Trade-offs between formal and informal care in Spain

Sergi Jiménez-Martín♦ Cristina Vilaplana Prieto♣

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1. Introduction

The remarkable growth of older population has forced long term care to the front ranks of the social policy agenda. Understanding the factors that determine the type and amount of formal care is important for predicting use in the future and developing long-term policy.

Formal care is defined as paid or free of charge attention provided by public or private institutions and non profit-making organisations, whereas informal care refers to the attention provided by family members, friends and neighbours. Some authors have considered that informal care is a source of better-quality care because of affective linkages and because it helps the patient to continue living in the community (Keating et al., 1997).

The growth of elder population cohorts during last decades has implied an increase in the proportion of people who suffer mental or physical disabilities for doing daily living activities. Graph 1 represents the evolution of the fraction of population older than 40 years. The cohort of +65 years has steadily grown since 1900, and in 2007 it represents 16,67% of total population[1]. The cohort of +80 years has increased from 0,6% in 1900 to 4,54% in 2007. These facts are explained by the decrease in mortality rate, both infant mortality and the corresponding to the group of +70 years[2].

Graph 2 shows that the participation of ageing expenditure with respect to GDP[3], health expenditure and social expenditure has increased, basically since 1999. However, Spanish economic effort is not enough when compared with figures of other European countries (Table A of the Appendix). Ageing expenditure

♦ Universitat Pompeu Fabra (Barcelona) y FEDEA.
♣ Universidad Católica San Antonio de Murcia y FEDEA.

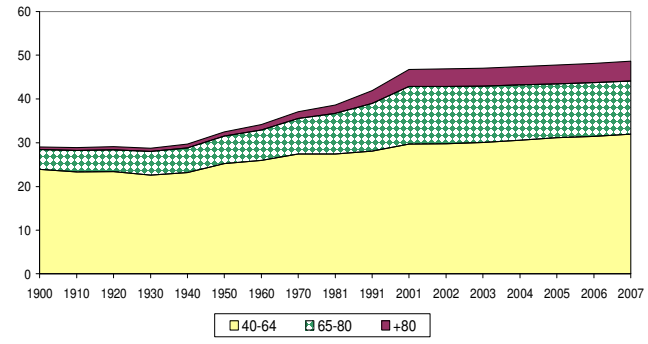
[1] Life expectancy at birth in 2005 was 83,48 (female) and 76,96 (male) with respect to 35,7 (female) and 33,9 (male) in 1900.

[2] Infant mortality rate has decreased from 43,7 in 1960 to 3,77 in 2006. Life expectancy after 65 years has increased from 15,3 (female) and 13,1 (male) in 1960 to 21,3 (female) and 17,3 (male) in 2005.

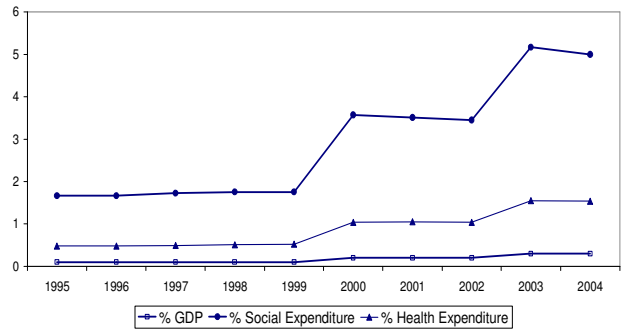
[3] The indicator is defined as the percentage share of social protection expenditure devoted to old age care in GDP. These expenditures cover care allowance, accommodation, and assistance in carrying out daily tasks.

to GDP ratio is lower than the average EU-25. Although the dependency ratio is slightly lower than the average (24,2 with respect to 25,3 for EU-25), this difference is not large enough to explain the gap observed in expenditure. Spain is positioned in the group of countries with lower ageing expenditure (with Germany, France and Portugal, 0,3%; Ireland, 0,2%; Greece and Italy, 0,1%) and very far from Austria (0,7%), United Kingdom (1%), Denmark (1,1%) and Sweden (2,6%).

Graph 1. Evolution of Spanish population +40 years, 1900-2007 (%)



Graph 2. Evolution of ageing expenditure in Spain



Some studies have analysed informal care from the perspective of public expenditure, that is, they have praised its advantages as a free of charge source of care. Nonetheless, they have ignored other type of costs associated with informal care, such as, psychological effects, loss of leisure time, decrease in labour supply and worsening of household finance (Fast et al., 1999; Van Exel et al., 2004; Hirst, 2005).

Some investigations (Zarit and Eggenbeen, 1995) have suggested that is would be desirable to force back public health expenditure through a redirection of dependent long-term care from the public sphere to the family core. Nevertheless, the family ability to carry most of the burden may be limited due to several sociodemographic changes, such as, smaller family size[4], increasing female participation in labour market[5] and higher divorce rates[6]. However, in future years, immigration will play an important role in the provision of formal care. In fact, between 1994 and 2004, (*Encuesta de Apoyo Informal*) the percentage of private household employees has increased form 2,29% to 8,89%, from which 30,1% (in 2004) where not Spanish.

In the economic literature about care to dependent people, there is a vexing question of whether formal caregiving hours (provided by clinical staff, nurses, physiotherapists) compensate, substitute, complement or reinforce informal caregiving hours provided by family members, friends or neighbours (Glazer, 1990;

[4] Birth rate (for 1000 inhabitants) has decreased from 18,76 in 1975 to 10,92 in 2006, with a minimum of 9,19 in 1998.

[5] According to *Encuesta de Población Activa*, female participation rate has increased from 28,80% in 1976 to 49,37% in the fourth term of 2007.

[6] Divorce rate (for 100 marriages) has increased from 4,7 in 1980 to 21,6 in 2003.

Chappell and Blandford, 1991; Mayall, 1993; Bass and Noelker, 1994; Denton, 1997). Four models for the relation between formal and informal care may be distinguished.

The compensatory model (Cantor, 1979) postulates the replacement of one care system by the other, but following an order of preference. The dependent individual only resorts to the use of formal care (social care services or specialized private employees) when all sources of informal care have been exhausted. However, few empirical studies have confirmed this theory (Penning, 1990; Cantor, 1991; Chappell, 1991).

The second model is the substitution one (Greene, 1983), according to which as the patient receives formal care, the family decreases the amount of informal care provided. This argument is used by those economists who propose formal care rationing with the aim of controlling public health expenditure. But applied papers have found that, in most cases, family do not give up providing care when receive formal aid (Archbold, 1982; Moscovice et al., 1988; Edelman and Hughes, 1990; Tennstedt et al., 1993).

The third model is called task-specificity and was proposed by Litwak (1985). According to this model, formal and informal care are different but complementary. It sustains that informal caregiver (a woman in most cases) is more suitable for day-to-day care (washing, dressing and undressing, eating and drinking) while formal care is set aside for more technological tasks. In contrast to compensatory model, it is the nature of the task and not the will of the patient what determines who is the most appropriate for providing care (the family or the skilled professional). Several papers, such as Penning and Chappell (1990) and Fisher and Eustis (1994) have upheld this model.

Finally, the complementary model was proposed by Chappell and Blandford (1991) and implies a merge of compensatory and substitution models. When dependent needs exceed informal care resources, formal care provide the necessary support (Bass and Noelker, 1989; Edelman and Hughes, 1990; Denton, 1997). For example, when informal caregivers need to make use of respite services. Chappell and Blandford (1991) spell out two circumstances in which formal care is used in conjunction with informal care: when medical requirements are very complex and when the family goes through a critical situation. In this manner, formal care becomes involved when informal caregiver realizes that he cannot deal with everything by himself.

In this paper we have the relation between formal and informal care in Spain. The structure of the paper is the following: in section 2 we describe the dataset and descriptive statistics. In section 3, we analyse the type of care choice (formal, informal or both of them). Next, in section 4 we study the relation between

hours an type of care by estimating a selection bias model as in Heckman (1979), where the selection criteria is given by a multinomial logit model (Bourguignon et al., 2004). Afterwards, in section 5, we consider in what situation is more probable that a problem of unmet personal or technical needs may arise. Finally, we conclude with some implications from the Law of Autonomy Promotion and Attention to Dependent People.

2. Data

The dataset consists of information from the Disabilities, Deficiencies and Health Status Survey (DDHSS) drew up by the National Institute of Statistics in 1999, with the objective of estimating the amount of Spanish resident people who suffer any disability and identifying risk factors associated with health status.

To design the sample we have followed a two-step procedure. First, using the Disabilities and Deficiencies Questionnaire we select those who answer in the affirmative to the question: "Do you suffer any kind of disability?", understanding as disability "a limitation for performing daily living activities that is going to last more than one year". Second, we focus on individuals older than 40 years. Although many studies have focussed on elder population (+65 years) (Ettner, 1996; Charmichael and Charles, 2003), we have observed that the amount of "young" people with disabilities is not negligible[7]. The final sample (+40 years with any disability) contains 17.442 observations.

We have defined three binary dependent variables: "informal care" (IC) that takes the value 1 if the individual only receives help from relatives (co-resident or not), friends or neighbours (6.216 observations); "formal care" (FC) if the individual only receives help from employees, public administration or private organizations[8] (562 observations) and "formal-informal care" (FIC) if the individual receives help from both types of care (1.002 observations). This implies that there are 9.662 individuals who suffer a disability but do not need or receive any type of care[9].

Respondents who declare to suffer any disability are required to give more details. There is a list of 36 disabilities, which, for the purpose of this paper, have been categorized, in personal or instrumental

[7] There are 1.442 individuals (584 male, 838 female) aged between 40 and 64 years old, who need a caregiver for doing daily living activities. In fact, some evidence have suggested the earlier onset of some degenerative diseases. According to data from *Fundación Alzheimer España* and *Asociación Parkinson Madrid*, around 2,5% of Alzheimer patients are younger than 55 years old and approximately 20% of Parkinsonism' cases are diagnosed before 50 years old..

[8] The survey indicates if formal care provider belongs to public social services, has been hired from a private firm or is a household employee. In the last case, we do not know if the individual has any specific knowledge (nursery) or he is only entitled to the surveillance of the patient,

[9] However, 87% of the individuals who do not receive any type of care only suffer moderate severe disabilities.

disabilities for daily living activities (PADL and IADL, respectively)[10], following the recommendations of the *Federal Interagency Forum on Aging Related Statistics* (2000). In any case, the interviewed must indicate the degree of severity and the expected forecast associated to each disability. Preliminary analysis suggests that there isn't a linear relation between the number of disabilities and number of caregiving hours. For that reason, we have defined six binary variables (3 for PADL and 3 for IADL) that take the value 1 if the individual suffers two, three or more than three disabilities.

For any disability, the interviewed is asked if he has applied for any kind of personal or technical aid. If this is the case, the individual may not be satisfied either because nobody answered to his application or because the quantity or quality of the aid received was not as expected. In both cases, we will consider that there is a (technical or personal) unmet need. Apart from information about disabilities, the survey contains a list of specific pathologies, from which we have selected (mental illness[11], arthritis, muscular, dystrophy, multiple sclerosis, stroke, head injury[12], dementia and Parkinsonism), due to the important limitations that they usually involve for doing daily living activities.

With respect to carereceiver's sociodemographic characteristics, we have considered those variables that may have an influence on the type of care received, either because they directly affect health status (age and sex) or because they have implications over the generation of informal networks (marital status, number of household adults). We have also included information about monthly household income[13], given that some authors have found a positive correlation between income and availability of formal care (Branch et al., 1981).

With the aim of taking into account geographical differences in the provision of formal care, and given that the DDHSS does not include information about the price of formal care received, we have defined a set of dummy variables to denote the place of residence and the size of the municipality.

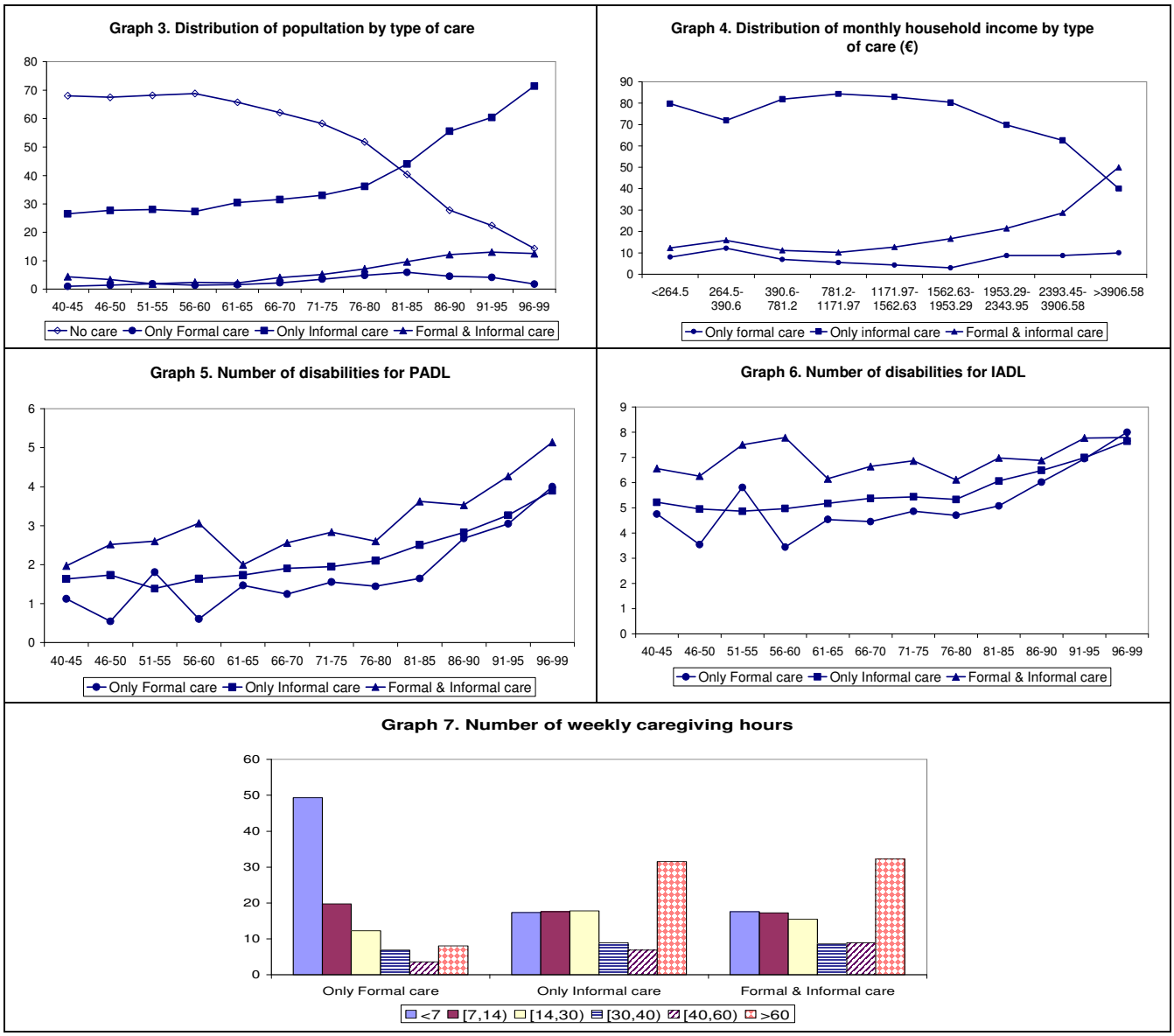
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[10] PADL include disabilities for getting up and down, standing up, moving inside home, washing oneself, controlling physical needs, dressing and undressing, eating and drinking. IADL include disabilities for carrying not heavy objects, using utensils and tools, clutching small things with hands and fingers, moving without way of transport, driving own vehicle, do the shopping, cooking, washing and ironing clothes, cleaning the house and looking after the well-being of the family.

[11] Mental illnesses refer to bipolar disorders, depression, anxiety, stress, schizophrenia, whereas dementia is related to all possible kinds of dementia (senile, Alzheimer, due to AIDS, brain tumour, brain damage).

[12] Cerebrovascular diseases are the second cause of death for male and the first one for female, according to the *Fundación Española de Enferemedades Neurológicas*.

[13] We have also included as explanatory variable the patient's level of education, since education may be considered a proxy of social status.



In Graph 3 we appreciate that as people get older the percentage of non-dependent decrease and at the same time, there is an increase in the fraction of people who need some type of care. The amount of individuals who receive IC raises from 24% at 40 years old to 70% at 90. In the second place, FIC represents 12,5% at the age of 90. By contrast, the trend for FC is increasing from 60 to 80 years old (5,95%) and decreasing afterwards (1,79% for the interval 96-99 years).

The distribution of the type of care by level of household income (Graph 4) shows that for high income levels, IC decreases while FIC increases. In fact, for the intervals (2.343,95 €-3.906,58 €] and more than 3.906,58€, the percentage of FIC raises from 28,5% to 50%. On the other side, low-income households [264,5 €, 390,6 €] attain the maximum level of FC. It is convenient to clarify that poorest and richest

households do not use the same kind of FC. Wealthiest families prefer to hire household employees and professionals of the private sector[14].

The average number of disabilities PADL and IADL (Graphs 5 and 6, respectively) increases with age and is much higher for dependent people who receive FIC. In Graph 6, we also observe that the distance among the three types of care decreases as the dependent becomes older.

Graph 7 represents the distribution of caregiving hours by type of care[15]. It is remarkable that very dependent people (those who receive more than 60 caregiving hours per week) have opted for IC or FIC, while people who receive less than 7 caregiving hours per week have mainly chosen FC.

3. Descriptive statistics

Table B of Appendix show detailed descriptive statistics for the explanatory variables. Very old dependent people (aged 80-89 or 90-99 years old) are more prone to receive FIC. Not married dependent people (single, widowed, separated/divorced) usually receive FC.

With respect to educational level, most dependent people who receive IC have only finished elementary education (59%) and only 1,48% have obtained a college degree. The same figures for dependent people with FC are 48,93% and 8,89%. It seems that as the educational level increases, it is more probable to get into FC. As we will see later, this may be because either education is a proxy variable for the level of income, or because as people become more educated, it turns out easier to be informed about services available for dependent people.

For the three types of care, more than 30% of dependent people are receiving a retirement benefit and those who receive IC show the highest concentration of disability benefits (both contributive (19%) and non-contributive (11%)).

FIC is mainly devoted to dependent belonging to high-income households (more than 1.562,63 €/month), while IC is concentrated among medium-low income households (390,66 € to 1.562,63 € per month). On the other hand, the highest fraction of FC appears in very low-income households (264,45 € to 390,66 €)[16]. With respect to the size of municipality, the smaller the township size, the higher the percentage of dependent with IC. Moreover, families with children are more inclined to take care of a dependent

[14] As a matter of fact, the household's employees rate for the hole sample is 0,71% whereas it goes up to 20% for households with more than 2.343,95 €/month.

[15] For the case of combination of formal and informal care, we only know the total amount of caregiving hours, but do not know how they are divided between FC and IC. Furthermore, we do not know how many hours are devoted to each type of disability (PADL and IADL).

[16] This may be due to the fact that public social services for dependent people do not only take into account the severity or physical and mental disabilities, the availability of close relatives, and the living conditions but also personal financial resources.

relative. This fact may point to the existence of intergenerational caregiving networks (grandparents that live together with adults and children), and the substitution of FC by IC.

Regarding the list of pathologies considered, dependent without any type of care show the lowest percentages for all the illnesses. For the three types of care, stroke and arthritis have the highest incidence rate. Carereceivers with FIC show the highest percentage for mental illnesses (25,88%), head injury (12,17%), dementia (13,27%), change of house (12,17%, to receive better medical treatment or have an adapted dwelling) and rehabilitation treatment (23,65%). We could consider that when the family receives information/advice (from doctors, nurses or therapist) about the type of aids they may apply for (home centres, day centres, respite centres, adapted transport…) and method of financing (free of charge, combined payment) the probabilities of applying for one of these aids increase considerably.

As for disabilities, carereceivers with IC suffer mainly disabilities for moving outside home (86%), doing housework (78%), maintaining body postures (51%) and taking care of oneself (46%). The incidence of disabilities for relating to people (30%) and communicating (30%) is much higher among those who receive FIC. Among those who receive FC, disability for doing housework is the most prevailing one (91%). This circumstance may be explained because in many Autonomous Communities, Home Care service[17] emphasizes houseworking rather than personal care.

Dependent people with FIC suffer higher number of PADL disabilities (3,07), followed by those with IC (2,15) and finally by those with FC (1,64). The same ranking is obtained when looking at IADL disabilities (6,78, 5,61, 4,97, respectively).

With respect to the degree of severity, FIC carereceivers exhibit disabilities with the highest degree of severity (98% are very severe, 95% can not do the activity), and for the three types of care, around 70% of carereceivers suffer disabilities with unfavourable forecast. On the other side, people who do not need a carereceiver generally report the lowest percentage of disabilities with stable or unfavourable forecast.

Concerning unmet needs, the percentage of unmet technical needs is approximately the same for the three types of care (around 3%). For the case of FIC, the rate of unmet personal needs is almost three times (10,38%) the rate of unmet technical needs (3,99%).

[17] Home Care Service is a program for helping dependent people and their families, without substituting the role of the informal caregiver. It is divided into four different areas: houseworking (shopping, cleaning the house, washing the clothes), personal care, psychological attention (to improve self-esteem and lower dependency from others) and attention to family members (strengthen family cohesion). With the exception of País Vasco, Cataluña and Rioja, in the rest of Autonomous Communities, most of the time is devoted to houseworking rather than to personal care activities (*Observatorio de Personas Mayores*, 2000).

4. Type of care received

Given the binary nature of the care variables defined, we have estimated a logistic regression with the objective of identifying which variables become a force on the reception of each type of care (odds ratios are shown in Table C of the Appendix[18]).

According to sex, the probability of FC (FIC) decreases by 56,88% (35,55%) for male, although sex is not a significant variable for IC.[19] Age is a meaningful variable for the reception of FC because probability increases by 572% from 40-49 years old to 90-99 years. Nonetheless this variable is not significant for IC, which is absolutely logical on account of the individual does not need to fulfil any legal requirement[20].

The higher level of education achieved, the lower probability of receiving IC (-32,57% for high school and -61,30% for college degree). In this sense, education of the dependent individual (which is also related with the level of education of his environment) may act as a measure of the cost of applying for[21] social services for people with disabilities.

Married dependent people show lower probability of receiving only CF. Some studies (Chappell and Blandford, 1991) consider that having a couple guarantees the reception of informal care. However, IC may be offered by other members of the family, such as adult children (Stoller and Earl, 1983). In fact, the estimated coefficients indicate that each adult member increase the probability of receiving IC by 34% (*Compensatory model*).

The three lowest intervals of monthly household income present higher probabilities of receiving only IC (104%, 44% and 35%, respectively). On the other hand, the probability of receiving FC (or FIC) increases by 219% (402%) for the interval [2.343,95 €, 3.906,58 €), and at the same time, the probability of receiving only IC decreases by 70,41%. It should be pointed that FC received by lower income intervals usually comes from public social services (day centres, home care service), whereas higher income intervals mainly prefer to hire private employees (that may or may not co-reside with the dependent).

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[18] It has not been possible to include the variable "kindship between caregiver and carereceiver" because that information was not available for half of the observations.

[19] This result is consistent with the difference of life expectancy between men and women. In 1999, female life expectancy was 6,87 years longer than for male (82,22 years for female opposite to 75,35 years for male). Thence, women are more prone to take care of male couple and to live longer than them. In case that older female could not receive attention from her family, they would be attended by FC.

[20] Age is a very important factor when applying for formal care. For example, in the application for day centres is required a minimum of 65 years in Aragón, Asturias, Castilla León, Cataluña, Extremadura, Galicia, Madrid, Navarra and Vizcaya, and 60 years for the rest of regions.

[21] For example, there is plenty of information about social services for dependent people available through Internet (*Imserso Mayores, Servicio de Información sobre Discapacidad, InfoElder*,…).

People who have benefited from a rehabilitation treatment show a higher probability of receiving both FC and FIC (53% and 33%, respectively) and lower probability of receiving only IC (-27,94%). Once again, we observe that the availability of information increases the award rate of FC. Each new disability raises the probability of receiving FC (FIC) by 17% (6%) and reduces the probability of IC (-11,51%).

This fact is consistent with Stoller and Pugliesi's (1991) conclusions in the sense that some times the dependent's needs are greater than the informal caregiver ability to satisfy them. Two more facts uphold this theory. First, for the case of disabilities whose forecast is recoverable with restrictions, the probability of using CF increases by 91%[22] (mainly because of the recourse to rehabilitation treatment). Second, as the degree of severity increases, the probability of using only IC decreases (from 65% for not severe disabilities to 21% for the case of impossibility for doing the activity).

There are great disparities in the probability of receiving IC depending on the size of the municipality. Dependent people who live in townships with less than 10.000 (50.000) inhabitants show 35% (25%) higher probability of receiving only IC, which confirms the greater robustness of informal networks in smaller municipalities.

Regarding the place of residence, Ceuta and Melilla are the regions with lowest probabilities of receiving FC and FIC[23]. This may be due to the fact that in neither of these regions there are any private or public day centres and because Ceuta shows the lowest coverage index for residential centres (1,46 opposite to 3,21 for Spain). It could be argued that Melilla holds the highest coverage rate for Home Care service (3,04 opposite to 2,07 for the national average), but 70% of the time is devoted to houseworking and consequently, the carereceiver does not perceive that aid as specialized or skilled. In these two regions, we may be witness of a substitution between formal care outside home by formal care inside of it. On the other hand, Ceuta and Melilla[24] are the regions with the lowest percentage of elder people living alone (14% and 16%, respectively, opposite to 19,9% for Spain[25]) which may justify the prevalence of IC over FC.

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[22] Rehabilitation treatments are more often used for disabilities with recoverable forecast (31,58%) rather than for other types of forecast (around 15%).

[23] Regional Administration is responsible for both the provision of residential homes and the determination of what requirements are needed to apply for one place. This requirements usually include a valuation of the degree of disability, the availability of informal care ant the financial situation of the applicant. (Casado and López Casanovas, 2001; Casado, 2005).

[24] Ceuta and Melilla have been grouped due to their small size (0,55% and 0,90% of total population, respectively).

[25] Census of Population and Households (INE, 2001).

Coverage index values for Home Care Service should be interpreted with caution. For example, estimations indicate that Cataluña is the region with the highest probability of receiving Home Care, although the coverage index is lower than the national average (1,23 opposite to 1,82). However, 85% of Home Care time is devoted to personal care and only 15% to houseworking. In this sense, estimated coefficients might reveal how useful is perceived each type of care by the carereceiver.

Extremadura is the region with the lowest probability for IC, which may be explained because is the third region with more elder people living alone (21,3%). By contrast, Cantabria shows the highest probability for IC in combination with a very low coverage index for Telecare service[26] (0,20 opposite to 0,78 for Spain). In this case, the shortage of mechanical devices for watching dependent people may act as reinforcement for family care.

Castilla-León shows the highest probability for both types of care. This situation may be a result of the reduced cost of Home Care service (5,58 €/hour opposite to 8,89 € /hour in Spain)[27].

5. Selectivity model for the number of caregiving hours

In the previous section we have analyzed which variables are more important for the choice of type of care. Now we want to address the question of what determinants affect the number of care hours chosen. However, the choice of the number of care hours (*H*) is not independent of the type of care (*C*). It is not a simple choice in which the dependent individual chooses the caregiver and the number of hours to be provided. Instead, it is more complex because there are several decision-making agents. First, family members (if there are any) may or may not adapt their lifestyle to the dependent needs. Second, some private professionals may be hired by the family or by the patient, and finally, Public Administration[28] offers special services for non-institutionalised dependent people (home care, Telecare, day centres and respite services). Because of these reasons, we have developed a two simultaneous equations model for estimating the decisions of type of care chosen and number of care hours received.

With this objective, we have defined an "outcome equation" (1a) that indicates the number of caregiving hours received and a "selection equation" (1b) that identifies the type of care chosen. There is a categorical variable *j* which denotes the choice of the type of care among the set of alternatives {1=

[26] Home Care and Telecare services depend on Town Hall's administration. Comparing the characteristics of theses services across regions, we have observed great disparities in their level of generosity.

[27] The cost of Home Care service differs a lot across regions (the most expensive one is Navarra with 19,08 €/hour). Moreover, the co-payment percentage varies from 0% in Ceuta and Melilla (5% in Andalucía and Murcia , 10% in País Vasco,) to 20% in Rioja.

[28] From a theoretical point of view, when informal care is not available or is not enough, public social services behave as subsidiary responsible for the attention of the dependent.

formal care, 2= informal care, 3= formal & informal care}. In this way, each one of the outcome variables is only observed for a single value of the selection variable.

$$H_j = X\beta_j + \varepsilon_j \qquad (1a)$$
$$C_j = Z\alpha_j + u_j \qquad (1b)$$

where ε_1 verifies that $E[\varepsilon_1|X, Z]=0$ and $V[\varepsilon_1|X, Z]= \sigma^2$. The vector Z represents the set of explanatory variables for the care alternatives and the vector X contains the determinants for the number of hours[29].

Without loss of generality, we will assume for the rest of the model that the outcome variable H_1 is observed if and only if the category "formal care" has been chosen, that is, if $C_1 > \max_{j\neq1}(C_j)$. The problem that we face is the estimation of β_j and $(\alpha_j)'$s taking into account that the error term ε_1 may not be independent of all $(u_j)'$s. This situation would introduce correlation between the explanatory variables and the residual term in the outcome equation. For this reason, OLS estimation is not consistent[30]. As a consequence, we have a selection bias model as in Heckman (1979), with the difference that the selectivity criterion is given by a multinomial logit model rather than by a univariate probit.

Several alternatives have been put forward in the econometric literature to achieve the estimation of this new model. Lee (1983) proposed a generalization of Heckman (1979) method. His approach is quite simple and only requires the estimation of one parameter in the error correction term. However, it imposes very restrictive assumptions about the structure of covariances between ε_1 and the error terms of the selection equation. To avoid this problem, Dubin and McFadden's approach (1984) does not require the imposition of any constraint between ε_1 and the error terms of the selection equation, but they restrict u_j to the family of Gumbell's distributions. More recently, Dahl (2002) has developed a semiparametric approach, but whose practical implementation is nearly computationally impossible as the number of alternatives to be estimated increases.

In this paper we are going to use the solution proposed by Bourguignon et al. (2004). They have considered a variation of Dubin and McFadden's (1984) estimation method that allows ε_1 to be a linear combination of normal distributions, and as a result, ε_1 also follows a normal distribution.

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[29] We suppose that the model is identified by excluding some of the variables of Z from the vector X. for example: the variable "education" is included in Z but not in X because it may gather the effect of available information about social services for dependent people. On the contrary, the variables "impairment certificate", "number of PADL and IADL disabilities" and "number of days at hospital" which concern mainly to the severity of the disease/disability are only included in X.

[30] A tobit regresión is not appropriate for the estimation of the determinants of the number of caregiving hours. Although a standard data set for tobit model application has a large number of zero observations, the tobit model assumes that the latent variable can take negative values, which is impossible for the case of caregiving hours.

$$u_j^* = \Phi^{-1}\left(G\left(u_j\right)\right) \qquad (2)$$

$$\varepsilon_1 = \sigma_1 \sum_j \rho_1 \Phi^{-1}\left(G\left(u_j\right)\right) + \eta_1 \qquad (3)$$

where Φ is the cumulative standard normal, G is the cumulative Gumbell distribution and ρ_1 is the correlation coefficient between ε_1 and u_j^*. For each j, it is assumed that the expected value of ε_1 and the error term u_j^* are linearly related[31], where η_1 denotes a residual term orthogonal to all (u_j^*)´s and such that E[η_1]=0. Substituting the error term of equation (1a) by its conditional expectation plus a residual term, we get the following expression:

$$H_1 = X\beta_1 + \sigma_1\left[\rho_1\delta(P_1) + \sum_{j>1}\frac{P_j}{P_j - 1}\delta(P_1)\right] + \nu_1 \qquad (4)$$

$$\delta(P_1) = \int \Phi^{-1}\left(G(u_j)\right) g\left(u_j + \log P_j\right) du$$

$$P_j = \frac{\exp(Z_j\alpha_j)}{\sum_s \exp(Z_s\alpha_s)}$$

where g is the Gumbell density distribution, P_j is the probability that alternative j is chosen, and ν_1 has zero-mean and is orthogonal to all equation terms. Therefore, OLS may be applied in this equation to obtain consistent estimations[32] of β_1.

Consequently, we can consider the resulting model as a two-step process. In the first step, we estimate a multinomial logit model for care choice, using as explanatory variables (marital status, main breadwinner, level of education, relation with economic activity, monthly household income, number of children, number of household adults, number of caregiving years and place of residence). Caregiving alternatives have been defined as a categorical variable (1 "only formal care", 2 "only informal care", 3 "both formal and informal care"). Not receiving any type of care is the reference group. Using the estimated coefficients ($\hat{\alpha}_j$) we obtain the predicted probabilities ($\hat{P}_j$). These estimated probabilities take on all the information gathered in the multinomial model. Thereby, $\delta\left(\hat{P}_j\right)$ provides a consistent estimation of the expected value of the residual in the outcome equation (1a).

Afterwards, a model for the number of caregiving hours is estimated by weighted least squares to consider the possibility of heteroskedasticity due to selectivity. For getting the standard errors, a bootstrap with 50 replications has been applied to take into account the two-step procedure. We have considered

[31] The linear combination assumption is based on the fact that all u_j^* are independent among them.
[32] See Bourguignon et al. (2004) for a more detailed explanation.

that the number of caregiving hours is explained by individual factors (age, sex, illnesses and other health variables, number, type and severity of disabilities, number of caregiving years), socio-economic factors (household income, number of household adult members and marital status) and geographic factors (coverage index of social services for dependent people).

Estimations for the three types of care are shown in Table D. The variables M_k (k=1,2,3) are consistent estimators of the expected conditional residuals of the multinomial model. Each coefficient M_k represents the covariance between the residual of the least squares regression and the corresponding residual from multinomial logit regression. The variable σ_1 represents the standard deviation of the regression error term of the selection equation.

For the three types of care, very old dependent people (aged 80-89 and 90-99) demand more caregiving hours. Dependent people who are receving IC and suffer some pathologies (mental illness, arthritis, stroke, multiple sclerosis, dementia) demand more caregiving hours. This evidence is supported by the fact that disabilities for remembering people, executing orders, communicating and relating to people and suffering three or more disabilities for PADL are also significant. In the present context, it seems quite worrying that family members are carrying all the burden by themselves, because these disabilities usually present an unfavourable forecast, because are associated to degenerative diseases. Addittionally, having changed of house to receive a better medical treatment of having stayed at hospital during last year increases the demand of IC caregiving hours (*Compensatory model*).

As for coverage index, IC hours are higher when telecare service and day centres are less developed. By contrast, the higher the coverage of public residential homes, the more IC caregiving hours, which may suggest that when dependent is at home, is exclusively looked after by the family, but if caregiving demands go beyond their abilities, the family may decide to look for a public institution (*Supplementary model or Task specificity Model*). This theory is supported by two facts. First, IC hours increase when severity of disabilities is low, medium or high but is not significant if the dependent is not able to perform daily living activities at all. And second, caregiving years are not significant for IC, which means that family members do not mind to care for their relative as long as their competences will allow it.

Dependent people with FC demand more caregiving hours if they suffer three or more disabilities for IADL or belong to high-income households. In this sense, the availability of wheelchair, crutches, kitchen accessories, devices for climbing stairs or bath adaptation combined with the surveillance of an employee, may lengthen the independence of the individual and delay his institutionalisation (*Substitution model*).

A higher coverage index of Home Care service increases the demand of FC caregiving hours. This type of care is generally associated to very severe disabilities and is independent of the length of the disability (because, nearly all caregiving year intervals are significant).

The number of adults living in the household is a significant variable for the three types of care, but it does not imply that these adults were involved in caregiving tasks. As a matter of fact, the adult coefficient for FC regression is the biggest one, but precisely in this case, family members have entrusted all the responsibility to employees (*Substitution model*).

6. Unmet needs

Although dependent people are receiving formal or informal care, they may have unmet needs (UN), that is, demands for personal or technical aids that are not being satisfied. With the information from the DDSHS we know, for each disability, if the individual has applied for a personal or technical aid and if his demand has been satisfied or not. We have defined two binary variables to design technical and personal unmet needs (UTN and UPN) that take the value one if the interviewed says that he applied for a particular type of aid but has not received it. From the sample of 7.780 carereceivers, 223 (2,87%) have declared an unmet technical need and 482 (6,20%) an unmet personal need.

To explore what characteristics determine the problem of not satisfied demands we have estimated two logistic regressions for the dependent variables UTN/ UPN, using as explanatory variables, personal characteristics (sex, age, illnesses and health related variables, number and classification of disabilities, number of adults living in the household), environment characteristics (size of municipality and coverage index of social services for dependent people) and the type of care received (formal, informal or both).

Results are shown in Table E. Male show higher probability of UTN (+34%) and lower probability of UPN (-34%)[33]. Having an impairment certificate (disability >33%) or having received a rehabilitation treatment increases both the probabilities of UTN and UPN around 30%.

Dementia and mental illnesses increase the probability of UPN by 60%, whereas multiple sclerosis increase the probability of UTN by 124%. On the other side, visual and auditory disabilities increase the probabilities of UTN (42% and 122%, respectively), while disabilities for seeing and relating to people increase the probability of UPN by 22% and 67%. Any additional disability for PADL increases both the probabilities of UTN and UPN (42% and 31%, respectively), but only disabilities for IADL increase the

[33] As we have said before, because of shorter life expectancy, men are usually looked after by spouse, which may explain the lower probability of UPN (there are 2.122 women older than 80 years old, but only 709 men +80 years).

probability of UTN. This evidence denotes that when a disability or illness reduce the ability for having an independent life, there is an increase in the probability of UTN. But if the disability or illness leads to the loss of self-awareness then UPN becomes more probable.

With regards to coverage index of social services for dependent people, we observe that telecare service and day centres are significant with positive sign in the regression for UPN. It seems to indicate that the support through mechanical devices or the attention received during some hours in a centre is not considered to be enough for the patient or his family. In this sense, some families do not seem very satisfied with social services and think that the only way of looking after dependent individuals is strictly by themselves. This theory in favour of *Compensatory model* is supported by the fact that when carereceiver only receives IC is less probable (-31%) that UPN might arise[34].

7. Conclusions

With respect to the debate about the relation between formal and informal care, the results obtained sustain the idea that FC reinforces family care in certain cases: very old dependent people, many disabilities, demand of many caregiving hours and in some specific pathologies such as mental illnesses and dementias. We have also found evidence of substitution between private and public formal care depending on the level of household income.

Regarding the provision of social services, estimations have revealed that there exist great regioinal disparities. In first place, the probability of receiving FC is lower in some communities. Second, the distribution of weights between houseworking and personal care in Home Care service is not homogeneous across regions. To our knowledge, if Home Care increased the fraction of time devoted to personal care, the service would be more efficient and would also generate a demand of skilled professionals (medical practioners, nurses, physiotherapist, psychologist)[35].

In some regions there is a high coverage index for home care service combined with a scarce development of home centres and day centres. This fact could be interpreted as an attempt for substituting formal care outside home by formal care inside it.

[34] And each additional adult in the household decreases the probability of UPN by 7%.

[35] According to estimations of "*Libro Blanco de la Dependencia*" and Herce et al. (2006), by 2010, the National Dependency System should have driven to the generation of 262.735 new jobs.

The immediate future of dependent people is conditioned by the Law of Personal Autonomy and Attention to Dependent People[36]. This law determines that an Individual Attention Program will be designed for each recipient[37], that will include what services are more suitable.

However, the mechanism for determining the degree of dependence has spark off a great controversy. Some sectors argue that certain pathologies (such as, Alzheimer and multiple sclerosis in their initial stage) are excluded from great dependence degree. From our point of view, it is precisely at the onset of the disability when family needs more support to accept the diagnosis and learn how to look for the patient.

The implementation of the Law of Dependence will be carried out progressively. In 2007, Great Dependent people (levels 1 and 2) has been covered, and in 2008 it will include Severe Dependent people (level 2). It is worthwhile to mention that people qualified as Great Dependent will have access to 70-90 hours of home care service (level 2) or 55-70 hours for level 1.

As for funding of the National Dependency System, we may distinguish tree different pathways. First, the Central Administration will guarantee a minimum protection level for all the recipients; second, the Autonomous Communities will contribute with at least the same amount of money, and third, the recipients will participate according to their financial resources (co-payment).

In terms of R.D. 614/2997, May 11th, Central Administration will contribute at most with 387 € (for level 1 of Great Dependence) and 507 € (for level 2), with a minimum of 387 € and 507 €, respectively. Given that Autonomous Communities must level Central Administration's contributions in their territories, dependent people will receive at most 774 € (level 1) and 1.014 € (level 2). However, in our opinion these economical aids are not enough to offset the cost of a great dependent[38] and consequently, the family ability to put up with the economic burden is of prime importance. And the situation is even worse for 44% of the carereceivers with high severe disabilities who are also the breadwinners of their families[39].

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[36] R.D. 504/2004, April 20th, has approved a scale to determine if the applicant is able to perform daily living activities by himself, or if he needs support or surveillance.

[37] There exist three dependency degrees: Grade I (moderate dependency) if the individual only needs help for daily living activities once a day; Grade 2 (severe dependency) if he needs help two or three times per day; Grade 3 (severe dependency) if he needs help more than tree times per day. Each degree of dependency is divided in two levels depending on the amount of help required.

[38] For example, it has been estimated that basic care for a +65 years dependent person costs 833 €/month (10.000 € per year), although some illnesses are much more expensive. Personal care for an Alzheimer patient may cost between 1.500 and 2.400 €/month.
http://www.imsersomayores.csic.es/documentos/documentos/consumer-ancianos-01.pdf
http://www.imsersomayores.csic.es/documentos/documentos/confederacion-costes-01.pdf

[39] 21,96% are receiving a contributive permanent disability benefit and 42,33% are retired.

In second place, Autonomous Communities are allowed to increase economic aids over the minimum fixed by law. But given the differences observed in coverage indexes of social services for dependent people, it does not seem very probable that all of them will be able to perform the same economic effort. In this sense, it may happen that the Law of Dependence will assure a minimum level of attention for all people independently of the level of income, but that certain disparities could arise beyond that minimum threshold.

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Table A. Public expenditure in ageing and long term care.

	Ageing and long term care expenditure (2004)			Dependency rate
	% GDP	% Health expenditure	% Social Expenditure	2007
Austria	1,1	3,89	15.49	25.0
Belgium	-	-	-	25.9
Denmark	1,7	5,70	27.87	23.2
Finland	0,7	2,70	10.61	24.8
France	0,3	1,02	3.41	24.9
Germany	0,3	1,06	3.90	29.9
Greece	0,1	0,40	1.49	27.6
Irland	0,2	1,23	2.90	16.2
Italy	0,1	0,40	1.54	30.2
Luxembourg	-	-	-	20.7
Netherlands	0,9	3,38	11.11	21.5
Portugal	0,3	1,29	2.82	25.6
Spain	0,3	1,54	5.00	24.2
Sweeden	2,6	8,20	32.50	26.4
United Kingdom	1	3,88	12.82	24.1
EU-15	0,6	2,26	8.00	-
Bulgaria	-	-	-	24.9
Czech Republic	0,3	1,59	4.48	20.2
Estonia	0,1	0,76	2.38	25.1
Hungary	0,4	1,97	6.67	23.2
Latvia	0,1	0,82	3.33	24.8
Lithuania	0,1	0,78	2.63	22.7
Malta	0,6	3,23	12.00	19.8
Poland	0,3	1,53	7.89	19.0
Romania	-	-	-	21.3
Slovak Republic	0,2	1,20	4.00	-
Slovakia	0,2	0,84	2.56	16.5
Slovenia	-	-	-	22.7
UE-25	0,5	1,91	6.76	25.3

Source: Eurostat (Population and Social Conditions). Information for Belgium, Cyprus, Bulgary and Romania is not available. Dependency ratio: number of people 65 and older divided by total active population (15-64 years old)

Table B. Descriptive Statistics

	No care	Receives some type of care		
		Only informal	Only formal	Formal and informal
Male	0.4765	0.3301	0.1743	0.2295
Age				
40-49	0.0990	0.0606	0.0249	0.0579
50-59	0.1609	0.1008	0.0765	0.0489
60-69	0.2728	0.2036	0.1352	0.1217
70-79	0.3122	0.2911	0.3701	0.3073
80-89	0.1393	0.2707	0.3416	0.3662

90-99	0.0156	0.0728	0.0516	0.0968
Marital Status				
Married / Cohabiting	0.6662	0.5180	0.3345	0.4421
Single	0.0910	0.1061	0.1797	0.1347
Divorced / Separated	0.2239	0.3637	0.4555	0.4051
Widow	0.0187	0.0119	0.0302	0.0169
Main breadwinner	0.6068	0.4306	0.6387	0.4331
Level of education				
No studies	0.4655	0.5945	0.4893	0.5129
Elementary	0.3945	0.3351	0.3327	0.3582
High School	0.0995	0.0555	0.0889	0.0808
College	0.0403	0.0148	0.0889	0.0479
Relation with economic activity				
Working	0.1088	0.0249	0.0124	0.0139
Unemployed	0.0237	0.0074	0.0017	0.0039
Retired	0.3647	0.3381	0.3274	0.3632
Contributive disability benefit	0.1721	0.1933	0.1797	0.1347
Non contributive disab. benefit	0.0530	0.1151	0.0693	0.1067
Houseworking	0.2118	0.1452	0.2206	0.1287
Monthly household income				
< 264,5 €	0.0195	0.0209	0.0231	0.0199
264,5 – 390,6 €	0.1503	0.1349	0.2526	0.1846
390,6 – 781,2 €	0.4032	0.3938	0.3683	0.3323
781,2 – 1.171,97 €	0.1929	0.2054	0.1476	0.1536
1.171,97 - 1.562,63 €	0.0863	0.0982	0.0569	0.0938
1.562,63 – 1.953,29 €	0.0359	0.0442	0.0177	0.0568
1.953.29 – 2.343,95 €	0.0169	0.0141	0.0195	0.0269
2.343,95 – 3.906,58 €	0.0137	0.0115	0.0177	0.0329
> 3.906,58 €	0.0024	0.0012	0.0035	0.0099
Number of adults at household	2.7460	3.0518	1.8576	2.4351
Number of children				
Less than 4 years	0.0223	0.0247	0.0017	0.0109
Between 5 and 12 years	0.0752	0.0841	0.0160	0.0349
Between 13 and 17 years	0.1055	0.1113	0.0160	0.0658
Size of municipality				
< 10.000 inhabitants	0.3057	0.3230	0.2758	0.2395
10.000 – 50.000	0.2233	0.2549	0.2046	0.2035
50.000 – 500.000	0.3672	0.3342	0.3914	0.4371
> 500.000	0.1037	0.0876	0.1281	0.1197
Illnesses				
Mental illness	0.0216	0.0559	0.0320	0.2588
Arthritis	0.2170	0.3021	0.3576	0.2854
Muscular distrophy	0.0284	0.0611	0.0658	0.0188
Multiple sclersosis	0.0122	0.0199	0.0195	0.0289
Stroke	0.0737	0.1077	0.0943	0.1087
Head injury	0.0276	0.0900	0.0516	0.1217
Dementia	0.0104	0.0822	0.0516	0.1327
Parkinsonism	0.0146	0.0398	0.0355	0.0658
Change of house	0.0259	0.1077	0.0818	0.1217
Rehabilitation treatment	0.1184	0.1819	0.2241	0.2365
Impairment certificate	0.1617	0.1933	0.1743	0.2125
Number days at hospital last year	1.4904	3.7968	3.7419	5.4371
Number of disabilities	3.1469	9.6819	8.3505	12.6147
Disability for:				
Seeing	0.3169	0.2712	0.2971	0.3013
Hearing	0.3634	0.1985	0.1975	0.2195
Communicating	0.0577	0.1970	0.1281	0.2964
Executing / Remembering	0.0692	0.2240	0.1850	0.3043
Maintaining body postures	0.2432	0.5183	0.4911	0.6357
Using hands and fingers	0.2106	0.4567	0.3932	0.5562
Moving outside home	0.4051	0.8605	0.7722	0.8952
Taking care of oneself	0.0417	0.4644	0.2829	0.5908
Houseworking	0.1677	0.7881	0.9181	0.9381
Relating to other people	0.0733	0.2268	0.1957	0.3043
Number of disabilities for PADL	0.5040	2.1476	1.6423	3.0708
PADL = 2	0.0768	0.1359	0.1227	0.1037
PADL = 3	0.0432	0.1219	0.1032	0.1217

PADL >= 4	0.0182	0.2446	0.1690	0.4071
Number of disabilities for IADL	1.4346	5.6134	4.9750	6.7754
IADL = 2	0.1481	0.1048	0.1120	0.0528
IADL = 3	0.1057	0.1140	0.1476	0.0708
IADL >= 4	0.1155	0.7089	0.6476	0.8522
Degree of severity				
No severe	0.0287	0.0476	0.0569	0.0469
Moderate severity	0.8751	0.9895	0.9786	0.9940
Very severe	0.5791	0.9565	0.9306	0.9860
Can not do the activity	0.3638	0.8812	0.8185	0.9510
Forecast				
Recoverable	0.0722	0.0157	0.0088	0.0139
Recoverable with restrictions	0.0509	0.0553	0.0747	0.0508
Stable	0.4399	0.4803	0.4466	0.4990
Can go worse	0.5291	0.7102	0.7117	0.7425
Do not know	0.0829	0.0928	0.0943	0.0998
Unmet needs				
Technical	0.0224	0.0267	0.0270	0.0399
Personal	0.0107	0.0765	0.0539	0.1038
N	9662	6216	562	1002

Table C. Odds-ratio of logistic regressions for the variable "Type of care received"

	Only formal	Only informal	Formal and informal
Male	0.4312 ***	1.1465	0.6445 ***
Age			
50-59	2.5226 **	1.0711	0.5439 ***
60-69	2.2102 **	1.1065	0.7413
70-79	4.6686 ***	1.0061	1.2082
80-80	6.2073 ***	1.0204	1.5215 **
90-99	6.7271 ***	0.9933	1.5509 *
Marital Status			
Married/ Cohabiting	0.6643 **	0.7647	0.9671
Widowed	0.8807	1.0659	0.7770 *
Divorced/ Separated	1.2964	0.7273	1.1494
Main breadwinner	1.1044	1.1208	0.6133 ***
Level of education			
Elementary	1.3200 **	0.9469	1.3599 ***
High School	2.0492 ***	0.6743 ***	1.7916 ***
College	5.4980 ***	0.3870 ***	2.2711 ***
Relation with economic activity			
Retired	0.7628 *	1.1969 *	1.0547
Contributive permanent disabiility benefit	1.1357	1.3620 ***	0.9476
Non contributive permanent disability benefit	1.4336	1.4123 ***	0.8511
Houseworking	1.5387 **	0.9918	0.8736
Monthly household income			
< 264,5 €	0.2062 ***	2.0488 ***	0.4432 **
264,5 – 390,6 €	0.3703 ***	1.4471 **	0.6232 ***
390,6 – 781,2 €	0.6141 **	1.3404 **	0.6028 ***
781,2 – 1.171,97 €	0.6996	1.2565 *	0.7030 **
1.171,97 - 1.562,63 €	0.7859	0.8776	1.1664
1.562,63 – 1.953,29 €	0.5627	0.7795	1.9953 ***
1.953.29 – 2.343,95 €	1.9442	0.5564 **	1.9334 **
2.343,95 – 3.906,58 €	3.1967 ***	0.2959 ***	5.0241 ***
> 3.906,58 €	3.3497	0.0794 ***	11.4143 ***
Number of adults at household	0.5818 ***	1.3400 ***	0.5333 ***
Number of children			
Less than 4 years	0.2596	0.7229	1.5915
Between 5 and 12 years	1.2660	0.8508	1.0659
Between 13 and 17 years	0.6142	0.8607	1.5824 ***
Size of municipality			
< 10.000 inhabitants	1.1131	1.3563 **	0.5164 ***
10.000 – 50.000	1.1808	1.2670 *	0.6556 ***
50.000 – 500.000	1.3206	0.8577	0.9920
Illnesses			
Mental illness	0.7273	1.1414	1.0874
Arthritis	1.1290	1.0830	0.8948
Muscular distrophy	1.3842	1.3106 *	0.7635

Multiple sclersosis	0.8534		0.8971		1.0180	
Stroke	1.0805		0.9629		1.1320	
Head injury	0.7718		1.1873		1.1081	
Dementia	0.6651		1.3851	**	0.9918	
Parkinsonism	0.9222		0.8900		1.3068	
Change of house	1.8271	***	1.0491		0.9585	
Rehabilitation treatment	1.3367	**	0.7206	**	1.5304	***
Impairment certificate	0.9983		0.9515		1.0486	
Number of days at hospital last year	1.0022		0.9999		1.0021	
Number of disabilities	1.1797	***	0.8849	***	1.0671	**
Disabilities for:						
Seeing	0.7064	**	1.1923	**	0.8525	
Hearing	0.5407	***	0.9609		0.8394	
Communicating	0.5723	*	1.2035		1.1352	
Executing / Remembering	0.6179		1.0520		0.9448	
Relating to other people	0.8779		1.2301		0.6662	*
Number of disabilities for PADL	0.6921	***	1.0208		1.0375	
PADL = 2	0.9615	***	1.4218	***	0.8156	***
PADL = 3	1.0614	***	1.0927	***	0.9159	***
PADL >= 4	2.1268	***	0.9781	***	0.8968	***
Number of disabilities for IADL	1.0653	**	1.0999	***	0.9864	
IADL = 2	2.3890		1.9579	**	2.3413	
IADL = 3	3.6241		2.6638	***	2.6554	
IADL >= 4	4.7643		2.7370	*	3.8693	
Degree of severity						
No severe	1.8691		1.6573		1.1038	
Moderate severity	1.0190		1.6985		0.8389	
Very severe	1.4242		1.5859		1.6500	
Can not do the activity	0.8131		1.2196		1.3558	
Forecast						
Recoverable	0.4558		0.7478		0.8928	
Recoverable with restrictions	1.9110	***	1.1315		1.0792	
Stable	1.2990	**	0.9553		1.1046	
Can go worse	1.4984	***	1.0697		1.1662	
Do not know	1.1573		1.0350		0.9917	
Autonomous Communities						
Andalucía	3.1560	**	1.5211	**	0.6887	
Aragón	3.1808	**	1.5391	*	0.7038	
Asturias	2.9014	**	1.9363	***	0.3746	**
Baleares	3.1198	*	1.2643		0.9086	
Canarias	1.1128		1.8077	**	0.7132	
Cantabria	1.3789		2.2185	***	0.4366	**
Castilla La Mancha	2.2236		1.5360	**	0.6952	
Castilla León	2.2058	*	1.6670	***	0.5884	*
Cataluña	3.8371	***	1.7550	***	0.6606	
Ceuta – Melilla	-		1.2466		-	
Extremadura	2.5143	*	-		1.3043	
Galicia	2.6492	**	1.5724	**	0.5412	*
Madrid	2.1722		1.6911	**	0.4603	**
Murcia	2.4368	*	2.2004	***	0.5230	*
Navarra	1.9595		1.1662		0.9307	
Rioja	1.1829		1.7282		0.6279	
País Vasco	1.3700		1.2793		0.8586	
C. Valenciana	2.2289		1.6509	**	0.5688	*
N	17442		17442		17442	
R^2	0.4288		0.6731		0.3600	

Omitted variables: age 40-49, single, no studies, active (working or unemployed), without children, missing variable for monthly household income, size of municipality >500.000 inhabitants. There are 7,83% of observations for which household income is missing(* p<0.10; ** p<0.05; *** p<0.01)

Table D. Model of caregiving hours depending of care choice (selectivity correction based on multinomial logit; second step regression is showed; bootstrapped standard errors with 50 replications)

	Only formal	Only informal	Formal & informal
Male	-0.0453	0.2044 ***	0.1475
Age			
50-59	0.0808	0.0428	0.2842
60-69	0.4808	0.0735	0.3593

70-79	0.6227		0.1570		0.6556	*
80-89	1.0324	**	0.2693	**	0.7469	**
90-99	1.8804	***	0.3319	**	0.9654	***
Illnesses						
Mental illness	0.1999		0.3404	***	0.2643	
Arthritis	-0.0692		0.1335	***	-0.2427	**
Muscular distrophy	-0.0096		-0.1207		-0.1192	
Multiple sclerosis	0.1278		0.2643	*	-0.0000	
Stroke	-0.0206		0.1798	***	-0.0483	
Dementia	0.5837		0.5234	***	0.3290	
Parkinsonism	0.2408		0.0816		-0.1662	
Change of house	0.1975		0.2656	***	0.1603	
Rehabilitation treatment	0.0008		-0.1226	**	-0.1835	
Impairment certificate	0.0899		0.0397		0.2407	*
Number days at hospital last year	-0.0029		0.0073	***	0.0008	
Number of disabilties	0.0130		0.2030		-0.0456	
Disabilities for:						
Seeing	-0.0851		0.0116		0.1189	
Hearing	-0.1520		-0.0366		0.0777	
Communicating	0.3669		0.2591	***	0.2151	
Remembering/Executing	-0.6420		-0.2344	**	-0.0225	
Relating to people	0.4813		0.2670	**	0.3380	
Number of disabilities for PADL	0.0112		0.0487		0.1168	
PADL= 2	-0.4196	*	0.1356	*	0.2567	
PADL= 3	-0.1514		0.0063		0.3924	*
PADL>= 4	0.0673		0.3669	**	0.6983	*
Number of disabilities for IADL	0.2354	**	0.1105	***	0.2204	***
IADL= 2	-0.2993		0.1715		-0.0349	
IADL= 3	-0.7446	***	0.1167		-0.1517	
IADL>= 4	-0.7365	**	0.1516		-0.2260	
Monthly household income						
< 264,5 €	-0.2834		-0.0512		-0.3739	
264,5 – 390,6 €	-0.2251		0.0474		-0.2658	
390,6 – 781,2 €	-0.3938		0.2419	**	-0.0066	
781,2 – 1.171,97 €	0.0045		0.1566		0.1072	
1.171,97 - 1.562,63 €	-0.0449		-0.0321		-0.1520	
1.562,63 – 1.953,29 €	0.3452		-0.0739		-0.4098	
1.953.29 – 2.343,95 €	2.3620	***	-0.1864		-0.5483	
2.343,95 – 3.906,58 €	1.7197		-0.2966		-0.6111	
> 3.906,58 €	1.9746	*	-0.5414		-0.1136	
Number of adult household members	0.6524	***	0.1355	**	0.2493	*
Marital status						
Married/cohabiting	0.0975		-0.0286		0.3565	*
Divorced/separated	0.2166		-0.3340	*	-0.5547	
Widowed	0.1879		-0.0536		0.0800	
Coverage index						
Home care service	0.2052	*	0.0560		-0.0603	
Telecare service	0.2044		-0.0792	*	0.0713	
Day centres	1.9352		-0.8591	**	0.1741	
Public residential homes	-0.2159		0.2692	***	-0.2931	
Private residential homes	-0.1512	*	-0.0154		0.1086	*
Number of caregiving years						
<1 year	1.4109	**	-0.0878		0.4441	
1-2 years	0.9694		-0.4369		0.6847	
2-4 years	1.2889	*	-0.3755		0.7319	
4-8 years	1.2946	*	-0.1552		1.0179	
+8 years	1.9739	**	0.1641		1.5662	**
Degree of severity						
No severe	0.0006		-0.2045	**	0.5823	**
Moderate severe	0.4608		-0.4822	**	-0.0896	
Very severe	0.4196	*	0.2365	*	0.1704	
Can not do the activity	0.0393		0.1429		0.1575	
Age at the onset last disability	0.0029		0.0019		-0.0007	
Constant	-1.1909		1.1506	*	1.0201	
M1	-0.6750	**	-0.0827		-0.1049	
M2	0.8312		-0.9871		0.1712	
M3	-2.3518	*	-2.4992	**	-0.9576	**

σ_1	1.1523	1.6439	1.5051

Omitted variables: age 40-49, single, missing value for household income, missing value for number of caregiving years. (There are 1,79% of carereceivers for which number of caregiving years is missing)
(* p<0.10; ** p<0.05; *** p<0.01)

Table E. Odds ratio of logistic regressions for the variable "Unmet need"

	Unmet technical need		Unmet personal need	
Male	1.3436	**	0.7543	**
Age				
50-59	1.1612		1.3643	
60-69	0.9683		1.2766	
70-79	0.9515		1.5213	*
80-89	0.5479	**	1.0391	
90-99	0.3437	**	0.8899	
Number of adults in household	0.9685		0.9220	**
Size of municipality				
< 10.000 inhabitants	0.8346		1.0389	
10.000 – 50.000	0.9050		1.3477	
50.000 – 500.000	1.1509		1.0634	
Change of house because of a disability	0.8846		1.1313	
Rehabilitation treatment	1.3063	*	1.3795	**
Impairment certificate	1.3513	*	1.3855	***
Number of days at hospital last year	1.0049	**	1.0033	*
Illnesses				
Mental illness	1.2240		1.5818	**
Arthritis	1.1576		1.0627	
Muscular dystrophy	1.0150		0.9555	
Multiple sclerosis	2.2457	***	1.2988	
Stroke	0.8851		1.2433	
Head injury	0.9240		0.9427	
Dementia	1.3341		1.6351	***
Number of disabilities	0.9925		0.9718	
Disabilities for:				
Seeing	1.4229	**	1.2243	*
Hearing	2.2254	***	1.0050	
Communicating	0.6530		1.1468	
Remembering/Executing	0.7725		0.6389	*
Relating to people	1.1159		1.6749	**
Number of disabilities for PADL	1.4230	***	1.3109	***
PADL= 2	0.6357		0.7907	
PADL= 3	0.6553		0.8855	
PADL>= 4	0.4473		0.5876	
Number of disabilities for IADL	1.0247		1.0554	
IADL= 2	2.7252	**	1.2639	
IADL= 3	1.8425		1.0643	
IADL>= 4	2.4310	*	1.4073	
Coverage index:				
Home care service	1.0390		1.1258	
Telecare service	1.0505		1.4238	***
Day centre	3.5272		40.99992	***
Public residential home	0.8735		0.8478	
Private residential home	0.9061		0.9906	
Type of care received:				
Only informal	0.9114		0.6958	**
Formal and informal	1.0874		0.9745	

Omitted variables: age 40-49, size of municipality >500.000, only formal care. (* p<0.10; ** p<0.05; *** p<0.01)