



ERUDITE

ÉQUIPE DE RECHERCHE SUR L'UTILISATION
DES DONNÉES INDIVIDUELLES EN LIEN
AVEC LA THÉORIE ÉCONOMIQUE

Sous la co-tutelle de :
UPEC • UNIVERSITÉ PARIS-EST CRÉTEIL
UPEM • UNIVERSITÉ PARIS-EST MARNE-LA-VALLÉE

Series of ERUDITE Working Papers

N° 21-2019

Title

Formal home care, informal support and caregiver health:
should other people care?

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FORMAL HOME CARE, INFORMAL SUPPORT AND CAREGIVER HEALTH: SHOULD OTHER PEOPLE CARE?

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Abstract

In the context of an aging population, it is important to study informal caregivers who are the main providers of support for dependent elderly people. This work estimates how social support (*i.e.* informal support received from the family/social network and formal home care) affects caregivers' general and mental health.

To take into account potential endogeneity biases, instrumental variables models are estimated on a sample of 755 non-coresiding caregivers from the French Disability and Health Survey (2008-2009). The results show that an increase in formal care hours significantly reduces the probability that caregiving affects health and that it leads to sleep disorders or depression. Regarding informal support, an increase in the number of informal caregivers limits the risk that caregivers feel morally tired and that they have palpitations/tachycardia or sleep disorders. This study highlights the importance of improving access to formal home care services and of encouraging informal support and solidarity.

Keywords: caregivers; informal care; formal home care; mental health; social support; France.

JEL: I10; D10; C26.

1. Introduction

The number of persons aged 80 and over is projected to increase from 3.7 million to 8 million in France and from 25.9 million to 61.7 million in Europe by 2060. People aged 80 and over will represent 12% of the European population in 2060, compared to 6% today (Eurostat projections). In France, the number of dependent elderly persons is projected to reach 1.5 million in 2040 (Marbot and Roy, 2015). In this context of an aging population, it is important to understand the consequences of informal care (i.e., care provided by the family, friends and neighbors) on caregivers' health. Indeed, informal caregivers are the main providers of support for dependent elderly people and may become even more important in the future, given increasing pressures on the sustainability of long-term care systems. In France, according to the High Family Council, informal caregivers provide more than three quarters of the total hours of care, and half of dependent elderly persons receive only informal care (HCFEA, 2017). Reports from the European Commission and the OECD (Colombo et al., 2011) have acknowledged the importance of supporting caregivers. In France, the Law on the adaptation of society to the aging of the population (*Loi d'adaptation de la société au vieillissement*), adopted in December 2015, recognizes the right to respite for family caregivers (through additional hours of formal home care, day-care services, temporary accommodation), reinforces counseling and training services and underlines the need to reconcile paid employment and informal care.

The economic literature has been more interested in the effect of providing informal care on labor market participation and wages (for literature reviews on this topic see Bauer and Sousa-Poza, 2015 and Lilly et al., 2007) rather than on health. In addition, studies on informal caregivers' health generally do not assess whether heterogeneous care arrangements lead to different health consequences. It is important to investigate the effect of informal care on health, not only because it is costly in terms of caregivers' well-being, but also because health problems can lead to many other negative consequences. Indeed, caregivers are characterized by a higher probability of medication use (Do et al., 2015; Van Houtven et al., 2005), the cost of which is borne by informal caregivers and by public expenditures. In addition, it has been shown that problems of depression among caregivers are associated with missed work (Wilson et al., 2007), which represents an economic cost to caregivers, care employers and to society as a whole. Caregivers' stress and burden may also lead to early institutionalization of dependent elderly people (Spillman and Long, 2009; Yaffe et al., 2002). In France, it has been

estimated that 29% of nursing home expenditures are covered by public expenditures, while 71% remain the responsibility of care recipients and their families (Charpin Report, 2011). Finally, caregivers' health problems may decrease the quality of informal care and even increase the risk of elder abuse (Schulz and Beach, 1999; Smith et al., 2011). Yuda and Lee (2016) find on Japanese data that a decline in caregivers' physical or mental health adversely affects care recipients' health.

This paper aims to estimate from French data the effect of social support (*i.e.* informal support and formal home care) on the health of non-coresiding informal caregivers. Informal support is defined as the assistance that the caregivers receive from family and other members of the social network (e.g., friends and neighbors). This work provides insights for policymakers on how to shape public policies aimed at supporting informal caregivers. It also explores to what extent a subsidy on formal care could protect caregivers' health.

The article is organized as follows: Section 2 summarizes the existing literature; Section 3 presents the data and methodology used; Section 4 provides some descriptive statistics, the results of the estimations, specification tests and a subsample analysis. The last section concludes.

2. Literature review

The health and well-being effects of informal care provision have been first documented in research in psychology, public health, epidemiology and medicine. The economic literature has addressed this topic in more recent years¹. Many empirical papers have compared the health status of groups of caregivers and non-caregivers, generally using cross-sectional and national data (see, e.g., Berglund et al., 2015 for a recent paper on Swedish data) and have been combined in meta-analyses (Pinquart and Sörensen, 2003; Vitaliano et al., 2003; Vlachantoni et al., 2013). It should be stressed that, in general, these papers use non-representative samples that over-represent caregivers of elderly with dementia. Other studies, based on longitudinal data, examine transitions of individuals into and out of caregiving (Burton et al., 2003; Hirst, 2005; O'Reilly et al., 2008; Schulz et al., 2003; Seltzer and Li, 2000). While cross-sectional analyses do not take into account endogeneity problems in the relationship between informal care and health, longitudinal studies allow investigating more causal effects. This research indicates that providing informal care has negative effects on

¹ Bauer and Sousa-Poza (2015) provide a careful review of the research on caregiving and health up to 2015.

both physical health (self-reported health, physical symptoms, antibodies and stress hormones) and mental health (stress, depression, distress and loss of subjective well-being) of caregivers. Vlachantoni et al. (2013) point out that the effects of informal care provision on health outcomes largely depend on the characteristics of caregivers and care receivers and on the nature of the care provided. The literature has mainly focused on high-income countries, but the results seem to be confirmed in low and middle-income countries (see Lambert et al., 2017 for a study based on data from Ghana, India and Russia).

More recently, papers have sought to address the endogeneity of informal care using instrumental variables methods (Coe and Van Houtven, 2009; Do et al., 2015), fixed effects models that control for time-invariant unobserved heterogeneity (Kaschowitz and Brandt, 2017; Oshio, 2014; Van den Berg et al., 2014) or propensity score matching (Di Novi et al., 2015; Schmitz and Westphal, 2015). Other studies have not explicitly taken into account the endogeneity problem but have underlined the importance of controlling for the health characteristics of dependent elderly persons (Bobinac et al., 2011, 2010; Byrne et al., 2009). Estimates confirm that informal care has negative consequences on health and well-being. Informal care significantly decreases the health-related quality of life (Bobinac et al., 2011); it increases the probability of having pain that affects daily activities and of reporting fair or poor health (Do et al., 2015); and it leads to heart conditions for single caregiver men who provide continued caregiving (Coe and Van Houtven, 2009). With regard to mental health, informal care has negative effects on happiness (Bobinac et al., 2010) and life satisfaction (Van den Berg et al., 2014), and it is positively associated with burden (Byrne et al., 2009) and psychological distress (Oshio, 2014). Caregiving also increases the depression index of married caregivers who provide continued caregiving (Coe and Van Houtven, 2009) and of coresiding caregivers (Kaschowitz and Brandt, 2017). Schmitz and Westphal (2015) stress that these negative effects on mental health fade out over time.

While the health consequences of providing informal care are now well established in the economic literature, less is known concerning the mediating effect of social support on caregivers' health. Theoretically, according to the health capital model (Grossman, 1972), caregivers may invest in formal home care services in order to reduce the caregiving burden and protect their health. In the stress process model, which was developed within the psychology and the sociology of mental health (Lawton et al., 1991; Pearlin et al., 1990), caregivers' health and well-being is the consequence of a dynamic process which depends on

the socioeconomic characteristics of the caregivers, the stressors to which they are exposed and social support. Social support may mitigate the intensity of caregiving primary and secondary stressors and their impact on health. Primary stressors stem directly from the objective caregiving demand (e.g., cognitive status of the dependent elderly, number of activity restrictions) and the intensity of care provided. They may lead to more subjective secondary stressors such as strains in roles and activities outside caregiving (e.g., family conflict, job-caregiving conflict) and intra-psychic strains (e.g., loss of self-esteem, role captivity).

Many empirical studies in nursing and social work, psychology, public health, epidemiology and medicine have assessed the effects of informal support and formal care on caregiver's health. They highlight that the use of formal care (home care, day-care centers and respite care) has no effect on caregivers' physical health (measured by self-reported health and the functional status) or on mental health (measured by burden, depression, stress, anxiety, distress, burnout and general well-being). By contrast, informal support received from the family and social network protects caregivers' mental health but it seems to have no effect on self-reported health (see, e.g., Ducharme et al., 2007; Lee et al., 2007; Moon and Dilworth-Anderson, 2015; Pinquart and Sörensen, 2007; Raina et al., 2004). Comparative studies based on European data bring out some interesting results for formal support. Colvez et al., (2002) focus on caregivers of patients with dementia in five types of specific care programs. They find that, compared with caregivers of patients in respite hospitalization program, caregivers of patients in group-living structures or receiving home social services experienced lower burden. They also stress that day-care centers help to reduce the feeling of social isolation among caregivers and that expert centers offering medical services decrease the risk of depression and work burden. Calvó-Perxas et al. (2018) assess the association between the policies of support to caregivers available in several European countries and the health of caregivers. They find that non-financial support measures such as respite care, counseling and training have a larger protective effect on caregivers' health than financial measures such as care allowances. However, there are two important limitations to the studies mentioned in this paragraph. First, they generally use non-representative samples of caregivers of people with dementia or of caregivers living in particular geographical areas. Second, they are based on correlation analyses or standard linear regressions that do not take into account the potential simultaneity bias between caregivers' health and social support. Interestingly, White-Means

(1997) accounts for the endogeneity of formal home care decisions and, unlike most studies, finds that formal care protects caregivers' health.

This work contributes in several ways to the existing literature. First, it estimates the effect of social support (*i.e.* informal support received from the family/social network and formal home care) on the health of non-coresiding caregivers, while also taking into account endogeneity biases with an instrumental variables approach. Second, it uses data that provide valuable information on the characteristics of both the caregivers and the dependent elderly persons. Finally, it provides insights on the health effects of informal care in France.

3. Method

3.1. Data and sample

In order to study the relationship between social support and caregivers' health, I use the Households section and the Caregivers section of the French Disability and Health Survey (*Enquête Handicap Santé*). This cross-sectional survey, carried out in 2008-2009 by the French Institute of Statistics and the Ministry of Health, provides valuable information on both non-institutionalized dependent people (in the Households section of the survey) and their caregivers (in the Caregivers section).

4151 dependent elderly persons aged 65 and over and living in the community were selected from the Households section based on activity restrictions (difficulties in performing alone at least one essential activity of daily living ADL or one instrumental activity of daily living IADL). Among these dependent persons, 3440 received informal care and they listed a total number of 3542 non-coresiding informal caregivers and 2047 coresiding caregivers, providing aid with daily life tasks, financial/material aid or moral support. However, the instruments used in the following analysis were not strong enough for coresiding caregivers, and the endogeneity problem could not be addressed. Consequently, the remainder of the paper focuses on non-coresiding caregivers. Some of the 3542 non-coresiding caregivers did not fall within the scope of the Caregivers section, could not be contacted or did not respond to the survey, which leaves us with 1107 non-coresiding caregivers². Finally, I removed the few caregivers who provided only financial or material assistance, who are at lower risk of health problems, and the caregivers who helped several persons. Indeed, information was available

² Beliard et al. (2012) have conducted a qualitative analysis on the role of the interviewer on the number of informal caregivers reported by dependent elderly persons in the Households survey and on the number of respondents to the Caregivers section of the French Disability and Health Survey.

on only one care relationship, and I wanted to exclude health variations associated with multiple caregiving roles. The final sample contains 755 non-coresiding caregivers after deleting missing values (see Figure A1 in Appendix A for a more detailed description of the sample selection).

Table A1 in Appendix A compares this sample (column 1) with other non-coresiding caregivers excluded from the study (2) and coresiding caregivers (3), based on information provided by the dependent elderly persons in the Households survey. The comparison of samples (1) and (2) of non-coresiding caregivers shows that the caregivers used in the following analysis over-represent caregiving daughters (37% vs. 30%) and under-represent caregivers of elderly living in couples (21% vs. 36%). In addition, the studied sample seems to be characterized by caregivers providing care to dependent elderly in poorer health (and receiving slightly more hours of formal care) than in the excluded sample. Coresiding caregivers in column (3) are older than non-coresiding ones: 51% are aged 70 and older as compared to only 12% in the studied sample of non-coresiding caregivers. They are mainly caregiving spouses and they provide care to elderly in poorer health, receiving less formal care. Coresiding caregivers provide more intensive care (27 hours per week on average vs. 12 hours for non-coresiding caregivers) and are less often helped by other informal caregivers. In sum, the reader should keep in mind that the sample of non-coresiding caregivers studied here is very specific and is not representative of all informal caregivers.

3.2. Variables of interest

In this study, the effect of social support on caregivers' health is approached through three standard health indicators (self-perceived health, longstanding illness or health problem, Global Activity Limitation Indicator - GALI³) and eight more specific questions. The self-perceived health variable is dichotomized; it takes the value one if the caregiver reports fair, bad or very bad health and 0 otherwise. The second standard health indicator is equal to 1 if the individual has a longstanding illness or health problem and 0 otherwise. Finally, the GALI indicator takes the value 1 if the individual is limited and 0 otherwise.

³ The questions are the following:

- Self-perceived health: *"How is your health in general? Very good / good / fair / bad / very bad."*

- Longstanding illness or health problems: *"Do you have any longstanding illness or health problem? Yes / no."*

- Global Activity Limitation Indicator (GALI): *"For at least the past 6 months, to what extent have you been limited because of a health problem in activities people usually do? Severely limited / limited but not severely / not limited at all."*

These measures are commonly used in the literature, but are very general and focus rather on physical health. Thus, I also use complementary health questions that directly ask caregivers whether informal care has negative effects on their health:

- *"Do you feel that providing informal care affects your health? Yes / no."*

- *"I am now going to read you a list of some less positive aspects of caregiving. Tell me if they currently apply to you:*

Do you feel physical fatigue? Yes / no.

Do you have sleep disorders? Yes / no.

Do you feel morally tired? Yes / no.

Do you feel depressive? Yes / no.

Do you feel anxious, stressed, overworked? Yes / no.

Do you have back problems? Yes / no.

Do you have palpitations, tachycardia? Yes / no."

For each of these questions, I create a binary variable that is equal to 1 if the caregiver answers "yes" and 0 if she answers "no". These indicators are interesting in that they focus on how caregivers experience informal care. Even if subjective data may result in response bias, the economic literature acknowledges more and more that subjective measures provide valuable information. For example, recent reports highlight that the subjective well-being is an important tool given that individuals are *"the best judges of their own conditions"* and that it *"provides an insight into human behavior and decision making"* (Commission on the Measurement of Economic Performance and Social Progress, Stiglitz, Sen, Fitoussi, 2009; OECD, 2013b). Nevertheless, it should be kept in mind that these variables are very specific.

The main explanatory variables are formal support and informal support. Formal support is measured by the number of formal home care hours received per week as reported by the dependent elderly persons in the Households survey. In the literature, there is no consensus on the measure of informal support received from the family/social network. It is generally approached by instrumental (i.e., tangible) support such as assistance with informal care, by emotional support, by scales of perceived support or by the number of informal caregivers. In this study, informal support is approached by the total number of informal caregivers reported by the dependent elderly persons. This variable refers to both coresiding and non-coresiding caregivers and goes from one to ten. Using these measures of formal and informal support reported by the dependent elderly persons, rather than the perception of social support by caregivers, may help limit potential biases.

3.3. Econometric model

The effects of formal care hours (FCH_i) and informal support (IS_i) on caregivers' health (H_i) are first estimated by ordinary least squares (Eq.1 below). I use linear probability models, rather than probit models, in order to compare these estimations with instrumental variables models. The control variables, X_i , are: demographic and socioeconomic characteristics of the caregiver (age, sex, education level, working or not and monthly household income); family characteristics of the caregiver (living with a partner or not and having at least one child or not) and of the care recipient (living with a partner or not); the frequency of informal care (daily, weekly or less intensive assistance); the caregiver type (daughter, son, child-in-law, sibling, friend or neighbor, other); the supply of nursing home beds in the department of the care receiver and, finally, the monthly household income and the health of the dependent elderly (number of restrictions in ADLs, in IADLs and cognitive limitations)⁴. Controlling for the health of the care receiver is important, since it has a direct effect on caregivers' health and subjective well-being (Bobinac et al., 2011, 2010). In addition, the health of the dependent elderly gives information on the difficulty of providing informal care (Pearlin et al., 1990). More precisely, the literature shows that providing informal care for demented people is more harmful to health than providing care for individuals with only physical problems (Pinquart and Sörensen, 2007, 2003; Schulz and Sherwood, 2008).

$$H_i = \alpha_1 FCH_i + \alpha_2 IS_i + X_i \alpha_3 + \epsilon_i \quad (\text{Eq.1})$$

Formal home care and informal support may be endogenous in standard linear models. Indeed, informal caregivers may purchase formal care hours if they have health problems. Similarly, they may ask other family members to help them with caregiving. This reverse causality bias is likely to underestimate the positive effect of social support on caregivers' health. In addition, some unobserved factors may be correlated to both social support and caregivers' health (e.g., the initial health status of the caregiver).

In order to address this potential endogeneity, instrumental variables linear probability models are estimated using two-stage least squares. Since the instrument for formal home care is at the departmental level (see below), I allow the errors within each of the 89 departments to be

⁴ Adding the duration of informal care – less than 3 years: 19% of the sample; 3-8 years: 32%; 8 years or more: 38% since always: 7%; missing: 4% – as a control variable does not change the results. Because this regressor is endogenous, I choose not to include it in the main analysis.

correlated. These cluster-robust standard errors are also robust to heteroskedasticity⁵. Instrumental variables linear probability models have the advantage of imposing very weak conditions on the endogenous regressors and the instruments. In particular, they can be used with discrete regressors such as the number of caregivers (which goes from 1 to 10). They also allow avoiding problems of convergence and give good estimates of marginal effects (Angrist, 2009, p. 107; Wooldridge, 2002, p. 455). Finally, instrumental variables models provide econometric tests of exogeneity and of the strength of the instruments used. However, this method also has its drawbacks (Lewbel et al., 2012). First, the error term in the linear probability model is generally not independent of the regressors. Second, the fitted probabilities can be negative or greater than one. This is particularly true when some regressors, such as formal care hours, take on a large range of values. As a robustness check, I use maximum likelihood estimation in Section 4.3 to take into account the binary nature of health indicators.

3.4. Instruments

In order to identify the causal effect of social support on caregivers' health, one has to find at least two instruments (vector Z_i) that are correlated with formal care, $corr(Z_i, FCH_i) \neq 0$, and with informal support, $corr(Z_i, IS_i) \neq 0$, but that are orthogonal to the error term in the health equation, $corr(Z_i, \epsilon_i) = 0$. Instruments for formal care are not well developed in the economic literature. The present work uses the same instrument than Barnay and Juin (2016): the proportion of individuals aged 75 and over, living in the community, who received the Personal Autonomy Allowance (PAA, *Allocation Personnalisée d'Autonomie*) at the departmental level⁶ in 2008. It captures French disparities in access to PAA. Indeed, several reports from French authorities (the Inspectorate of Social Affairs, 2009⁷; the Court of Auditors, 2009⁸; the National Assembly, 2010⁹) highlight that the General Councils have set up heterogeneous appraisal, decision-making and management processes. These reports stress that this situation leads to a problem of equity between French departments. For instance,

⁵ It should be stressed that some caregivers in the sample provide care to the same dependent elderly person. Indeed, the 755 caregivers provide care to 533 dependent elderly persons. The effect of social support on caregivers' health remains unchanged when errors are correlated for the caregivers of the same dependent elderly person.

⁶ In the department of the dependent elderly person being cared for.

⁷ Fouquet A, Laroque M, Puydebois C. 2009. La gestion de l'allocation personnalisée d'autonomie. Synthèse des contrôles de mise en œuvre de l'APA réalisés dans plusieurs départements (Report n°RM2009-024P).

⁸ Cour des Comptes. 2009. La prise en charge des personnes âgées dépendantes (Annual report).

⁹ Assemblée Nationale. 2010. Rapport d'information sur la prise en charge des personnes âgées dépendantes (Report n°2647).

application forms display varying degrees of complexity and require varying numbers of supporting documents. Moreover, the AGGIR scale used to assess the level of dependence is very sensitive (poor reproducibility of the classification) and likely to lead to departmental inequalities for eligibility to PAA. The professional profile of medico-social teams, the date and the period of entitlement to PAA may also vary between departments. Finally, a recent study (Arrighi et al., 2015) stresses that French elderly tend to apply more for the PAA in more generous departments (where the subsidy rate is higher). It should be kept in mind that this variability in the proportion of beneficiaries of the PAA partly reflects socioeconomic and political differences between French departments, which may have a direct impact on caregivers' health. It may also be correlated with the local supply of nursing home beds. For instance, it is possible that in departments with few nursing homes, more individuals live in the community and receive the PAA. The regressions partly take into account this effect by controlling for the number of nursing home beds in the departments.

As far as informal support is concerned, the number of caregivers is instrumented by the number of daughters of the dependent elderly persons. It relies on the assumptions that women have a higher propensity to provide care than men and that when the dependent persons have several children, the burden of caregiving can be shared between siblings. Instruments based on the number of children and their sex are commonly used in the literature to instrument the provision of informal care (Barnay and Juin, 2016; Bolin et al., 2008; Bonsang, 2009; Charles and Sevak, 2005; Van Houtven and Norton, 2004).

4. Results

4.1. Descriptive statistics

28% of caregivers considered in the following analysis report a fair, bad or very bad health, 42% have a longstanding illness or health problem, 23% report activity limitations (GALI) and 11% feel that providing informal care affects their health. The most commonly reported negative consequences of caregiving are anxiety/stress/overwork (27% of the sample), back problems (27%), moral and physical fatigue (24% and 21%) and sleep disorders (17%). Depression and palpitations/tachycardia, reported by, respectively, 10% and 9% of caregivers, are much less common. On average, dependent elderly persons have 2.7 caregivers and receive 8.3 hours of formal home care per week.

As regard control variables, most caregivers are daughters or sons (68%), women (65%), less than 60 years of age (66%), live with a partner (89%) and have children (84%). Around half

of individuals work, 27% have no diploma and 17% receive less than 1200 euros per month. Finally, dependent elderly have on average 1.4 restrictions in ADLs, 5.5 restrictions in IADLs and 46% report cognitive limitations.

Table 1. Descriptive statistics on caregivers.

	Mean or proportion (Std. dev.)
Health indicators	
Self-perceived health (fair, bad, very bad)	0.282 (0.450)
Longstanding illness or health problem	0.423 (0.494)
Global Activity Limitation Indicator (GALI)	0.232 (0.422)
Caregiving affects health	0.115 (0.320)
Physical fatigue	0.216 (0.412)
Sleep disorders	0.171 (0.377)
Moral fatigue	0.236 (0.425)
Depression	0.105 (0.306)
Anxiety, stress, overwork	0.275 (0.447)
Back problems	0.268 (0.443)
Palpitation, tachycardia	0.094 (0.292)
Social support	
Number of informal caregivers	2.736 (1.832)
Hours of formal care per week	8.326 (13.946)
Control variables	
<i>Care arrangements</i>	
Frequency of informal care	
- Daily	0.385 (0.487)
- Weekly	0.473 (0.500)
- Less often	0.139 (0.346)
- Missing value	0.003 (0.051)
Relationship between the caregiver and the elderly	
- Daughter	0.437 (0.496)
- Son	0.240 (0.427)
- Friend or neighbor	0.098 (0.298)
- Other relatives	0.070 (0.256)
- Child-in-law	0.065 (0.247)
- Sibling	0.049 (0.216)
- Grandchild	0.041 (0.199)
<i>Socio-demographic controls</i>	
Age	
- Less than 50 years of age	0.306 (0.461)
- Between 50 and 60 years of age	0.350 (0.477)
- Between 60 and 70 years of age	0.197 (0.398)
- 70 and older	0.117 (0.321)
- Missing value	0.030 (0.172)
Female	0.652 (0.477)
Education level	
- No diploma or Certificate of primary education (low)	0.275 (0.447)
- Junior school certificate or vocational qualification (medium)	0.391 (0.488)
- Higher diploma (high)	0.277 (0.448)
-Missing value	0.057 (0.232)
Work	0.519 (0.500)
Monthly household income	
- Less than 1200 €	0.168 (0.374)
- 1200-1800 €	0.192 (0.394)
- 1800-2500 €	0.179 (0.383)
- 2500-4000 €	0.195 (0.396)
- More than 4000 €	0.094 (0.292)
- Missing value	0.172 (0.378)
<i>Family controls</i>	
Living with a partner	0.891 (0.311)
Having at least one child	0.844 (0.363)
<i>Characteristics of the dependent elderly</i>	
Number of restrictions in ADLs	1.419 (1.666)

Number of restrictions in IADLs	5.461 (2.910)
Cognitive limitations	0.458 (0.499)
Living with a partner	0.208 (0.406)
Monthly household income	
- Less than 1000 €	0.367 (0.482)
- 1000/1500 €	0.297 (0.457)
- 1500/2000 €	0.123 (0.329)
- More than 2000 €	0.159 (0.366)
- Missing value	0.054 (0.227)
Number of nursing home beds at the departmental level (per 1,000 inhabitants aged 75+)	74.127 (25.617)
Instruments	
Proportion of individuals aged 75+ receiving the PAA at the departmental level (per 1,000 inhabitants)	144.708 (71.992)
Number of daughters of the dependent elderly person	1.789 (1.669)
Number of observations	755

Source: French Disability and Health Survey, 2008-2009.

Field: non-coresiding informal caregivers of dependent elderly persons.

4.2. Estimation results

Specification tests

Tables 2 below summarizes the results of linear probability models (LPM) and instrumental variables linear probability models (IV-LPM), for the different health indicators. Table B1 in Appendix B presents the effects of control variables on caregivers' health. First of all, the null hypothesis of exogeneity¹⁰ of formal care is rejected in the model that estimates whether caregiving affects health (p -value=0.024), in the model for sleep disorders (p =0.087) and in the model for depression (p =0.031). The exogeneity of informal support, measured by the number of informal caregivers, is rejected in the study of sleep disorders (p =0.052), moral fatigue (p =0.061) and palpitations/tachycardia (p =0.035). For these health indicators, IV-LPM models are preferable to LPM. Concerning the strength of the instruments, the proportion of PAA recipients has a positive and significant effect at the 1% level in the formal care equation (coefficient: 0.021***). Similarly, the number of daughters of the dependent elderly persons has a positive effect at the 1% level on the number of caregivers (coefficient: 0.247***). The Angrist-Pischke F -statistics for formal home care and informal support are equal, respectively, to 13.12 and 15.37, which is higher than the conventional $F=10$ threshold (Staiger and Stock, 1997), and significant at the 1% level. Furthermore, the comparison of the Kleibergen-Paap Wald F -statistic to Stock and Yogo (2005)'s critical values¹¹ shows that the

¹⁰ In the `ivreg2` command in Stata, the exogeneity test is the difference of two Sargan-Hansen statistics (one for the equation treating the regressor(s) as endogenous and one for the equation treating the regressor(s) as exogenous). This statistics is distributed as chi-squared with degrees of freedom equal to the number of regressors tested.

¹¹ The Kleibergen-Paap Wald F -statistic is 6.26. The critical values that allow restricting the size distortion to 15% and 10% are, respectively, 4.58 and 7.03.

maximum Wald test size distortion ranges between 10% and 15%. The exclusion restriction cannot be tested in this study, since there is no extra instrument.

Table 2. Effect of social support on caregivers' health – health consequences of caring.

Health indicators	Effect of social support on health		Exogeneity tests, <i>p-value</i>			
	FCH	IS	FCH	IS	Global	
Self-perceived health (fair, bad, very bad)	LPM	-1.43e-6 (0.001)	0.001 (0.009)	-	-	-
	IV-LPM	-0.007 (0.011)	-0.036 (0.052)	0.563	0.478	0.705
Longstanding illness or health problem	LPM	-0.002 (0.001)	0.003 (0.011)	-	-	-
	IV-LPM	-0.009 (0.014)	-0.034 (0.057)	0.644	0.546	0.741
Global Activity Limitation Indicator (GALI)	LPM	-0.002 (0.001)	-0.007 (0.009)	-	-	-
	IV-LPM	0.003 (0.012)	-0.042 (0.043)	0.647	0.388	0.594
Caregiving affects health	LPM	-0.001 (0.001)	-0.002 (0.010)	-	-	-
	IV- LPM	-0.020* (0.011)	-0.044 (0.048)	0.024	0.382	0.060
Physical fatigue	LPM	7.90e-5 (0.002)	-0.002 (0.010)	-	-	-
	IV- LPM	-0.006 (0.009)	-0.056 (0.046)	0.505	0.151	0.331
Sleep disorders	LPM	-0.002 (0.001)	0.003 (0.008)	-	-	-
	IV- LPM	-0.022** (0.010)	-0.082 (0.051)	0.087	0.052	0.029
Moral fatigue	LPM	-0.002* (0.001)	-0.004 (0.012)	-	-	-
	IV- LPM	-0.013 (0.010)	-0.082* (0.047)	0.380	0.061	0.127
Depression	LPM	-0.001 (0.001)	-0.004 (0.007)	-	-	-
	IV- LPM	-0.017* (0.009)	-0.024 (0.033)	0.031	0.679	0.090
Anxiety, stress, overwork	LPM	-2.76e-4 (0.002)	-0.016 (0.012)	-	-	-
	IV- LPM	-0.002 (0.011)	-0.071 (0.051)	0.936	0.234	0.491
Back problems	LPM	-0.001 (0.001)	-0.008 (0.008)	-	-	-
	IV- LPM	-0.010 (0.012)	-0.027 (0.047)	0.512	0.735	0.765
Palpitations, tachycardia	LPM	-0.001 (0.001)	-0.010* (0.006)	-	-	-
	IV- LPM	-0.010 (0.009)	-0.058** (0.025)	0.350	0.035	0.030
First-stage equation for formal care hours (IV)						
Proportion of PAA recipients		0.021*** (0.006)				
Number of daughters		-0.055 (0.288)				
First-stage equation for informal support (IV)						
Proportion of PAA recipients		-0.002 (0.001)				
Number of daughters		0.247*** (0.063)				
AP <i>F-test</i> for FCH		13.124***				
AP <i>F-test</i> for IS		15.372***				
Number of observations		755				

Source: French Disability and Health Survey, 2008-2009.

Field: non-coresiding informal caregivers of dependent elderly persons.

Note: regressions include all the control variables listed in Table 1.

Standard errors are reported in parentheses and clustered at the departmental level (89 clusters).

*: significant at the 10% level, **: 5% level, ***: 1% level.

Effect of social support

Comparing LPM and IV-LPM results highlights the importance of adjusting for the endogeneity of formal care and informal support. Indeed, while naïve models find generally no significant effect, IV estimations show that social support reduces the risk that caregiving affects health and the risk that it leads to sleep disorders, moral fatigue, depression or palpitations/tachycardia. The simultaneity bias thus results in an underestimation of the beneficial effects of social support on caregivers' health and may explain why most of the existing studies find no effect of formal care.

More specifically, social support seems to have no significant effect on standard health variables (self-perceived health, longstanding illness or health problem, GALI) and physical health (physical fatigue, back problems). By contrast, a one-unit increase in formal home care hours reduces the risk that caregiving affects health by 2.0 percentage points (pp) and decreases the probability that caregiving leads to sleep disorders and depression by, respectively, 2.2pp and 1.7pp. As far as informal support is concerned, when the number of informal caregivers increases by one unit, it reduces the risk that caregivers feel morally tired and that they have palpitations or tachycardia by, respectively, 8.2pp and 5.8pp. These results highlight that the effect of social support depends on which aspect of health is measured and that the effects are more pronounced when caregivers are asked directly about the interaction between their health and the care they provide than with more general questions.

Other determinants of caregivers' health

Concerning other care arrangements, daily care is associated with a higher probability of physical fatigue, moral fatigue, anxiety or back problems (see Table B1 in Appendix B). Caregivers' health also depends on the relationship between the caregiver and the elderly person. Indeed, the risk of health problems is generally lower for children-in-law, friends and neighbors and adult grandchildren than for adult children. These effects might be explained by differences in initial health, in family ties and in the decision to provide informal care. They are in line with Hirst (2005), who shows that providing care to a friend or neighbor decreases the risk of distress and with Do et al. (2015), who find that the health effect of care is higher for daughters than for daughters-in-law. Regarding demographic and socioeconomic characteristics, women report more often than men that caregiving leads to health problems, fatigue, sleep disorders, depression or anxiety. In contrast, caregivers' income has a protective effect on most health variables. Individuals who work and individuals with higher education

are characterized by better general health indicators (self-perceived health, longstanding illness or health problems, GALI) but report more often that caregiving has negative health consequences. The positive effect of work on health is probably due to selection effects. Caregivers who live with a partner and who have children have a higher probability of reporting fair or bad self-perceived health, longstanding illnesses or health problems, anxiety and palpitations. This may be explained by the fact that caregiving may interfere with private and family life. Finally, restrictions in activities of daily living of the elderly increase the risk of caregivers' health problems. Caregivers also report more often difficulties when the care receiver has higher incomes. Not surprisingly, non-coresiding caregivers have less health problems when the dependent elderly lives in couple. This is because partners, and more generally coresiding caregivers, provide the majority of assistance.

What are the mechanisms at work?

In order to better understand the effect of social support on caregivers' health, I have included in IV models the type of care provided and role strains (see Table 3 below). If formal care and informal support are no longer significant, this would imply that the positive effect of social support on health is entirely explained by a reorganization of the care provided and by a better articulation of caregiving with family, social and professional life. These alternative models are estimated only for health dimensions that were affected by social support in the main analysis.

The type of care is measured through dummy variables indicating whether the caregiver provides personal care (33% of the sample), moral support (96%), supervision (34%), or help with administrative tasks (65%), with health problems (68%), with household chores (91%) or with mobility (22%). In addition, six indicators are used to control for potential role strains associated with caregiving. Four dummy variables indicate whether providing care reduces the quality of the relationship of the caregiver with her partner (5%), her children (2%), the elderly (6%) or friends (6%). Another variable identifies individuals who have the impression that caregiving represents a financial burden (7% of the sample). Finally, the last indicator measures whether caregivers have made adjustments in their working life, have had to give up a professional change, or have taken time off to care for the dependent elderly (20% of the sample).

The results show that the negative consequences of caregiving on family and social relationships and on working life have also a strong effect on caregivers' health. When the type of care and role strains are taken into account, the effect of informal support on moral

fatigue and the effect of formal care on depression are no longer significant. It suggests that, for these health indicators, the effect of social support on health is entirely explained by a reorganization of the care provided and by changes in family, social and professional life. However, these results are only meant to give some insights. Indeed, a full understanding of all mechanisms at work would require an in-depth analysis and is outside the scope of this study. Role strains and the type of care are very likely to be endogenous, which makes the different effects difficult to disentangle. For this reason, and for the sake of parsimony, other estimations reported in this paper do not control for these variables.

Table 3. Inclusion of the type of care and role strains in IV linear probability models.

	Caregiving affects health	Sleep disorders	Moral fatigue	Depression	Palpitations, tachycardia
Social support					
Formal care hours	-0.019** (0.009)	-0.019* (0.010)	-0.007 (0.009)	-0.010 (0.009)	-0.010 (0.008)
Informal support	-0.042 (0.047)	-0.075 (0.052)	-0.072 (0.050)	-0.024 (0.032)	-0.053* (0.029)
Role strains					
Relationship elderly	0.234*** (0.084)	0.155** (0.077)	0.163* (0.085)	0.174** (0.070)	0.063 (0.052)
Relationship partner	0.161** (0.082)	0.297*** (0.080)	0.219*** (0.080)	0.074 (0.059)	0.073 (0.057)
Relationship children	0.017 (0.139)	0.186 (0.118)	0.162 (0.161)	0.210* (0.120)	0.068 (0.098)
Relationship friends	0.174** (0.076)	0.073 (0.069)	0.179*** (0.069)	0.045 (0.068)	-0.025 (0.052)
Job-caregiving	0.073** (0.037)	0.133*** (0.046)	0.133*** (0.040)	0.035 (0.034)	0.093** (0.044)
Financial burden	0.025 (0.077)	0.124 (0.096)	0.238*** (0.083)	0.037 (0.054)	0.111 (0.077)
Type of care					
Household chores	-	-	-	-	-
Administrative tasks	0.030 (0.034)	0.029 (0.039)	0.039 (0.035)	0.007 (0.033)	0.037 (0.034)
Health problems	-0.023 (0.034)	-0.002 (0.033)	-0.003 (0.037)	0.027 (0.026)	-0.004 (0.028)
Personal care	0.040 (0.041)	0.025 (0.049)	-0.038 (0.043)	-0.021 (0.032)	-0.004 (0.029)
Mobility	0.014 (0.043)	0.060 (0.050)	0.025 (0.047)	-0.020 (0.045)	0.013 (0.040)
Moral support	-0.012 (0.072)	-0.058 (0.084)	-0.065 (0.078)	0.016 (0.053)	-0.017 (0.050)
Supervision	-0.042 (0.030)	-0.011 (0.036)	0.031 (0.037)	-0.015 (0.034)	0.010 (0.032)
First-stage for FCH					
PAA recipients	0.021*** (0.006)				
Number of daughters	0.055 (0.283)				
First-stage for IS					
PAA recipients	-0.001 (0.001)				
Number of daughters	0.218*** (0.060)				
AP <i>F-test</i> for FCH	13.869***				
AP <i>F-test</i> for IS	13.456***				
Exog. tests, <i>p-value</i>					
Formal care hours	0.026	0.105	0.642	0.170	0.284
Informal support	0.472	0.122	0.123	0.643	0.122
Global	0.060	0.051	0.288	0.330	0.073
Observations	755				

Source: French Disability and Health Survey, 2008-2009.

Field: non-coresiding informal caregivers of dependent elderly persons.

Note: regressions include all the control variables listed in Table 1.

Standard errors are reported in parentheses and clustered at the departmental level (89 clusters).

*: significant at the 10% level, **: 5% level, ***: 1% level.

4.3. Alternative econometric specifications

As underlined in the econometric section, linear probability models present some drawbacks. For instance, in the models run in the previous subsection, some fitted probabilities are strictly negative, which makes little sense¹². In this subsection, I estimate jointly caregivers' health (equation 1, probit model), formal care hours (equation 2, linear model) and informal support (equation 3, linear model) using simultaneous equations models. These models rely on the assumption that the error terms of equations (1), (2) and (3) follow a multivariate normal distribution and are estimated by the maximum likelihood method (cmp package in Stata, Roodman, 2011). Thus, these models allow taking into account the binary nature of health indicators, but require that the joint distribution of error terms be fully parameterized and correctly specified (Lewbel et al., 2012). Table C1 in Appendix C presents the results of naïve probit models and of these simultaneous three-equations models (SEM). They are consistent with those estimated using instrumental variables linear probability models. A one-unit increase in formal care hours reduces the risk that caregiving affects health by 1.7pp (*vs.* 2.0pp in the IV-LPM) and decreases the probability that caregiving leads to sleep disorders and depression by, respectively, 1.8pp (*vs.* 2.2pp in the IV-LPM) and 2.0pp (*vs.* 1.7pp in the IV-LPM). A one-unit increase in the number of informal caregivers reduces the risk of moral fatigue and palpitations/tachycardia by, respectively, 6.6pp (*vs.* 8.2pp in the IV-LPM) and 7.5pp (*vs.* 5.8 pp in the IV-LPM). The only slight difference is that informal support, which was slightly insignificant in previous estimations (p-value of 0.104) becomes significant at the 5% level in the model for sleep disorders (-7.0pp).

So far, a linear effect has been assumed for informal support. However, moving from one to two informal caregivers may be different than moving from nine to ten caregivers. Table C2 in Appendix C provides the results of probit and simultaneous equations models treating informal support as a categorical variable with three levels (only one caregiver: 26% of the sample; two caregivers: 32%; more than two caregivers: 42%). Equation (3) is now supposed to follow an ordered probit. The results confirm that informal support significantly decreases the probabilities of sleep disorders and moral fatigue. By contrast, the effect on the risk of

¹² The proportion of negative fitted probabilities is equal to: 3% for self-reported health, 0% for longstanding illnesses or health problems, 4% for activity limitations, 28% for the probability that caregiving affects health, 7% for physical fatigue, 23% for sleep disorders, 16% for moral fatigue, 22% for depression, 2% for anxiety, stress and overwork, 2% for back problems and 22% for palpitations and tachycardia. The higher is the coefficient of formal care hours, the higher is the proportion of negative fitted probabilities.

palpitations and tachycardia becomes less clear¹³. Table C2 highlights two new significant effects. When there are two informal caregivers (as compared to only one), it decreases the probability that caregiving affects health and the probability of anxiety/stress/overwork by, respectively, 13.3pp and 11.8pp. When there are more than two caregivers, these probabilities are reduced by, respectively, 21.4pp and 9.5pp.

4.4. Subsample analysis

In the main analysis, dependent elderly persons are defined as people aged 65 and older, having difficulties in performing alone at least one activity of daily living (ADL or IADL). In fact, old-age dependency is multidimensional and hard to measure. Similarly, the relation between age and long-term care needs is nontrivial. It changes over time and depends on whether additional years of life are spent in good health or not. To test the sensitivity of the results to the definition of old-age dependency, the model is first re-estimated on non-coresiding caregivers of dependent persons aged 75 and older, instead of 65 and older (subsample 1; 613 observations). Then, the model is re-estimated only on caregivers of elderly with *total disability* in at least one activity of daily living (subsample 2; 645 observations). Finally, in the main sample, a large proportion of non-coresiding caregivers (34%) provide care to dependent elderly persons who receive no formal care. This makes it difficult to assess whether there exist differences according to the number of formal care hours (and not only between caregivers assisted by formal support and the others). To do so, the last estimations focus on caregivers of dependent elderly persons who receive a strictly positive amount of formal care (subsample 3; 499 observations). The results are summarized in Table C3 in Appendix C. They remain unchanged when the definition of old-age dependency is restricted to people who are 75 and older. The effects of formal care are pretty robust¹⁴ across subsamples. By contrast, informal support becomes non-significant when the analysis is restricted to caregivers of dependent elderly with total disability in at least one activity of daily living. It is possible that, for high levels of disability, formal care is more effective in protecting caregivers' health than informal support. Informal support is also not significant for caregivers of elderly dependent people receiving formal care (except for

¹³ The p-value of the correlation coefficient between informal support and health being equal to 0.108, it is difficult to choose between the probit and the simultaneous equations models.

¹⁴ The only difference is that formal care becomes significant in the physical fatigue model and non-significant in the depression model in subsample (3).

palpitations and tachycardia). These persons are probably more dependent than the one in the main sample.

5. Conclusion

The objective of this work was to estimate the effect of social support (informal support and formal home care) on the health of non-coresiding caregivers, while taking into account endogeneity bias with an instrumental variables approach. Contrary to most of the existing studies, which do not take into account the endogeneity of formal care, IV estimations show that a one-unit increase in formal care hours significantly reduces the probability that caregiving affects health (-2.0pp) and decreases the risk that caregiving leads to sleep disorders (-2.2pp) or depression (-1.7pp). Regarding informal support, the number of informal caregivers limits the risk that caregivers feel morally tired (-8.2pp) and that they have palpitations or tachycardia (-5.8pp) or sleep disorders (-7.0pp¹⁵). By contrast, social support seems to have no effect on physical health.

In terms of public policies, improving financial access to formal home care services could protect the health of non-coresiding caregivers. Policies aimed at encouraging informal support and solidarity, not only from family members but also from the social network of dependent elderly people, may also have beneficial health effects.

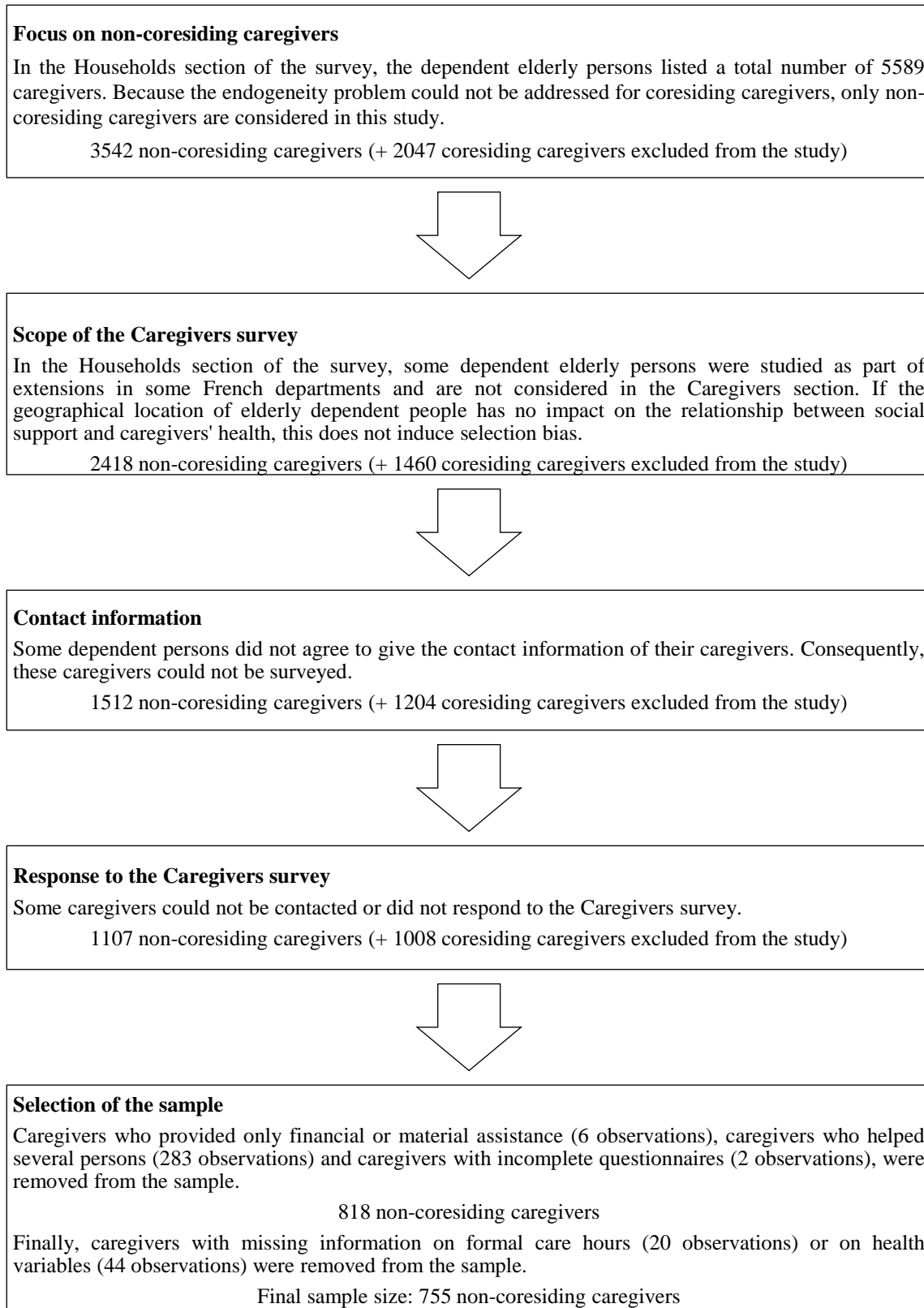
A limitation of this study is that it focuses on non-coresiding caregivers, which limits the generalizability of the results. Future research could investigate the effect of social support on caregiving spouses and other coresiding caregivers, who are generally highly burdened and at higher risk of health problems. Another significant limitation is the use of cross-sectional data. It makes it difficult to fully understand the dynamics of informal care and to capture the effect of the duration of caregiving on caregivers' health. Longitudinal data that allow controlling for baseline health characteristics and observing health transitions and changes in care arrangements and caregivers' life would be of particular interest. Finally, it should also be noted that the measure of mental health in this study is based on specific questions that directly ask caregivers whether informal care has negative health effects. These indicators are interesting in that they focus on how caregivers experience informal care. However, they have not been widely used in the literature, which makes it difficult to compare the present results

¹⁵ This effect is slightly insignificant in the instrumental variables linear probability models (p-value of 0.104) but is significant in the simultaneous equations model and in the subsample of caregivers of dependent elderly persons aged 75 and older.

with existing studies. Thus, it would be interesting to reproduce the analysis with more standard measures of mental health. More generally, further research is needed to fully understand the channels through which social support may affect caregivers' health: is it a direct effect? Is it an indirect effect through other aspects of caregivers' life?

Appendix A. Description of the sample selection.

Figure A1. Description of the sample selection of caregivers.



Source: French Disability and Health Survey, 2008-2009.

Table A1. Comparative statistics on the different samples of caregivers.

Mean or proportion (Std. dev.)	(1) Studied sample of non-coresiding caregivers	(2) Non-coresiding caregivers excluded from the study	(3) Coresiding caregivers excluded from the study	<i>p</i> -value of the mean and proportion equality tests between samples (1) and (2)	<i>p</i> -value of the mean and proportion equality tests between samples (1) and (3)
Care arrangements					
Number of informal caregivers	2.736 (1.832)	2.998 (2.063)	1.748 (1.381)	0.002	0.000
Hours of formal care per week	8.326 (13.496)	6.639 (11.888)	6.021 (14.666)	0.003	0.000
Hours of informal care provided per week by the caregiver (if non-missing)	11.542 (16.299)	11.694 (22.029)	26.693 (25.615)	0.896	0.000
Relationship between the caregiver and the elderly					
- Spouse	0.001 (0.036)	0.003 (0.055)	0.623 (0.485)	0.441	0.000
- Daughter	0.366 (0.482)	0.300 (0.458)	0.149 (0.356)	0.001	0.000
- Son	0.217 (0.413)	0.236 (0.425)	0.107 (0.309)	0.316	0.000
- Sibling	0.052 (0.221)	0.045 (0.208)	0.017 (0.130)	0.481	0.000
- Friend or neighbor	0.101 (0.301)	0.137 (0.344)	0.000 (0.000)	0.012	0.000
- Other relatives or missing information	0.264 (0.441)	0.279 (0.449)	0.105 (0.306)	0.430	0.000
Characteristics of the caregiver					
Age					
- Less than 50 years of age	0.306 (0.461)	0.316 (0.465)	0.154 (0.361)	0.632	0.000
- Between 50 and 60 years of age	0.350 (0.477)	0.338 (0.473)	0.132 (0.338)	0.573	0.000
- Between 60 and 70 years of age	0.197 (0.398)	0.188 (0.391)	0.201 (0.401)	0.572	0.823
- 70 and older	0.117 (0.321)	0.103 (0.305)	0.510 (0.500)	0.334	0.000
- Missing value	0.030 (0.172)	0.055 (0.229)	0.003 (0.058)	0.008	0.000
Female	0.652 (0.477)	0.598 (0.490)	0.521 (0.500)	0.013	0.000
Characteristics of the dependent elderly					
Number of restrictions in ADLs	1.419 (1.666)	1.423 (1.771)	1.888 (2.021)	0.955	0.000
Number of restrictions in IADLs	5.461 (2.910)	5.118 (3.016)	5.724 (3.398)	0.008	0.057
Cognitive limitations	0.458 (0.499)	0.397 (0.490)	0.490 (0.500)	0.005	0.160
Living with a partner	0.208 (0.406)	0.363 (0.481)	0.697 (0.460)	0.000	0.000
Number of daughters	1.789 (1.669)	1.615 (1.568)	1.441 (1.389)	0.015	0.000
Monthly household income					
- Less than 1000 €	0.367 (0.482)	0.288 (0.453)	0.070 (0.255)	0.000	0.000
- 1000/1500 €	0.297 (0.457)	0.280 (0.449)	0.212 (0.409)	0.389	0.000
- 1500/2000 €	0.123 (0.329)	0.165 (0.372)	0.201 (0.401)	0.007	0.000
- More than 2000 €	0.159 (0.366)	0.171 (0.376)	0.430 (0.495)	0.470	0.000
- Missing value	0.054 (0.227)	0.096 (0.295)	0.088 (0.283)	0.000	0.005
Number of observations	755	1663	1460	-	-

Source: Households section of the French Disability and Health Survey, 2008-2009.

Field: caregivers reported by the dependent elderly persons in the Households survey and who fall within the scope of the Caregivers survey.

Appendix B. Effects of control variables.

Table B1. Effects of control variables on caregivers' health.

	Self-perceived health (LPM)	Longstanding illness/health problem (LPM)	GALI (LPM)	Caregiving affects health (IV-LPM)	Physical fatigue (LPM)	Sleep disorders (IV-LPM)	Moral fatigue (LPM)	Depression (IV-LPM)	Anxiety, stress, overwork (LPM)	Back problems (LPM)	Palpitations, tachycardia (IV-LPM)
Care arrangements											
Frequency of care (ref. less than once a week)											
- Daily	0.068 (0.051)	0.003 (0.061)	-0.018 (0.051)	-0.023 (0.092)	0.084* (0.042)	-0.055 (0.078)	0.098** (0.046)	-0.023 (0.072)	0.103* (0.057)	0.120*** (0.044)	-0.012 (0.051)
- Weekly	0.028 (0.050)	0.016 (0.062)	-0.048 (0.044)	-0.080 (0.064)	-0.014 (0.036)	-0.044 (0.061)	0.022 (0.043)	-0.048 (0.046)	0.096** (0.046)	0.069 (0.047)	0.023 (0.041)
Relationship (ref. daughter)											
- Son	-0.001 (0.079)	-0.029 (0.089)	-0.125 (0.075)	0.043 (0.086)	-0.035 (0.043)	0.035 (0.086)	0.003 (0.055)	0.007 (0.064)	0.057 (0.070)	-0.086 (0.069)	0.076 (0.061)
- Friend/neighbor	-0.086 (0.079)	-0.150* (0.084)	-0.170*** (0.063)	-0.129** (0.055)	-0.181*** (0.049)	-0.162** (0.066)	-0.167*** (0.060)	-0.105** (0.045)	-0.141** (0.064)	-0.109 (0.075)	0.018 (0.050)
- Child-in-law	0.028 (0.080)	0.072 (0.080)	0.018 (0.072)	-0.088 (0.072)	-0.120* (0.065)	-0.136** (0.065)	-0.102 (0.070)	-0.122** (0.052)	-0.124* (0.072)	-0.109 (0.073)	-0.040 (0.041)
- Sibling	-0.101 (0.101)	0.018 (0.092)	0.096 (0.102)	-0.043 (0.084)	-0.009 (0.080)	0.001 (0.095)	-0.098 (0.089)	-0.085 (0.065)	-0.025 (0.098)	-0.134* (0.081)	-0.054 (0.061)
- Grandchild	-0.050 (0.086)	0.025 (0.063)	-0.135** (0.064)	-0.186*** (0.072)	-0.105 (0.082)	-0.103 (0.082)	-0.180** (0.074)	-0.085 (0.068)	-0.043 (0.085)	-0.141* (0.084)	-0.033 (0.049)
Socio-demographic controls											
Age (ref. less than 50)											
- 50-60	0.017 (0.037)	0.067 (0.048)	0.044 (0.042)	-0.047 (0.050)	-0.020 (0.037)	-0.026 (0.042)	-0.024 (0.034)	0.005 (0.033)	-0.031 (0.042)	-0.058 (0.046)	-0.041 (0.031)
- 60-70	-0.010 (0.052)	0.138** (0.063)	-0.063 (0.052)	-0.014 (0.056)	-0.015 (0.052)	-0.017 (0.053)	-0.044 (0.044)	0.016 (0.043)	-0.048 (0.057)	-0.047 (0.061)	-0.018 (0.050)
- 70 and older	0.198** (0.085)	0.131 (0.090)	0.029 (0.085)	0.106 (0.083)	0.016 (0.068)	0.090 (0.076)	0.015 (0.069)	0.064 (0.068)	0.003 (0.073)	-0.019 (0.080)	0.097 (0.070)
Female	0.060 (0.060)	-0.057 (0.068)	-0.103* (0.059)	0.087* (0.052)	0.123*** (0.036)	0.138*** (0.052)	0.181*** (0.043)	0.077* (0.042)	0.185*** (0.056)	0.058 (0.054)	0.070 (0.046)
Education level (ref. low)											
- Medium	-0.094* (0.049)	-0.034 (0.054)	-0.036 (0.042)	0.036 (0.034)	0.007 (0.034)	0.004 (0.043)	0.021 (0.036)	0.058* (0.031)	0.034 (0.037)	0.005 (0.041)	0.005 (0.034)

- High	-0.095* (0.053)	-0.075 (0.056)	-0.055 (0.053)	0.133*** (0.049)	0.016 (0.041)	0.068 (0.070)	0.075 (0.046)	0.072 (0.044)	0.066 (0.045)	-0.031 (0.047)	0.030 (0.050)
Work	-0.096** (0.039)	-0.133*** (0.048)	-0.110*** (0.040)	0.019 (0.032)	0.090** (0.037)	-0.011 (0.043)	-0.032 (0.035)	-0.016 (0.028)	-0.006 (0.040)	0.059 (0.043)	-0.033 (0.032)
Monthly household income (ref. less than 1200 €)											-
- 1200-1800 €	-0.084 (0.059)	-0.015 (0.060)	-0.078 (0.057)	0.035 (0.050)	-0.054 (0.056)	-0.062 (0.072)	-0.064 (0.056)	-0.040 (0.051)	0.006 (0.053)	-0.004 (0.054)	0.003 (0.039)
- 1800-2500 €	-0.102 (0.066)	-0.045 (0.074)	-0.050 (0.053)	-0.008 (0.059)	-0.124* (0.067)	-0.036 (0.079)	-0.123** (0.055)	-0.034 (0.063)	-0.076 (0.063)	-0.075 (0.062)	0.016 (0.054)
- 2500-4000 €	-0.202*** (0.063)	-0.049 (0.067)	-0.129** (0.060)	-0.084 (0.060)	-0.064 (0.059)	-0.180** (0.075)	-0.127** (0.053)	-0.156** (0.065)	-0.103 (0.064)	-0.095 (0.065)	-0.103* (0.059)
- More than 4000 €	-0.290*** (0.075)	-0.193** (0.074)	-0.210*** (0.074)	-0.097 (0.084)	-0.168** (0.069)	-0.134 (0.104)	-0.144** (0.062)	-0.125* (0.068)	-0.164** (0.074)	-0.215*** (0.066)	-0.081 (0.056)
<i>Family controls</i>											
Living with a partner	0.095* (0.051)	0.118** (0.056)	-0.022 (0.051)	0.028 (0.050)	0.013 (0.050)	0.084 (0.061)	0.076 (0.051)	0.065 (0.049)	0.006 (0.059)	-0.041 (0.046)	0.067 (0.044)
Having at least one child	0.072* (0.038)	0.040 (0.049)	0.036 (0.049)	-0.015 (0.045)	-0.060 (0.044)	0.067 (0.050)	-0.006 (0.042)	0.055 (0.039)	0.085* (0.044)	0.084 (0.058)	0.091** (0.037)
<i>Dependent elderly</i>											
Number of ADLs	0.019* (0.011)	0.021 (0.014)	0.031*** (0.011)	0.046** (0.022)	0.020 (0.013)	0.045** (0.021)	0.026* (0.014)	0.042** (0.017)	0.010 (0.014)	0.030** (0.012)	0.029* (0.017)
Number of IADLs	-0.008 (0.007)	-0.011 (0.010)	-0.008 (0.007)	0.045* (0.024)	0.005 (0.008)	0.060** (0.025)	0.012 (0.009)	0.027 (0.019)	0.010 (0.009)	-0.002 (0.007)	0.022 (0.016)
Cognitive limitations	-0.011 (0.036)	0.014 (0.042)	-0.084** (0.036)	0.058 (0.044)	0.025 (0.036)	-0.001 (0.040)	0.066* (0.038)	0.041 (0.034)	0.024 (0.043)	0.008 (0.038)	0.005 (0.027)
Living with a partner	-0.036 (0.050)	-0.083* (0.046)	-0.032 (0.044)	-0.077* (0.047)	-0.060 (0.039)	-0.076* (0.044)	-0.072* (0.042)	-0.106** (0.044)	0.017 (0.047)	-0.055 (0.041)	-0.016 (0.038)
Monthly household income (ref. less than 1000 €)											
- 1000/1500 €	-0.054 (0.039)	0.018 (0.046)	-0.007 (0.038)	0.034 (0.051)	0.040 (0.038)	0.063 (0.057)	0.041 (0.037)	0.052 (0.036)	0.038 (0.045)	0.084* (0.048)	0.013 (0.032)
- 1500/2000 €	-0.051 (0.050)	0.018 (0.066)	-0.023 (0.048)	0.047 (0.066)	0.030 (0.043)	0.158** (0.069)	0.100 (0.064)	0.053 (0.054)	0.048 (0.043)	0.039 (0.053)	0.088** (0.040)
- More than 2000 €	0.068 (0.048)	0.141* (0.073)	0.037 (0.055)	0.121 (0.090)	0.092 (0.058)	0.197** (0.093)	0.187*** (0.052)	0.121* (0.067)	0.124** (0.061)	0.156*** (0.057)	0.106** (0.054)
Nursing home beds	4.96e-4 (5.58e-4)	0.001 (0.001)	5.00e-4 (5.36e-4)	-0.001 (0.001)	-6.26e-4 (4.85e-4)	2.39e-4 (8.46e-4)	0.001 (0.001)	3.59e-4 (7.37e-4)	0.001 (0.001)	4.54e-4 (6.29e-4)	1.11e-4 (0.001)
Number of observations	755										

Source: French Disability and Health Survey, 2008-2009.

Field: non-coresiding informal caregivers of dependent elderly persons.

Standard errors are reported in parentheses and clustered at the departmental level (89 clusters).

*: significant at the 10% level, **: 5% level, ***: 1% level.

Appendix C. Alternative specifications and subsample analysis

Table C1. Probit and simultaneous equations models.

Health equation (1) Average marginal effects	Effect of social support on health		Correlation coefficients			
	FCH	IS	Health & FCH	Health & IS	FCH & IS	
Self-perceived health (fair, bad, very bad)	Probit SEM	0.000 (0.001) -0.006 (0.010)	0.002 (0.008) -0.036 (0.047)	- 0.222	- 0.190	- -0.072*
Longstanding illness or health problem	Probit SEM	-0.002 (0.001) -0.008 (0.013)	0.004 (0.011) -0.029 (0.051)	- 0.189	- 0.138	- -0.072*
Global Activity Limitation Indicator (GALI)	Probit SEM	-0.002 (0.001) 0.004 (0.011)	-0.005 (0.009) -0.042 (0.042)	- -0.237	- 0.240	- -0.072*
Caregiving affects health	Probit SEM	-2.79e-4 (0.001) -0.017*** (0.007)	-0.003 (0.009) -0.030 (0.040)	- 0.782***	- 0.122	- -0.072*
Physical fatigue	Probit SEM	1.22e-4 (0.001) -0.007 (0.007)	-0.002 (0.009) -0.059 (0.038)	- 0.268	- 0.335	- -0.072*
Sleep disorders	Probit SEM	-0.002* (0.001) -0.018*** (0.006)	0.002 (0.007) -0.070** (0.034)	- 0.651**	- 0.379*	- -0.072*
Moral fatigue	Probit SEM	-0.002* (0.001) -0.011 (0.007)	-0.004 (0.011) -0.066** (0.033)	- 0.345	- 0.364*	- -0.072*
Depression	Probit SEM	-0.001 (0.001) -0.020*** (0.006)	-0.004 (0.006) -0.022 (0.033)	- 0.819***	- 0.053	- -0.072*
Anxiety, stress, overwork	Probit SEM	-2.26e-4 (0.001) -0.001 (0.011)	-0.017 (0.012) -0.069 (0.044)	- 0.018	- 0.288	- -0.072*
Back problems	Probit SEM	-0.001 (0.001) -0.007 (0.011)	-0.009 (0.008) -0.025 (0.044)	- 0.228	- 0.071	- -0.072*
Palpitations, tachycardia	Probit SEM	-0.001 (0.001) -0.012 (0.009)	-0.011 (0.007) -0.075** (0.030)	- 0.492	- 0.438*	- -0.072*
Formal care hours equation (2)						
Proportion of PAA recipients		0.021*** (0.005)				
Number of daughters		-0.055 (0.281)				
Informal support equation (3)						
Proportion of PAA recipients		-0.002 (0.001)				
Number of daughters		0.247*** (0.062)				
Number of observations		755				

Source: French Disability and Health Survey, 2008-2009.

Field: non-coresiding informal caregivers of dependent elderly persons.

Note: regressions include all the control variables listed in Table 1.

Standard errors are reported in parentheses and clustered at the departmental level (89 clusters).

*: significant at the 10% level, **: 5% level, ***: 1% level.

Table C2. Probit and simultaneous equations models with a categorical variable for informal support.

Health equation (1) Average marginal effects	Effect of social support on health			Correlation coefficients		
	FCH	Two informal caregivers (ref. one caregiver)	> 2 informal caregivers (ref. one caregiver)	Health & FCH	Health & IS	FCH & IS
Self-perceived health (fair, bad, very bad) Probit SEM	-5.67e-5 (0.001) -0.006 (0.010)	-0.065 (0.045) -0.185** (0.082)	0.017 (0.040) -0.248 (0.180)	- 0.198	- 0.324	- -0.054
Longstanding illness or health problem Probit SEM	-0.002* (0.001) -0.008 (0.013)	-0.047 (0.049) -0.115 (0.121)	-0.023 (0.056) -0.167 (0.251)	- 0.170	- 0.173	- -0.054
Global Activity Limitation Indicator (GALI) Probit SEM	-0.002 (0.001) 0.005 (0.011)	0.028 (0.041) -0.067 (0.101)	0.005 (0.043) -0.194 (0.207)	- -0.290	- 0.334	- -0.054
Caregiving affects health Probit SEM	-3.91e-4 (0.001) -0.017*** (0.006)	-0.063** (0.030) -0.133*** (0.048)	-0.055** (0.027) -0.214** (0.098)	- 0.767***	- 0.257	- -0.053
Physical fatigue Probit SEM	-2.32e-6 (0.001) -0.005 (0.008)	-0.065 (0.042) -0.159** (0.067)	-0.047 (0.036) -0.254** (0.128)	- 0.200	- 0.351	- -0.051
Sleep disorders Probit SEM	-0.002* (0.001) -0.018** (0.007)	0.009 (0.034) -0.095* (0.056)	0.035 (0.033) -0.189* (0.110)	- 0.659*	- 0.325	- -0.050
Moral fatigue Probit SEM	-0.003** (0.001) -0.010 (0.006)	-0.114*** (0.040) -0.238*** (0.057)	-0.100*** (0.038) -0.399*** (0.143)	- 0.311	- 0.525	- -0.051
Depression Probit SEM	-0.001 (0.001) -0.020*** (0.006)	-0.023 (0.024) -0.061 (0.053)	-0.010 (0.025) -0.092 (0.106)	- 0.805***	- 0.092	- -0.053
Anxiety, stress, overwork Probit SEM	-3.21e-4 (0.001) 0.001 (0.011)	-0.118** (0.047) -0.198** (0.086)	-0.095** (0.038) -0.271* (0.157)	- -0.065	- 0.272	- -0.052
Back problems Probit SEM	-0.001 (0.001) -0.006 (0.011)	-0.012 (0.044) -0.020 (0.110)	-0.044 (0.042) -0.060 (0.209)	- 0.195	- 0.014	- -0.054
Palpitations, tachycardia Probit SEM	-0.001 (0.001) -0.009 (0.010)	0.005 (0.030) -0.092* (0.051)	-0.017 (0.030) -0.228** (0.098)	- 0.394	- 0.443	- -0.053
Formal care hours equation (2) Proportion of PAA recipients Number of daughters	0.021*** (0.005 or 0.006 depending on the model) Between -0.063 and -0.004 (0.247 to 0.307) depending on the model					
Informal support equation (3) Proportion of PAA recipients Number of daughters	-0.001 (0.001) Between 0.148*** and 0.158*** (0.037 to 0.041) depending on the model					
Number of observations	755					

Source: French Disability and Health Survey, 2008-2009.

Field: non-co-residing informal caregivers of dependent elderly persons.

Note: regressions include all the control variables listed in Table 1.

Standard errors are reported in parentheses and clustered at the departmental level (89 clusters).

*: significant at the 10% level, **: 5% level, ***: 1% level.

Table C3. Effects of social support on health in different subsamples.

Health indicators	Main analysis		(1) Caregivers of dependent persons aged 75 and older		(2) Caregivers of dependent persons with total disability in at least one ADL or IADL		(3) Caregivers of dependent persons who receive formal care (FCH > 0)	
	FCH	IS	FCH	IS	FCH	IS	FCH	IS
Self-perceived health (fair, bad, very bad) (LPM)	-1.43e-6 (0.001)	0.001 (0.009)	-0.001 (0.001)	0.006 (0.009)	2.05e-4 (0.001)	0.003 (0.009)	-1.35e-4 (0.001)	-0.001 (0.011)
Longstanding illness or health problem (OLS)	-0.002 (0.001)	0.003 (0.011)	-0.002 (0.001)	0.014 (0.012)	-0.002 (0.001)	0.007 (0.012)	-0.002 (0.002)	-0.001 (0.014)
Global Activity Limitation Indicator (GALI) (LPM)	-0.002 (0.001)	-0.007 (0.009)	-0.001 (0.001)	-0.003 (0.011)	-0.002 (0.001)	-0.00 (0.010)	-0.003* (0.001)	-0.007 (0.011)
Caregiving affects health (IV- LPM)	-0.020* (0.011)	-0.044 (0.048)	-0.017** (0.009)	-0.032 (0.044)	-0.020** (0.009)	-0.020 (0.050)	-0.017** (0.008)	0.028 (0.045)
Physical fatigue (LPM for samples (1), (2), (3) and IV-LPM for sample (4))	7.90e-5 (0.002)	-0.002 (0.010)	1.80e-4 (0.002)	0.002 (0.010)	-3.06e-4 (0.002)	-2.99e-4 (0.010)	-0.013** (0.006)	-0.002 (0.047)
Sleep disorders (IV-LPM)	-0.022** (0.010)	-0.082 (0.051)	-0.015* (0.008)	-0.090* (0.048)	-0.026** (0.011)	-0.081 (0.060)	-0.011* (0.007)	-0.060 (0.050)
Moral fatigue (IV-LPM for samples (1), (2), (3) and LPM for sample (4))	-0.013 (0.010)	-0.082* (0.047)	-0.011 (0.009)	-0.101** (0.050)	-0.014 (0.011)	-0.078 (0.050)	-0.003* (0.001)	-0.003 (0.013)
Depression (IV-LPM for samples (1), (2), (3) and LPM for sample (4))	-0.017* (0.009)	-0.024 (0.033)	-0.016** (0.007)	-0.033 (0.032)	-0.017* (0.009)	-0.033 (0.037)	-0.002 (0.001)	-0.003 (0.009)
Anxiety, stress, overwork (LPM)	-2.76e-4 (0.002)	-0.016 (0.012)	-6.40e-5 (0.002)	-0.021 (0.013)	-0.003 (0.011)	-0.064 (0.051)	-0.001 (0.001)	-0.011 (0.016)
Back problems (LPM)	-0.001 (0.001)	-0.008 (0.008)	-0.002 (0.001)	0.002 (0.009)	-0.010 (0.010)	0.015 (0.046)	-0.001 (0.002)	-0.012 (0.012)
Palpitations, tachycardia (IV-LPM for samples (1), (2), (4) and LPM for sample (3))	-0.010 (0.009)	-0.058** (0.025)	-0.006 (0.006)	-0.058** (0.025)	-0.001 (0.001)	-0.009 (0.006)	0.001 (0.006)	-0.054** (0.026)
AP <i>F-test</i> for FCH in IV- LPM models	13.124***		12.345***		13.165***		8.370***	
AP <i>F-test</i> for IS in IV- LPM models	15.372***		18.532***		14.759***		9.941***	
Number of observations	755		613		645		499	

Source: French Disability and Health Survey, 2008-2009.

Field: non-coresiding informal caregivers of dependent elderly persons.

Note: regressions include all the control variables listed in Table 1.

Standard errors are reported in parentheses and clustered at the departmental level (89 clusters).

In this table, only one model is presented for each health indicator and subsample, based on the p-values of exogeneity tests.

*: significant at the 10% level, **: 5% level, ***: 1% level.

Acknowledgements

I would like to thank the two anonymous reviewers for their constructive comments. I also thank Thomas Barnay (University of Créteil), Carole Bonnet (French Institute for Demographic Studies), Eric Bonsang (University Paris-Dauphine), Robin Hege (Mutualité Française) and Jérôme Wittwer (University of Bordeaux) for their advice on previous versions of this work. This paper has also benefitted from comments by participants at the *Journées des Économistes de la Santé Français*, at the TEPP Conference and at many seminars (at the Liraes laboratory, the Sesstim laboratory, at Irdes, at the French Institute for Demographic Studies, and the Munich Center for the Economics of Aging).

References

- Angrist, J.D., 2009. Mostly harmless econometrics: an empiricist's companion. Princeton University Press, Princeton.
- Arrighi, Y., Davin, B., Trannoy, A., Ventelou, B., 2015. The non-take up of long-term care benefit in France: A pecuniary motive? *Health Policy* 119, 1338–1348. <https://doi.org/10.1016/j.healthpol.2015.07.003>
- Barnay, T., Juin, S., 2016. Does home care for dependent elderly people improve their mental health? *Journal of Health Economics* 45, 149–160. <https://doi.org/10.1016/j.jhealeco.2015.10.008>
- Bauer, J.M., Sousa-Poza, A., 2015. Impacts of Informal Caregiving on Caregiver Employment, Health, and Family. *Journal of Population Ageing* 8, 113–145. <https://doi.org/10.1007/s12062-015-9116-0>
- Beliard, A., Billaud, S., Perrin-Heredia, A., Weber, F., 2012. Circulation de l'enquêteur, relations familiales et aide informelle : Post-enquête qualitative sur les situations de handicap, la santé et l'aide aux personnes en situation de handicap DREES-CNSA, halshs-00813125.
- Berglund, E., Lytsy, P., Westerling, R., 2015. Health and wellbeing in informal caregivers and non-caregivers: a comparative cross-sectional study of the Swedish general population. *Health and Quality of Life Outcomes* 13. <https://doi.org/10.1186/s12955-015-0309-2>
- Bobinac, A., van Exel, N.J.A., Rutten, F.F.H., Brouwer, W.B.F., 2011. Health effects in significant others: separating family and care-giving effects. *Medical decision making: an international journal of the Society for Medical Decision Making* 31, 292–298. <https://doi.org/10.1177/0272989X10374212>
- Bobinac, A., van Exel, N.J.A., Rutten, F.F.H., Brouwer, W.B.F., 2010. Caring for and caring about: disentangling the caregiver effect and the family effect. *Journal of health economics* 29, 549–556. <https://doi.org/10.1016/j.jhealeco.2010.05.003>
- Bolin, K., Lindgren, B., Lundborg, P., 2008. Informal and formal care among single-living elderly in Europe. *Health economics* 17, 393–409. <https://doi.org/10.1002/hec.1275>
- 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. <https://doi.org/10.1016/j.jhealeco.2008.09.002>
- Burton, L.C., Zdaniuk, B., Schulz, R., Jackson, S., Hirsch, C., 2003. Transitions in spousal caregiving. *The Gerontologist* 43, 230–241.
- Byrne, D., Goeree, M.S., Hiedemann, B., Stern, S., 2009. Formal home health care, informal care, and family decision making. *International Economic Review* 50, 1205–1242. <https://doi.org/10.1111/j.1468-2354.2009.00566.x>
- Calvo-Perxas, L., Vilalta-Franch, J., Litwin, H., Turró-Garriga, O., Mira, P., Garre-Olmo, J., 2018. What seems to matter in public policy and the health of informal caregivers? A cross-sectional study in 12 European countries. *PLOS ONE* 13, e0194232. <https://doi.org/10.1371/journal.pone.0194232>
- Charles, K.K., Sevak, P., 2005. Can family caregiving substitute for nursing home care? *Journal of Health Economics* 24, 1174–1190. <https://doi.org/10.1016/j.jhealeco.2005.05.001>
- Charpin, J.-M., Tlili, C., 2011. Perspectives démographiques et financières de la dépendance.
- Coe, N.B., Van Houtven, C.H., 2009. Caring for mom and neglecting yourself? The health effects of caring for an elderly parent. *Health economics* 18, 991–1010. <https://doi.org/10.1002/hec.1512>

- Colombo, F., Llana-Nozal, A., Mercier, J., Tjadens, F., OECD (Eds.), 2011. Help wanted? providing and paying for long-term care, OECD health policy studies. OECD, Paris.
- Colvez, A., Joël, M.-E., Ponton-Sanchez, A., Royer, A.-C., 2002. Health status and work burden of Alzheimer patients' informal caregivers. *Health Policy* 60, 219–233. [https://doi.org/10.1016/S0168-8510\(01\)00215-9](https://doi.org/10.1016/S0168-8510(01)00215-9)
- 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. <https://doi.org/10.1007/s10680-014-9336-7>
- Do, Y.K., Norton, E.C., Stearns, S.C., Van Houtven, C.H., 2015. Informal Care and Caregiver's Health. *Health Economics* 24, 224–237. <https://doi.org/10.1002/hec.3012>
- Ducharme, F., Lévesque, L., Zarit, S.H., Lachance, L., Giroux, F., 2007. Changes in health outcomes among older husband caregivers: a one-year longitudinal study. *International Journal of Aging & Human Development* 65, 73–96.
- Grossman, M., 1972. On the concept of health capital and the demand for health. *The Journal of Political Economy* 80, 223–255.
- HCFEA, 2017. La prise en charge des aides à l'autonomie et son incidence sur la qualité de vie des personnes âgées et de leurs proches aidants. HCFEA (Haut Conseil de la famille, de l'enfance et de l'âge).
- Hirst, M., 2005. Carer distress: A prospective, population-based study. *Social Science & Medicine* 61, 697–708. <https://doi.org/10.1016/j.socscimed.2005.01.001>
- Kaschowitz, J., Brandt, M., 2017. Health effects of informal caregiving across Europe: A longitudinal approach. *Social Science & Medicine* 173, 72–80. <https://doi.org/10.1016/j.socscimed.2016.11.036>
- Lambert, S.D., Bowe, S.J., Livingston, P.M., Heckel, L., Cook, S., Kowal, P., Orellana, L., 2017. Impact of informal caregiving on older adults' physical and mental health in low-income and middle-income countries: a cross-sectional, secondary analysis based on the WHO's Study on global AGEing and adult health (SAGE). *BMJ Open* 7, e017236. <https://doi.org/10.1136/bmjopen-2017-017236>
- Lawton, M.P., Moss, M., Kleban, M.H., Glicksman, A., Rovine, M., 1991. A two-factor model of caregiving appraisal and psychological well-being. *Journal of Gerontology* 46, P181-189.
- Lee, M., Yoon, E., Kropf, N.P., 2007. Factors affecting burden of South Koreans providing care to disabled older family members. *International Journal of Aging & Human Development* 64, 245–262.
- Lewbel, A., Dong, Y., Yang, T.T., 2012. Comparing features of convenient estimators for binary choice models with endogenous regressors: Comparing features of convenient estimators. *Canadian Journal of Economics/Revue canadienne d'économique* 45, 809–829. <https://doi.org/10.1111/j.1540-5982.2012.01733.x>
- Lilly, M.B., Laporte, A., Coyte, P.C., 2007. Labor market work and home care's unpaid caregivers: a systematic review of labor force participation rates, predictors of labor market withdrawal, and hours of work. *The Milbank Quarterly* 85, 641–690. <https://doi.org/10.1111/j.1468-0009.2007.00504.x>
- Marbot, C., Roy, D., 2015. Projections du coût de l'APA et des caractéristiques de ses bénéficiaires à l'horizon 2040 à l'aide du modèle Destinie. *Economie et Statistique* 185–209.
- Moon, H., Dilworth-Anderson, P., 2015. Baby boomer caregiver and dementia caregiving: findings from the National Study of Caregiving. *Age and Ageing* 44, 300–306. <https://doi.org/10.1093/ageing/afu119>
- OECD, 2013. OECD Guidelines on Measuring Subjective Well-being. OECD Publishing.

- O'Reilly, D., Connolly, S., Rosato, M., Patterson, C., 2008. Is caring associated with an increased risk of mortality? A longitudinal study. *Social Science & Medicine* 67, 1282–1290. <https://doi.org/10.1016/j.socscimed.2008.06.025>
- Oshio, T., 2014. The association between involvement in family caregiving and mental health among middle-aged adults in Japan. *Social Science & Medicine* 115, 121–129. <https://doi.org/10.1016/j.socscimed.2014.06.016>
- Pearlin, L.I., Mullan, J.T., Semple, S.J., Skaff, M.M., 1990. Caregiving and the Stress Process: An Overview of Concepts and Their Measures. *The Gerontologist* 30, 583–594. <https://doi.org/10.1093/geront/30.5.583>
- Pinquart, M., Sörensen, S., 2007. Correlates of physical health of informal caregivers: a meta-analysis. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences* 62, P126-137.
- Pinquart, M., Sörensen, S., 2003. Differences between caregivers and noncaregivers in psychological health and physical health: A meta-analysis. *Psychology and Aging* 18, 250–267. <https://doi.org/10.1037/0882-7974.18.2.250>
- Raina, P., McIntyre, C., Zhu, B., McDowell, I., Santaguida, L., Kristjansson, B., Hendricks, A., Massfeller, H., Chambers, L., 2004. Understanding the influence of the complex relationships among informal and formal supports on the well-being of caregivers of persons with dementia. *Canadian Journal on Aging = La Revue Canadienne Du Vieillissement* 23 Suppl 1, S49-59.
- Roodman, D., 2011. Fitting fully observed recursive mixed-process models with cmp. *The Stata Journal* 11, 159–206.
- Schmitz, H., Westphal, M., 2015. Short- and medium-term effects of informal care provision on female caregivers' health. *Journal of Health Economics*. <https://doi.org/10.1016/j.jhealeco.2015.03.002>
- Schulz, R., Beach, S.R., 1999. Caregiving as a risk factor for mortality: the Caregiver Health Effects Study. *JAMA: the journal of the American Medical Association* 282, 2215–2219.
- Schulz, R., Mendelsohn, A.B., Haley, W.E., Mahoney, D., Allen, R.S., Zhang, S., Thompson, L., Belle, S.H., 2003. End-of-Life Care and the Effects of Bereavement on Family Caregivers of Persons with Dementia. *New England Journal of Medicine* 349, 1936–1942. <https://doi.org/10.1056/NEJMsa035373>
- Schulz, R., Sherwood, P.R., 2008. Physical and Mental Health Effects of Family Caregiving: AJN, *American Journal of Nursing* 108, 23–27. <https://doi.org/10.1097/01.NAJ.0000336406.45248.4c>
- Seltzer, M.M., Li, L.W., 2000. The dynamics of caregiving: transitions during a three-year prospective study. *The Gerontologist* 40, 165–178.
- Smith, G.R., Williamson, G.M., Miller, L.S., Schulz, R., 2011. Depression and quality of informal care: A longitudinal investigation of caregiving stressors. *Psychology and Aging* 26, 584–591. <https://doi.org/10.1037/a0022263>
- Spillman, B.C., Long, S.K., 2009. Does high caregiver stress predict nursing home entry? *Inquiry: A Journal of Medical Care Organization, Provision and Financing* 46, 140–161.
- Staiger, D., Stock, J.H., 1997. Instrumental variables regression with weak instruments. *Econometrica* 65, 557–586.
- Stock, J., Yogo, M., 2005. Testing for weak instruments in linear IV regression., in: *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*. Cambridge University Press, New York, pp. 80–108.
- Van den Berg, B., Fiebig, D.G., Hall, J., 2014. Well-being losses due to care-giving. *Journal of Health Economics* 35, 123–131. <https://doi.org/10.1016/j.jhealeco.2014.01.008>

- Van Houtven, C.H., Norton, E.C., 2004. Informal care and health care use of older adults. *Journal of health economics* 23, 1159–1180. <https://doi.org/10.1016/j.jhealeco.2004.04.008>
- Van Houtven, C.H., Wilson, M.R., Clipp, E.C., 2005. Informal Care Intensity and Caregiver Drug Utilization. *Review of Economics of the Household* 3, 415–433. <https://doi.org/10.1007/s11150-005-4942-0>
- Vitaliano, P.P., Zhang, J., Scanlan, J.M., 2003. Is Caregiving Hazardous to One's Physical Health? A Meta-Analysis. *Psychological Bulletin* 129, 946–972. <https://doi.org/10.1037/0033-2909.129.6.946>
- Vlachantoni, A., Evandrou, M., Falkingham, J., Robards, J., 2013. Informal care, health and mortality. *Maturitas* 74, 114–118. <https://doi.org/10.1016/j.maturitas.2012.10.013>
- White-Means, S.I.I., 1997. The demands of Persons with disabilities for home health care and the economic consequences for informal caregivers. *Social Science Quarterly* 78, 955–971.
- Wilson, M.R., Houtven, C.H., Stearns, S.C., Clipp, E.C., 2007. Depression and Missed Work among Informal Caregivers of Older Individuals with Dementia. *Journal of Family and Economic Issues* 28, 684–698. <https://doi.org/10.1007/s10834-007-9081-8>
- Wooldridge, J.M., 2002. *Econometric analysis of cross section and panel data*. MIT Press, Cambridge, Mass.
- Yaffe, K., Fox, P., Newcomer, R., Sands, L., Lindquist, K., Dane, K., Covinsky, K.E., 2002. Patient and caregiver characteristics and nursing home placement in patients with dementia. *JAMA* 287, 2090–2097.
- Yuda, M., Lee, J., 2016. Effects of Informal Caregivers' Health on Care Recipients: Effects of Informal Caregivers' Health on Care Recipients. *The Japanese Economic Review* 67, 192–210. <https://doi.org/10.1111/jere.12102>