Formal home care use and spousal health outcomes

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Abstract

This study explores the relationship between formal home care provided by paid professionals and spousal health outcomes. We use data from the Survey of Health, Ageing, and Retirement in Europe, a panel of older adults living in several European countries. We match new formal home care users to non-users to eliminate baseline ($t-1$) differences between couples who decide to seek formal home care in t and those who do not. After considering several potentially confounding changes between baseline and t, and looking closer at specific subgroups, we conclude that in the short run, use of formal home care is unlikely to affect spousal physical or mental health.

Keywords: formal home care, informal care, caregiver burden, spouse caregivers, health index, health shocks, statistical matching

JEL codes: C29, D19, I19

1 Introduction

Population aging is a worldwide phenomenon that poses unique challenges to governments and societies. People aged 65 years and over already represented 19.5% of the European Union population in 2016; a share that is projected to increase to almost 30% by 2050. Dependency rates —measured by prevalence of longstanding limitations in activities because of health problems— vary across countries and increase with age, from as much as 18% in the 65-69 age group to 66% in the 85+ age group in Slovakia (European Commission 2018). The increase in both life expectancy and number of years that people live with varying degree of disability translates into increasing demand for long-term care (LTC) that is provided informally or by paid professionals.

LTC includes services required by people with reduced physical or cognitive capacity, who are dependent on help with activities of daily living, like bathing or taking medication, for a long period of time. Across the OECD, most LTC is provided informally by family members or friends, mostly spouses and adult children (Colombo et al. 2011). LTC can also be provided in people's homes by paid professionals (i.e., formal home care), or in institutions such as nursing homes, day care centers, and assisted living facilities.

Providing informal care may be detrimental to caregivers' health, particularly in the case of spouses, who are typically older and frailer, provide more hours of care, and have fewer resources to cope with the strains of caregiving (Pinquart and Sörensen 2003a). Formal LTC may help alleviate the caregiver burden if it can replace some care activities (fully or partially). Understanding the impacts of different LTC services on the caregiver is crucial to design better policies aiming to reduce the burden of caregiving. This study contributes to informing LTC policymaking by answering the following question: "How does formal home care use relate to spousal health outcomes?"

Answering this question requires recognizing various sources of endogeneity affecting the decision to use formal home care, which make the identification of a causal effect of formal home care use on spousal health extremely difficult. First, several household characteristics and couple dynamics may be related to both formal home care use and spousal health. Examples include health status of the potential care receiver, social network/support from family members inside and outside the household, and preferences. Some of these are usually available in survey data and can be accounted for. Others, such as preferences, are harder to capture (i.e., unobserved confounders). A

second important source of endogeneity is reverse causality, as health status of the potentially caregiving spouse influences use of formal home care (Bakx and de Meijer 2013). A third source is the so-called "family effect": deterioration of the health status of the care recipient causes emotional strain on the spouse (Bobinac et al. 2010). A fourth source of endogeneity is selection, which can differ by gender: male caregivers are more likely to institutionalize their spouses, resulting in selection out of samples of community-residing individuals, and more likely to hire formal home help, resulting in selection into "treatment" (Pinquart and Sörensen 2006).

Assessing the health of spouse caregivers is particularly important, as they represent the bulk of caregivers and usually, they are older and at higher risk of having physical or mental health problems themselves. We contribute to the so far very limited literature (see next section) by exploring the relationship between formal home care use and spousal health. We carefully consider the empirical challenges presented above, distinguish between physical and mental health, and investigate heterogeneity by type of formal home care (personal care vs. domestic help) and between spouses who accumulate or not other caregiving responsibilities (e.g., to elderly parents).

Using data from the Survey of Health, Ageing, and Retirement in Europe (SHARE) for 17 European countries, we identify new users of formal home care, which we compare to similar couples that never use formal home care using matching techniques (adaptation of Schmitz and Westphal 2015, Stöckel and Bom 2020, and de Zwart et al. 2017). This strategy takes into account both observed and time-invariant unobserved confounders. To tackle the family effect, we introduce "health shock" indicators capturing significant drops in health status of the care recipient between two waves (Stöckel and Bom 2020). Although we are unable to formally account for remaining reverse causality, we make some further explorations and interpret our findings in light of that possibility. All analyses are run separately for female and male spouses, addressing potentially different selection mechanisms by gender.

Comparing new home care users with non-users, we find a negative association between home care use and spousal health. Accounting for the family effect reduces the strength of that association. Upon closer inspection of specific subgroups, it seems that reverse causality may still play a role. We conclude that formal home care use is unlikely to affect spousal health, in the short run.

The remainder of this text is organized as follows: the next section reviews prior literature and outlines the conceptual background and hypotheses. The following one details the data and methodology. Results are presented in section 4. Section 5 discusses the main findings and concludes.

2 Background and hypotheses

2.1 Informal caregiving and health

Informal caregiving may involve heavy tasks, such as lifting and transferring the care receiver, which may cause physical pain or back problems. There are also important sources of emotional strain, for example from observing the health of a loved one decline —the so-called "family effect", whereby a related caregiver not only cares for but also cares about the care receiver (Bobinac et al. 2010). Informal caregiving may also restrict the caregiver's personal, social, and professional life, mainly if they are not sharing the task with other family members or professional providers, which can have additional negative health implications. The economics literature has documented the negative physical and mental health consequences of providing informal care (see Boom et al. 2019 for a review). For example, Coe and Van Houtven (2009), Do et al. (2015), and Heger (2016) provide evidence of the detrimental impacts of informal caregiving in the case of adult children caring for their elderly parents. Schmitz and Westphal (2015) and Stöckel and Bom (2020) consider both spouse and child caregivers, and de Zwart et al. (2017) and Uccheddu et al. (2019) focus on spouses; all find negative impacts of informal caregiving, especially on mental health. These authors address the selection of the unhealthy out of informal caregiving —at least partly— by using fixed-effects models, instrumental variables, or matching strategies.

Some factors may help mitigate the negative impacts of informal caregiving on health. For example, in retirement, providing informal care is one way for the caregiver to remain active. Informal caregiving can also be a source of positive affect, such as feeling useful and appreciated, enhanced self-esteem and pride from being able to help (Pinquart and Sörensen 2003b). Han et al. (2021)'s findings suggest that when an individual's spouse has significant health problems, caring for them is good for mental health. Whether these positive aspects are enough to compensate for the negative ones depends on the duration and intensity of informal caregiving, as well as the type and severity of the illness or limitations of the care receiver. For example, Zwar et al. (2018) find

that providing domestic help, but not personal care, is associated with increased depressive symptoms.

2.2 Formal home care

Generally, the literature has found that an increase in informal care decreases utilization of formal home care, suggesting that the two are substitutes (see Bonsang 2009 and references therein). The literature on the reverse relationship —the impact of formal home care on informal caregiving— is more limited. Perdrix and Roquebert (2019), using French data, find that using more hours of formal home care reduces informal caregiving (i.e., substitutability). However, Carrino et al. (2018), using data for France, Germany, Austria, and Belgium, find evidence of complementarity. The authors interpret this finding in light of substantial unmet LTC needs in European populations (Spasova et al. 2018), whereby it is possible that additional public supply of formal home care leads to greater informal care use, e.g. because formal home care providers identify unmet needs. Other studies have found that informal caregiving increases when formal home care coverage/reimbursement policies become less generous (Golberstein et al. 2009, Miyawaki et al. 2020).

Importantly, the literature has typically focused on non-co-residing informal caregivers, which poses fewer measurement challenges (see section 3.2). In the context of spousal caregiving, it is unlikely that formal home care would replace informal care, on the extensive margin. If one spouse needs support and the other is able to provide it, they will, especially considering that they live under the same roof, 24/7, while usually formal home care consists of few hours per week. (On the intensive margin, there could be some substitutability.)

A few other studies indirectly consider the role of formal LTC in shaping the impact of informal caregiving on health by looking separately at (groups of) countries with different generosity of formal LTC policies (Brenna and Di Novi 2016, Calvó-Perxas et al. 2021, Di Novi et al. 2015, Kaschowitz and Brandt 2017, Uccheddu et al. 2019).

Besides interacting with informal caregiving, formal home care can impact informal caregivers' health more directly. Regarding mental health, on the one hand, formal home care providers can reduce social isolation and even loneliness. On the other hand, formal home care can induce stress,

as e.g. some individuals may feel uncomfortable with letting strangers in their house. Additionally, in some cases, formal home care providers may detect symptoms in the informal caregivers and recommend treatment or support, which may then improve caregivers' physical/mental health.

The health status of (potential) informal caregivers influences the receipt of formal LTC by the care receiver; that is, selection must also be taken into account in this context (Bakx and de Meijer 2013). For example, the deterioration of the health of an informal caregiver may lead to the institutionalization of the care receiver or to hiring professional home help. In a Grossman model framework, informal caregivers may invest in formal LTC to reduce their caregiving burden and protect their health.

2.3 The role of gender

Gender seems to modify the relationship between informal caregiving and health. The literature suggests that women may be more vulnerable to the negative consequences of informal caregiving than men (see e.g. Uccheddu et al. 2019 or Zwar et al. 2020 for a review). For instance, men are more likely to be praised for caring for their spouse; women may tend to feel obligated to care as per "traditional gender roles". Moreover, men are more likely to seek formal home care or to institutionalize their spouses (Pinquart and Sörensen 2006). When using survey data pertaining to community-dwelling individuals, this may translate into male caregivers having healthier spouses than female caregivers, on average —another source of selection.

2.4 Hypotheses

To summarize, we can put forward three tentative hypotheses. First, the impact of formal home care on physical/mental health of the spouse is ambiguous. Second, that impact differs by gender of the spouse and third, it differs by type of formal home care (personal care or domestic help).

2.5 Related literature

To our knowledge, only one study has explored the impacts of formal home care use on informal caregivers' health, by Juin (2019), who considers non-coresiding adult children caring for their

parents. The author finds that an increase in formal home care hours reduces the probability that informal caregiving affects health, suggesting that improving access to formal home care could protect the health of child caregivers.

Three related studies are also worth mentioning: Wagner and Brandt (2018) find a positive association between formal LTC availability at the regional level, measured by the number of nursing home beds, and spouse caregivers' wellbeing, measured in terms of life satisfaction, loneliness, and depression. One possible interpretation of this finding is that knowing that there is an alternative setting of care provides spouse caregivers with some reassurance that their loved ones will be taken care of, if need be. Dong et al. (2019) compare spouses of individuals receiving formal home care with spouses of individuals living in nursing homes and find that the first have worse physical health (possibly because of implicit informal caregiving responsibilities), but better mental health (possibly because they continue to live with their loved ones). Lastly, Miyawaki et al. (2020) find that a reform reducing the generosity of formal LTC reimbursement in Japan increased informal caregiving to coresident elderly and deteriorated caregiver health.

3 Data and methodology

3.1 Data source and countries

This study uses SHARE data (share-project.org). SHARE is a multidisciplinary, cross-national panel database that includes representative samples of individuals 50 years and older and their partners irrespective of age, in 28 European countries and Israel. We use data from Wave 1 (2004/05, 12 countries), Wave 2 (2006/07, 15 countries), Wave 4 (2011/12, 3 countries), Wave 5 (2013, 15 countries), Wave 6 (2015, 18 countries), and Wave 7 (2017, 12 countries). The questionnaire applied in Wave 3 (2008/09) covered respondents' life histories (SHARELIFE) and is not comparable with the regular questionnaire. Similarly in Wave 7, new respondents answered the SHARELIFE questionnaire instead of the regular one (about 80% of the sample). Lastly, in Wave 4 the formal home care use questions were asked in only 3 countries. In total, 17 countries are included in this study: Austria, Germany, Sweden, the Netherlands, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium, Israel, Czech Republic, Poland, Luxemburg, Slovenia, and Estonia.

These countries differ in their socioeconomic, demographic, and cultural contexts, as well as their LTC policies. Nevertheless, most share some features, such as some kind of public support for formal LTC (social insurance, subsidies, direct public provision), privileging home care over institutional LTC, the main types of services available under formal home care (personal care, domestic help), or strong reliance on informal caregivers. Please refer to European Union (2021) and Spasova et al. (2018) for the recent trends in LTC in Europe and detailed country profiles.

3.2 Sample selection

First, we match both members of a couple and keep complete couples. Second, we identify individuals that report any limitation in the activities of daily living (ADL, e.g., dressing) or the instrumental activities of daily living (IADL, e.g., taking medications), expected to last longer than three months, in a given wave. The population with longstanding limitations is the most directly affect by LTC policy and the focus of this study (see also Golberstein et al. 2009).

Individuals that report limitations are considered potential care receivers —they potentially need either formal or informal help with the ADL (i.e., personal care) or IADL (i.e., domestic help). The health status of their spouses (the potential informal caregivers) is the outcome of interest in this study (see Figure 1). This lax definition of (potential) informal caregiving is to account for the fact that an individual living under the same roof as someone who has limitations in their daily activities is likely to help them in some way. SHARE only asks about the provision of informal personal care to the spouse ("*Is there someone living in this household whom you have helped regularly during the last twelve months with personal care, such as washing, getting out of bed, or dressing? Who is that?")* and not about other types of help, for instance with IADL. So, using this variable would capture only a subset of informal spouse caregivers. See also Urwin et al. (2021), who document (1) discrepancies between caregiver and care receiver reports of informal care, (2) caregiver under reporting of caregiving, and (3) that (I/)ADL limitations strongly predict agreement in caregiver and care receiver reports of informal care.

[Figure 1 here.]

3.3 Formal home care use

We construct an indicator that captures whether the potential care receiver (i.e., spouse who needs help with the (I/)ADL) obtained formal personal care or help with domestic tasks ("Treatment status" in Figure 1). In complementary analyses, we look separately at the utilization of formal personal care and domestic help. We only consider whether the couple uses any formal home care, because intensity of use is only asked in waves 1, 2, and 7 (see Appendix A).

3.4 Health

Physical health is measured by a continuous standardized health index that combines several health indicators, e.g. health conditions like hypertension or cancer, grip strength, mobility limitations. The index is obtained by regressing self-assessed health on those indicators using an ordered probit model and predicting the underlying latent variable. Lastly, we standardize the predictions to interpret changes in standard deviations. Appendix B contains all details on the motivation and methodology underlying our measure of physical health.

Mental health is measured by the EURO-D scale (Prince et al. 1999), a 12-item scale capturing symptoms of depressed mood, pessimism, suicidality, guilt, sleep, interest, irritability, appetite, fatigue, concentration, enjoyment, and tearfulness. The scale was developed to capture late-life depressive symptoms in Europe and has been shown to be highly correlated with CES-D and other scales (Courtin et al. 2015). The symptoms are added up, such that EURO-D scores range from zero to twelve. To interpret changes in mental and physical health in a similar manner, we reverse the EURO-D scores, so that higher values denote better mental health, and standardize them. We measure physical and mental health of the potentially care receiving spouse —control variables— in the same manner (Figure 1).

3.5 Baseline empirical strategy

We define a "treatment group" of couples that start to use formal home care at some point between two waves. Couples that never report formal home care use constitute the "comparison group". We match the two groups on baseline characteristics, as illustrated in Figure 2. This strategy presents three advantages. First, formal home care use (i.e., treatment status) cannot affect the

covariates, which are measured in the past. Second, we can include the lags of the outcomes among the matching variables, partly addressing selection of the unhealthy into treatment (i.e., those too unhealthy at baseline to provide informal care to the spouse are more likely to hire formal home care). Third, the lagged outcomes also capture time-invariant unobserved confounders, which will already have affected the outcomes in the past.

[Figure 2 here.]

The matching variables include information on the potential caregiver, the potential care receiver, and couple level information, and are all measured in $t-1$ (Figure 1). Information on the potential caregiver includes baseline health status, H_{t-1} (both physical and mental health), provision of informal personal care to the spouse (potential complement or substitute to formal home care), age and age squared, education according to the ISCED-97 classification (regrouped into ISCED 1/2, ISCED 3/4, ISCED 5/6, vs. None/other), employment status (employed or self-employed, permanently sick or disabled, vs. retired/unemployed/homemaker/other), participation in charitable activities or voluntary work (proxy for personality or willingness/ability to provide informal care to the spouse), and providing help to someone else outside the household, such as elderly parents ("double burden"; may compete with informal caregiving to the spouse). Baseline characteristics of the potential care receiver are health status (both physical and mental health) and age. Couple-level information includes number of children and household size (to capture other potential sources of informal help), log of household income, and square root of household wealth (plus a binary indicator to capture negative wealth). We use imputations for missing income and wealth provided in the SHARE database. Lastly, we match on country and wave dummies.

This set of variables includes characteristics that explain the outcome (i.e., health of the potentially caregiving spouse in t) or both the outcome and treatment assignment (i.e., confounders), but not variables that affect only treatment assignment as they have been shown to increase variance without reducing bias (Austin 2011, 2020). Because they are measured in $t-1$, the matching variables may not be influenced by the treatment (Austin 2011).

We estimate the propensity to use formal home care in t using a probit model and kernel matching (bandwidth=0.04), given the large number of matching characteristics. We assess common support and whether balance of covariates is achieved after matching, using the standardized bias (Rosenbaum and Rubin 1985). Finally, we regress spousal health in t on formal home care use in t and all matching variables, restricting the sample to the common support region and using the kernel weights from the matching procedure as probability weights (i.e., regression adjustment on matched samples, sometimes called doubly-robust estimator; Rubin 1979, Bang and Robins 2005). In the results section, this regression, which adjusts only for baseline characteristics, is referred to as specification (1).

Standard errors are clustered at the couple level to account for multiple observations of couples in the comparison group over time (couples in the treatment group appear only once, when they start to use formal home care for the first time). All analyses are conducted separately by gender of the potentially caregiving spouse, for two reasons. First, formal home care use is likely to affect female and male caregiving spouses differently, as discussed in section 2.3. Second, it is a way of guaranteeing that the Stable Unit Treatment Value Assumption (SUTVA) holds, which in this case implies that health status of a potential informal caregiver in a given couple does not depend on treatment status of another couple. According to our sample selection criteria (section 3.2), it is possible that both individuals in a given couple report limitations in the (I/)ADL. This happens in about 5% of the couples; in the other 95%, only one member reports limitations. In such cases, the couple would enter twice in the analyses, as both spouses would be considered to be potential care receivers as well as potential caregivers, resulting in a violation of the SUTVA (health of caregiver i would depend on treatment status of caregiver j). Note that there are no same-sex couples left after applying our selection criteria.

3.6 Additional specifications

Despite its advantages, the matching strategy described has one main limitation that is amplified by the large time interval between two waves in our study: two years is enough time for important changes affecting both treatment status and the outcomes. Related to that is the timing of treatment with respect to those changes.

To control for the changes that appear most relevant, we consider three additional regression specifications:

Specification (2) controls —in addition to the matching variables— for the family effect, by including binary indicators capturing physical and mental health shocks to the health of the potential care receiver since $t-1$ (Stöckel and Bom 2020). Health shocks are defined as drops of at least one standard deviation in the physical/mental health variables.

Specification (3) additionally controls for shocks to the health of the potential caregiver, in the same manner.

Specification (4) additionally controls for changes in employment status (retiring or becoming disabled), and starting or stopping informal personal care provision to the spouse between t and $t-1$.

Specification (3) is a crude approach to exploring potentially remaining reverse causality. In practice, we compare between potential caregivers with major health declines (drops in health of at least one standard deviation), or between potential caregivers with relatively small health declines (drops in health of less than one standard deviation). Implicitly, this assumes that formal home care use having a very large impact on potential caregivers' health would be unlikely.

4 Results

4.1 Summary statistics

Our final sample includes about 1,700 observations of potentially caregiving women and 1,500 observations of potentially caregiving men. Taken together, about 14% of the couples use formal home care.

Figure 3 shows the distributions of physical and mental health of the potential caregivers by home care use status in t. Comparing the solid (home care users) and dashed lines (non-users), we see that potentially caregiving spouses in couples that use formal home care tend to have worse physical (black lines) and mental health (gray lines).

Pooled summary statistics for all variables are shown in Appendix C; more detail by gender of the potential caregiver and home care use status is provided in Appendix D and discussed in the next section.

[Figure 3 here.]

4.2 Propensity to use formal home care and matching quality

The results of the probit models used to estimate the propensity to use formal home care are shown in Appendix D (Table D1). Providing informal personal care to the spouse in $t-1$ is strongly associated with higher likelihood of using formal home care in t; similarly for older age of the potential care receiver. Other characteristics have statistically significant associations with formal home care use only among potentially caregiving women or men. Among potentially caregiving women, being permanently sick or disabled in $t-1$ is associated with higher likelihood of formal home care use in t. Among potentially caregiving men, higher income and worse physical health of the potential care receiver in $t-1$ are both associated with formal home care use in t. The likelihood of formal home care use also varies across countries. Lagged health of the potentially caregiving spouse does not explain formal home care use.

Tables D2 (women sample) and D3 (men sample) in Appendix D show the averages of all covariates at baseline in the treatment, unmatched comparison, and matched comparison groups. Potentially caregiving spouses in households that use formal home care in t (treatment group) have worse baseline health and are about 5 years older, on average, compared with potentially caregiving spouses in the unmatched comparison group. The two groups differ in several other aspects at baseline, such as employment status of the potentially caregiving spouse, as well as health status and age of the potential care receiver. These differences illustrate the need to make the two groups more comparable.

After matching, we achieve excellent balance on an exhaustive list of observable baseline characteristics, with standardized bias well below 10% for all covariates (Austin 2011, Rosebaum and Rubin 1985). With the bandwidth set at 0.04, two (twelve) treatment observations in the men (women) sample fall outside the common support region, with propensity scores too high to be reliably matched to untreated individuals. Increasing the bandwidth up to 0.1 does not solve this. Those observations are excluded.

4.3 Formal home care use and spousal health outcomes

Results of the four specifications introduced in sections 3.5 and 3.6, for physical and mental health, are shown in Tables 1 (women) and 2 (men). Home care use in t has a significant negative association with spousal health in t in specification (1), which controls only for baseline characteristics, and specification (2), which additionally controls for shocks to the health of the potential care receiver. Going from (1) to (2), the coefficients become slightly smaller in absolute terms, indicating that part of the negative association is explained by significant declines in care receivers' health. Furthermore, formal home care is more strongly associated with spousal physical health than with mental health, in the case of women: among formal home care users, physical health is about 0.2 standard deviations lower ($p<0.01$), and mental health is about 0.1 standard deviations lower ($p<0.1$), on average (specification (2), Table 1). In the case of men, mental health is about 0.1 standard deviations lower among formal home care users, on average ($p<0.1$), while there is no association with physical health (specification (2), Table 2).

When including in the regression shocks to the potential caregiver's health (specification (3)), the negative association between formal home care and spousal health disappears. The fact that specification (3) produces coefficients that are statistically and economically indistinguishable from zero suggests that the strong negative associations found with specification (2) are at least partly contaminated by reverse causality. In the next section, we present additional results that also point to this conclusion.

Lastly, specification (4) provides identical results to specification (3). Regarding the main baseline characteristics, better health in $t-1$ is associated with better health in t, while health of the care receiving partner in $t-1$ appears broadly unrelated to spousal health in t.

[Tables 1 and 2 here.]

4.4 Additional explorations

In this section, we discuss additional results based on specification (2), as we try to disentangle possible explanations for the negative association between formal home care and spousal health

presented in the previous section. Results using specification (3) are shown for comparison —in general, no significant associations are found. Results tables are available in Appendix E.

First, we distinguish between formal personal care and professional domestic help —two very different types of formal home care with potentially different impacts on spousal health (e.g., Zwar et al. 2018). We find that only use of professional domestic help is associated with worse spousal health in t.

Second, as some individuals accumulate the responsibility of caring for someone else outside the household, such as an elderly parent, we also explore potential differences between spouses who have such an extra responsibility and those who don't. We find that the overall negative association between formal home care and spousal health documented in the previous section is driven by spouses who do not provide informal care outside the household. These results must be interpreted with caution, as providing care outside the household is also endogenous to spousal health.

4.5 Sensitivity and falsification tests

We test the sensitivity of our results (specifications (2) and (3)) to the choice of bandwidth and to the exclusion of extreme propensity scores. Using bandwidths equal to 0.02 or 0.06, instead of 0.04, provides virtually the same results. Excluding observations with propensity scores in the bottom or top 5% provides qualitatively the same results, with slight changes in magnitudes and significance. We also compare the results with those obtained using simple regression adjustment, instead of regression adjustment on matched samples. Again, results are very similar, with only very small changes in magnitudes. These results are presented in Appendix F.

We also present results from two falsification tests. First, we considered a health outcome unlikely to be affected by formal home care use: whether the individual has cataracts. If we were to find an impact of treatment on this outcome, it might signal something wrong with our specification. We adapt specification (1) by including a lagged indicator of cataracts among the matching variables, and using probit regression. The estimated marginal effects for women and men are 0.002 and -0.010, respectively, with p-values well above 0.1. These compare with sample frequencies of 0.114 and 0.106, so we may say that formal home care use is not associated with having cataracts, as expected.

The second falsification test is a "pseudo treatment assignment" test, whereby we replace our dummy variable of interest, formal home care use, by a dummy that takes value 1/0 randomly (Bernoulli with probability of success p=0.14, which is the rate of formal home care use in our sample). We do this 5,000 times. The estimates should be centered around zero, which is what the distributions of the resulting t-statistics in Figures F1-F4 show.

5 Discussion

This study explores the relationship between formal home care use and spousal health. We start by finding a negative association between the two, but additional explorations lead us to conclude that formal home care likely has little to no impact on spousal physical or mental health, for men or women, in the short run.

First, we do not find an association between formal home care and spousal health if we restrict the comparison to potential caregivers with similarly large or small health declines (specification (3), which controls for shocks to the health of the potential caregiver). This is a very crude exploration that implicitly assumes that formal home care use causing large declines in spousal health (one standard deviation or more) is unreasonable and probably a symptom of remaining reverse causality. Two additional results point in the same direction. We find that only use of professional domestic help, and not formal personal care, is associated with worse spousal health —spouses, particularly women, likely only hire professional domestic help when they are no longer able to do the domestic chores themselves. Second, we do not find an association between formal home care use and spousal health among spouses who provide informal care to someone else outside the household —these individuals must still be in relatively good health to be able to do so. Looking at these two findings from a different angle, if reverse causality is causing a negative bias in the estimated relationship between formal home care and spousal health, then formal home care could have a positive impact on health among spouses subject to a double caregiving burden (i.e., those caring for the spouse and for someone else outside the household). Additionally, a negative bias may be offsetting a potential positive effect of formal personal care —typically help with heavier tasks, like bathing— on spousal health.

Alternative explanations for the negative association between formal home care and spousal health are first, that receipt of formal home care directly and negatively impacts spousal health. Possibly,

some spouses (especially women) feel that they should be able to handle the domestic chores (but not necessarily personal care), such that receiving professional domestic help hurts their pride (see e.g. Uccheddu et al. 2019). Some people (more often men) derive positive feelings from informal caregiving —e.g., sense of usefulness and self-esteem from being able to help. Formal home care use may eliminate those feelings —e.g., by reminding the spouse that they are not capable of handling the situation (Ribeiro et al. 2007). Some spouses may also feel uncomfortable with having strangers in the house, or consider that professional domestic helpers don't perform the chores in the way they would like. This explanation seems plausible when thinking about spousal mental health, but not so much when thinking about physical health.

The second alternative explanation is that formal home care requires spousal informal support (i.e., formal and informal home care are complements), and spousal informal caregiving is detrimental for health. Looking at intensity of formal home care utilization in SHARE (available only in Waves 1, 2, and 7), we that find that among users, median hours per week of professional domestic help is 4 hours, and median hours per week of formal personal care is 3 hours. This low intensity, coupled with the fact that we are considering potential caregivers living under the same roof as the care receiver, 24/7, suggests that formal and informal home care are likely to be complements, along the extensive margin. Carrino et al. (2018) find complementarity between formal and informal home care and suggest that as there are significant unmet LTC needs in Europe, it may be that when individuals start formal home care, professionals identify problems and signal the need for informal support as well. Furthermore, we find that formal home care use is only associated with worse spousal health among women who do not provide informal care outside the household. The lack of a negative association for those who care for example for an elderly parent outside the household may be related to the fact that those are the women with the greater potential to benefit from some respite. Overall, complementarity between any use of formal home care and informal spousal caregiving could be a plausible explanation for the negative association found.

Regarding limitations, we are unable to explore formally the relationship between formal home care intensity and spousal health. If the next SHARE waves maintain the intensity questions, this could be explored in a few years. We are also unable to study medium to long run impacts of formal home care use, as we seldom observe couples in more than two consecutive waves. The two-year interval between waves is another important limitation, for three main reasons. First, starting home care use can occur at any point between two waves, so spousal health in t may be

"affected" by one-month utilization or 23-months utilization of formal home care services. This means that on average, there may not be enough time to observe an impact on spousal health. Second, as discussed in section 3.6, many important changes, related to both spousal health outcomes and formal home care use, can take place in a two-year interval. We try to control for the most important ones with our specifications (2)-(4). Third, those changes can occur before or after couples start to use formal home care, a source of endogeneity that we cannot disentangle. Fully addressing endogeneity of formal home care (with survey data) likely requires finding a valid instrumental variable, like the ones employed by Juin (2019), who uses a local-level indicator of reliance on a subsidy for formal home care use in France, Perdrix and Roquebert (2019), who use the lowest regulated price of formal home care at the local level, also in France, or Carrino et al. (2018), who use an indicator of eligibility for public home care programs based on variations in needs-based eligibility criteria across four European countries. However, such strategy is likely to require focusing on fewer countries, like those studies, because it is hard to collect the data for and devise an instrument that is comparable across countries. One last limitation is that it is unclear whether the formal home care use variable may include respite care, in the countries where it is available (respite care utilization is not asked separately in SHARE). In general, respite care has little take-up and is not available in several European countries, so this concern is limited (Spasova et al. 2018).

Our study is based on a sample from 17 European countries and Israel, which confers generalizability to the findings. We focus on spouses of individuals with longstanding limitations in daily activities, which is the population most directly affected by LTC policy. However, spouses in relatively poor health may be underrepresented, because their dependent partners may be more likely to be recommended for institutional care and not appear in the sample.

Spouse informal caregivers provide much of the long-term support required by dependent older adults. Moving forward, they are likely to be increasingly important, as other sources of informal support become scarcer and countries privilege community-based over institutional formal LTC. Caregiving can be burdensome, physically and mentally, although depending on a number of factors, it can also involve positive experiences, such as a sense of self-esteem from being able to help. Formal home care interacts with informal care, such that policies aimed at fostering formal LTC, restructuring LTC offer, or refining eligibility criteria should take into consideration, besides costs and outcomes of the care receivers, the effects on caregivers and family members in general,

including spouses. Although our results suggest limited or no impacts of formal home care on spousal health, they only consider the short run and don't take into account the amount of formal help provided. In the long run, home care may impact spousal health. It could also be that among formal home care users, increasing the amount of support would improve spousal health by relieving caregiver burden (Juin 2019). Lastly, our findings may suggest that as formal home care reaches more people, reducing the extent of unmet LTC needs, it may generate more benefits in terms of spousal health, especially for spouses who accumulate caregiving responsibilities and especially formal personal care services.

References

Austin P 2011. An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research* 46: 399-424

Austin P 2020. Advances in propensity score analysis. *Statistical Methods in Medical Research* 29(3): 641-643

Bakx P & de Meijer C 2013. *The influence of spouse ability to provide informal care on long-term care use*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2407926

Bang H & Robins J 2005. Doubly robust estimation in missing data and causal inference models. *Biometrics* 61(4): 962-972

Bobinac A, van Exel J, Rutten F, & Brouwer W 2010. Caring for and caring about: disentangling the caregiver effect and the family effect. *Journal of Health Economics* 29: 549-556

Boom J, Bakx P, Schut F, & van Doorslaer E 2019. The impact of informal caregiving for older adults on the health of various types of caregivers: a systematic review. *The Gerontologist* 59(5): e629-e642

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

Brenna E & Di Novi C 2016. Is caring for older parents detrimental for women's mental health? The role of the European North-South gradient. *Review of the Economics of the Household* 14: 745-778

Calvó-Perxas L, Vilalta-Franch J, Litwin H, Mira P, & Garre-Olmo J 2021. A longitudinal study on public policy and the health of in-house caregivers in Europe. *Health Policy* 125: 436-441

Carrino L, Orso C, & Pasini G 2018. Demand of long-term care and benefit eligibility across European countries. *Health Economics* 27: 1175-1188

Coe N & Van Houtven C 2009. Caring for Mom and Neglecting Yourself? The Health Effects of Caring for an Elderly Parent. *Health Economics* 18: 991-1010

Colombo F, Llena-Nozal A, Mercier J, & Tjadens F 2011. Help Wanted? Provinding and Paying for Long-Term care. *OECD Health Policy Studies*. https://doi.org/10.1787/9789264097759-en

Courtin E, Knapp M, Grundy E, Avendano-Pabon M 2015. Are diferente measures of depressive symptoms in old age comparable? An analysis of the CES-D and EURO-D scales in 13 countries. *International Journal of Methods in Psychiatric Research* 24(4): 287-304

de Zwart P, Bakx P, & van Doorslaer E 2017. Will you still need me, will you still feed me when I'm 64? The health impact of caregiving to one's spouse. *Health Economics* 26(S2): 127-138

Di Novi C, Jacobs R, & Migheli M 2015. The quality of life of female informal caregivers: from Scandinavia to the Mediterranean Sea. *European Journal of Population* 31: 309-333

Do Y, Norton E, Stearns S, & Van Houtven C 2015. Informal care and caregiver's health. *Health Economics* 24: 224-237

Dong J, Pollack H, & Konetzka T 2019. Effects of long-term care setting on spousal health outcomes. *Health Services Research* 54: 158-166

European Commission 2018. *The 2018 Ageing Report. Economic and budgetary projections for the 28 EU member states (2016-2070)*. Luxembourg: Publications Office of the European Union

European Union 2021. *2021 long-term care report. Trends, challenges, and opportunities in an ageing society. Country profiles*. Luxembourg: Publications Office of the European Union

Golberstein E, Grabowski D, Langa K, & Chernew M 2009. Effect of Medicare home health care payment on informal care. *Inquiry* 46: 58-71

Han S, Kim K, & Burr J 2021. Take a sad song and make it better: spousal activity limitations, caregiving, and depressive symptoms among couples. *Social Science & Medicine* 281: 114081

Heger D 2017. The Mental Health of Children Providing Care to their Elderly Parent. *Health Economics* 26: 1617-1629

Juin S 2019. *Formal Home Care, Informal Support and Caregiver Health: Should Other People Care?* https://www.cairn.info/revue-economie-et-prevision-2019-2-page-91.htm

Kaschowitz J & Brandt M 2017. Health effects of informal caregiving across Europe: a longitudinal approach. *Social Science & Medicine* 173: 72-80

Miyawaki A, Kobayashi Y, Noguchi H, Watanabe T, Takahashi H, & Tamiya N 2020. Effect of reduced formal care availability on formal/informal care patterns and caregiver health: a quasi-experimental study using the Japanese long-term care insurance reform. *BMC Geriatrics* 20: 207

Perdrix E & Roquebert Q 2020. *Does an increase in formal care affect informal care? Evidence among the French elderly*. https://halshs.archives-ouvertes.fr/halshs-02370689v2/document

Pinquart M & Sörensen S 2003a. Differences between caregivers and noncaregivers in psychological health and physical health: A meta-analysis. *Psychology and Aging* 18: 250-267

Pinquart M & Sörensen S 2003b. Associations of stressors and uplifts of caregiving with caregiver burden and depressive mood: A meta-analysis. *Journals of Gerontology - Series B Psychological Sciences and Social Sciences* 58B: 112-128

Pinquart M & Sörensen S 2006. Gender differences in caregiver stressors, social resources, and health: an updated meta-analysis. *Journal of Gerontology: Psychological Sciences* 61B(1): 33-45

Prince M, Reischies F, Beekman A, Fuhrer R, Jonker C, Kivela S, Lawlor B, Lobo A, Magnusson H, Fichter M, Van Oyen H, Roelands M, Skoog I, Turrina C, & Copeland J 1999. Development of the EURO-D scale - A European Union initiative to compare symptoms of depression in 14 European centres. *British Journal of Psychiatry* 174: 330-338

Ribeiro O, Paúl C, & Nogueira C 2007. Real men, real husbands: Caregiving and masculinities in later life. *Journal of Aging Studies* 21: 302-313

Rosenbaum P & Rubin D 1985. Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician* 39: 33-38

Rubin D 1979. Using multivariate matched sampling and regression adjustment to control bias in observational studies. *Journal of the American Statistical Association* 74: 318-328

Schmitz H & Westphal M 2015. Short- and medium-term effects of informal care provision on female caregivers' health. *Journal of Health Economics* 42: 174-185

Spasova S, Baeten R, Coster S, Ghailani D, Peña-Casas R, & Vanhercke B 2018. *Challenges in long-term care in Europe. A study of national policies.* European Social Policy Network (ESPN), Brussels: European Commission

Stöckel J & Bom J 2020. *The Dynamic Effects of Informal Caregiving on Caregivers' Health*. https://www.netspar.nl/assets/uploads/P20200224_DP011_Bom.pdf

Uccheddo D, Gauthier A, Steverink N, & Emery T 2019. The pains and reliefs of the transitions into and out of spousal caregiving. A cross-national comparison of the health consequences of caregiving by gender. *Social Science & Medicine* 240: 112517

Urwin S, Lau Y-S, Grande G, & Sutton M 2021. The extent and predictors of discrepancy between provider and recipient reports of informal caregiving. *Social Science & Medicine*: 113890

Wagner M & Brandt M 2018. Long-term care provision and the well-being of spousal caregivers: an analysis of 138 European regions. *Journals of Gerontology - Series B Psychological Sciences and Social Sciences* 73: e24-e34

Zwar L, König H-H, & Hajek A 2018. Consequences of different types of informal caregiving for mental, self-rated, and physical health: longitudinal findings from the German Ageing Survey. *Quality of Life Research*. https://doi.org/10.1007/s11136-018-1926-0

Zwar L, König H-H, & Hajek A 2020. Psychosocial consequences of transitioning into informal caregiving in male and female caregivers: Findings from a population-based panel study. *Social Science & Medicine* 264: 113281

Figures

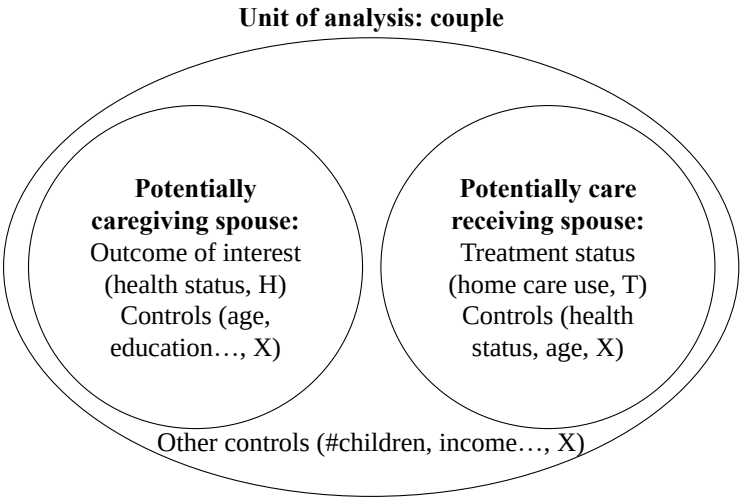
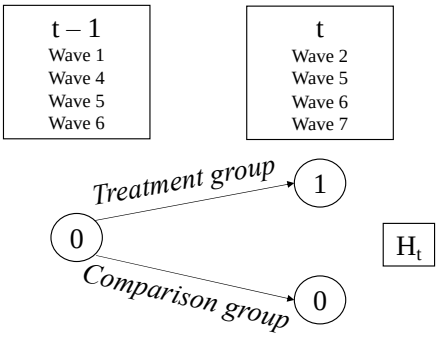


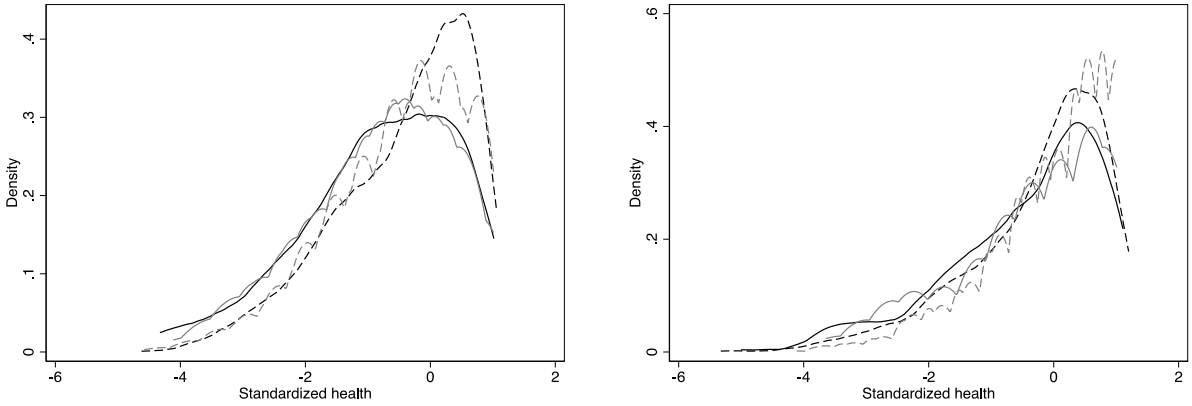
Figure 1. Sources of information for the analyses



Conditional on: X_{t-1}, H_{t-1}

0 – Not using formal home care; 1 – Using formal home care

Figure 2. Matching design



3.1. Women 3.2. Men

Legend: physical health in black; mental health in gray. Home care users in solid pattern; non-users in dashed pattern.

Figure 3. Potential caregivers' health by home care use status in t

Tables

Table 1. Impacts of formal home care use on spousal health, women

	Physical health (t)				Mental health (t)			
	(1)	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**
Home care use (t)	-0.201***	-0.188***	-0.077	-0.074	-0.179**	-0.125*	-0.029	-0.013
	(0.065)	(0.066)	(0.049)	(0.050)	(0.071)	(0.072)	(0.051)	(0.053)
Changes since t-1								
Shock to potential care receiver's physical health		-0.005	0.001	-0.017		-0.185**	-0.028	-0.015
		(0.077)	(0.056)	(0.055)		(0.083)	(0.062)	(0.065)
Shock to potential care receiver's mental health		-0.183*	-0.064	-0.046		-0.263**	-0.000	-0.002
		(0.097)	(0.067)	(0.062)		(0.102)	(0.067)	(0.067)
Shock to potential caregiver's physical health			-1.618***	-1.554***			-0.265***	-0.250***
			(0.069)	(0.059)			(0.081)	(0.079)
Shock to potential caregiver's mental health			-0.043	-0.089			-1.765***	-1.761***
			(0.068)	(0.065)			(0.060)	(0.059)
Potential caregiver retired				0.114				0.041
				(0.100)				(0.161)
Potential caregiver became disabled				-1.903***				-0.279
				(0.393)				(0.229)
Potential caregiver starts caregiving to spouse (self-reported)				0.079				-0.038
				(0.060)				(0.063)
Potential caregiver stops caregiving to spouse (self-reported)				0.023				0.230
				(0.102)				(0.141)
Covariates (t-1)								
Potential caregiver's physical health	0.639***	0.639***	0.773***	0.775***	0.174***	0.167***	0.150***	0.158***
	(0.038)	(0.037)	(0.030)	(0.030)	(0.038)	(0.038)	(0.030)	(0.030)
Potential caregiver's mental health	0.050	0.052	0.010	0.015	0.413***	0.420***	0.618***	0.614***
	(0.037)	(0.037)	(0.027)	(0.027)	(0.040)	(0.040)	(0.034)	(0.033)
Potential caregiver provides help to spouse (self-reported)	0.028	0.016	-0.076	-0.037	-0.089	-0.091	-0.126*	-0.226**
	(0.081)	(0.081)	(0.060)	(0.068)	(0.104)	(0.100)	(0.073)	(0.097)
Potential caregiver's age	0.033	0.018	0.030	0.013	0.043	0.029	0.054	0.052

	(0.048)	(0.047)	(0.040)	(0.040)	(0.058)	(0.056)	(0.038)	(0.040)
Potential caregiver's age2	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of children	-0.031	-0.033	-0.026	-0.028	-0.027	-0.032	-0.006	-0.011
	(0.027)	(0.027)	(0.019)	(0.019)	(0.026)	(0.026)	(0.016)	(0.016)
Household size	0.016	0.014	-0.005	-0.016	-0.055	-0.062	-0.028	-0.031
	(0.062)	(0.062)	(0.041)	(0.041)	(0.049)	(0.048)	(0.037)	(0.037)
Potential caregiver's education (ref.: none/other)								
ISCED 1/2	0.240*	0.221	0.114	0.104	0.124	0.082	-0.045	-0.043
	(0.143)	(0.141)	(0.097)	(0.097)	(0.167)	(0.164)	(0.103)	(0.102)
ISCED 3/4	0.283*	0.270*	0.105	0.129	0.027	-0.003	-0.120	-0.109
	(0.158)	(0.156)	(0.109)	(0.104)	(0.180)	(0.177)	(0.114)	(0.113)
ISCED 5/6	0.193	0.173	0.088	0.085	0.047	0.003	-0.239*	-0.233*
	(0.172)	(0.172)	(0.116)	(0.117)	(0.190)	(0.190)	(0.128)	(0.128)
Income (ln)	0.046	0.040	-0.023	-0.005	0.074*	0.064	0.065**	0.072**
	(0.045)	(0.045)	(0.036)	(0.033)	(0.044)	(0.042)	(0.032)	(0.032)
Wealth (sqrt)	0.000***	0.000***	0.000*	0.000*	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wealth<0	0.121	0.134	0.132	0.105	-0.066	-0.010	-0.032	-0.032
	(0.217)	(0.211)	(0.203)	(0.195)	(0.209)	(0.200)	(0.166)	(0.170)
Potential caregiver's employment status (ref.: retired/unemployed/homemaker/other)								
(Self-/)employed	0.028	0.009	-0.022	-0.032	-0.006	-0.034	-0.027	-0.053
	(0.113)	(0.113)	(0.083)	(0.070)	(0.144)	(0.142)	(0.102)	(0.128)
Permanently sick or disabled	-0.434**	-0.456**	-0.124	-0.109	-0.280	-0.317	-0.019	-0.014
	(0.219)	(0.222)	(0.137)	(0.132)	(0.302)	(0.303)	(0.185)	(0.179)
Charity or voluntary work	-0.038	-0.037	-0.093	-0.092	0.126	0.123	0.057	0.044
	(0.088)	(0.088)	(0.064)	(0.063)	(0.106)	(0.107)	(0.076)	(0.075)
Potential caregiver provides help outside the household	0.065	0.050	0.024	0.031	0.028	0.007	-0.037	-0.038
	(0.068)	(0.067)	(0.052)	(0.050)	(0.079)	(0.079)	(0.060)	(0.061)
Potential care receiver's physical health	-0.007	-0.013	-0.006	0.001	-0.051	-0.034	-0.066**	-0.072***
	(0.035)	(0.037)	(0.027)	(0.027)	(0.036)	(0.038)	(0.027)	(0.027)
Potential care receiver's mental health	-0.047	-0.034	-0.011	-0.011	0.016	0.033	0.006	0.007
	(0.036)	(0.036)	(0.027)	(0.028)	(0.038)	(0.039)	(0.029)	(0.029)

Potential care receiver's age	0.004	0.004	0.007	0.009*	-0.007	-0.008	0.000	0.001
	(0.008)	(0.007)	(0.005)	(0.005)	(0.007)	(0.007)	(0.005)	(0.005)
R-squared	0.570	0.573	0.770	0.780	0.381	0.394	0.678	0.681
Number of observations	1,756	1,756	1,756	1,750	1,791	1,791	1,791	1,786
Number of couples	1,654	1,654	1,654	1,648	1,687	1,687	1,687	1,682

Standard errors in parentheses are clustered at the couple level (only couples in the comparison group may appear more than once). *p<0.1, **p<0.05, ***p<0.01.

Physical and mental health were standardized based on a larger sample, which means that the interpretation of changes in standard deviations is not 100% accurate.

Table 2. Impacts of formal home care use on spousal health, men

	Physical health (t)				**Mental health (t)**			
	(1)	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**
Home care use (t)	-0.066	-0.056	0.010	0.006	-0.159**	-0.136*	-0.002	0.006
	(0.066)	(0.067)	(0.046)	(0.046)	(0.077)	(0.076)	(0.051)	(0.051)
Changes since t-1								
Shock to potential care receiver's physical health		-0.010	0.064	0.063		-0.047	-0.011	-0.007
		(0.086)	(0.058)	(0.058)		(0.102)	(0.069)	(0.069)
Shock to potential care receiver's mental health		-0.157	-0.116*	-0.115*		-0.426***	-0.198**	-0.193**
		(0.103)	(0.068)	(0.067)		(0.120)	(0.079)	(0.079)
Shock to potential caregiver's physical health			-1.786***	-1.786***			-0.231***	-0.230***
			(0.076)	(0.077)			(0.089)	(0.089)
Shock to potential caregiver's mental health			-0.136*	-0.132*			-1.870***	-1.865***
			(0.071)	(0.071)			(0.074)	(0.075)
Potential caregiver retired				0.069				-0.162
				(0.182)				(0.150)
Potential caregiver became disabled				-0.172				-0.151
				(0.181)				(0.190)
Potential caregiver starts caregiving to spouse (self-reported)				0.031				-0.095
				(0.072)				(0.073)
Potential caregiver stops caregiving to spouse (self-reported)				0.097				0.077
				(0.135)				(0.156)

Covariates (t-1)								
Potential caregiver's physical health	0.666***	0.663***	0.737***	0.737***	0.261***	0.254***	0.116***	0.116***
	(0.041)	(0.041)	(0.030)	(0.030)	(0.046)	(0.045)	(0.033)	(0.033)
Potential caregiver's mental health	0.084**	0.085**	0.062**	0.066**	0.413***	0.414***	0.541***	0.544***
	(0.041)	(0.041)	(0.029)	(0.029)	(0.047)	(0.047)	(0.035)	(0.036)
Potential caregiver provides help to spouse (self-reported)	0.147	0.153	0.093	0.048	-0.055	-0.029	-0.046	-0.117
	(0.125)	(0.124)	(0.080)	(0.106)	(0.118)	(0.117)	(0.085)	(0.111)
Potential caregiver's age	-0.030	-0.027	-0.037	-0.040	-0.044	-0.040	-0.070*	-0.065*
	(0.057)	(0.057)	(0.036)	(0.036)	(0.056)	(0.055)	(0.037)	(0.037)
Potential caregiver's age2	0.000	0.000	0.000	0.000	0.000	0.000	0.001**	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of children	-0.054**	-0.053**	-0.047***	-0.047***	0.027	0.029	0.015	0.016
	(0.025)	(0.025)	(0.016)	(0.016)	(0.028)	(0.027)	(0.023)	(0.023)
Household size	-0.024	-0.022	0.004	0.004	-0.074	-0.071	-0.016	-0.018
	(0.065)	(0.065)	(0.034)	(0.034)	(0.068)	(0.064)	(0.042)	(0.043)
Potential caregiver's education (ref.: none/other)								
ISCED 1/2	0.083	0.087	-0.050	-0.056	-0.217	-0.211	-0.082	-0.071
	(0.179)	(0.178)	(0.128)	(0.129)	(0.201)	(0.203)	(0.151)	(0.152)
ISCED 3/4	0.090	0.102	-0.063	-0.066	-0.334	-0.310	-0.112	-0.104
	(0.186)	(0.183)	(0.129)	(0.130)	(0.218)	(0.218)	(0.161)	(0.161)
ISCED 5/6	0.085	0.084	-0.061	-0.065	-0.236	-0.243	-0.103	-0.092
	(0.195)	(0.195)	(0.137)	(0.138)	(0.222)	(0.223)	(0.163)	(0.164)
Income (ln)	0.110	0.106	0.036	0.039	0.054	0.042	0.035	0.034
	(0.069)	(0.071)	(0.042)	(0.043)	(0.056)	(0.057)	(0.038)	(0.038)
Wealth (sqrt)	0.000	0.000	0.000	0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wealth<0	-0.023	-0.018	0.110	0.124	-0.356	-0.337	0.017	0.032
	(0.307)	(0.299)	(0.123)	(0.132)	(0.347)	(0.327)	(0.159)	(0.171)
Potential caregiver's employment status (ref.: retired/unemployed/homemaker/other)								
(Self-/)employed	0.094	0.089	0.045	0.028	-0.033	-0.049	-0.023	0.025
	(0.130)	(0.132)	(0.089)	(0.087)	(0.145)	(0.145)	(0.102)	(0.112)
Permanently sick or disabled	0.024	0.016	-0.076	-0.076	0.311	0.311	0.154	0.167
	(0.230)	(0.236)	(0.155)	(0.157)	(0.274)	(0.266)	(0.161)	(0.162)

Charity or voluntary work	0.209***	0.210***	0.104*	0.106*	0.055	0.058	0.041	0.043
	(0.076)	(0.077)	(0.056)	(0.057)	(0.104)	(0.104)	(0.071)	(0.071)
Potential caregiver provides help outside the household	-0.038	-0.033	-0.060	-0.058	0.005	0.018	-0.114**	-0.114**
	(0.077)	(0.077)	(0.050)	(0.051)	(0.086)	(0.085)	(0.057)	(0.057)
Potential care receiver's physical health	0.067*	0.069**	0.035	0.036	-0.037	-0.026	-0.026	-0.033
	(0.036)	(0.034)	(0.024)	(0.025)	(0.040)	(0.043)	(0.028)	(0.028)
Potential care receiver's mental health	-0.009	0.008	0.007	0.006	0.034	0.079*	0.049**	0.048*
	(0.035)	(0.035)	(0.022)	(0.022)	(0.039)	(0.040)	(0.025)	(0.025)
Potential care receiver's age	0.000	-0.000	0.006	0.005	-0.000	-0.002	-0.004	-0.003
	(0.009)	(0.009)	(0.005)	(0.005)	(0.010)	(0.010)	(0.006)	(0.006)
R-squared	0.524	0.527	0.783	0.783	0.315	0.333	0.687	0.688
Number of observations	1,538	1,538	1,538	1,534	1,544	1,544	1,544	1,540
Number of couples	1,448	1,448	1,448	1,444	1,448	1,448	1,448	1,444

Standard errors in parentheses are clustered at the couple level (only couples in the comparison group may appear more than once). *p<0.1, **p<0.05, ***p<0.01.

Physical and mental health were standardized based on a larger sample, which means that the interpretation of changes in standard deviations is not 100% accurate.

Appendix A

A.1 Further details on the formal home care use variable

Information on formal home care use by the household is based on the potential care receiver's answer to the question *"During the last twelve months, did you receive in your own home any professional or paid services listed on this card due to a physical, mental, emotional or memory problem? 1. Help with personal care (e.g. getting in and out of bed, dressing, bathing and showering) 2. Help with domestic tasks (e.g. cleaning, ironing, cooking)"*. This is the question in the Wave 7 questionnaire. It has suffered slight changes from wave to wave (Table A1).

Table A1. Comparability of the formal home care use variable across waves

	Formal home care use question	**Information on duration of formal home care use?**
Wave 1	During the last twelve months, did you receive in your own home any of the kinds of care mentioned on this card? 1. Professional or paid nursing or personal care 2. Professional or paid home help, for domestic tasks that you could not perform yourself due to health problems 3. Meals-on-wheels	Yes (How many weeks and how many hours per week, for nursing/ personal care and domestic help)
Wave 2	During the last twelve months, did you receive in your own home any of the kinds of care mentioned on this card? 1. Professional or paid nursing or personal care 2. Professional or paid home help, for domestic tasks that you could not perform yourself due to health problems 3. Meals-on-wheels	Yes (How many weeks and how many hours per week, for nursing/ personal care and domestic help)
Wave 3	SHARELIFE —data from this wave are not used.	
Wave 4	Not available in the main questionnaire. France, Spain, and Hungary asked about "receipt of professional/paid nursing/personal care in own home" and "receipt of professional/paid home help for domestic tasks due to health problems"	No
Wave 5	During the last twelve months, did you receive in your own home any professional or paid services listed on this card due	No

	to a physical, mental, emotional or memory problem? 1. Help with personal care (e.g. getting in and out of bed, dressing, bathing and showering) 2. Help with domestic tasks (e.g. cleaning, ironing, cooking) 3. Meals-on-wheels (i.e. ready-made meals provided by a municipality or a private provider) 4. Help with other activities (e.g. filling a drug dispenser)	
Wave 6	During the last twelve months, did you receive in your own home any professional or paid services listed on this card due to a physical, mental, emotional or memory problem? 1. Help with personal care (e.g. getting in and out of bed, dressing, bathing and showering) 2. Help with domestic tasks (e.g. cleaning, ironing, cooking) 3. Meals-on-wheels (i.e. ready-made meals provided by a municipality or a private provider) 4. Help with other activities (e.g. filling a drug dispenser)	No
Wave 7	During the last twelve months, did you receive in your own home any professional or paid services listed on this card due to a physical, mental, emotional or memory problem? 1. Help with personal care (e.g. getting in and out of bed, dressing, bathing and showering) 2. Help with domestic tasks (e.g. cleaning, ironing, cooking) 3. Meals-on-wheels (i.e. ready-made meals provided by a municipality or a private provider) 4. Help with other activities (e.g. filling a drug dispenser)	Yes (How many weeks and how many hours per week, for nursing/ personal care and domestic help)

Appendix B

B.1 Measure of physical health

SHARE data include a rich battery of health indicators. As usual in surveys of this type, one of the available health variables is self-assessed health, in five levels —Excellent, Very good, Good, Fair, or Poor. Albeit subjective, this is possibly the most comprehensive health variable available. Other, more objective, variables capture specific dimensions of health (e.g. specific health conditions like diabetes, specific limitations like not being able to climb a flight of stairs), and are subject to measurement errors. However, precisely because of the underlying subjectivity, it may be difficult or inappropriate to compare individuals based on self-assessed health, because different individuals interpret the question and the levels differently (e.g. individuals from different demographic or socioeconomic groups; Bago d'Uva et al. 2008a, 2008b). It may even be difficult to compare the same individual over time using self-assessed health, because of the so-called state dependence (e.g. Contoyannis et al. 2004).

One methodology frequently employed in the literature to overcome those biases in self-assessed health and at the same time measure health comprehensively is to generate a health index, by regressing self-assessed health on a set of objective health indicators using an ordered probit model and predicting the underlying latent variable. We do just that, following for example Coe and Zamarro (2011), García-Gomez et al. (2010), Jürges (2007), and Ryser et al. (2018).[1]

The health variables included in the model are binary indicators for health conditions (heart attack, hypertension, cholesterol, stroke, diabetes, lung disease, cancer, ulcer, Parkinson's, cataracts, and hip fracture), binary indicators for symptoms/troubles (pain, falls, fear of falling, dizziness), categorized body mass index (underweight, normal, overweight, obese), whether the individual was hospitalized in the past year, grip strength (maximum grip strength measure, treated continuously, and binary indicators for individuals unwilling or unable to take the grip

[1] Bonsang (2009) applies the same methodology to compute a disability index, regressing not self-assessed health but a variable that captures the degree of limitations (severely limited, limited but not severely, not limited) on dummy indicators of limitations in each ADL/IADL and other variables. De Meijer et al. (2009) and Kohn and Averett (2014) apply the same reasoning for computing a health/disability index but employ instead principal components and multiple correspondence analysis, respectively. Bound et al. (1999) and Lindeboom and Kerkhofs (2009) account for the biases in self-assessed health by modelling it as a function of objective health indicators within their integrated models for health and work decisions, even though they never actually need to compute the underlying health indices because they estimate the models jointly.

strength test), binary indicators for each mobility limitation (walking 100 meters, sitting for two hours, getting up from a chair, climbing several flights of stairs, climbing one flight of stairs, stooping/kneeling/crouching, reaching or extending the arms above the shoulders, pulling or pushing large objects, lifting or carrying weights over 5 kilograms, picking up a small coin from a table), binary indicators for each ADL limitation (dressing, walking across a room, bathing/showering, eating, getting in or out of bed, using the toilet), and binary indicators for each IADL limitation (cooking, shopping, answering the phone, taking medications, housekeeping, managing money).

The data are treated as pooled cross-sections and the standard errors are clustered at the couple level, accounting for correlations in the errors both between individuals living together and for the same individual over time. The health index is obtained by predicting the latent variable underlying the ordered probit model and standardizing the predictions. So, changes in the health index are interpreted in standard deviations.

Table B1 reports the estimation results. The table also shows the summary statistics of the included health indicators. Overall, the health indicators have the expected associations with self-assessed health. The four coefficients with unexpected signs that are statistically significant correspond to (I/)ADL limitations with very low frequencies; given that most health indicators are binary, we suspect some degree of multicollinearity may be at the root of these results. The distribution of the resulting standardized health index is plotted in Figure B1.

Table B1. Results of the ordered probit model to predict the health index (full sample)

	Descriptive statistics	**Oprobit estimation results**
	Average	**Coefficient**
	(Standard deviation)	**(Standard error)**
Health conditions		
Heart attack	0.11206	-0.48474***
	(0.31545)	(0.01405)
Hypertension	0.37874	-0.22385***
	(0.48507)	(0.00914)
Cholesterol	0.24253	-0.07544***
	(0.42862)	(0.00967)
Stroke	0.03278	-0.35855***
	(0.17806)	(0.02625)
Diabetes	0.12307	-0.34388***
	(0.32852)	(0.01353)

Lung disease	0.05404	-0.48966***
	(0.22610)	(0.02004)
Cancer	0.04577	-0.48508***
	(0.20900)	(0.02161)
Ulcer	0.03937	-0.28407***
	(0.19447)	(0.02148)
Parkinson's	0.00776	-0.67960***
	(0.08773)	(0.06404)
Cataracts	0.06940	-0.05267***
	(0.25414)	(0.01612)
Hip fracture	0.01340	-0.03551
	(0.11499)	(0.03715)
Symptoms/troubles		
Pain	0.40834	-0.34308***
	(0.49153)	(0.00846)
Falls	0.04908	-0.11361***
	(0.21604)	(0.02001)
Fear of falling	0.09174	-0.15475***
	(0.28866)	(0.01600)
Dizziness	0.11574	-0.30946***
	(0.31992)	(0.01327)
BMI (ref.: normal weight)		
Underweight	0.00912	-0.13507***
	(0.09506)	(0.05004)
Overweight	0.43211	-0.10359***
	(0.49537)	(0.00988)
Obese	0.20817	-0.20928***
	(0.40600)	(0.01279)
Acute events		
Hospitalized in the past year	0.13667	-0.33968***
	(0.34350)	(0.01183)
Grip strength		
Unable to take measurement	0.03578	-0.28646***
	(0.18575)	(0.02852)
Unwilling to take measurement	0.02290	-0.01213
	(0.14959)	(0.02862)
Maximum grip strength measure	32.89766	0.00710***
	(13.95620)	(0.00039)
Mobility limitations		
Walking 100 meters	0.07967	-0.29530***
	(0.27079)	(0.01993)
Sitting for two hours	0.09218	-0.15616***
	(0.28929)	(0.01554)
Getting up from a chair	0.16304	-0.09020***
	(0.36941)	(0.01285)
Climbing several flights of stairs	0.24405	-0.27594***
	(0.42952)	(0.01147)

Climbing one flight of stairs	0.10098	-0.12023***
	(0.30130)	(0.01651)
Stooping/kneeling/crouching	0.26719	-0.21447***
	(0.44250)	(0.01109)
Reaching or extending the arms above the shoulders	0.07661	-0.13547***
	(0.26597)	(0.01734)
Pulling or pushing large objects	0.11786	-0.17917***
	(0.32245)	(0.01627)
Lifting or carrying weights over 5 kilograms	0.16780	-0.24156***
	(0.37369)	(0.01339)
Picking up a small coin from a table	0.03111	-0.08300***
	(0.17362)	(0.02759)
Limitations in the ADLs		
Dressing	0.06116	-0.13667***
	(0.23962)	(0.02227)
Walking across a room	0.01491	0.17742***
	(0.12119)	(0.05576)
Bathing/showering	0.03804	-0.05746*
	(0.19129)	(0.03359)
Eating	0.01386	0.10664**
	(0.11693)	(0.05262)
Getting in or out of bed	0.02825	-0.05489
	(0.16569)	(0.03400)
Using the toilet	0.01696	0.10956**
	(0.12912)	(0.04697)
Limitations in the IADLs		
Cooking	0.02750	0.02839
	(0.16355)	(0.03945)
Shopping	0.04050	-0.15164***
	(0.19712)	(0.03273)
Answering the phone	0.01465	-0.15365***
	(0.12016)	(0.05087)
Taking medications	0.01336	0.03234
	(0.11482)	(0.05732)
Housekeeping	0.08376	-0.19499***
	(0.27703)	(0.01956)
Managing money	0.02740	-0.18918***
	(0.16325)	(0.03503)
Cut-offs		
1		-2.65015***
		(0.01969)
2		-1.18060***
		(0.01688)
3		0.13876***
		(0.01664)
4		1.09204***
		(0.01731)

Pseudo R-squared		0.178
Number of observations	97,588	97,588
Number of couples		19,288

Standard errors in parentheses are clustered at the couple level. *p<0.1, **p<0.05, ***p<0.01. All variables are binary except for the maximum grip strength measure (0-90). The sample pools both members of the couple and multiple observations over time. Individuals only observed in one wave are already excluded.

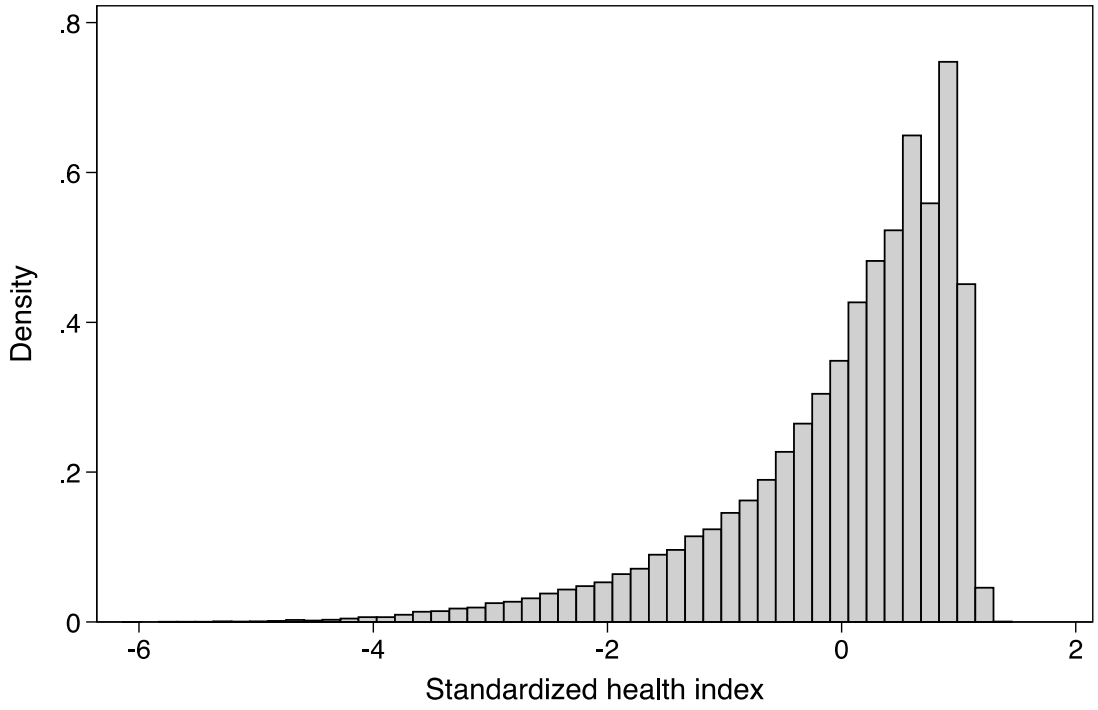


Figure B1. Distribution of the health index (average=0 and standard deviation=1)

References

Bago d'Uva T, O'Donnell O, & Van Doorslaer E 2008. Differential health reporting by education level and its impact on the measurement of health inequalities among older Europeans. *International Journal of Epidemiology* 37: 1375-1383

Bago D'Uva T, Van Doorslaer E, Lindeboom M, & O'Donnell O 2008. Does reporting heterogeneity bias the measurement of health disparities? *Health Economics* 17: 351-375

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

Bound J, Schoenbaum M, Stinebrickner T, & Waidmann T 1999. The dynamic effects of health on the labor force transitions of older workers. *Labour Economics* 6: 179-202

Coe N & Zamarro G 2011. Retirement effects on health in Europe. *Journal of Health Economics* 30: 77-86

Contoyannis P, Jones A, & Rice N 2004. The dynamics of health in the british household panel survey. *Journal of Applied Econometrics* 19: 473-503

de Meijer C, Koopmanschap M, Koolman X, & van Doorslaer E 2009. The role of disability in explaining long-term care utilization. *Medical Care* 47: 1156-1163

García-Gómez P, Jones A, & Rice N 2010. Health effects on labour market exits and entries. *Labour Economics* 17: 62-76

Jürges H 2007. True health vs response styles: Exploring cross-country differences in self-reported health. *Health Economics* 16: 163-178

Kohn J & Averett S 2014. Can't we just live together? New evidence on the effect of relationship status on health. *Journal of Family and Economic Issues* 35: 295-312

Lindeboom M & Kerkhofs M 2009. Health and work of the elderly: subjective health measures, reporting errors and endogeneity in the relationship between health and work. *Journal of Applied Econometrics* 24: 1024-1046

Ryser VA, Weaver F, & Gonçalves J 2018. Health-related inequalities in life satisfaction among the 50+ population in Europe: Evidence from SHARE. *Swiss Journal of Sociology* 44: 301-325

Appendix C

Table C1. Pooled summary statistics (women and men)

	Average	Standard deviation	Minimum	Maximum
Women	0.536	0.499	0	1
Formal home care use (t)	0.143	0.350	0	1
Outcomes (t)				
Potential caregiver's physical health	-0.389	1.120	-5.327	1.200
Potential caregiver's mental health	-0.312	1.109	-4.578	1.011
Changes since t-1				
Shock to potential care receiver's physical health	0.264	0.441	0	1
Shock to potential care receiver's mental health	0.166	0.372	0	1
Shock to potential caregiver's physical health	0.129	0.335	0	1
Shock to potential caregiver's mental health	0.140	0.347	0	1
Potential caregiver retired	0.044	0.205	0	1
Potential caregiver became disabled	0.004	0.063	0	1
Potential caregiver starts caregiving to spouse (self-reported)	0.181	0.385	0	1
Potential caregiver stops caregiving to spouse (self-reported)	0.049	0.216	0	1
Covariates (t-1)				
Potential caregiver's physical health	-0.214	1.042	-5.653	1.215
Potential caregiver's mental health	-0.176	1.071	-4.578	1.011
Potential caregiver provides help to spouse (self-reported)	0.115	0.320	0	1
Potential caregiver's age	68.535	9.390	39	94
Number of children	2.469	1.492	0	16
Household size	2.365	0.868	2	10
Potential caregiver's education (ref.: none/other)	0.063	0.244	0	1
ISCED 1/2	0.446	0.497	0	1
ISCED 3/4	0.330	0.470	0	1

ISCED 5/6	0.161	0.367	0	1
Income (€)	29,831	33,690	0.004	532,285
Wealth (€)	235,397	386,691	0	8,982,947
Wealth<0	0.025	0.156	0	1
Potential caregiver's employment status (ref.: retired/unemployed/homemaker/other)	0.810	0.392	0	1
(Self-/)employed	0.168	0.374	0	1
Permanently sick or disabled	0.022	0.146	0	1
Charity or voluntary work	0.137	0.344	0	1
Potential caregiver provides help outside the household	0.277	0.447	0	1
Potential care receiver's physical health	-0.813	1.149	-5.739	1.200
Potential care receiver's mental health	-0.482	1.147	-4.578	1.011
Potential care receiver's age	69.332	9.691	38	94
Country (ref.: Austria)	0.052	0.221	0	1
Germany	0.085	0.278	0	1
Sweden	0.081	0.273	0	1
Netherlands	0.025	0.156	0	1
Spain	0.101	0.302	0	1
Italy	0.097	0.296	0	1
France	0.078	0.268	0	1
Denmark	0.070	0.255	0	1
Greece	0.046	0.210	0	1
Switzerland	0.018	0.134	0	1
Belgium	0.118	0.323	0	1
Israel	0.052	0.221	0	1
Czech Republic	0.075	0.263	0	1
Poland	0.026	0.160	0	1
Luxemburg	0.006	0.077	0	1
Slovenia	0.019	0.138	0	1
Estonia	0.052	0.221	0	1
Wave (ref.: wave 2)	0.322	0.467	0	1
Wave 5	0.047	0.211	0	1
Wave 6	0.411	0.492	0	1

Wave 7	0.220	0.414	0	1
Number of observations		3,214		

Income and wealth include imputations provided in the SHARE database. The potential caregiver's age enters the models in quadratic form, income is applied the natural logarithm, and wealth the square root transformation.

Appendix D

Table D1. Results of the propensity score models

	Women	Men
Potential caregiver's physical health	-0.052	-0.019
	(0.044)	(0.045)
Potential caregiver's mental health	0.039	-0.030
	(0.042)	(0.047)
Potential caregiver provides help to spouse (self-reported)	0.374***	0.326**
	(0.116)	(0.143)
Potential caregiver's age	0.016	-0.077
	(0.062)	(0.067)
Potential caregiver's age^2	0.000	0.001
	(0.000)	(0.000)
Number of children	-0.020	-0.019
	(0.027)	(0.027)
Household size	0.006	-0.009
	(0.059)	(0.061)
Potential caregiver's education (ref.: none/other)		
ISCED 1/2	-0.238	0.244
	(0.148)	(0.178)
ISCED 3/4	0.028	0.313
	(0.171)	(0.197)
ISCED 5/6	0.117	0.289
	(0.192)	(0.211)
Income (ln)	0.031	0.159**
	(0.053)	(0.065)
Wealth (sqrt)	-0.000*	0.000
	(0.000)	(0.000)
Wealth<0	0.049	0.065
	(0.272)	(0.301)
Potential caregiver's employment status (ref.: retired/unemployed/homemaker/other)		
(Self-/)employed	0.074	0.024
	(0.154)	(0.173)
Permanently sick or disabled	0.503**	0.254
	(0.256)	(0.307)
Charity or voluntary work	-0.065	0.071
	(0.126)	(0.122)
Potential caregiver provides help outside the household	0.099	0.152
	(0.098)	(0.101)
Potential care receiver's physical health	-0.044	-0.155***
	(0.041)	(0.042)
Potential care receiver's mental health	-0.052	0.051
	(0.042)	(0.041)
Potential care receiver's age	0.022**	0.025**
	(0.009)	(0.010)

Country (ref.: Austria)		
Germany	0.638***	0.034
	(0.246)	(0.244)
Sweden	0.524**	-0.096
	(0.259)	(0.246)
Netherlands	0.219	0.366
	(0.350)	(0.323)
Spain	0.658**	0.553**
	(0.261)	(0.249)
Italy	0.540**	-0.079
	(0.259)	(0.255)
France	0.577**	0.492**
	(0.268)	(0.247)
Denmark	0.512*	-0.202
	(0.268)	(0.262)
Greece	-0.810*	-0.741*
	(0.447)	(0.398)
Switzerland	0.800**	0.093
	(0.368)	(0.350)
Belgium	0.771***	0.411*
	(0.243)	(0.228)
Israel	1.045***	0.681***
	(0.268)	(0.261)
Czech Republic	-0.104	-0.421
	(0.289)	(0.285)
Poland	-0.063	-1.007*
	(0.396)	(0.533)
Luxemburg	0.707	0.677
	(0.673)	(0.453)
Slovenia	0.139	-0.680
	(0.380)	(0.493)
Estonia	-0.107	-0.201
	(0.293)	(0.310)
Wave (ref.: wave 2)		
Wave 5	-0.127	-0.443**
	(0.205)	(0.213)
Wave 6	-0.117	-0.116
	(0.106)	(0.109)
Wave 7	-0.362***	-0.212*
	(0.129)	(0.128)
Constant	-4.788**	-2.767
	(2.254)	(2.538)
Pseudo R-squared	0.151	0.150
Number of observations	1,861	1,618

Standard errors in parentheses. *p<0.1, **p<0.05, ***p<0.01.

Table D2. Balance of covariates before and after matching (averages) —women sample

	Unmatched		Matched	Standardized bias (%)	
	T	**C**	**C**	**U**	**M**
Potential caregiver's physical health	-0.58334	-0.31373	-0.63458	-24.5	4.6
Potential caregiver's mental health	-0.468	-0.37959	-0.47852	-7.9	0.9
Potential caregiver provides help to spouse (self-reported)	0.18776	0.12843	0.21071	16.3	-6.1
Potential caregiver's age	72.102	66.769	71.981	59.6	1.3
Potential caregiver's age^2	5272.9	4543.8	5263.2	59.5	0.8
Number of children	2.6531	2.4807	2.6367	10.7	1
Household size	2.2367	2.3847	2.2747	-18.4	-4.7
Potential caregiver's education (ref.: none/other)					
ISCED 1/2	0.42449	0.47007	0.42847	-9.2	-0.8
ISCED 3/4	0.2898	0.32045	0.28369	-6.7	1.3
ISCED 5/6	0.14286	0.13217	0.1403	3.1	0.7
Income (ln)	9.9369	9.8519	9.9122	9	2.6
Wealth (sqrt)	382.63	391.09	374.9	-3.4	3.1
Wealth<0	0.02449	0.02681	0.02214	-1.5	1.5
Potential caregiver's employment status (ref.: retired/unemployed/homemaker/other)					
(Self-/)employed	0.08571	0.16958	0.09374	-25.3	-2.4
Permanently sick or disabled	0.03265	0.01808	0.03342	9.3	-0.5
Charity or voluntary work	0.12245	0.12656	0.12417	-1.2	-0.5
Potential caregiver provides help outside the household	0.22857	0.27307	0.23995	-10.3	-2.6
Potential care receiver's physical health	-0.87698	-0.6784	-0.94656	-17.3	5.8
Potential care receiver's mental health	-0.42999	-0.27999	-0.43329	-13.7	0.3
Potential care receiver's age	75.796	70.504	75.671	58.6	1.4
Country (ref.: Austria)					
Germany	0.11429	0.08167	0.1063	11	2.7
Sweden	0.08163	0.06858	0.0744	4.9	2.8
Netherlands	0.01633	0.02556	0.02428	-6.4	-5.6

Spain	0.16327	0.10162	0.15796	18.2	1.6
Italy	0.0898	0.09352	0.10591	-1.3	-5.6
France	0.07755	0.07294	0.07237	1.7	2
Denmark	0.06122	0.06172	0.05352	-0.2	3.2
Greece	0.00408	0.06234	0.01084	-32.9	-3.8
Switzerland	0.02041	0.01621	0.02313	3.1	-2.1
Belgium	0.15918	0.10786	0.14985	15.1	2.8
Israel	0.09388	0.05112	0.08782	16.5	2.2
Czech Republic	0.03265	0.08167	0.03603	-21.2	-1.5
Poland	0.01224	0.03304	0.01384	-14	-1.1
Luxemburg	0.00408	0.00436	0.0027	-0.4	2.1
Slovenia	0.01224	0.0212	0.01336	-7	-0.9
Estonia	0.03265	0.05923	0.0388	-12.7	-3
Wave (ref.: wave 2)					
Wave 5	0.06531	0.04738	0.06064	7.8	2
Wave 6	0.40816	0.40212	0.43032	1.2	-4.5
Wave 7	0.16735	0.23691	0.15978	-17.4	1.9

T=treatment group, C=comparison group, U=unmatched, M=matched. All variables included in specification (4). Sample limited to the region of common support. The standardised bias in percentage is the difference in the sample means in the treatment and comparison groups as a percentage of the square root of the average of the sample variances in the two groups (Rosenbaum and Rubin 1985).

Table D3. Balance of covariates before and after matching (averages) —men sample

	Unmatched		**Matched**	**Standardized bias (%)**	
	T	**C**	**C**	**U**	**M**
Potential caregiver's physical health	-0.27894	-0.09703	-0.25978	-16.9	-1.8
Potential caregiver's mental health	-0.04901	0.04028	-0.02186	-8.9	-2.7
Potential caregiver provides help to spouse (self-reported)	0.1341	0.06716	0.1198	22.4	4.7
Potential caregiver's age	74.747	69.619	74.779	55.8	-0.3

Potential caregiver's age^2	5670.1	4932.6	5675.9	56.5	-0.4
Number of children	2.5057	2.4923	2.5831	0.8	-4.7
Household size	2.2529	2.3993	2.2596	-18.4	-0.8
Potential caregiver's education (ref.: none/other)					
ISCED 1/2	0.44828	0.431	0.44151	3.5	1.4
ISCED 3/4	0.30651	0.33506	0.3056	-6.1	0.2
ISCED 5/6	0.17625	0.17565	0.17774	0.2	-0.4
Income (ln)	10.091	9.8862	10.068	22.7	2.6
Wealth (sqrt)	441.64	406.49	433.34	13	3.1
Wealth<0	0.01533	0.02288	0.0192	-5.5	-2.8
Potential caregiver's employment status (ref.: retired/unemployed/homemaker/other)					
(Self-/)employed	0.08429	0.18376	0.08886	-29.5	-1.4
Permanently sick or disabled	0.01916	0.02509	0.0174	-4	1.2
Charity or voluntary work	0.14943	0.13432	0.14622	4.3	0.9
Potential caregiver provides help outside the household	0.26054	0.26863	0.25176	-1.8	2
Potential care receiver's physical health	-1.2703	-0.89076	-1.2469	-32.8	-2
Potential care receiver's mental health	-0.73601	-0.68117	-0.71951	-4.7	-1.4
Potential care receiver's age	72.364	66.881	72.425	57.6	-0.6
Country (ref.: Austria)					
Germany	0.0728	0.07749	0.07136	-1.8	0.5
Sweden	0.07663	0.08782	0.06715	-4.1	3.5
Netherlands	0.03065	0.02066	0.02854	6.3	1.3
Spain	0.16475	0.09815	0.16816	19.8	-1
Italy	0.0728	0.10996	0.0719	-12.9	0.3
France	0.11494	0.07528	0.10632	13.5	2.9
Denmark	0.04598	0.07528	0.04164	-12.3	1.8
Greece	0.00766	0.04649	0.01109	-24.1	-2.1
Switzerland	0.02299	0.01697	0.02205	4.3	0.7
Belgium	0.17625	0.10332	0.18086	21.1	-1.3
Israel	0.09195	0.05166	0.10756	15.6	-6
Czech Republic	0.03065	0.08339	0.03332	-22.9	-1.2
Poland	0.00383	0.03026	0.00547	-20.5	-1.3

Luxemburg	0.01533	0.00517	0.0108	10.1	4.5
Slovenia	0.00383	0.02362	0.00589	-17.1	-1.8
Estonia	0.02299	0.04945	0.02623	-14.2	-1.7
Wave (ref.: wave 2)					
Wave 5	0.05747	0.04945	0.04651	3.6	4.9
Wave 6	0.4023	0.40074	0.39233	0.3	2
Wave 7	0.18774	0.24133	0.20867	-13.1	-5.1

T=treatment group, C=comparison group, U=unmatched, M=matched. All variables included in specification (4). Sample limited to the region of common support. The standardised bias in percentage is the difference in the sample means in the treatment and comparison groups as a percentage of the square root of the average of the sample variances in the two groups (Rosenbaum and Rubin 1985).

Appendix E

Table E1. Impacts of formal home care on spousal health —personal care vs. domestic help

	Women				Men			
	Physical health (t)		Mental health (t)		Physical health (t)		Mental health (t)	
	(2)	(3)	(2)	(3)	(2)	(3)	(2)	(3)
a) Any type (i.e. baseline)								
Home care use (t)	-0.188***	-0.077	-0.125*	-0.029	-0.056	0.010	-0.136*	-0.002
	(0.066)	(0.049)	(0.072)	(0.051)	(0.067)	(0.046)	(0.076)	(0.051)
R-squared	0.573	0.770	0.394	0.678	0.527	0.783	0.333	0.687
Number of observations	1,756	1,756	1,791	1,791	1,538	1,538	1,544	1,544
Number of couples	1,654	1,654	1,687	1,687	1,448	1,448	1,448	1,448
b) Personal care								
Home care use (t)	-0.126*	-0.049	-0.085	0.016	-0.018	-0.001	-0.138	0.026
	(0.074)	(0.052)	(0.084)	(0.059)	(0.088)	(0.056)	(0.085)	(0.058)
R-squared	0.615	0.804	0.389	0.679	0.548	0.806	0.401	0.721
Number of observations	1,859	1,859	1,894	1,894	1,755	1,755	1,758	1,758
Number of couples	1,743	1,743	1,776	1,776	1,613	1,613	1,610	1,610
c) Domestic help								
Home care use (t)	-0.242***	-0.053	-0.232***	-0.096	-0.058	-0.001	-0.185**	-0.032
	(0.074)	(0.052)	(0.084)	(0.062)	(0.068)	(0.048)	(0.077)	(0.053)
R-squared	0.600	0.793	0.397	0.668	0.516	0.778	0.331	0.672
Number of observations	1,809	1,809	1,837	1,837	1,607	1,607	1,615	1,615
Number of couples	1,695	1,695	1,722	1,722	1,500	1,500	1,503	1,503

Standard errors in parentheses are clustered at the couple level (only couples in the comparison group may appear more than once). *p<0.1, **p<0.05, ***p<0.01. Physical and mental health were standardized based on a larger sample, which means that the interpretation of changes in standard deviations is not 100% accurate.

Table E2. Impacts of formal home care on spousal health —spouses providing help outside the household vs. spouses who don't

	Women				Men			
	Physical health (t)		Mental health (t)		Physical health (t)		Mental health (t)	
	(2)	(3)	(2)	(3)	(2)	(3)	(2)	(3)
a) Spouses of individuals with limitations (i.e. baseline)								
Home care use (t)	-0.188***	-0.077	-0.125*	-0.029	-0.056	0.010	-0.136*	-0.002
	(0.066)	(0.049)	(0.072)	(0.051)	(0.067)	(0.046)	(0.076)	(0.051)
R-squared	0.573	0.770	0.394	0.678	0.527	0.783	0.333	0.687
Number of observations	1,756	1,756	1,791	1,791	1,538	1,538	1,544	1,544
Number of couples	1,654	1,654	1,687	1,687	1,448	1,448	1,448	1,448
b) Also providing care outside the household								
Home care use (t)	-0.096	-0.028	0.000	0.013	0.118	0.085	-0.025	0.014
	(0.107)	(0.084)	(0.131)	(0.089)	(0.085)	(0.064)	(0.137)	(0.094)
R-squared	0.676	0.802	0.482	0.752	0.578	0.756	0.377	0.697
Number of observations	449	449	456	456	412	412	406	406
Number of couples	435	435	442	442	397	397	391	391
c) Not providing care outside the household								
Home care use (t)	-0.227***	-0.118**	-0.147*	-0.022	-0.096	0.004	-0.120	0.036
	(0.079)	(0.056)	(0.081)	(0.059)	(0.081)	(0.055)	(0.090)	(0.061)
R-squared	0.567	0.776	0.419	0.690	0.523	0.788	0.362	0.711
Number of observations	1,228	1,228	1,253	1,253	1,060	1,060	1,070	1,070
Number of couples	1,175	1,175	1,201	1,201	1,013	1,013	1,017	1,017

Standard errors in parentheses are clustered at the couple level (only couples in the comparison group may appear more than once). *p<0.1, **p<0.05, ***p<0.01. Physical and mental health were standardized based on a larger sample, which means that the interpretation of changes in standard deviations is not 100% accurate.

Appendix F

Table F1. Sensitivity of the main results to the choice of bandwidth

	Women				Men			
	Physical health (t)		Mental health (t)		Physical health (t)		Mental health (t)	
	(2)	(3)	(2)	(3)	(2)	(3)	(2)	(3)
a) Bandwidth = 0.04 (baseline)								
Home care use (t)	-0.188***	-0.077	-0.125*	-0.029	-0.056	0.010	-0.136*	-0.002
	(0.066)	(0.049)	(0.072)	(0.051)	(0.067)	(0.046)	(0.076)	(0.051)
b) Bandwidth = 0.02								
Home care use (t)	-0.186***	-0.073	-0.128*	-0.035	-0.047	0.014	-0.132*	-0.007
	(0.066)	(0.049)	(0.071)	(0.051)	(0.067)	(0.046)	(0.077)	(0.052)
c) Bandwidth = 0.06								
Home care use (t)	-0.181***	-0.074	-0.124*	-0.029	-0.057	0.009	-0.137*	0.002
	(0.066)	(0.048)	(0.072)	(0.051)	(0.066)	(0.046)	(0.076)	(0.051)

Standard errors in parentheses are clustered at the couple level (only couples in the comparison group may appear more than once). *p<0.1, **p<0.05, ***p<0.01. Physical and mental health were standardized based on a larger sample, which means that the interpretation of changes in standard deviations is not 100% accurate.

Table F2. Other sensitivity checks

	Women				Men			
	Physical health (t)		Mental health (t)		Physical health (t)		Mental health (t)	
	(2)	(3)	(2)	(3)	(2)	(3)	(2)	(3)
a) Baseline: regression adjustment on matched samples								
Home care use (t)	-0.188***	-0.077	-0.125*	-0.029	-0.056	0.010	-0.136*	-0.002
	(0.066)	(0.049)	(0.072)	(0.051)	(0.067)	(0.046)	(0.076)	(0.051)
R-squared	0.573	0.770	0.394	0.678	0.527	0.783	0.333	0.687
Number of observations	1,756	1,756	1,791	1,791	1,538	1,538	1,544	1,544
Number of couples	1,654	1,654	1,687	1,687	1,448	1,448	1,448	1,448
b) Simple regression adjustment								
Home care use (t)	-0.140**	-0.056	-0.113	-0.021	-0.010	0.024	-0.145*	-0.013
	(0.063)	(0.046)	(0.073)	(0.052)	(0.064)	(0.044)	(0.075)	(0.051)
R-squared	0.581	0.774	0.364	0.632	0.530	0.781	0.336	0.665
Number of observations	1,756	1,756	1,791	1,791	1,538	1,538	1,544	1,544
Number of couples	1,654	1,654	1,687	1,687	1,448	1,448	1,448	1,448
c) Exclusion of bottom and top 5% pscores								
Home care use (t)	-0.147**	-0.044	-0.150**	-0.038	-0.004	0.009	-0.150*	-0.011
	(0.066)	(0.050)	(0.075)	(0.054)	(0.069)	(0.048)	(0.079)	(0.054)
R-squared	0.578	0.770	0.400	0.679	0.487	0.762	0.312	0.665
Number of observations	1,595	1,595	1,626	1,626	1,390	1,390	1,397	1,397
Number of couples	1,504	1,504	1,534	1,534	1,307	1,307	1,309	1,309

Standard errors in parentheses are clustered at the couple level (only couples in the comparison group may appear more than once). *p<0.1, **p<0.05, ***p<0.01. Physical and mental health were standardized based on a larger sample, which means that the interpretation of changes in standard deviations is not 100% accurate.

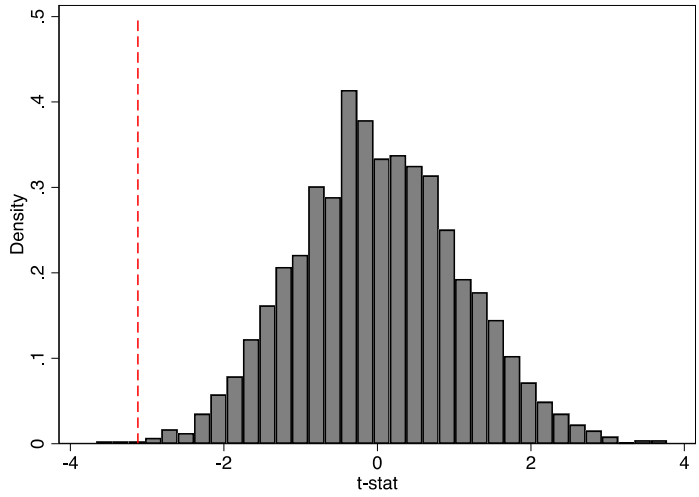


Figure F1. Falsification test: placebo assignment to home care use —women, physical health

Distribution of t-statistics resulting from 5,000 random assignments of home care use to individuals, and t-statistic from actual treatment (red dashed line).

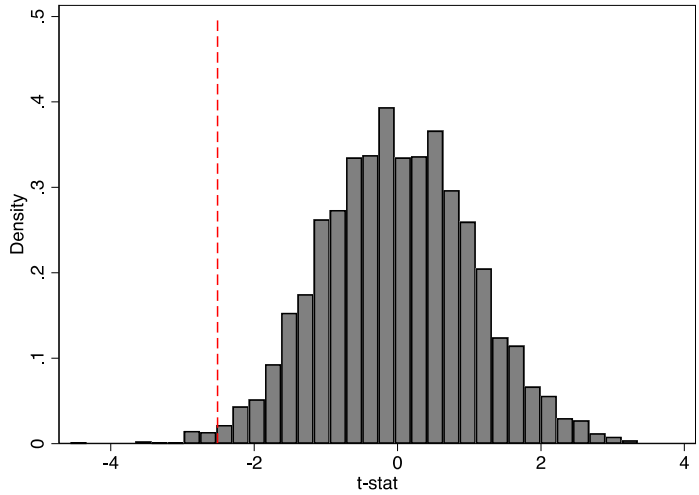


Figure F2. Falsification test: placebo assignment to home care use —women, mental health

Distribution of t-statistics resulting from 5,000 random assignments of home care use to individuals, and t-statistic from actual treatment (red dashed line).

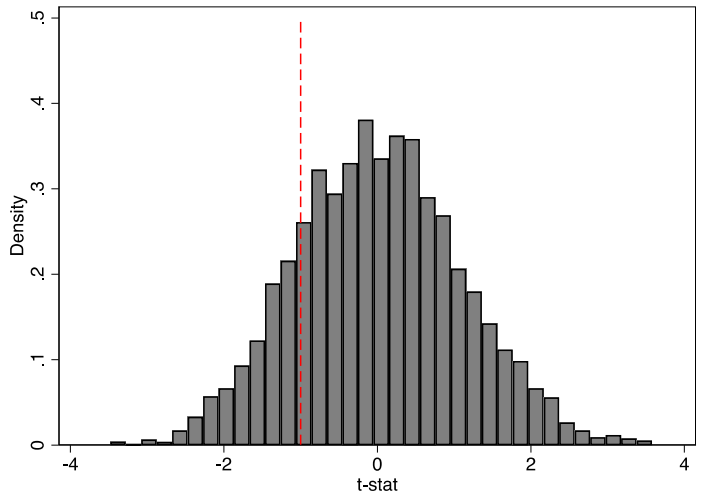


Figure F3. Falsification test: placebo assignment to home care use —men, physical health

Distribution of t-statistics resulting from 5,000 random assignments of home care use to individuals, and t-statistic from actual treatment (red dashed line).

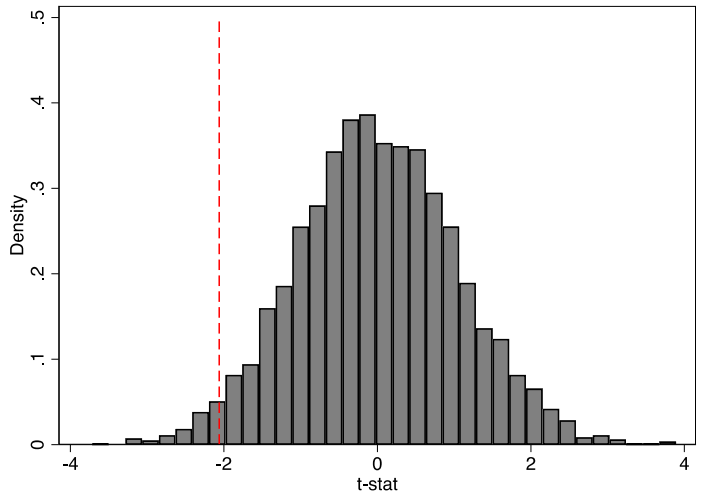


Figure F4. Falsification test: placebo assignment to home care use —men, mental health

Distribution of t-statistics resulting from 5,000 random assignments of home care use to individuals, and t-statistic from actual treatment (red dashed line).