson et al. 2015). As such, our findings are in line with a recent Swedish study (Artamonova et al. 2021). Haberkern et al. (2015) has suggested that gender inequality in intergenerational care may be lower in countries with low levels of intergenerational care, high provision of professional care services, low family obligation norms, and low levels of gendered division of labor, which to a large degree applies both to Sweden and Norway. However, in a Norwegian study of the relationship between old-age care and work, Gautun (2008) finds that women are more likely to modify their work, e.g. work part time or take longer vacations, to deal with an increasing care load as their next-of-kin become increasingly frail. However, among both male and female children with elderly parents that live at home and need help, receiving home care is positively correlated with more paid work among children (Gautun 2008). On a different note, Johansson (1991) suggest that such findings may result because daughters-in-law help their husbands take care of frail parents, whereas our results are very similar whether the nearby child is partnered or not. Consequently, the gender of children was not included in the final models shown in the current study. Along the same lines, children's age is strongly related to the age of elderly. As such, both younger and older ages of children were more likely to reflect the age of the elderly themselves, which

is strongly related to LTC uptake, rather than the actual resources of children. As such, we opted to exclude also children's age from the final models.

In Norway, the total effort from informal caregivers is estimated to comprise close to 100 0000 man-years (Otnes 2013, Tonnessen 2017, Blix et al. 2021), albeit there is generally much uncertainty associated with such estimates, whereas the public health and care services provide around 140 000 man-years (Hjemaas et al. 2019).[21] The important role played by partners is underscored in this study, as well as that of adult children in the absence of partners. The role of close family members as informal caregivers will likely become even more important in the years to come (Blix et al. 2021). The amount of informal care is expected to increase further in the years to come, primarily within households due to population ageing, as elderly are most likely to provide care within their households.

In terms of spatial variation, the estimates for our main explanatory variables remained remarkably stable even after inclusion of municipal characteristics. Furthermore, we found only minor differences in the associations between LTC uptake and having advantaged or disadvantaged partners and/or children between rural and more urbanized areas. Moreover, preliminary variance component analysis suggested just 0.03 percent of variance in the uptake of LTC existed at the municipality level. Consequently, *Hypothesis vii*, stating that the uptake of LTC is likely to vary across space, and that the variation is only in part explained by the resources of the individual municipalities, was only partially confirmed.

In Norway, there is considerable municipal variation in service profiles, in part related to municipal size, location, economic capacity and economic workload. For instance, Otnes and Haugstveit (2015) found that higher economic capacity is correlated with higher use of practical assistance, whereas higher economic workload is correlated with higher use of institutionalized care, especially long-term. They also showed that less populated municipalities tend to have a relatively larger coverage of home health nursing, whereas the largest cities have a relatively smaller coverage (ibid). Langorgen (2004) found that although municipalities with higher economic capacity were better able to meet client needs, individual needs remained the most important predictor for the distribution of home care. In addition, a recent report by Forland and Rostand (2019) discusses unwarranted variation in Norwegian LTC distribution, and points to some areas where regulatory and generally accepted professional norms are less well followed-up. Our findings are thus partly in line with previous research, in that

[21] For a more thorough discussion and references regarding informal care in Norway, cf. Section 8.1 in Hjemaas et al. (2019).

although there is regional variation in suggested care allocation, need or uptake, this is largely unexplained by individual or area level characteristics (Langorgen 2004, Syse et al. 2015).

Norwegian municipalities have increasingly taken steps to ensure that people in need of LTC who wish to live at home for as long as possible can do so. However, many people will at some point require services that cannot be delivered at home. Providing LTC in institutions can be more efficient than community or home health care for people with intensive needs, owing to economies of scale and the fact that care workers do not need to travel to each person separately, the latter being especially relevant for elderly living in remote areas with limited possibilities for informal care. However, such care is at the same time often costlier (OECD 2019). Although we observed variation in LTC uptake and institutionalization among elderly in rural and urbanized municipalities, the general patterns were surprisingly similar across characteristics of partners and children, as is shown in Figure 4 and Appendix Figures D1-D3. As stated, geographic proximity between parents and their adult children plays one of the main roles in determining the quality and intensity of intergenerational relationships and support exchange (Hank 2007, Bordone 2009). In general, the distances between elderly parents and children is smaller for elderly residing in rural areas, and in particular in municipalities in the Northern and Western parts of Norway (Lappegaard 2009). However, our comparisons take these distributional differences into account.

Lastly, previous research has shown that there are municipal differences not only in *types* of care, but also in the *quality* of the services (Gautun 2008) and that service standards are not independent of the budget constraints of each municipality (Langorgen 2004). However, these aspects could not be examined by our data and thus warrant further research.

4.2 Limitation, strengths and generalizability

4.2.1 Limitations

This is a purely descriptive study, and no causal relationships have been explored. Consequently, the term 'effect' is used as a technical term to denote statistical associations. Future studies should attempt to include also measures of the elderly's health, preferably a year or two prior to the start of LTC uptake. As reduced health and functioning are among the main indicators for uptake of LTC, the lack of data on health status prior to LTC uptake is a clear limitation of the current study, and we are thus not able to determine whether the observed differences in uptake across various sociodemographic characteristics are appropriate or if there might be inequity or unwarranted variability in the provision of formal LTC. Furthermore, we cannot assess whether there are unwarranted geographic differences, as health is likely to vary across geographic areas, as indicated by for instance mortality differences

across space (Statistics Norway 2020c). Along the same lines, we are not able to ascertain the extent to which the pronounced associations between LTC uptake and characteristics of elderly themselves, their partners and their children result from selection and/or social support. On the one hand, more knowledge on whether elderly with resourceful partners and/or adult children are healthier at the outset and thus more likely to avoid later health problems, or whether their family members 'step up' and provide informal care should the need arise is clearly warranted. On the other hand, resourceful partners and/or adult children may be better at navigating a fairly complex health care system, in particular in municipal out-patient settings where user-provider communication is key.

The IPLOS registry is generally of acceptable quality (Beyrer 2015), but due to its pseudonymized form the quality is generally more appropriate for municipal level comparisons than for individual level comparisons. From 2017 onwards, the registry has been continued in a non-pseudonymized form (in the KPR registry, i.e. the Norwegian Registry for Primary Health Care), and future studies should examine whether the associations described here also appear in these data. One limitation of the IPLOS registry is that, albeit diagnostic information is available, the share of missing is rather pronounced and likely differential, and as such the data are not deemed appropriate for individual level examination. Among elderly individuals, dementia, functional limitations, and depressive symptoms are the major predictors of the use of LTC, regardless of whether they live alone or have a partner (see e.g. Larsson et al. 2006). However, as we have no reliable information on diagnoses, we could not explore this matter, but future studies should assess this in more detail.

Furthermore, in our study, we only examined actual uptake of care. Consequently, we did not consider other positive or negative relational or emotional aspects of having children close by. While having children nearby might not substantially reduce care use, it might heighten quality of life or general well-being, in particular in the absence of partners (van der Pers et al. 2015b). A recent study underscores the negative link between childlessness and the availability of informal support among elderly Danish individuals, mainly among unpartnered individuals and stronger for men than women, and the support gap intensifies with increasing health needs (Kjaer & Siren 2021). Along the same lines, this study limited the proxies for social support to include partners and children. Including additional information also on other next-of-kin, such as neighbors or other measures of social ties, could have added valuable information. As an example, Thomeer (2016) finds that non-spousal help and monthly contact with neighbors decrease the risk of institutionalization, and more so for women than men.

There is a high level of homogamy in age, income and education between younger partners in Norway, whereas older partners in general follow a 'bread-winner' husband pattern, as is the case also

in many other countries (Szinovacz & Davey 2008). It may thus be that couples with 'non-normative' distributions in age or education also differ in other ways, and similarly might be the case where children appear to do worse than their parents in terms of for instance education and labor market participation. The issue of homogamous versus heterogamous distributions need to be explored further but was too much to take on in this paper. Similarly, for new generations, people might have changed partners over the life course. For the cohort that we study here, this pertains only to a small percentage of elderly. However, in future studies, with new generations of elderly and children, this matter should be considered.

The Norwegian old-age care system is best understood as a mix between publicly funded service provision, either provided by municipalities or non-profit organizations, and informal care. However, in recent years, commercial (privately funded and provided) care markets have developed, focusing primarily on practical assistance although also old-age health services have begun to emerge, especially in urbanized areas (Christensen 2012, NOU 2020:13). In this study, we had no information of the use of privately purchased care services, and as such this issue could not be explored.

4.3.2 Strengths and generalizability

This is the first study to explore the importance of family resources for LTC uptake in older people while simultaneously accounting for characteristics of partners and adult children, as well as the geographic proximity to adult children. Furthermore, the time-span covered is rather large, and we have complete, high quality data on all married and cohabiting individuals. Further, partners were identified in more than 99 percent of the cases, and there is thus virtually no selection bias. We were further able to account for changes in partnership status and/or partners. We believe this is important in studies of elderly where marital status change into widowhood is not uncommon. Although some authors argue that the protective effects of having been married to a resourceful partner lasts beyond the period that the marriage lasts (Skalicka & Kunst 2008), we find it less clear how this would be the case. Many studies show negative effects on health and quality of life in periods after marital status change (see e.g Jin & Christiakis 2013), and it is likely that this may have implications for elderly's ability to handle their possible care needs and follow-up care (ibid).

Contrary to many other systems worldwide, the public healthcare system in Norway provides highly subsidized diagnosis, treatment and long-term follow-up, including old-age care services, universally (Kjonstad et al. 2017). Nevertheless, it is reasonable to expect that the associations we find in terms of the presence and resources of family members and formal care uptake could be found in other countries, especially the other Nordic countries where patterns of geographical distances between

elderly parents and adult children are similar (Kolk 2017). Should that be confirmed in later studies, an important next step is to learn more about the relative importance of the various mechanisms, and particularly the role of resourceful family members in informal care.

4.4 Policy implications

Demographic changes, such as population ageing, an increase in complex families and male childlessness, centralization, and increasing globalization underscores the importance of an improved understanding of the role played by family members for elderly's health, welfare and long-term care uptake as well as its interplay with both privately and publicly run old-age care services (cf. for instance van Houten & Norton 2004, Bonsang 2009, Jacobs et al. 2013, Bremer et al. 2017). Our study suggests that informal care to some extent is a substitute to formal care, as uptake (use) of formal care is negatively correlated with the presence and resources of family members, net of elderly's own characteristics. This is in line with the findings of Bremer et al. (2017).[22] In Norway, as in most developed countries, the support ratio is changing: The relative number of tax payers in prime working age is expected to decline (Syse et al. 2020). In addition, health care standards are increasing, resulting in increasing costs. These trends have well known adverse fiscal implications in terms of tax hikes and/or cutting other types of public welfare (Holmoy et al. 2020). Meeting the future needs (demand) also requires a relatively strong growth in the employment share of health and old-age care workers (Hjemaas et al. 2019), which requires a break from the historical trends that may be unrealistic given the present incentives with respect to relative wages and working conditions. Population ageing thus presents a fundamental challenge for future long-term care service provision, as needs threaten to exceed both the labor supply and the public funds that individuals, as workers and voters, are willing to allocate to tax financed health and old-age care, in Norway as in many other countries (Muir 2017, Lorenzoni et al. 2019, OECD 2019). The importance of informal care is likely to increase in the years to come, as public resources become increasingly strained (Holmoy et al. 2020). Based on our findings, it seems likely that inequality in the health and welfare of elderly with and without (resourceful) family members will increase in the years to come.

In Norway, the assistance tasks in old-age care are divided between the municipalities and the family, albeit the formal care system generally undertake the most demanding part (Daatland & Herlofson 2003). Consequently, one could expect the differences between elderly with and without partners and/or children to be smaller in Norway as compared to other countries, since the formal care system

[22] Bremer et al. (2017) underscore that albeit increased informal caregiving effectively reduces public health care spending by reducing the amount of formal home care services, pronounced differences exist between countries.

should step in when the care demands become pronounced. However, there is relatively scarce research on old-age care use, and our findings align fairly well with those of others. This might suggest that there is more ongoing informal care in Norway than what is generally acknowledged, especially among older wives (Tonnessen 2017). This is in line with discrepancies observed in current estimates (cf. for instance Hjemaas et al. 2019). Findings from Denmark show that this might extend also to adult children, as childless men living alone risk insufficient support in older age, particularly when in poor health (Kjaer & Siren 2021). The extent of informal care provided by adult children residing outside the household, needs further exploration. Furthermore, increased knowledge of the type and timing of informal care that family members outside the household undertake is warranted. Perhaps it is so well targeted that it really alleviates the need for formal care? This matter needs further exploration, in particular in light of the competing policy aims of increasing both the amounts of informal care as well as ensuring a high (female) labor force participation, well into older ages (Norwegian Directorate of Health 2019, NOU 2019:7). Whereas the evidence is mixed as to the gender balance among recipients of care, women are the dominant care providers both in the formal and the informal (family) sector (NOU 2019:7). Consequently, it is important to assess whether formal LTC distribution reproduce or level out existing gender inequalities in informal care provision.

Health and care personnel are increasingly encouraged to include caregivers in their interactions (see e.g. Norwegian Directorate of Health 2019) and may take advantage of the knowledge generated in this study and thus gather information on resources in immediate networks that may contribute favorably and help elderly utilize these to improve their health, well-being and quality of life, and perhaps ultimately reduce the need for formal care. Although it is positive to include caregivers in considerations of care needs, there are also costs associated with caregiving tasks, and these needs to be balanced appropriately. In Norway (Gautun 2008, Kotsadam 2011), as in many other societies (cf. for instance Jacobs et al. 2013), heavy caregiving burdens may have adverse consequences for the labor force participation, and perhaps especially for women. A recent Norwegian study confirms that there is competition (trade-off) between paid and unpaid work, and that retirement increases the probability of performing unpaid work aged 62-75 compared to continuing to work full time (Vangen et al. 2021). A high female labor force participation is, however, instrumental to uphold or increase the tax base, not least as a response to an ageing society. Disregarding this issue in formulating old-age care policies may therefore be counterproductive, and an important question will be to examine the extent to which future adult children, and perhaps women in particular, will prefer to care for their own family members or undertake paid health and care work, as resources become increasingly constrained?

Our findings do not suggest that there is considerable inequity in allocation of old-age care in Norway. On the contrary, our results suggest that available support, proxied by the presence of family members, enters decisions regarding allocation of care. We find that unpartnered elderly and elderly with disadvantaged partners are the most likely to use LTC, net of their own resources. Had we found the opposite, it could have implied that resourceful family members instead of partaking in informal care tasks used their resources to successfully push for formal services. However, this does not seem to be the case for Norway. On the other hand, we do see that partnered men in general use less LTC than partnered women, which may imply that wives are thought to be more able to provide (more) informal care than husbands. Romoren (2003) argues, however, that there is a close correspondence between care needs and care supply so that those most in need receive the most, while the gender of the recipient is insignificant when needs are controlled for. While this might be the case for unpartnered elderly, it is interesting that we find more pronounced gender differences among partnered elderly. Consequently, this matter needs further exploration to ensure that there is no discrimination based on gender of the informal caregiver.

We also find little evidence of inequity in terms of municipality of residence, albeit prior research has shown that municipalities with higher economic capacity meet client needs better (Langorgen 2004). However, going forward, it will be important that central governments continues to aim to reduce inequalities in the service standards by means of fiscal equalization policies towards municipalities, as population ageing puts pressure on resources at both national and local levels.

Although the Norwegian old-age care system primarily is comprised of a mix between publicly funded service provision, either by the municipalities or by non-profit organizations, and informal care, commercial (privately funded and provided) care markets are beginning to develop in more urbanized areas. This might result in increased inequalities in overall care provision between economically resourceful and less resourceful elderly and family members, as well as between elderly in geographic areas where such markets do and do not exist (NOU 2020:13). This will be important to monitor in the years to come as such markets continue to grow. An important question for policy makers will be whether such services should complement public care, or whether public care should be disproportionally awarded to those most in need and unable to utilize commercial, privatized care options.

Trends in population ageing and social trends in society represent fundamental challenges for future LTC demands, which are feared to exceed the resources of the family, the welfare state, and other caregivers, both in quantity and in complexity. This paper contributes new knowledge on both individual and societal levels of care exchanges and may thus help inform sustainable policies and

practices for an ageing society, in line with the WHO and UN action plans for active ageing and a society for all ages (e.g. WHO 2002), as well as national aims and guidelines (e.g. Norwegian Ministry of Health 2018). Our main message is that policy makers must carefully weigh the possible consequences for caregiving tasks for partners when they plan that older individuals ought to prolong their working lives, participate in volunteer organizations, and care for grandchildren to help ensure their adult children's labor supply. Similarly goes for adult children who are approaching retirement: Is it always better that they work in the labor market than that they help care for frail parents with care needs? This discussion needs to be brought to the front line.

5 Conclusions

Factors associated with health outcomes are often examined in an individual perspective, even though persons often are influenced both through selection and causation by the resources of surrounding family members. Our study shows that having resourceful partners and/or adult children is associated with reduced use of formal health and care services, net of the elderly' own resources. Consequently, the importance of elderly's own resources may be overestimated unless one also accounts for the resources of partners and nearby adult children. Similarly, the differences between elderly with and without resourceful partners might be expected to increase in the years to come, as public resources become increasingly strained.

Although we are unable to distinguish between selection and social support mechanisms, our findings align well with the theory of social support for both health promotion and informal care provision. One may speculate that elderly with resourceful partners/adult children might be healthier at the outset and thus more likely to avoid later health problems, and/or that they are better able to rely on informal care than elderly without such support. At the same time, our findings suggest that municipal service provision in Norway appears to be awarded based on an overall assessment of need, in line with what is mandated by law, accounting also for the availability of informal care. Consequently, our findings suggest a fair distribution of the health and care for elderly, across individual, family and location-specific characteristics.

With population ageing, health and care resources for elderly are becoming limited. Thus, acknowledging the presence of informal care appears appropriate. Our findings should thus be relevant in broad setting, and it is reasonable to expect similar trends also in other countries, and perhaps especially in countries where informal care comprises a larger share of health and care provisions in older age. An important next step is to learn more about the relative importance of the various mechanisms that have been discussed. Future demographic changes, such as population ageing,

centralization, and an increase both in complex families and immigration, underscores the importance of understanding the role played by family members for elderly's health, welfare and use of health and care services, from both an individual and a societal perspective.

References

Allison PD (1995). *Survival analysis using SAS: A practical guide.* Cary, NC: SAS Institute Inc.

Artamonova A, Branden M, Gillespie BJ & Mulder CH (2021). Adult children's gender, number, and proximity and older parents' moves to institutions: Evidence from Sweden. In press *Ageing and Society*.

Bago d'Uva T & Jones MA (2009). Health care utilisation in Europe: new evidence from the ECHP. *Journal of Health Economics* 28: 265-79.

Banack HR, Kaufman JS, Wactawski-Wende J, Troen BR & Stovitz SD (2019), Investigating and remediating selection bias in geriatrics research: The selection bias toolkit. *Journal of the American Geriatrics Society* 67: 1970-6.

Barclay K & Kolk M (2020). The influence of health in early adulthood on male fertility. *Population and Development Review* 46(4): 757-85.

Bauer J & Sou-sa-Poza A (2015). Impacts of informal caregiving on caregiver: Employment, health and family. *Journal of Population Ageing* 8: 113-45.

Beyrer S (2015). *Kvalitet I IPLOS-registeret. Gjennomgang av datakvaliteten på kommunenes IPLOS-rapportering 2013*. Reports 2015/16, Oslo: Statistics Norway.

Blix BH, Stalsberg H & Moholdt J-M (2021). Demografisk utvikling og potensialet for uformell omsorg i Norge. *Tidsskrift for omsorgsforskning* 7(1): 1-14.

Bonsang E (2009). Does informal care from children to their elderly parents substitute for formal care in Europe? *Journal of Health Economics* 28: 143–154.

Bordone V (2009). Contact and proximity of older people to their adult children: A comparison between Italy and Sweden. *Population, Space and Place* 15(4): 359-80.

Bremer P, Challis D, Hallberg IR, et al. (2017). Informal and formal care: Substitutes or complements in care for people with dementia? Empirical evidence for 8 European countries. *Health Policy* 121: 613–622.

Brown DC, Hummer RA & Hayward MD (2014). The importance of spousal education for the self-rated health of married adults in the United States. *Population Research and Policy Review* 33(1): 127-51.

Cantor MH (1991). Family and community: Changing roles in an aging society. *The Gerontologist* 31(3): 337-46.

Chappel N & Blandsford A (1991). Informal and formal care: Exploring the complementarity. *Ageing and Society* 11: 299-317.

Christensen K (2012). Towards a mixed economy of long-term care in Norway? *Critical Social Policy* 32(4): 577-96.

Colombo F, Llena-Nozal A, Mercier J & Tjadens F. (2011). *Help wanted? Providing and paying for long-term care*. Paris: OECD Publishing. Online at: https://doi.org/10.1787/9789264097759-en.

Connidis IA & Barnett AE (2018). *Family Ties and Aging*. 3rd ed. Thousand Oaks, CA: Sage Publications Inc.

Cutler DM & Lleras-Muney A (2010). Understanding differences in health behaviors by education. *Journal of Health Economics* 29(1): 1-28.

Daatland SO & Herlofson K (2003). 'Lost solidarity' or 'changed solidarity': a comparative European view of normative family solidarity. *Ageing and Society* 23(5): 537-60.

Daatland SO & Veenstra M (eds.) (2012). Bærekraftig omsorg? Familien, velferdsstaten og aldringen av befolkningen. NOVA report 2/2012, Oslo: NOVA.

DiMatteo MR (2004). Social support and patient adherence to medical treatment: a meta-analysis. *Health Psychology* 23(2): 207-18.

Dohl O, Garaasen H, Kalseth J & Magnussen J (2016). Factors associated with the amount of public home care received by elderly and intellectually disabled individuals in a large Norwegian municipality. *Health and Social Care in the Community* 24(3): 297-308.

Kickbusch I, Pelikan JM, Apfel F & Tsouros AD (2013). *Health literacy. The solid facts*. Copenhagen: WHO. Online at: https://www.euro.who.int/__data/assets/pdf_file/0008/190655/e96854.pdf.

Fiva JH, Haegeland T, Ronning M & Syse A (2014). Access to treatment and educational inequalities in cancer survival. *Journal of Health Economics* 36: 98-111.

Forland O & Rostad HM (2019). *Variasjon og uønsket variasjon i kvalitet i omsorgstjenestene. En kunnskapsoppsummering.* Reports 2019/4, Gjovik: Centre for Care Research.

Freedman VA, Berkman LF, Rapp SR & Ostfeld AM (1994). Family networks: predictors of nursing home entry. *American Journal of Public Health* 84(5): 843-5.

Gautun H (2008). *Arbeidstakere og omsorg for gamle foreldre – den nye tidsklemma*. Rapport 2008/40, Oslo: Fafo.

Goldman N (1993). Marriage selection and mortality patterns: inferences and fallacies. *Demography* 30(2): 189-208.

Grigoryeva A (2017). Own gender, sibling's gender, parent's gender. *American Sociological Review* 82(1): 116-46.

van Groenou B & De Boer A (2016). Providing informal care in a changing society. *European Journal of Ageing* 13: 271–9.

Grundy E & Jitlal M (2007). Socio-demographic variations in moves to institutional care 1991–2001: a record linkage study from England and Wales. *Age and Ageing* 36(4): 424-30.

Haberkern K, Schmid T & Szydlik M (2015). Gender differences in intergenerational care in European welfare states. *Ageing and Society* 35(2): 298-320.

Haberkern K & Szydlik M (2010). State care provision, societal opinion and children's care of older parents in 11 european countries. *Ageing and Society* 30: 299.

Hanaoka C & Norton EC (2008). Informal and formal care for elderly persons: How adult children's characteristics affect the use of formal care in Japan. *Social Science and Medicine* 67: 1002-8.

Hank, K. (2007). Proximity and contacts between older parents and their children: A European comparison. *Journal of Marriage and Family* 69(1): 157-73.

Hayward L, Davies S, Robb R, Denton M & Auton G (2004). Publicly funded and family-friend care in the case of long-term illness: the role of the spouse. *Canadian Journal of Aging* 23(S1): S39-48.

Hjemaas G, Holmoy E & Haugstveit F (2019). *Fremskrivninger av etterspørselen etter arbeidskraft i helse- og omsorg mot 2060*. Reports 2019/12. Oslo: Statistics Norway.

Holmoy E, Hjemaas G, Sagelvmo I & Strom B (2020). *Skatteregningen for helse- og omsorgsutgifter mot 2060*. Reports 2020/42. Oslo: Statistics Norway.

van Houtven CH & Norton EC (2004). Informal care and health care use of older adults. *Journal of Health Economics* 23: 1159–1180.

Jacobs JC, Lilly MB, Ng C & Coyte PC (2013). The fiscal impact of informal caregiving to home care recipients in Canada: How the intensity of care influences costs and benefits to government. *Social Science & Medicine* 81: 102-109.

Jakobsson N, Kotsadam A, Syse A & Oien H (2016). Gender bias in public long-term care? A survey experiment among care managers. *Journal of Economic Behavior and Organization* 131(B): 126-38.

Jin L & Christiakis NA (2013). Investigating the mechanism of marital mortality reduction: the transition to widowhood and quality of health care. *Demography* 46(3): 605-25.

Johansson L (1991). Informal care of dependent elderly at home—some Swedish experiences. *Ageing and Society* 11(1): 41-58.

Katz SJ, Kabeto M & Langa KM (2000). Gender disparities in the receipt of home care for elderly people with disability in the United States. *JAMA* 284(23): 3022-7.

Kjaer, AA & Siren A (2021). Aging without children: The link between parental status and tangible support. *Journal of Family Issues*. Online first: doi:10.1177/0192513X21993203.

Kjonstad A, Syse A, Kjelland M (2017). *Velferdsrett I: Grunnleggende rettigheter, rettssikkerhet og tvang*, 6th ed. Oslo: Gyldendal akademisk.

Knijn TCM & Liefbroer AC (2006). More kin than kind: instrumental support in families. In: Dykstra PA, Kalmijn M, Knijn TCM, Komter AE, Liefbroer AC & Mulder CH: *Family solidarity in the Netherlands* (pp. 89-105). Amsterdam: Dutch University Press.

Kolk M (2017). A life-course analysis of geographical distance to siblings, parents and grandparents in Sweden. *Population, Space and Place* 23: e2020.

Kotsadam A (2011). Does informal eldercare impede women's employment? The case of European welfare states. *Feminist Economics* 17: 121-44

Kravdal O (2000). Social inequalities in cancer survival. *Population Studies* 54(1): 1-18.

Kravdal O, Grundy E, Lyngstad TH, et al. (2012). Family life history and late mid-life mortality in Norway. *Population and Development Review* 38(2): 126-38.

Langorgen A (2004). Needs, economic constraints, and the distribution of public home-care. *Applied Economics* 36(1): 485-96.

Langorgen A, Lokken S & Aaberge R (2015). *Gruppering av kommuner etter folkemengde og økonomiske rammebetingelser 2013*. Reports 2015/19, Oslo: Statistics Norway.

Lappegaard T (2009). De fleste bor nær foreldre og voksne barn. *Samfunnsspeilet* 1: 84-8.

Larsson K, Thorslund M & Kaareholt I (2006). Are public care and services for older people targeted according to need? Applying the behavioural model on longitudinal data of a Swedish urban older population. *European Journal of Ageing* 3(1): 22-33.

Leopold T, Raab M, Engelhardt H (2014). The transition to parent care: Costs, commitments, and caregiver selection among children. *Journal of Marriage and Family* 76: 300-18.

Lillard LA & Panis CW (1996). Marital status and mortality: the role of health. *Demography* 33(3): 313-27.

Lindström M (2009). Marital status, social capital, material conditions and self-rated health: a population-based study. *Health Policy* 93(2-3): 172-9.

Lingsom S (1997). *The substitution issue. Care policies and their consequences for family care*. Reports 1997/6, Oslo: Norwegian Social Research.

Lee GR, Dwyer JW & Coward RT (1993). Gender differences in parent care: demographic factors and same-gender preferences. *Journal of Gerontology* 48(1): S9-S16.

Lorenzoni L, Marino A, Morgan D & James C (2019). Health Spending Projections to 2030: New results based on a revised OECD methodology. OECD Health Working Papers No. 110, Paris: OECD Publishing. Online at: https://dx.doi.org/10.1787/5667f23d-en.

Malmusi D, Artazcoz L, Benach J & Borrell C (2011). Perception or real illness? How chronic conditions contribute to gender inequalities in self-rated health. *European Journal of Public Health* 22(6): 781-6.

Marks R, Ok H, Joung H & Allegrante JP (2010). Perceptions about collaborative decisions: Perceived provider effectiveness among 2003 and 2007 health information national trends survey (HINTS) respondents. *Journal of Health Communication* 15(83): 135-46.

McCann M, Donnelly M & O'Reilly D (2011). Living arrangements, relationship to people in the household and admission to care homes for older people. *Age and Ageing* 40(3): 358-63.

Monden C, van Lenthe F, de Graaf ND & Kraaykamp G (2003). Partner's and own education: Does who you live with matter for self-assessed health, smoking and excessive alcohol consumption? *Social Science and Medicine* 57(10): 1901-12.

Mood C (2010). Logistic Regression: Why we cannot do what we think we can do, and what we can do about it. *European Sociological Review* 26(1): 67-82.

Mork E, Beyrer S, Haugstveit F, et al. (2017). *Kommunale helse- og omsorgstjenester 2016. Statistikk om tjenester og tjenestemottakere*. Reports 2017/26, Oslo: Statistics Norway.

Muir T (2017). Measuring social protection for long-term care. OECD Health Working Papers No. 93, Paris: OECD Publishing. Online at: http://dx.doi.org/10.1787/a411500a-en.

Mulder CH & van der Meer MJ (2009). Geographical distances and support from family members. *Population, Space and Place* 15(4): 381-99.

National Academies of Sciences, Engineering, and Medicine (NASEM) (2018). *Health-care utilization as a proxy in disability determination*. Washington, DC: The National Academies Press. Online at: https://doi.org/10.17226/24969.

Noël-Miller C (2010). Spousal loss, children, and the risk of nursing home admission. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 65(3): 370-80.

Norwegian Directorate of Health (2019). Pårørendeveileder. Online at: https://www.helsedirektoratet.no/veiledere/parorendeveileder.

Norwegian Ministry of Finance (2021). *Meld. St. 14 (2020–2021). Perspektivmeldingen 2021*. Online at: https://www.regjeringen.no/no/dokumenter/meld.-st.-14-20202021/id2834218/

Norwegian Ministry of Health (2018). *Meld. St. 15 (2017–2018). Leve hele livet — En kvalitetsreform for eldre*. Online at: https://www.regjeringen.no/no/dokumenter/meld.-st.-15-20172018/id2599850/.

NOU (2019). *NOU 2019: 7. Work and benefits – Measures to increase employment*. Online at: https://www.regjeringen.no/en/dokumenter/nou-2019-7/id2637967/.

NOU (2020). *NOU 2020: 13. Private aktører i velferdsstaten – Velferdstjenesteutvalgets delutredning I og II om offentlig finansierte velferdstjenester*.

OECD (2019). *Health at a glance 2019: OECD indicators*. Paris: OECD Publishing. Online at: https://doi.org/10.1787/4dd50c09-en.

Oien H, Karlsson M & Iversen T (2012). The impact of financial incentives on the composition of long-term care in Norway. *Applied Economic Perspectives and Policy* 34(2): 258-74.

Otnes B (2013). Familieomsorg – fortsatt viktig. In J Ramm (ed): Eldres bruk av helse- og omsorgstjenester. Statistical Anaylses, Oslo: Statistics Norway

Otnes B & Haugstveit FV (2015). *Kommunal variasjon i omsorgstjenester*. Reports 2015/44, Oslo: Statistics Norway.

Parker M (2009). Könsskillnader i vård och omsorg. *Äldre i centrum* 1: 24-25.

van der Pers M, Kibele EU & Mulder CH (2015a). Intergenerational proximity and the residential relocation of older people to care institutions and elsewhere. *Ageing and Society* 35(7): 1429.

van der Pers M, Mulder CH & Steverink N (2015b). Geographic proximity of adult children and the well-being of older persons. *Research on Aging* 37(5): 524-51.

Pezzin LE, Pollak RA & Schone BS (2013). Complex families and late-life outcomes among elderly persons: Disability, institutionalization, and longevity. *Journal of Marriage and Family* 75(5): 1084-97.

Romoren TI (2003). *Pleie- og omsorgstjenesten i kommunene: tjenestemottakere, hjelpebehov og tilbud*. NOVA report 10/2003, Oslo: NOVA.

Seltzer JA, Yahirun JJ & Bianchi SM (2013). Coresidence and geographic proximity of mothers and adult children in stepfamilies. *Journal of Marriage and Family* 75(5): 1164-80.

Seo HS & Lee NK (2010). Predictors of PSA screening among men over 40 years of age who had ever heard about PSA. *Korean Journal of Urology* 51(6): 391-7.

Silverstein M, Gans D & Yang FM (2006). Intergenerational support to aging parents: The role of norms and needs. *Journal of family Issues* 27(8): 1068-84.

Skalicka V & Kunst A (2008). Effects of partners' socioeconomic characteristics on mortality among men and women in a Norwegian longitudinal study. *Social Science and Medicine* 66(9): 2035-47.

Smith SK, Dixon A, Trevena L, Nutbeam D & McCaffery KJ (2009). Exploring patient involvement in healthcare decisions across different education and functional literacy groups. *Social Science and Medicine* 69: 1805-12.

Stark A (2005). Warm hands in cold age – On the need of a new world order of care. *Feminist Economics* 11(2): 7-36.

Statistics Norway (2020a). *Health accounts*. Online at: https://www.ssb.no/en/nasjonalregnskap-og-konjunkturer/statistikker/helsestat.

Statistics Norway (2020b). *KOSTRA - Key figures on municipal activities. Municipal-state-reporting*. Online at: https://www.ssb.no/en/offentlig-sektor/kostra.

Statistics Norway (2020c). *Deaths*. Online at: https://www.ssb.no/en/befolkning/statistikker/dode.

Syse A, Thomas M & Gleditsch R (2020a). *Norway's 2020 population projections. National level results, methods and assumptions*. Reports 2020/25, Oslo: Statistics Norway.

Syse A, Dommermuth L & Hart RK (2020b). Does health influence fertility? Discussion Papers No. 921, Oslo: Statistics Norway.

Syse A, Leknes S, Lokken S & Tonnessen M (2018a). *Norway's 2018 population projections. Main results, methods and assumptions*. Reports 2018/22, Oslo: Statistics Norway.

Syse A, Dzamarija MT, Kumar BN & Diaz E (2018b). An observational study of immigrant mortality differences in Norway by reason for migration, length of stay and characteristics of sending countries. *BMC Public Health* 18(1).

Syse A & Lyngstad TH (2017). In sickness and in health: the role of marital partners in cancer survival. *SSM Population Health* 3: 99-110.

Syse A, Oien H, Solheim MB & Jakobsson N (2015). Variasjoner i kommunale tildelingsvurderinger av helse- og omsorgstjenster til eldre. *Tidsskrift for velferdsforskning* 18(3): 211-23.

Szebehely M (2000). Älreomsorg i förändring: knappare resurser och nya organisationsformer. SOU 2000: 38. Online at: https://www.regeringen.se/rattsliga-dokument/statens-offentliga-utredningar/2000/05/sou-200038/.

Szinovacz ME & Davey A (Eds.) (2008). *Caregiving contexts: Cultural, familial, and societal implications*. New York: Springer.

Teachman J (2010). Work-related limitations, education and risk of marital disruption. *Journal of Marriage and Family* 72: 919-32.

Thomeer MB, Mudrazija S & Angel JL (2016). Relationship status and long-term care facility use in later life. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 71(4): 711-23.

Torssander J & Erikson R (2009). Marital partner and mortality: the effects of the social positions of both partners. *Journal of Epidemiology and Community Health* 63(12): 992-8.

Torssander J (2014). Adult children's socioeconomic positions and their parents' mortality: a comparison of education, occupational class, and income. *Social Science and Medicine* 122: 148-56.

Tonnessen S (2017). Pårørende: Usynlige bærebjelker i velferdsstaten. In: Vike H, Debesay J & Haukelien H (Eds.). *Tilbakeblikk på velferdsstaten: Politikk, styring og tjenester*. Oslo: Gyldendal Akademisk.

Vangen H, Hellevik T & Herlofson K (2021). Associations between paid and unpaid work among Norwegian seniors: competition, complementarity or continuity? *European Journal of Ageing* (2021). Online at: https://doi.org/10.1007/s10433-021-00615-9.

Waite LJ & Lehrer EL (2003). The benefits from marriage and religion in the United States: a comparative analysis. *Population and Development Review* 29(2): 255-76.

WHO (2002). *Active ageing. A policy framework*. Geneve: World Health Organization.

Wiik KA & Dommermuth L (2014). Who remains unpartnered by mid-life in Norway? Differentials by gender and education. *Journal of Comparative Family Studies* 45(3): 405-24.

Williams R (2012). Using the margins command to estimate and interpret adjusted predictions and marginal effects. *Stata Journal* 12(2): 308-31.

Zhang Y, Engelman M & Agree EM (2013). Moving considerations: A longitudinal analysis of parent–child residential proximity for older Americans. *Research on Aging* 35(6): 663-87.

Zigante V, Fernandez J & Mazzotta F (2021). Changes in the balance between formal and informal care supply in England between 2001 and 2011: Evidence from census data. *Health Economics, Policy and Law* 16(2): 232-249.

Appendix A: Detailed descriptive statistics

Table A1 provides background statistics for the full sample. There were equal shares of women and men in the full sample, both in terms of elderly individuals and person-years of observations. Around two-thirds of the observations were below age 75, and the age structure was similar across gender. The majority was partnered, and men were more likely to be partnered than women. The main reason for the difference can be attributed to widowhood, as around one-quarter of the women had lost their partner (not shown). Women were, however, slightly less likely to be childless than men, and more likely to have children in their vicinity. In terms of socioeconomic resources, the vast majority received pensions, although quite a few also held some form of employment. More men than women held a higher education. A similar share of men and women had partners who received LTC. In terms of children's characteristics, most elderly had at least one child with either a high education or a partner. The majority (62 percent) had at least one child living near, i.e. within 10 kilometers. At the same time, many elderly had a child in poor health, whereas fewer had a child who was out of work. Only a minor share had children who received social assistance benefits. In summary, near 7 out of 10 elderly had at least one advantaged child, whereas 4 out of 10 had at least one disadvantaged child.

Table A1. Background descriptive sociodemographic statistics of elderly, partners and children. In percent of total person-years.

	All	Men	Women		All	Men	Women
Focal elderly's characteristics				***Children's characteristics***			
Age 65-69	40	41	40	No children	12	13	11
Age70-74	27	27	26				
Age 75-79	17	16	17	Only daughters	21	21	22
Age 80-84	10	10	11	Only sons	23	22	23
Age 85-89	5	5	5	Both genders	44	44	44
Age 90+	1	1	1				
				1+ child highly educated	54	54	53
Partnered	68	77	59				
				1+ child partnered	61	58	63
Childless	12	13	11				
1 child	13	13	13	1+ child poor health	42	41	43
2+ children	75	74	76				
				1+ child out of work	22	21	22
High education	38	47	30				
Pension or other public support	94	94	94	1+ child receives social assistance	3	3	3
Employed	22	27	17				
				1+ child advantaged	69	67	70
Partner's characteristics				1+ child disadvantaged	42	42	43
No partner	32	23	41				
				Children nearby[a]			
Age < 60	3	5	1	No children	12	13	11
Age 60-64	8	14	2	No children nearby	26	27	25
Age 65-69	20	25	15	At least 1 child nearby	62	60	64
Age70-74	17	17	18				
Age 75-79	11	9	12	1 child nearby	33	33	34
Age 80-84	6	5	7	2 children nearby	23	22	24
Age 85-89	2	2	3	3 children nearby	6	6	6
Age 90+	1	0	1				
Immigrant	3	4	2	*Advantaged/disadvantaged child nearby*			
High education	27	26	29	1+ advantaged child nearby	47	45	49
LTC services use	6	6	6	1+ disadvantaged child nearby	29	28	31

[a]Nearby is defined as living within 10 kilometres.

Appendix B: Elderly's own characteristics and additional analyses of the role of family members' characteristics

Associations between sociodemographic characteristics of individuals and family members are shown in Models I-IV in Table B1.

Table B1. Modeled estimates of the impact of characteristics of elderly (Model I), elderly and their partners (Model II), elderly and children (Model III), and elderly, partners and children (Model IV) on the risk of uptake of formal LTC services among elderly men and women.[a]

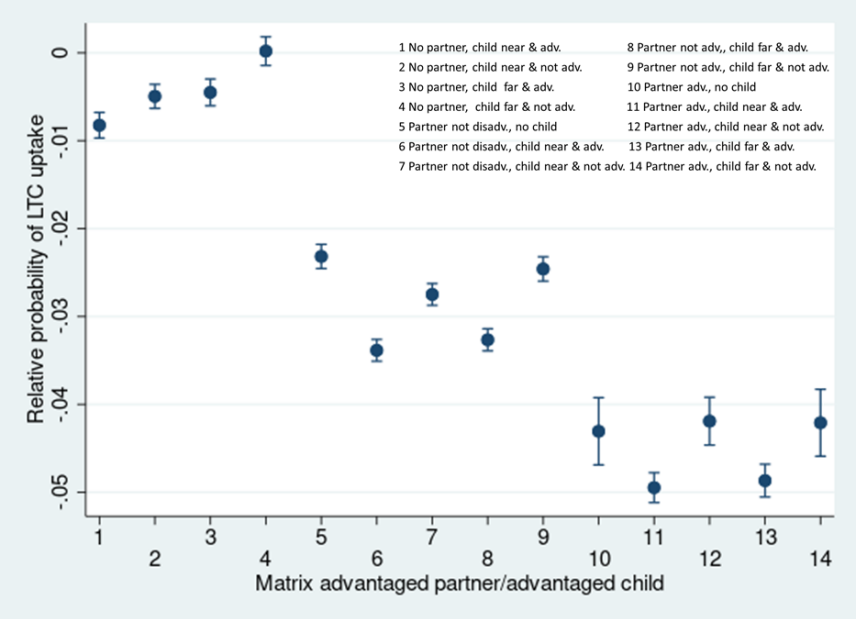
	Male elderly								Female elderly							
	Model I		Model II		Model III		Model IV		Model I		Model II		Model III		Model IV	
	OR[b]	95% CI[c]	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Elderly's characteristics																
Unpartnered/never-married	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref
Partnered	0.62	0.61-0.64	0.44	0.42-0.47	0.63	0.61-0.65	0.46	0.44-0.49	0.63	0.61-0.65	0.67	0.60-0.75	0.64	0.62-0.66	0.69	0.61-0.77
Divorced/separated	1.18	1.14-1.22	N/A	N/A	1.17	1.13-1.21	1.08	1.04-1.11	1.17	1.13-1.21	N/A	N/A	1.16	1.12-1.19	1.07	1.04-1.11
Widowed	0.93	0.90-0.96	N/A	N/A	0.93	0.89-0.96	1.06	1.02-1.09	**0.97**	**0.94-1.00**	N/A	N/A	**0.97**	**0.95-1.00**	1.03	1.01-1.07
No children	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref
No children nearby	0.89	0.87-0.92	0.92	0.90-0.94	0.90	0.84-0.96	0.89	0.84-0.95	0.97	0.95-0.99	**0.99**	**0.97-1.02**	0.91	0.86-0.97	0.92	0.87-0.97
At least 1 child nearby	0.89	0.87-0.92	0.92	0.90-0.94	0.90	0.84-0.96	0.89	0.83-0.95	0.91	0.88-0.93	0.92	0.90-0.94	0.85	0.80-0.89	0.85	0.80-0.90
2+ children (ref=0 or 1 child)	0.92	0.90-0.93	0.95	0.93-0.97	0.92	0.90-0.94	0.95	0.93-0.97	0.90	0.89-0.92	0.92	0.91-0.94	0.91	0.89-0.92	**0.92**	**0.90-0.94**
High education (ref=low education[d])	0.90	0.89-0.92	0.91	0.90-0.93	0.91	0.90-0.93	0.92	0.91-0.93	0.85	0.84-0.86	0.89	0.88-0.91	0.85	0.84-0.87	0.90	0.89-0.92
Lowest income quartile[e]	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref
3rd income quartile	0.93	0.92-0.95	0.93	0.91-0.95	0.94	0.92-0.95	0.93	0.92-0.95	0.96	0.94-0.97	**1.00**	**0.99-1.02**	0.96	0.94-0.97	**1.00**	**0.99-1.02**
2nd income quartile	0.76	0.75-0.78	0.77	0.76-0.79	0.77	0.76-0.79	0.78	0.76-0.80	0.89	0.88-0.91	0.94	0.92-0.95	0.90	0.88-0.92	0.94	0.92-0.96
Highest income quartile	0.50	0.49-0.51	0.53	0.51-0.54	0.51	0.50-0.53	0.53	0.52-0.54	0.68	0.66-0.69	0.69	0.68-0.71	0.69	0.67-0.70	0.70	0.69-0.72
Immigrant (ref=native)	0.80	0.77-0.83	0.80	0.77-0.83	0.79	0.76-0.82	0.79	0.76-0.82	0.77	0.75-0.80	0.78	0.75-0.80	0.78	0.75-0.80	0.77	0.75-0.80
Partners' characteristics																
High education (ref=low education[d])	N/A	N/A	0.98	0.95-0.99	N/A	N/A	**0.98**	**0.96-1.01**	N/A	N/A	0.92	0.90-0.94	N/A	N/A	0.93	0.91-0.95
Lowest income quartile[e]	N/A	N/A	1	ref	N/A	N/A	1	ref	N/A	N/A	1	ref	N/A	N/A	1	ref
3rd income quartile	N/A	N/A	**1.00**	**0.98-1.02**	N/A	N/A	**1.00**	**0.98-1.02**	N/A	N/A	0.95	0.93-0.98	N/A	N/A	0.96	0.94-0.98
2nd income quartile	N/A	N/A	**0.99**	**0.97-1.02**	N/A	N/A	**0.99**	**0.97-1.02**	N/A	N/A	0.90	0.87-0.92	N/A	N/A	0.91	0.88-0.93
Highest income quartile	N/A	N/A	**0.99**	**0.96-1.02**	N/A	N/A	**1.00**	**0.97-1.03**	N/A	N/A	0.81	0.79-0.84	N/A	N/A	0.83	0.80-0.86
Immigrant (ref=native)	N/A	N/A	1.19	1.15-1.24	N/A	N/A	1.18	1.14-1.23	N/A	N/A	1.13	1.07-1.20	N/A	N/A	1.12	1.06-1.19
Poor health (ref=good health[f])	N/A	N/A	3.11	3.05-3.18	N/A	N/A	3.09	3.02-3.15	N/A	N/A	3.30	3.23-3.37	N/A	N/A	3.28	3.21-3.35
Children's characteristics																
Only sons	N/A	N/A	N/A	N/A	**1.05**	**0.98-1.12**	**1.05**	**0.98-1.12**	N/A	N/A	N/A	N/A	1.09	1.03-1.16	1.08	1.02-1.14
Only daughters	N/A	N/A	N/A	N/A	**1.02**	**0.95-1.09**	**1.01**	**0.95-1.08**	N/A	N/A	N/A	N/A	1.06	1.01-1.13	**1.06**	**0.99-1.12**
Both genders	N/A	N/A	N/A	N/A	**1.02**	**0.95-1.10**	**1.02**	**0.95-1.10**	N/A	N/A	N/A	N/A	**1.03**	**0.97-1.10**	**1.02**	**0.96-1.09**
1+ child partnered (ref=no child partnered)	N/A	N/A	N/A	N/A	**1.00**	**0.98-1.01**	0.98	0.96-0.99	N/A	N/A	N/A	N/A	**1.00**	**0.98-1.02**	**1.00**	**0.99-1.02**
1+ child high education (ref=no child high educatior	N/A	N/A	N/A	N/A	0.89	0.86-0.91	0.92	0.90-0.94	N/A	N/A	N/A	N/A	0.91	0.89-0.92	0.92	0.91-0.94
1+ child in poor health (ref=no child in poor health[g]	N/A	N/A	N/A	N/A	1.08	1.06-1.09	1.06	1.04-1.08	N/A	N/A	N/A	N/A	1.14	1.12-1.16	1.13	1.11-1.14
1+ child on social assistance benefits (ref=no child on soc. ass.)	N/A	N/A	N/A	N/A	1.16	1.11-1.20	1.14	1.10-1.19	N/A	N/A	N/A	N/A	1.29	1.24-1.33	1.26	1.22-1.31
1+ child out of work (ref=no child out of work)	N/A	N/A	N/A	N/A	1.08	1.06-1.10	1.06	1.04-1.08	N/A	N/A	N/A	N/A	1.06	1.04-1.07	1.05	1.04-1.07
Additional controls[h]	x		x		x		x		x		x		x		x	
Model information																
Log likelihood/Pseudo R2	-349,983/0.09		-343,075/0.11		-349,749/0.09		-342,912/0.11		-410,756/0.09		-403,523/0.10		-410,275/0.09		-403,118/0.11	
Number of observations/events	1,949,549/96,736		1,949,549/96,736		1,949,549/96,736		1,949,549/96,736		2,007,354/118,602		2,007,354/118,602		2,007,354/118,602		2,007,354/118,602	

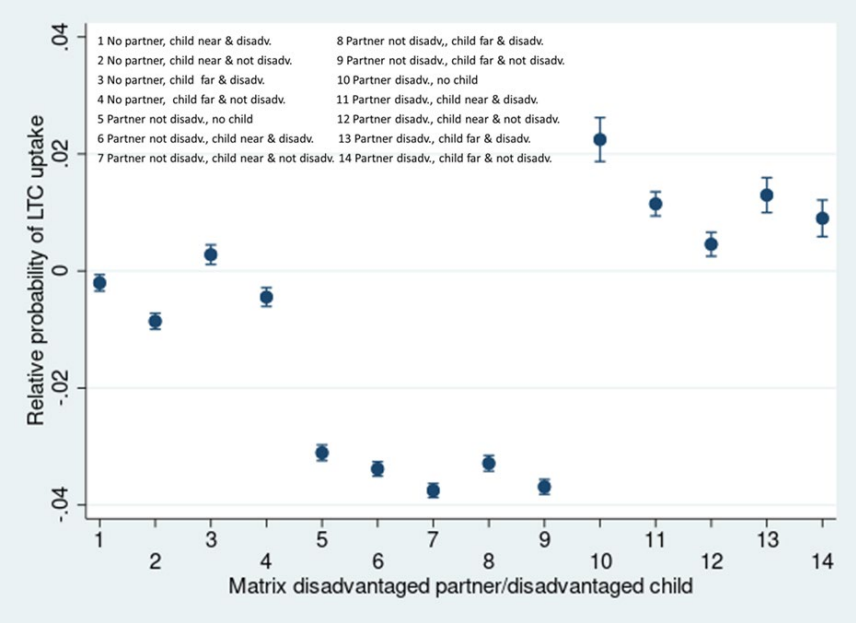
[a]This table portrays estimates from four models: Model I includes only the elderly's own characteristics; Model II includes both the elderly's and the partner's characteristics; Model III includes only the elderly's own charateristics and those of children; Model IV simultaneously accounts for characteristics of elderly, partners, and children. [b]Odds ratio. Estimates not in bold are statistically significant at the 5% level. [c]Confidence interval. [d]Low education refers to no education beyond high school, whereas high education refers to any college education. [e]Income is categorized into quartiles, by age group and sex, and includes both earnings, pensions and other public financial support. [f]Poor health is proxied by uptake of LTC services. [g]Poor health is proxied by uptake of health related benefits. [h]Additional controls (not shown) include age group and calendar year. In Models II and IV, also partner's age group is included. Categorizations are shown in Table 1.

Model 1 confirms the well-established associations between individual sociodemographic characteristics and LTC uptake. It also confirms the association with health, proxied by LTC uptake. Partnered elderly use less LTC than those without a partner, and divorced elderly use the most LTC. For men, the protective effect of having a child nearby is fairly similar to that of having a high education, whereas for women the protective effect is a bit weaker than that of having a high education. Model II shows that the importance of having children nearby remains fairly stable with the inclusion of partners' resources. For women, the importance of one's own education was weakened somewhat by the inclusion of partners' education. For men, there was almost no additional protection of wives' higher education and/or income, whereas husbands' higher education and income contributed to reduce women's use of LTC. Partners' age was associated with elderly's LTC uptake, albeit far weaker than that of elderly's own age (not shown). Having a partner in poor health had a marked impact on the elderly's own LTC uptake, for both men and women.

Similarly, whereas immigrant elderly use less LTC, having an immigrant partner actually resulted in an increased uptake. Model III shows the influence of children's characteristics. Having at least one child nearby significantly reduces the uptake of LTC, net of children's characteristics. Whereas we find no (men) or a weak (women) effect of the child's gender, and no effect of the child's partnership status, having a child with a higher education reduces the LTC use. On the other hand, having a child in poor health, out of work or on social assistance was associated with an increased use of LTC, but more for women than men. Model IV, which portrays the characteristics of elderly, partners and children in the same model, shows that the estimates remain fairly stable when partners and children are included simultaneously, and thus that both characteristics of the elderly self, the partners and the child(ren) matter for LTC use. When we compared partners' estimates from Model II to those from Model IV, the overall pattern appeared to be very similar. Having children nearby (or at all) becomes somewhat more important, however. Similarly, a comparison between Model III and IV shows that the protective effect of having children nearby became weaker. Otherwise, the children's estimates appear virtually identical.

Figure B1. Average marginal effects for the uptake of any LTC for the advantaged (upper panel) and disadvantaged (lower panel) composite variables.





Note: The figure shows estimates for both genders combined. The categories are mutually exclusive. The reference category is 'no partner/no child'. The portrayed effects are net of averaged covariates using the full two-sex sample. 95% confidence intervals are shown at the predicted values.

Appendix C: LTC profiles

Table C1 shows the odds ratios (OR) for the advantaged and disadvantaged composite variables resulting from gender-specific analyses.

Table C1. Modeled estimates of the impact of joint i) favorable and ii) unfavorable characteristics of partners and children on the risk of different forms of long-term care uptake, net of characteristics of the elderly individual.[a]

	Male elderly								Female elderly							
	Institutionalization		Home health		Practical assistance		Other services		Institutionalization		Home health		Practical assistance		Other services	
	OR[b]	95% CI[c]	OR	95%	OR	95%	OR	95% CI	OR	95% CI	OR	95%	OR	95%	OR	95% CI
i) Matrix advantaged partner, advantaged child [d]																
No partner, no child	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref
No partner, child near and advantaged	0.87	0.81-0.93	0.82	0.77-0.87	0.84	0.74-0.95	**0.97**	0.89-1.07	0.89	0.84-0.94	0.87	0.83-0.91	0.86	0.79-0.93	**0.98**	0.92-1.04
No partner, child near and not advantaged	**0.95**	0.90-1.01	0.90	0.86-0.95	0.77	0.69-0.86	**1.02**	0.94-1.11	**1.01**	0.96-1.06	0.93	0.89-0.96	0.85	0.79-0.92	**1.00**	0.95-1.06
No partner, child far and advantaged	0.85	0.80-0.91	0.88	0.83-0.93	0.87	0.78-0.98	**0.95**	0.87-1.04	0.89	0.84-0.94	**0.97**	0.93-1.01	**0.99**	0.91-1.08	**1.06**	0.99-1.12
No partner, child far and not advantaged	0.93	0.87-0.99	0.90	0.86-0.96	**0.99**	0.89-1.11	1.15	1.05-1.26	**0.99**	0.94-1.06	**0.99**	**0.94-1.04**	1.11	1.02-1.21	1.19	1.11-1.26
Partner not advantaged, no child	0.67	0.64-0.72	0.63	0.60-0.66	0.28	0.25-0.32	0.86	0.80-0.93	0.76	0.70-0.81	0.68	0.64-0.72	0.73	0.65-0.81	0.73	0.67-0.79
Partner not advantaged, child near and advantaged	0.58	0.55-0.61	0.50	0.47-0.52	0.19	0.17-0.22	0.73	0.68-0.78	0.55	0.52-0.59	0.51	0.49-0.53	0.48	0.44-0.52	0.59	0.56-0.64
Partner not advantaged, child near and not advantaged	0.66	0.63-0.70	0.58	0.55-0.60	0.19	0.17-0.21	0.77	0.71-0.82	0.69	0.66-0.73	0.62	0.59-0.65	0.58	0.53-0.63	0.66	0.62-0.70
Partner not advantaged, child far and advantaged	0.57	0.54-0.60	0.52	0.50-0.54	0.18	0.16-0.20	0.71	0.66-0.76	0.57	0.53-0.60	0.55	0.52-0.57	0.56	0.52-0.62	0.60	0.56-0.64
Partner not advantaged, child far and not advantaged	0.63	0.59-0.67	0.59	0.56-0.62	0.23	0.20-0.27	0.74	0.77-0.91	0.73	0.68-0.78	0.70	0.66-0.74	0.79	0.72-0.88	0.74	0.69-0.80
Partner advantaged, no child	0.35	0.26-0.49	0.41	0.33-0.52	0.07	0.02-0.22	**0.79**	0.59-1.06	0.47	0.32-0.68	0.32	0.24-0.44	0.22	0.11-0.47	0.51	0.34-0.76
Partner advantaged, child near and advantaged	0.37	0.32-0.43	0.32	0.28-0.35	0.04	0.02-0.08	0.59	0.51-0.63	0.36	0.31-0.42	0.28	0.25-0.31	0.14	0.10-0.19	0.42	0.36-0.49
Partner advantaged, child near and not advantaged	0.50	0.41-0.62	0.35	0.29-0.42	0.06	0.03-0.15	**0.84**	0.68-1.05	0.45	0.35-0.60	0.39	0.33-0.46	0.24	0.16-0.37	0.51	0.40-0.65
Partner advantaged, child far and advantaged	0.35	0.30-0.41	0.33	0.29-0.38	0.06	0.04-0.11	0.52	0.44-0.62	0.34	0.28-0.40	0.34	0.30-0.38	0.14	0.10-0.20	0.41	0.35-0.50
Partner advantaged, child far and not advantaged	0.44	0.33-0.60	0.43	0.34-0.54	0.05	0.01-0.21	0.64	0.45-0.90	0.46	0.32-0.64	0.40	0.31-0.51	0.28	0.15-0.50	0.49	0.34-0.70
ii) Matrix disadvantaged partner, disadvantaged child [e]																
No partner, no child	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref
No partner, child near and disadvantaged	**0.99**	0.94-1.06	0.93	0.89-0.98	0.80	0.71-0.89	**1.05**	0.97-1.15	**1.05**	1.00-1.11	**0.98**	0.94-1.02	**0.93**	**0.86-1.00**	**1.04**	0.98-1.09
No partner, child near and not disadvantaged	0.85	0.80-0.90	0.84	0.80-0.89	0.80	0.71-0.89	**0.97**	0.89-1.06	0.92	0.87-0.97	0.87	0.84-0.91	0.82	0.76-0.88	**0.98**	0.92-1.03
No partner, child far and disadvantaged	0.93	0.86-0.99	**0.95**	0.90-1.01	**0.99**	0.88-1.11	1.17	1.07-1.28	**1.01**	0.95-1.08	**1.06**	1.01-1.12	1.14	1.05-1.25	1.23	1.15-1.31
No partner, child far and not disadvantaged	0.92	0.86-0.99	0.85	0.80-0.90	0.88	0.78-0.99	**0.99**	0.90-1.09	0.92	0.86-0.98	0.93	0.89-0.98	**1.02**	0.94-1.12	1.08	1.02-1.15
Partner not disadvantaged, no child	0.58	0.55-0.62	0.53	0.50-0.55	0.21	0.18-0.25	0.74	0.69-0.81	0.61	0.57-0.67	0.53	0.50-0.57	0.54	0.48-0.62	0.61	0.56-0.67
Partner not disadvantaged, child near and disadvantaged	0.58	0.55-0.61	0.49	0.47-0.52	0.11	0.10-0.13	0.67	0.63-0.73	0.59	0.56-0.63	0.53	0.50-0.55	0.45	0.41-0.49	0.55	0.51-0.58
Partner not disadvantaged, child near and not disadvantaged	0.54	0.51-0.56	0.44	0.42-0.46	0.11	0.09-0.12	0.67	0.62-0.72	0.53	0.50-0.56	0.44	0.42-0.46	0.41	0.37-0.44	0.52	0.48-0.55
Partner not disadvantaged, child far and disadvantaged	0.55	0.52-0.58	0.50	0.47-0.53	0.12	0.10-0.14	0.72	0.66-0.78	0.58	0.54-0.62	0.55	0.52-0.59	0.60	0.54-0.66	0.57	0.53-0.62
Partner not disadvantaged, child far and not disadvantaged	0.50	0.47-0.53	0.46	0.44-0.48	0.12	0.10-0.14	0.66	0.61-0.72	0.53	0.49-0.57	0.47	0.45-0.50	0.44	0.40-0.49	0.53	0.49-0.57
Partner disadvantaged, no child	1.13	1.02-1.25	1.17	1.08-1.27	0.63	0.50-0.78	1.60	1.41-1.82	1.75	1.53-1.99	1.70	1.53-1.89	2.00	1.66-2.40	1.58	1.35-1.84
Partner disadvantaged, child near and disadvantaged	**1.06**	0.99-1.13	**1.02**	0.96-1.08	0.59	0.51-0.67	1.31	1.20-1.43	1.37	1.26-1.49	1.47	1.38-1.57	1.50	1.33-1.69	1.62	1.49-1.77
Partner disadvantaged, child near and not disadvantaged	**1.00**	0.93-1.07	0.92	0.87-0.97	0.64	0.56-0.73	1.24	1.13-1.35	1.21	1.10-1.32	1.25	1.17-1.34	1.37	1.21-1.56	1.40	1.27-1.54
Partner disadvantaged, child far and disadvantaged	**1.06**	0.96-1.16	**1.04**	0.96-1.12	0.62	0.52-0.74	1.36	1.21-1.52	1.23	1.08-1.41	1.54	1.40-1.69	1.81	1.54-2.13	1.74	1.53-1.97
Partner disadvantaged, child far and not disadvantaged	**1.01**	0.91-1.11	**0.93**	0.86-1.02	0.66	0.55-0.80	1.15	1.01-1.30	1.40	1.22-1.60	1.46	1.32-1.61	1.87	1.57-2.22	1.64	1.43-1.88

[a]This table portrays estimates from four fully adjusted multinomial models, i.e. i) and ii) for males and females, respectively. No uptake is the base outcome, to which all comparisons are made. In addition to the estimates shown, the models were also adjusted for age group, year, and elderly's immigrant status, education, income, number of children and gender. [b]Odds ratio. Estimates not in bold are statistically significant at the 5% level. [c]Confidence interval. [d]The groups are mutually exclusive. Near is defined as < 10 km. The variable is coded so that first we check if there is at least 1 child near that is advantaged, next we check if there is child(ren) near that are not advantaged. Then we check if there is at least 1 child further away that is advantaged, before we check if there is child(ren) far that are not advantaged. [e]The groups are mutually exclusive. Near is defined as < 10 km. The variable is coded so that first we check if there is at least 1 child near that is disadvantaged, next we check if there is child(ren) near that are not disadvantaged. Then we check if there is at least 1 child further away that is disadvantaged, before we check if there is child(ren) far that are not disadvantaged.

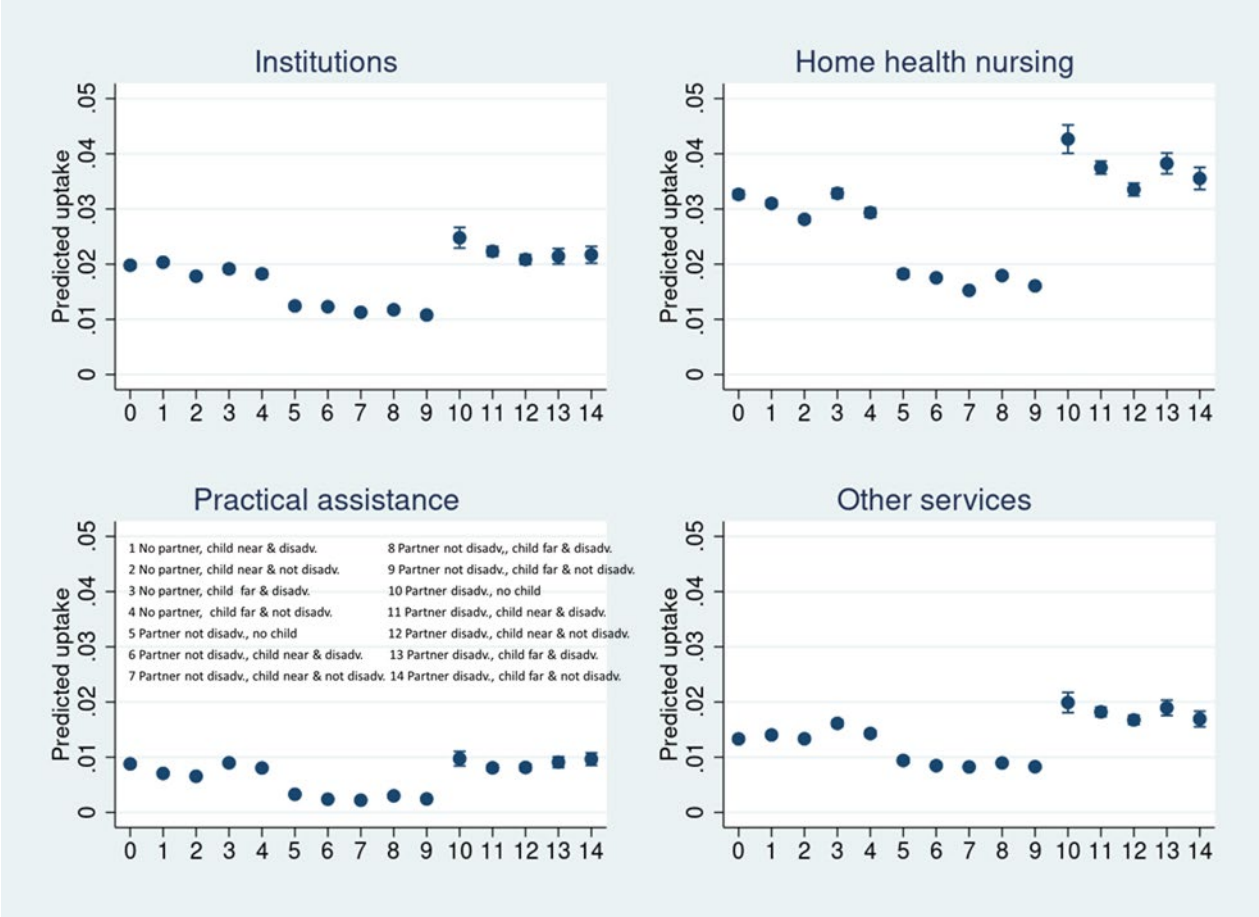
Figure C1 shows the predictive margins for the use of different types of LTC for the advantaged composite variable, for both genders combined. Patterns for specific types of uptake are very similar as those described previously, across services. Home health nursing is the most common service used by unpartnered elderly, and elderly with partners who are not advantaged. Furthermore, not having a partner is associated with an increased use of all types of services, with institutionalizations being the second most common service. There appears to be some additional protection associated with having an advantaged partner for these same services, for instance is practical assistance rarely used by elderly with partners who are advantaged. The added value of having more or less resourceful children close by or further away appears minor or non-existent across most services and partner categories. A general trend suggests that having an advantaged child may be more important for LTC uptake than geographic proximity, although having a child nearby appears to reduce the uptake of practical assistance for unpartnered elderly (categories 1 and 2).

Figure C1. Predictive margins for the use of different types of LTC for the advantaged composite variable for both genders combined.

Note: The categories are mutually exclusive. The 0-category refers to no partner/no child. The margins in the upper panel result from the fully adjusted model (Table C1). As such, the portrayed effects are net of averaged covariates. 95% confidence intervals are shown at the predicted values.

Figure C2 portrays the estimates for the disadvantaged composite variable for both genders combined and shows that having a disadvantaged partner was generally associated with the highest uptake across service types, albeit with slightly varying patterns. The highest uptake was observed for home health nursing, followed by institutionalization. Across all types of services, the uptake was lowest for elderly with partners who are not disadvantaged. The added value of having more or less resourceful children close by or further away appears minor or non-existent across most services and partner categories.

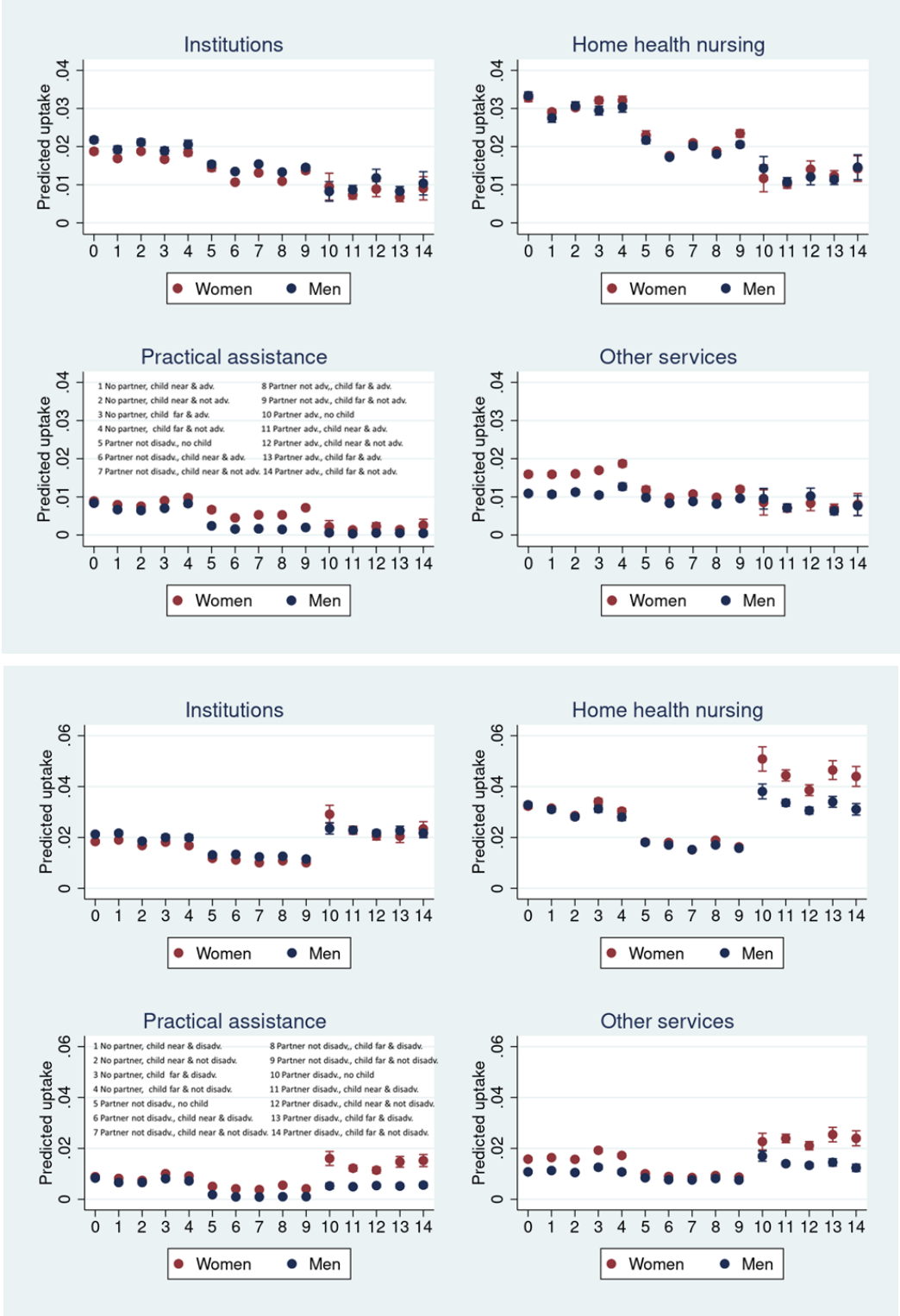
Figure C2. Predictive margins for the use of different types of LTC for the disadvantaged composite variable for both genders combined.



Note: The categories are mutually exclusive. The 0-category refers to no partner/no child. The margins in the upper panel result from the fully adjusted model (Table C1). As such, the portrayed effects are net of averaged covariates. 95% confidence intervals are shown at the predicted values.

Gender differences are tested formally in a joint model and are illustrated in Appendix Figure C3. The upper panel shows that there were some gender differences, but there does not appear to be a consistent pattern in that either men or women receive substantially more or less services.

Figure C3. Predictive margins for the use of different types of LTC for the advantaged (upper panel) and disadvantaged (lower panel) composite variables for men and women.



Note: The categories are mutually exclusive. The 0-category refers to no partner/no child. The margins were calculated by including an interaction term between the composite variables and gender in the fully adjusted model (Table C1). As such, the portrayed effects are net of averaged covariates. 95% confidence intervals are shown at the predicted values.

Unpartnered women were more likely to use ‘other services’ than men, and women with not advantaged partners were more likely to use practical assistance. Overall, the most pronounced differences across various categories of characteristics of partners and children were observed for home health nursing, but here the gender differences appeared rather minor. Unpartnered men were somewhat more likely to be institutionalized directly, as opposed to unpartnered women. The lower panel shows that women with disadvantaged partners were more likely than men to use home health nursing, practical assistance and other services than their male counterparts. Similarly, women with disadvantaged partners clearly used most of any type of service, whereas for men there was almost no difference whether they are unpartnered or have a disadvantaged partner across the service types.

Appendix D: Spatial variation

Norwegian municipalities face different costs of meeting minimum standards and statutory tasks, due to various demographic, social and geographical conditions. Some of the important differences are portrayed in Table D1. We see that around one-sixth of the elderly resided in rural areas, and that both the relative share of elderly and the relative health care costs were higher in these locations. This applied both to home health care costs and nursing home costs, although the difference was more pronounced for the former. The rural municipalities were also on average more sparsely populated than the more urbanized municipalities (mean 6 700 versus 125 800 inhabitants) and had a more favorable income situation, as indicated by the index of economic capacity (Langorgen et al. 2015, Statistics Norway 2020b).[23] At the same time, however, also the expenditure needs were higher in rural areas, as indicated by the index of economic workload (ibid). Together, these indexes provide summary expressions of the financial conditions for single municipalities.

Table D1. Descriptive municipal statistics overall, and by rural/urban status.

	All	Rural areas (16%)	Urbanized areas (84%)
	% or mean (range)	% or mean (range)	% or mean (range)
No children	12	13	11
No children nearby	26	34	25
At least 1 child nearby	62	53	64
Population count	106,472 (209-623,966)	6,623 (209-21,392)	126,753 (20,057-623,966)
Share of elderly age 67+	12.2 (6.0-24.0)	15.0 (7.0-24.0)	11.7 (6.0-21.0)
< 10 %	11	3	13
10-14%	73	38	79
15-19%	15	54	8
≥ 20%	1	5	0
Index of economic capacity[a]	0.94 (0.61-2.47)	1.03 (0.61-2.47)	0.93 (0.72-1.91)
Index of economic workload[b]	0.85 (0.75-2.64)	0.98 (0.8-2.64)	0.82 (0.75-1.85)
Health care costs (net) as share of all costs[c]	39.6 (24.2-207.5)	43.1 (24.2-207.5)	38.9 (25.5-61.3)
Municipal home health care costs for elderly[d]	32.7 (20.7-55.7)	36.9 (21.3-55.7)	31.9 (20.7-51.1)
Municipal institutional care costs for elderly[e]	14.4 (0-63.6)	15.5 (0-50.0)	14.2 (4.5-63.6)

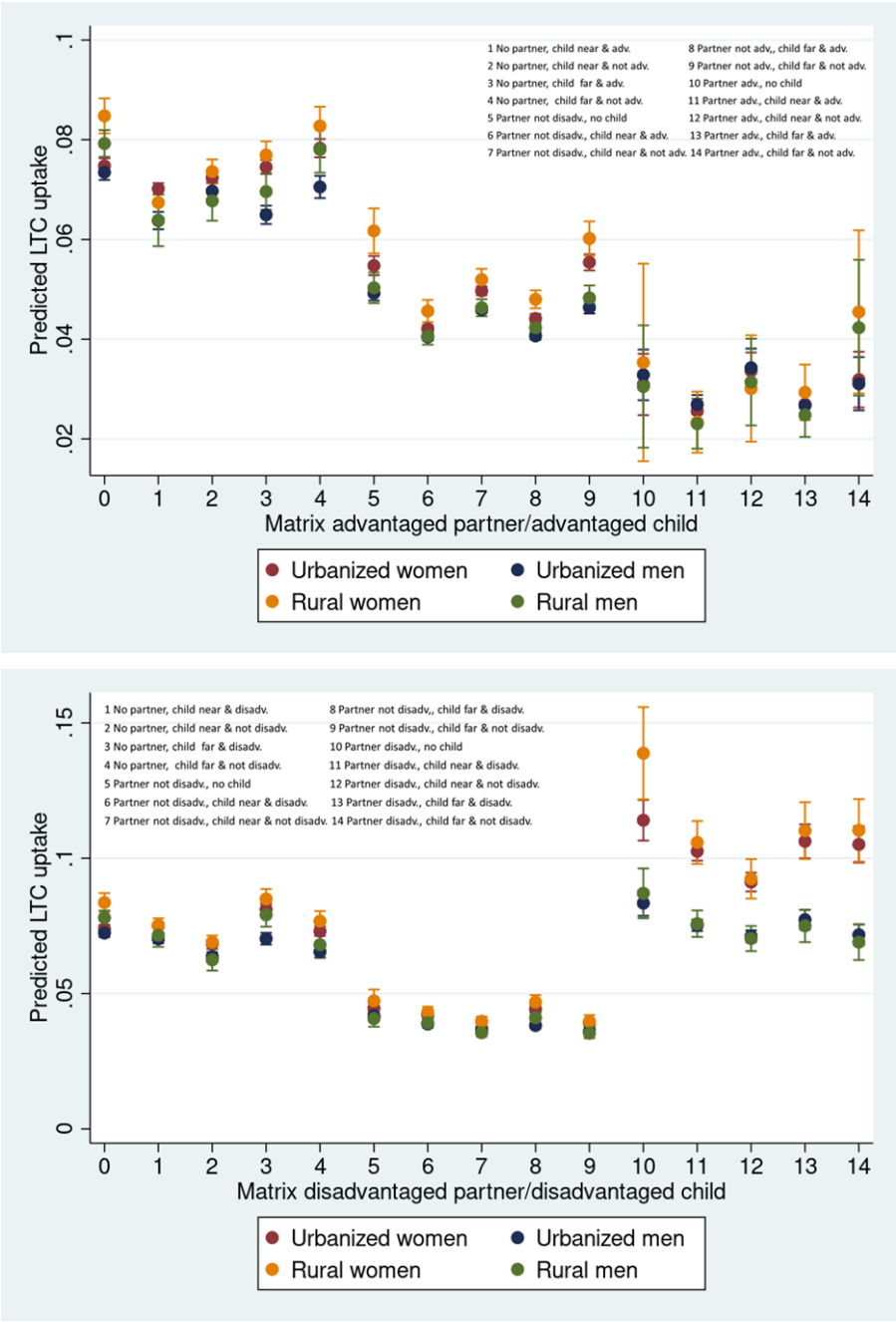
[a]An 'index of economic capacity' is used to rank municipalities according to the relative size of their incomes beyond what is needed to cover their expenditure needs (i.e. economic workload, footnote b). [b]An 'index of economic workload' is used to rank municipalities according to their costs per capita necessary to achieve the minimum standards and statutory tasks set forth by the State. [c]The net share of the municipal budget devoted to healthcare and long-term care services. [d]The share of health care costs (footnote c) devoted to home health care (as opposed to other forms of care). [e]The share of health care costs (footnote c) devoted to institutionalized care (as opposed to other forms of care).

The upper panel of Figure D1 presents estimates from joint models which include interaction terms between the advantaged partner/advantaged child composite variable and rurality and gender. It shows that women in rural areas have a higher tendency transition to LTC than their male counterparts,

[23] Municipalities cover their expenses from tax revenues and state transfers. The municipalities are ranked according to the relative size of such expenditure needs by an 'index of economic workload', defined as the costs per capita in municipalities that are necessary to achieve the minimum standards and statutory tasks set forth by the state. Many municipalities have incomes beyond what is needed to cover their expenditure needs (i.e. economic workload), and the municipalities are ranked according to the relative size of such incomes by an 'index of economic capacity'. The magnitude of the economic capacity therefore provides an indication of the *financial freedom of action* of municipalities (Langorgen et al. 2015).

though here again the estimated effects mostly overlap. The most pronounced difference across gender and location is observed for elderly where neither the partner nor the child is advantaged, and where the child does not live nearby.

Figure D1. Predictive margins for the uptake of any LTC for the advantaged (upper panel) and disadvantaged (lower panel) composite variables for men and women separately.

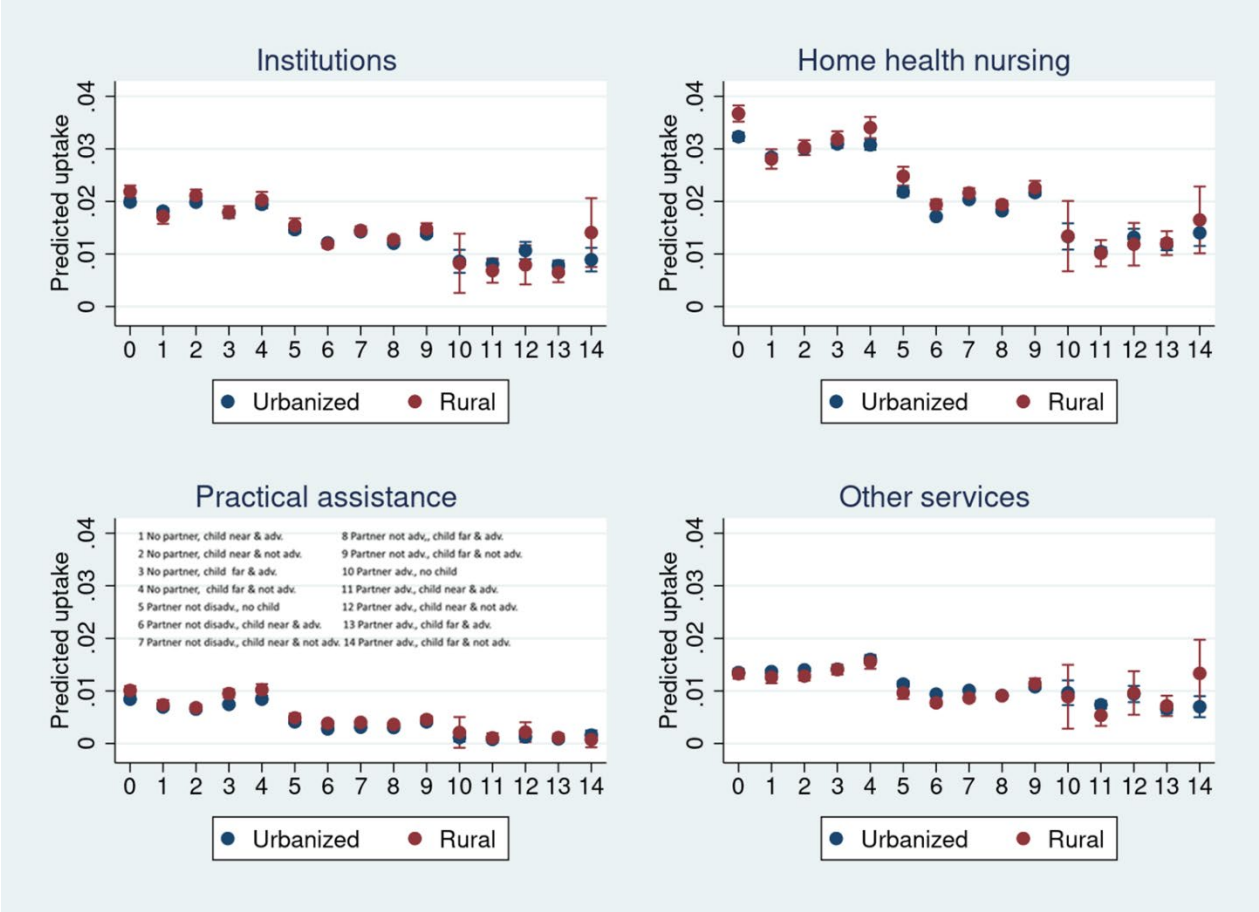


Note: The categories are mutually exclusive. The 0-category refers to no partner/no child. The margins were calculated by including an interaction term between the composite variable, gender and rurality in the fully adjusted models (Model A, Table 6). As such, the portrayed effects are net of averaged covariates. 95% confidence intervals are shown at the predicted values.

The lower panel of Figure D1 shows estimates for joint models including an interaction term between the disadvantaged composite variable, rurality and gender. We see that the differences are generally small between men and women in rural and urbanized areas, respectively. Whereas there are no differences across urban and rural areas for women, unpartnered men with a disadvantaged child not living in the vicinity have a statistically significant lower risk of transitioning into LTC in urban areas. On the other hand, the differences between men and women are pronounced for elderly with a disadvantaged partner, with women having a higher uptake than men both in rural and urban areas, irrespective of the location and the characteristics of their children.

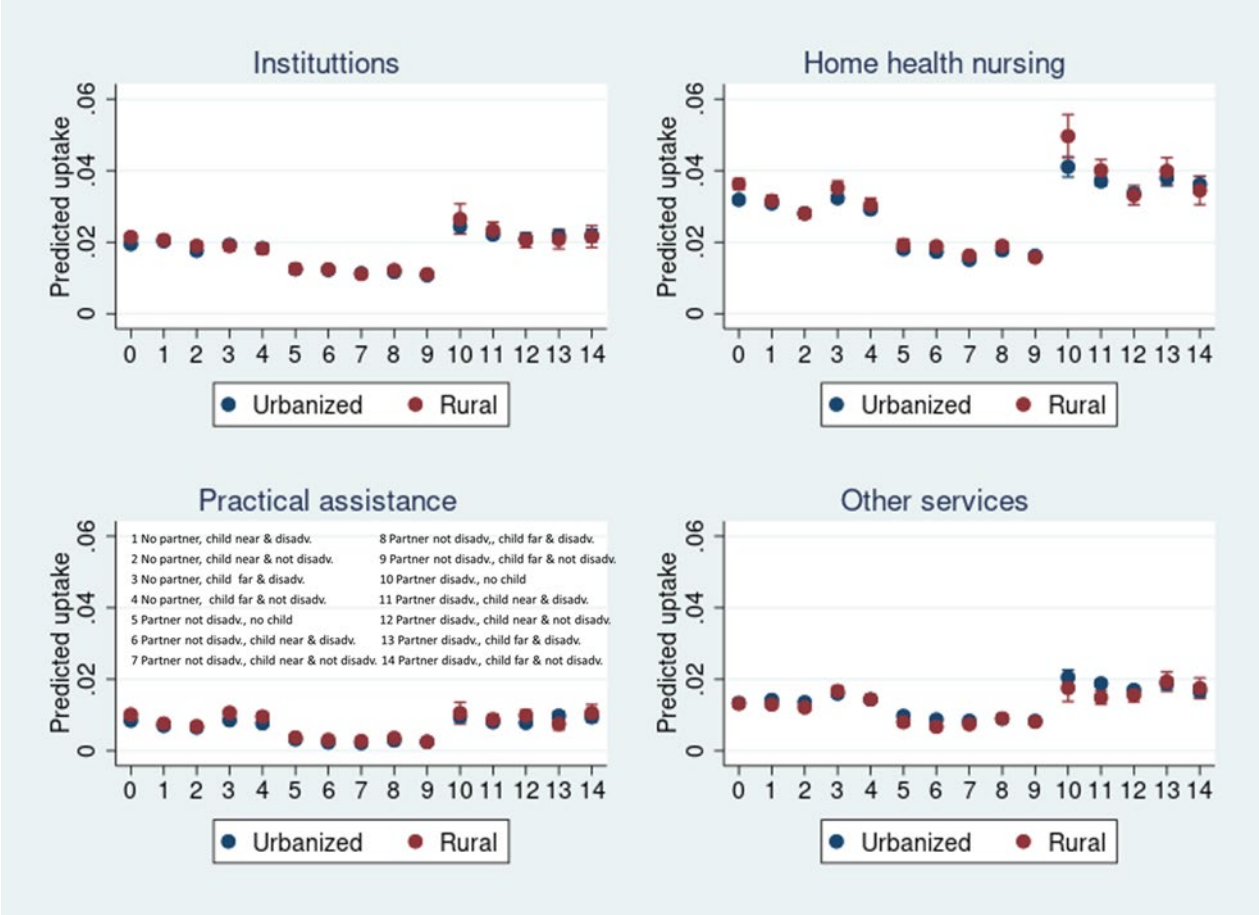
Figures D2 and D3 also show little difference between urban and rural areas in terms of the risk of uptake of different forms of LTC for each given family configuration.

Figure D2. Predictive margins for the use of different types of LTC for the advantaged composite variable for elderly in rural and urbanized areas.



Note: The categories are mutually exclusive. The 0-category refers to no partner/no child. The margins were calculated by including an interaction term between the composite variable and rurality using the full two-sex sample (Table C1). As such, the portrayed effects are net of averaged covariates. 95% confidence intervals are shown at the predicted values.

Figure D3. Predictive margins for the use of different types of LTC for the disadvantaged composite variable for elderly in rural and urbanized areas.



Note: The categories are mutually exclusive. The 0-category refers to no partner/no child. The margins were calculated by including an interaction term between the composite variable and rurality using the full two-sex sample (Table C1). As such, the portrayed effects are net of averaged covariates. 95% confidence intervals are shown at the predicted values.