Does Long-Term Care Subsidisation Reduce Hospital Admissions?

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CESIFO WORKING PAPER NO. 6078
CATEGORY 3: SOCIAL PROTECTION
ORIGINAL VERSION: SEPTEMBER 2016
THIS VERSION: MARCH 2017

ISSN 2364-1428

CESifo *Working Paper No. 6078*

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Abstract

One of the intended effects of an integrated network of long-term care (LTC) services lies in the reduction of (unnecessary) health care utilisation. This paper draws upon the quasi-experimental evidence from Spain to examine the causal effect of the expansion of affordable long-term care (LTC) access (after the introduction of a new universal LTC subsidy) on hospital admissions (both on the internal and external margin) and its duration or length of stay (LOS). We find robust evidence of a reduction in both measures of hospitalisation among both those receiving a caregiving allowance and, though less intense, among beneficiaries of publicly funded home care (amounting to 11% of total hospital costs), and among regions coordinating health and social care. Consistently, a reduction in the subsidy is found to significantly attenuate such effects.

JEL-Codes: I180, J140, H530.

Keywords: hospital admissions, hospital utilisation, long-term care reform, bed-blocking, hurdle Poisson model, Spain.

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1. **Introduction**

Health care systems face the challenge of responding to the rising costs of health care treatments (Breyer et al., 2010). Part of such rise in health care demand is deemed to result from an inefficient use of health services (especially hospital care) by individuals who would need long-term care (LTC) instead. This is typically the case when LTC services are not affordable, and/or not adequately-coordinated with health care services. A shortage of either suitable and/or affordable LTC due to limited insurance or public subsidy, or inadequate integration, is suggested to result in inefficient and costlier hospital care utilisation (Mur-Veeman and Govers, 2011; Hofmarcher et al., 2007; Bodenheimer, 2008). However, limited research has so far focused on the identification of such an effect.

In this paper, we contribute to the literature by exploiting the causal evidence of an exogenous variation in the affordability of LTC. Specifically, we exploit evidence from a quasi-natural experiment, namely, a reform that unexpectedly expanded LTC funding in Spain (so called SAAD in Spanish), which universalised the previously means-tested funding system to anyone that qualifies after a needs test and provides either a home-help (in kind) subsidy or a cash subsidy (caregiving allowance). The effects of the SAAD can be empirically identified given that the program was heterogeneously implemented across different Spanish regions (e.g., differences emerged in the stringency of needs tests, diversity in the co-payment rules, etc.). An additional feature of the quasi-experimental evidence from Spain lies in the contraction of the subsidy in 2012 in the midst of the austerity cuts which we can identify in our data. Hence, we can test whether the reversion of the subsidy expansion delivered comparable effects on hospitalisation. Finally, an additional advantage of examining the Spanish reform is that the responsibility for LTC policy befalls at the same level of government as that of healthcare (at the regional level), and regions differed in the extent of health and social care coordination. Hence, we can exploit how the funding expansion interacted with pre-existing coordination plans. Prior evidence for Spain suggests that about 68% of all patients needing social care end up being treated by health services, and care management coordination can bring savings up to 27% (Graces et al., 2006). Hence, we hypothesize that the presence of health and social care coordination plans can reduce hospitalisations.

Given that LTC may influence health care use through different mechanisms, we distinguish the effects of SAAD on hospital admissions at both the intensive and the extensive margin (namely, the probability of hospitalisation, the number of hospital admissions, and its duration or the length of stay (LOS)). In addition, we examine the heterogeneity that results from the use of different types of LTC. As individuals receiving home care benefit and caregiving subsidies may face different incentives to use hospital care, we run a separate subsample analysis. We draw upon data from the Survey of Health, Ageing and Retirement in Europe 2004-2013, which contains a rich set of time varying controls both at individual and regional level, which we can use to measure both social and health-related needs. We are then able to produce baseline results that are robust and consistent with the effect of the decline in the subsidy after the 2012 austerity spending cuts. The paper ends with an estimation of the effect of the LTC subsidy over hospital costs, disentangling costs estimates due to variations in the number of hospital admissions and due to variations in the average hospital LOS.

Our findings report robust evidence of a reduction in hospitalisations (in both the intensive and the extensive margin) and in LOS after the implementation of SAAD. We find a higher reduction in the number of hospitalisations among those receiving a caregiving subsidy compared to those receiving home-care. Conversely, hospital LOS was shorter among those receiving home care services. We find a larger effect size among regions with prior health and social care coordination plans. Finally, we examine some specific mechanisms driving the effect such as an increased use of outpatient care, the adoption of housing adjustment and, a reduction of perceived loneliness and depressive symptoms.

The rest of the paper is structured as follows. The next section describes the literature to which the study contributes. Section 3 describes the background and identification strategy. Section 4 contains a description of the data and variables. Section 5 reviews the empirical strategy and section 6 contains the key results regarding hospital admissions, explanatory mechanism and impact on hospitalization costs. Finally, the paper ends with a discussion section containing its concluding remarks.

2. Related Literature

The effect of the introduction of social care programmes on hospitalisations has shown mixed results so far. Hospital readmissions, lower rate of hospital-delayed discharges and lower emergency readmission rates are found to decline after the introduction of a home visits programme (Hermit et al., 2002; Weaver and Weaver, 2014; Sands et al. 2006), but other studies find no evidence of such an effect (Balaam et al., 1988; Fabacher et al., 1994, and Stuck et al., 1995 for the US; Van Rossum et al., 1993 for the Netherlands; and Pathy et al., 1992 for the UK). Receiving informal care is found to decrease the length of hospital stay of US Medicare patients following a hip fracture, stroke or heart attack (Picone et al., 2003).

Another set of studies that use a methodology closer to ours, draw on quasi-experimental data. Rapp *et al*. (2015) measure the impact of financial assistance for non-medical provision on the probability of requiring emergency care among patients with Alzheimer’s disease. They conclude that the beneficiaries of LTC subsidies have a significantly lower rate of emergency care than non-beneficiaries. Holmäs et al. (2008) found that a system of penalties for a non-smooth transfer process from hospital to LTC services involved hospital stays that were approximately 2.3 days shorter. However, the elimination of the penalties lead to hospital stays that are three days longer. Our study described below seeks to fill some of the gaps in the literature, and as in previous studies, draws upon individual data to study hospital admissions

(Norton and van Houtven, 2004; Card et al. 2004; Nielsen, 2016; Geilet al, 2007).

Finally, some literature related to our study examines the effect of improvements in integration and care coordination on health care use. Health and social care coordination is found to improve individual's quality of life (Hofmarcher et al., 2007), but without a cost increase (Singh and Ham 2005). However, the effects on hospital admission are not always consistent across different programmes. We add to this literature insofar as we examine how the combined effects of subsidisation and coordination influence hospital admissions. This is a question we specifically address in this paper.

3. Background and identification

The 'Promotion of Personal Autonomy and Care of Dependent People' Bill 39/2006 was passed in 14 December 2006 (we refer to it using the acronym SAAD, resulting from the name of the reform in Spanish), was implemented in 2007 in Spain. The reform was effectively an unexpected expansion of public funding (resulted from a last-minute political agreement of different political groups supporting a minority socialist government elected after the 2004 Madrid bombings). The reform replaces the previous underfunded means-tested system[1] with a universally and only 'need-tested' system. Unlike in the pre-reform period, when care was means-tested, SAAD entailed a universal entitlement. After the reform, an individual care

[1] Spain's LTC reforms arose from a government formed by a Parliament elected three days after the 2004 Madrid bombings (Garcia Montalvo, 2011). The new minority socialist government began to announce an agreement at the end of 2006 to implement a tax-funded subsidisation of the LTC system. It is therefore plausible to assume that the reform was not expected.

assessment is carried out by regional officials to determine the services and/or benefits that best match the applicant's needs which are classified as 'moderate', 'severe' or major dependency. The classification into these three dependency levels were the result of the Official Ranking Scale of the SAAD[2].

The catalogue of benefits of the Dependency System included in-kind services and cash benefits. On the one hand, in-kind services grouped home care[3], day and night centres and residential services. On the other hand, cash subsidies for informal caregivers (caregiving allowances). These benefits constitute an attempt to acknowledge the effort of informal caregivers who provided long-term care to people in dependency situations. Informal caregivers (named also non-professional caregivers) could receive a caregiving subsidies under the following circumstances: (i) kinship with the person in need of care within the third degree of consanguinity, (ii) co-residence with the person in need of care, (iii) housing conditions make it possible to provide the required caregiving tasks. In addition to caregiving subsidies, informal caregivers were covered by Social Security System. The amount of caregiving subsidies for major dependent was between 390€/month and 487€/month in

[2] The Ranking Scale evaluates 47 tasks grouped into ten activities (eating and drinking, control of physical needs, bathing and basic personal care, other personal care, dressing and undressing, maintaining one's health, mobility, moving outside home and housework). Each task is assigned a different weight, and there exists a different scale for individuals with mental illness or cognitive disability. Additionally, the evaluation considers the degree of supervision required to perform each task. The final score is the sum of the weights of the tasks for which the individual has difficulty times the degree of supervision required. The degree of dependency is determined as the result of the sum: no eligible (less than 25 points), moderate dependent (between 25 and 49 points), severe dependent (between 50 and 74 points) and major dependent (above 74 points). Royal Decree 504/2007, of April, 20, that approves the dependency rating scale established by the law 39/2006, of December 14, of *promoción de la autonomía personal y atención a las personas en situación de dependencia.*

[3] Home care services are provided by professional caregivers and include services related to household work and services related to personal care. Quality standards are defined and professional services to become home careers are accredited by regional authorities.

2007, between 417€ and 530€ in 2011 and between 387€ and 442€ in 2013. For severe dependent the amount was set between 180€ and 300€ in 2011 and between 236€ and 268€ in 2013. For moderate dependent: 153 € in 2013. For a better understanding of the amount of caregiver and disability allowance, they can be compared with minimum wage: 570.60 €/month (2007), 641.40 €/month (2011), 645.30 €/month (2013).

Although the principles are set at a nationwide level, regulation and funding is regionally set, and the implementation varies regionally. Indeed, each region (autonomous community) proceeded at different speeds (Costa-Font, 2010; see Table A1), and different assessment of needs or basic activities of daily living (ADLs). Consequently, there was a wide variation in the percentage of the population benefiting from the program (e.g., 3.19% in Andalusia versus 1.17% per cent in the Canaries, using data for 2010)[4]. Similarly, regions differed in their reliance on caregiving subsidies or in-kind benefits[5].

Unfortunately, just a year after the SAAD was introduced, Spain went into a deep economic recession. The recession increased the country's public deficit (8.9% at the beginning of 2012) and led to a series of spending cuts that included delays in the SAAD entitlements in July 2012 (Royal Decree 20/2012, 13 July 2012). Specifically, the subsidy for 'moderate dependency' was delayed until 2015; hence, only those with severe and major dependency were supported. Among these, support for home care fell from 70–90 hours/month

[4] Beneficiaries with respect to the population aged 18 and over. We have used this threshold given the differences in the ranking scale between the population under and over the age of 18.

[5] The latter lead to a wide dispersion rate in the cost per dependent (e.g., €5,093 in the Murcia region versus €12,715 in the Madrid region, while the percentages of informal caregivers' benefits with respect to total benefits awarded were 68.7% and 18.6%, respectively; Barriga Martí et al., 2015).

to 56–70 hours/month for individuals with ‘major dependency’, and from 40–55 hours/month to 31–45 hours/month for those with ‘severe dependency’. Finally, the subsidy for those receiving an unconditional caregiving subsidy designed to pay for informal caregivers was reduced by between 15 and 25% conditional upon the degree of dependency, and the Social Security stopped paying social contributions for informal caregivers.

Evidence from Spain offers some important insights on the effect of health and social care coordination. Traditionally, coordination between health and social care has been limited. One of the traditional reasons for such limited coordination falls in the asymmetric jurisdictional functional allocation. Social care was typically a local responsibility, which is subject to needs/means testing, while healthcare is run by the regional governments, and is free at the point of need, with the exception of pharmaceutical co-payments.

The other main reason for limited coordination lies in the chronic underfunding of social care. Hence, for a reform to exert an influence in the health system it should not only coordinate health and social care by making use of different policies such as a joint commissioning mechanism, but also expand the funding of underfunded social care. **Table 1** reports the health and social care coordination plans in several Spanish regions. However, as we argue, the benefits of health and social care coordination only materialised when the underfunding was corrected.[6]

[Insert Table 1 about here]

[6] For the case of Catalonia, Vargas and Vázquez (2007) have found evidence of scarce resource of coordination mechanisms and preponderance of intra-class efficiency incentives without taking into consideration the most cost-effective treatment in the continuum of care.

Based on the above description, our analysis aims at analysing (i) the effect of the implementation of SAAD on hospital admissions, (ii) it pays special attention to the effect of *health and social care coordination* plans in some regions and (iii) examine the effect of the reduction in the subsidy after the *2012 austerity cuts*.

4. Data

Consistently with other studies (Norton and van Houtven, 2004; Card et al. 2004; Nielsen, 2016; Geilet al, 2007) examining hospital care use, we use individual data from the Survey of Health, Ageing and Retirement in Europe (SHARE) for Wave 1 (2004), Wave 2 (2006/2007), Wave 4 (2011) and Wave 5 (2013)[7]. Individual survey data is especially important given that administrative data often lack the richness of individual specific control for socio-economic and demographic characteristics available in survey data. SHARE is the European equivalent of the Health and Retirement Survey[8], a panel dataset of interviewees born in 1960 or earlier, and their partners covering a number of European countries[9]. SHARE[10] is the most comprehensive dataset available across Europe for examining the effects of changes in LTC subsidies among the elderly.

[7] Unfortunately, wave 3 could not be included as it was not comparable with other waves.

[8] Other authors (Van Houtven and Norton, 2004; Card et al., 2004; Nielsen; 2016) have also used survey data to analyze the use of healthcare services.

[9] Countries included are Austria, Germany, Sweden, the Netherlands, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium, Israel, the Czech Republic, Poland and Ireland.

[10] SHARE data collection has been funded primarily by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812) and FP7 (SHARE-PREP: No. 211909, SHARE-LEAP: No. 227822, SHARE M4: No. 261982). Additional funding from the German Ministry of Education and Research, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064), and from various national funding sources is gratefully acknowledged (see www.share-project.org).

Our data contain records of the amounts individuals have received from caregiving allowances and, the support received from public home care services for waves 1, 2 and 5. However, wave 4 records only contain data on the caregiving allowance amount, as questions concerning public home care were omitted from the questionnaire. However, given that we do identify the information at the individual level from previous waves, a multiple imputation procedure has been used to tackle missing data (Rubin, 1987). This technique allows predicting what the random missing values would have been using information from the whole dataset (waves 1, 2, 4 and 5)[11]. It requires two main assumptions: (i) the data must be missing at random, which is clearly the case because observations for public home care are missing for all the individuals in wave 4, and (ii) the reasons for the missing data must be captured by other variables that do not have missing values. As the missing variable is binary, a logistic imputation method has been chosen, and the following explanatory variables have been introduced: age, gender, being married, having co-resident children, pathologies (stroke, mental illness, Parkinsonism, hip fracture), and a left-wing regional government. To test the sensitivity of our results, we have selected five different random seed values, and added five different imputations to our main dataset. The results in these alternative cases were very similar to the original estimations.

Before the onset of the SAAD, individuals receiving a caregiving subsidy are identified through SHARE questionnaire as those belonging to one of the following groups: permanent disability benefit, third-party benefits, non-contributory invalidity pensions or family benefits for dependent children.

[11] Kalton (1986) and Lepkowski (1989) review methods for compensating for wave non-response and recommend cross-wave imputation if there exist data from multiple waves.

After 2007, the access to the SAAD could only result from either: (i) individuals who were not receiving any type of benefit previously (permanent disability benefit, third-party benefits, non-contributory invalidity pensions, family benefits for dependent children) which started the application process, and they were evaluated according to the Official Ranking Scale of the SAAD; and (ii) individuals who were already receiving any of the benefits mentioned in the previous point were re-evaluated according to the Ranking Scale and re-classified as moderate, severe or major dependent. Although the law guarantees that the disability scales in needs tests are valid throughout the Spanish territory, the test is carried out by officers working for each region where the applicant resides to determine the services or benefits that best match the applicant's needs. Hence, there is important regional variability in addition to the other differences in actual reform implementation.

Given the LTC support provided by SAAD we define two binary variables. CB_i refers to a binary variable that takes the value 1 if the beneficiary receives a caregiving allowance, and takes the value of zero otherwise. The allowance is paid to the dependent individual to compensate the informal caregiver. HB_i refers to a binary variable taking the value 1 if the beneficiary receives public home care benefit, and zero otherwise. Caregiving allowance and home care benefits are mutually exclusive. In our sample (see Table A2 for a description), we identify 1,254 out of 13,512 observations corresponding to beneficiaries of LTC benefits. 751 of those received caregiving allowances (CA_i) and 503 received home care benefits (HB_i).

Furthermore, 355 of them (as well as 1,034 non-beneficiaries) have been hospitalized.[12]

Hospital admissions. Our data contain records on whether the survey respondent has spent a night in hospital over the past twelve months (including medical, surgical, psychiatric or any other specialized wards), and the total number of hospital overnights over the past twelve months. We use this information to define three dependent variables:

a) *Hospital Admission (extensive margin)* (H_i) is a variable that takes the value 0 if the individual has not spent any nights in hospital over the past twelve months, and is equal to 1 if they have. It includes stays due to inpatient surgery, medical tests or non-surgical treatments and mental health problems. Therefore, hospital admissions do not include stays in long-term care facilities or nursing homes.

b) *Hospital Admissions* (intensive margin) (HN_i) is a count variable taking the value 0 if the individual has not been admitted to hospital over the past twelve months, and a positive value equal to the number of times they have been admitted over the past year. Given that the Spanish LTC reform was first introduced in 2007, and hospital admissions are recorded over the twelve months prior to the survey, admissions coded in the 2007 wave may have actually taken place in 2006. To capture the reform's true effect on

[12] Regarding the number of observations, Forster et al. (2003) analyzed the incidence of injuries after hospital discharge using a survey of 400 respondents interviewed by telephone and Seymour and Pringle (1982) studied the incidence of postoperative morbidity and other socioeconomic and administrative factors using a sample of 1,590 individuals aged 65 and older. Finally, Geil et al (1987) analyze hospital admissions in Germany with a comparable number of observations for a general and chronic condition subsamples. Additionally, Schwartz and Giles (2016) have shown that the maximum likelihood estimation of the zero-inflated Poisson model exhibits very little bias, even in relative small samples.

hospital admissions, we will assume that the pre-reform period covers waves 1 and 2 (2004, 2006, 2007),[13] and the post-reform period covers waves 4 and 5 (2011 and 2013).

c) Duration of a Hospital Admission (length of stay, LOS) (HLS_i) is a count variable taking the value 0 if the individual has not spent a single night in hospital over the past twelve months, and a positive value equal to the number of nights they have spent in a hospital over the past year.

A core assumption of the difference-in-differences strategy we follow to identify the key parameters of the model is that the time trend is common to both groups. Hence, both treatment and control individuals are expected to exhibit hospital admissions that are parallel without the LTC reform, after controlling for observables. Although this common time trend assumption is not directly testable, it is very plausible to hold in our context based on existing comparable pre-trends. Since no other long-term care legislation was passed after 2007, a priori, we would expect to see a change in the percentage of hospital admissions for the treatment group in the reform year, but parallel time trends in subsequent years. And this is what we find.

Figure 1 displays the trends in the external margin of our dependent variable, that is, the percentage of hospitalised individuals by type of long-term care support received. Importantly, after 2007 we observe a reduction in hospital admissions among both beneficiaries of caregiving allowances and home care, but not among those who do not receive any benefits. Consistently, in 2013, possibly due to the effect of the austerity cuts in 2012, some of these

[13] For 2007 the interviews were made at the beginning of the year as they correspond to the 2006-2007 wave.

benefits were reversed. However, these are trends that need to be controlled for a number of other misleading effects, and we do so in our econometric analysis below.

[Insert Figure 1 about here]

Figure 2 displays the density function for the number of hospital admissions distinguishing those who benefit from SAAD and those who do not at the time of the survey. It is noticeable that SAAD beneficiaries and non-beneficiaries exhibit opposite patterns. We find a decrease in hospital admissions among beneficiaries between 2004/07 and 2011. In contrast, we find a shift to the right among non-beneficiaries of SAAD. Consistently, between 2011 and 2013, the density functions for both groups partially reverse the displacements observed in the previous sub-period (e.g., a higher concentration of a lower number of hospital overnights for non-beneficiaries, but an increase for beneficiaries).

[Insert Figure 2 about here]

Table A2 in the Appendix displays the descriptive statistics for the number of hospital admissions and hospital LOS. It is noticeable that in almost all the cases, the standard deviation exceeds the mean, which is a clear indication of overdispersion of the data. Between waves 1&2 and wave 4, hospital LOS has decreased both among those receiving caregiving allowances (from 11.35 to 8.75) and home care (from 15.36 to 11.54). However, importantly, between the last two waves we find that previous reduction in hospital LOS were partially wiped out, especially among those receiving caregiving allowances (from 8.75 in W4 to 12.09 in W5). Similar conclusions are obtained from the analysis for the number of hospital admissions.

***Explanatory variables*.** The SHARE questionnaire contains information on the respondents' main socio-demographic characteristics which is typically not available in many observational studies. The choice of explanatory variables follows the literature and includes age, gender, education attainment, marital status, self-reported health status, Katz's index[14], net income (€2011), and net wealth (€2011) (Van Rossum et al., 1993; Rapp et al., 2015). A detailed table reporting descriptive statistics for individual explanatory variables is reported in **Table A3**. Individuals that receive public home care are on average 10 years older than beneficiaries of caregiving allowances. They also record a higher concentration of women, widowed, and more dependent individuals. Regardless of beneficiary status, all the groups have suffered a sharp decrease in real net income and real net wealth between both sub-periods.

Additionally, a set of regional variables is included for region-specific unobservables at the time of the survey (see **Table A4**). First, given that hospital deployment might be explained by resource constraints and demand pressures in the health sector rather than LTC subsidisation, we control for per capita public health expenditure (€2011) and degree of satisfaction with the public healthcare received. We find that real public health expenditure and the degree of satisfaction with the public healthcare system peaked in 2011. Second, the number of resources and the quality of care received at hospitals is

[14] Katz's index is not directly provided by SHARE, but has been obtained using data on disabilities for ADLs, following Katz (1983).

proxied by the hospital infection rate and complication rate[15] as well as the number of public hospital beds per 1,000 inhabitants. We notice an increase in the infection rate at hospitals in the last two waves, and a progressive rise in the number of hospital beds per 1,000 inhabitants in publicly owned hospitals during the period. Finally, the rate of hospital complications has acutely increased in the last two-waves.

Third, as described in **Table 1**, some regions implemented health and social care coordination plans both before and during the period of analysis. Hence, we define a binary variable ($Coord$) that takes the value 1 if that coordination programme is in place in the region at the time of the survey. Finally, Spain went through a recession during at least some of our data waves, which led to significant employment shocks which we control for, as well as other shocks to the economy as a whole. In addition, we include both time and regional fixed effects.

5. Empirical Strategy

5.1. The count nature of hospital admissions

Given the discrete nature of both the number of hospital admissions or the LOS we need to account for the fact that the dependent variables do not have negative values. Hence, a linear model is likely to misspecify the count data generating process, and may lead to negative or non-integer predictions (King, 1988). Although the Poisson specification is the natural candidate for these processes, a Poisson specification might be too restrictive if the variance of the data exceeds its mean (overdispersion). A common alternative to the

[15] The infection rate and the complications rate are considered by the AHRQ (2007) and the ECHI (2013) as quality indicators of healthcare services.

Poisson model is the negative binomial model. However, even though the negative binomial solves the problem of overdispersion, typically neither of them provides a suitable fit if there is a large percentage of zero observations in the dataset[16].

The empirical approaches normally used in the empirical literature include zero-inflated and double-hurdle specifications. The zero-inflated model is sensitive to the fact that zeros may arise in two circumstances, namely, either as a consequence of a strategic decision, or due to incidental reasons (Winkelmann, 2008). Some individuals may report zero hospital admissions because they have not suffered a health shock which is serious enough to require admission to a hospital. These individuals may be referred to as 'strategic non-hospitalised'. On the other hand, an individual who does require inpatient care and it is not admitted to hospital would qualify as an 'incidental zero observation'.[17]

Our preferred alternative is the double-hurdle model, also referred to as the two-part model. The double-hurdle model assumed that 'the zeros' are only the result of strategic decisions, and hence, are generated by a mechanism separated from that of non-zeros (Mullahy, 1986; Gurmu, 1998). The first hurdle determines whether the count variable is zero or has a positive realization (i.e., if the individual has been hospitalised at least once in the past

[16] We have not exploited the panel nature of the SHARE survey because if would imply an acute decrease in the number of observations (from 14,766 to 5,647). Moreover, Lechner et al. (2015) have shown that in the case of an unbalanced panel (as it is the panel composed by the four waves of SHARE used in this paper), OLS and fixed effects estimators of the difference-in-difference model are not numerically equivalent. Deviating results between OLS and fixed effects estimates constitutes evidence that attrition is not ignorable for the difference-in-differences estimation.

[17] Given the characteristics of the Spanish health system, this situation seems in principle highly improbable. SHARE only provides information on unmet hospitalisation needs for wave 1: 0.29% (0.33%) of respondents reported not having received surgery or hospital treatment because they could not afford it (it was not available).

12 months). A positive value indicates that the first hurdle is met, and in this case the exact number of days spend in hospital (intensive margin of hospital admissions) is modelled using a truncated distribution. Both stages are independent, and the first hurdle is usually modelled with a logit distribution, and the second hurdle as a zero-truncated negative binomial or Poisson (Cameron and Trivedi, 2013).[18]

5.2 *The empirical specification of the double hurdle model*

Regarding the specification of the hurdle model, it must answer two questions. First, how could one best identify the way SAAD has affected hospital variables in both the internal and external margin. Second, how should the estimation itself be specified, and more specifically, how to define a two-part model in the presence of potentially endogenous covariates. We review in this subsection the first issue, while the second will be discussed in the following subsection.

To address the first question, that is, the effect of SAAD on the hospital admission (at both the intensive and extensive margin) and the LOS, we use a difference-in-difference specification. This approach has been widely used to measure the effect of a new policy or to analyse the impact of policy changes

[18] The truncated Poisson allows us to solver the overdispersion problem of the simple Poisson model:

$$H_{ict} = W_{it}'\Omega + \nu_{ict}$$
$$Var[H_{ict}|\Omega] = E[H_{ict}|\Omega] + E[H_{ict}|\Omega]\left(e^{W_{it}'\Omega} - E[H_{ict}|\Omega]\right)$$
$$E[H_{ict}|\Omega] = \frac{e^{W_{it}'\Omega}}{1+e^{e^{-W_{it}'\Omega}}} * \frac{e^{W_{it}'\Omega}}{1-e^{e^{-W_{it}'\Omega}}}$$

Where H_{ict} denotes the dependent variable of our model (number of hospital admissions during last year, LOS of individual *i* living in region *c* in year *t*), W_{it}' includes all regressors and ν_{ict} is the residual term. Depending on $e^{W_{it}'\Omega}$ and $E[H_{ict}|\Omega]$, the mean may be bigger or smaller than the variance, and therefore, it can accommodate overdispersion and underdispersion situations.

(Cameron and Trivedi, 1986; Wooldridge, 2002). The difference-in-difference method is a standard policy evaluation tool that assesses the effect of a policy intervention on a treatment group in comparison of a control group once this specific policy has been implemented. Since our data do not come from a real experiment, the assignment to treatment and control is based on the evidence available at SHARE. In our model, $SAAD_{ict}$ is a binary variable representing the treatment group that takes the value 1 for individuals receiving LTC benefits (either caregiving allowances (CB_{ict}) or home care benefits (HB_{ict})). Therefore, individuals who at the time of the survey were not receiving any type of benefit compose the control group. As regards the second issue, the estimation of the double hurdle model faces two important challenges, namely, model specification and the existence of potentially endogenous variables. Let us start describing first the specification.

The first hurdle determines whether the count variable is zero or has a positive realization i.e., if the individual i living in region c has been hospitalised at least once in the past 12 months ($H_{ict} = 1$). It may be expressed as the following difference-in-differences regression for the probability of a hospital admission:

$$H_{ict} = \begin{array}{c} F(SAAD_{ict}\alpha_1 + POST_t\alpha_2 + SAAD_{ict} * POST_t\alpha_3 + X'_{ict}\alpha_4 + \\ +HC'_{ct}\alpha_5 + C_c + T_t + \varepsilon_{ict}) \end{array} \quad (1)$$

$$SAAD_{ict} = \{CA_{ict} \text{ or } HB_{ict}\}$$

where F denotes a probability function, $POST_t$ is a binary variable taking the value one for waves 4 and 5 and the value zero for waves 1 and 2, X_{ict} refers to the individual characteristics (age, gender, marital status, level of education, self-reported health status and dependency degree approximated by Katz's index) and HC_{ct} denote the characteristics of the regional healthcare sector (public health expenditure per capita in real terms, number of public hospital beds per 1,000 inhabitants, infection rate at hospitals[19], and satisfaction with the public healthcare system). In addition, C_c and T_t denote regional and temporal dummy variables, respectively, and ε_{ict} is a random error term that also captures individual unobserved characteristics.

The coefficient of $SAAD_{ict} * POST_t$, α_3, captures the effect of the reform. It evaluates whether receiving a benefit after the reform has any differential effect on hospital admissions and hospital LOS with respect to the pre-reform period. Although the reform was introduced nationally, the speed of the introduction varied widely by region, so the identification of the effect of the reform implicitly comes (it is reinforced) from its regional variation.

When the first hurdle is met, that is when $H_{ict} = 1$, the second hurdle (or count variable), H^*_{ict} (either the LOS, HLS_{ict}, or the exact number of hospital admissions, HN_{ict}), is modelled using a truncated Poisson distribution[20].

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[19] We have also estimated the model substituting the infection rate and number of public hospital beds by the rate of medical complications at hospital. The complete set of results is available upon request.

[20] A statistical exploration of the data has led us to consider a logit plus zero-truncated Poisson (double-hurdle) model to solve the overdispersion problem mentioned earlier. The results (available from the authors upon request) point to the same conclusions for the three types of benefits. First, the significance of the overdispersion parameter (alpha) and the comparison of the AIC and BIC statistics for the Poisson and negative binomial models indicate that the negative binomial model fits the data better. Second, the likelihood ratio test between the Poisson and the hurdle Poisson indicates the suitability of a double-hurdle model. Third, the likelihood ratio test between the negative binomial and the hurdle negative binomial rejects the former. Finally, a comparison between both hurdle models rejects the hurdle negative binomial.

$$H_{ict}^{*} = \begin{gathered} G(SAAD_{ict}\beta_1 + POST_t\beta_2 + SAAD_{ict} * POST_t\beta_3 + X'_{ict}\beta_4 + \\ + HC_{ct}\beta_5 + C_c + T_t + \nu_{ict}) \text{ if } H_{ict} = 1 \end{gathered} \quad (2)$$

$$H_{ict}^{*} = \{HLS_{ict}, HN_{ict}\}$$

where G denotes a truncated count specification and ν_{ict} is an error term assumed independent of the first stage error. The coefficient of $SAAD_{ict} * POST_t$, β_3, captures the effect of the reform on either the conditional LOS or the number of hospital admissions. It evaluates whether receiving a benefit after the reform has any differential effect on hospital admissions (both in its internal and external margin) and the LOS compared with respect to the pre-reform period.

Estimation by maximum likelihood of equations (1) and (2) yields consistent and efficient estimations if $SAAD$ and X'_{ict} are exogenous. However, if the unobserved determinants of $SAAD_{ict}$ are correlated with ε_{ict} or ν_{ict} the estimated coefficients will be biased.

5.3 Dealing with Endogeneity of the SAAD variables

As noted above, one of the threats of our empirical strategy is the potential endogeneity of SAAD. For example, SAAD has been implemented at a different pace in each region, and possibly some regions have a significantly higher propensity to award economic benefits, whereas others are more prone to set up a network of home care services. As a result, the error term of (1) or (2) could be correlated with unobservable variables that affect the implementation of the SAAD. Hence, assuming that SAAD is exogenous in (1) or (2) may lead to inconsistent estimates of the key parameters of the model.

Given the difference-in-difference specification used, we have two potential endogenous variables: $SAAD_{ict}$ and $SAAD_{ict} * POST_t$. Hence, we propose using a control function (CF) approach to account for the potential endogeneity of both of them. This technique, suggested by both Wooldridge (2002) and Blundell and Powell (2003) is useful for estimating non-linear models[21]. In a first stage, we run a linear regression of the endogenous variables on all exogenous variables and instruments, and obtain the residuals.

$$SAAD_{ict} = Z'_{ict}\partial_1 + X'_{ict}\partial_2 + HC'_{ct}\partial_3 + C_c + T_t + \xi_{ict} \quad (3)$$

$$SAAD_{ict} * POST_t = Z'_{ict}\vartheta_1 + X'_{ict}\vartheta_2 + HC'_{ct}\vartheta_3 + C_c + T_t + \varsigma_{ict} \quad (4)$$

where $SAAD_{ict}$ is either CB_{ict} (caregiving allowances) or HB_{ict} (home benefits), Z'_{ict} is a vector of instruments, and ξ_{ict} and ς_{ict} are residuals distributed according to a N(0,1). We obtain the first stage residuals ($\hat{r}_{SAAD\_\square ct}$ and $\hat{r}_{SAAD\_POST\_ict}$) and, in a second stage, we use them as additional control variables in both hurdles. We use bootstrapping to obtain valid standard errors. Hence, the final difference-in-difference double hurdle model controlling by the potential endogeneity of the LTC variables is given by the following equations:

$$H_{ict} = \begin{matrix} F(SAAD_{ict}\alpha_1 + POST_t\alpha_2 + SAAD_{ict} * POST_t\alpha_3 + X'_{ict}\alpha_4 + \\ +HC'_{ct}\alpha_5 + \hat{r}_{SAAD\_ict}\alpha_6 + \hat{r}_{SAAD\_POST\_ict}\alpha_7 + C_c + T_t + \varepsilon^*_{ict}) \end{matrix} \quad (5)$$

$$H^*_{ict} = \begin{matrix} G(SAAD_{ict}\beta_1 + POST_t\beta_2 + SAAD_{ict} * POST_t\beta_3 + X'_{ict}\beta_4 + \\ +HC_{ct}\beta_5 + \hat{r}_{SAAD\_ict}\beta_6 + \hat{r}_{SAAD\_POST\_ict}\beta_7 + C_c + T_t + v^*_{ict}) \end{matrix} \quad (6)$$

$$SAAD_{ict} = \{CA_{ict} \text{ or } HB_{ict}\}$$

$$H^*_{ict} = \{HLS_{ict}, HN_{ict}\}$$

[21] Terza et al. (2008) discuss that two-stage least squares estimation may lead to inconsistent estimates and thus, in non-linear settings, the residual inclusion estimation is the preferred approach.

Implementing a significance test on the joint effect of $\hat{r}_{SAAD_i\square t}$and $\hat{r}_{SAAD\_POST\_ict}$ provides a simple way to test the assumption that SAAD and SAAD*POST are exogenous in the first and the second hurdle, respectively. In case the effect of $\hat{r}_{SAAD\_ict}$ or $\hat{r}_{SAAD\_POST\_ict}$ is significant in one or both equations, we can reject the exogeneity of SAAD or SAAD * POST in the corresponding equation[22].

Regarding the vector of instruments (Z'_{ict}), we have considered six different instruments. The first one refers to the percentage of support for the socialist party in the last general elections (Soc_{ct}), as the socialist party's electoral mandate included the development and implementation of a new LTC Act[23] (see Table A5). Specifically, given that the reform was the 'star social programme' of a newly elected government, and that the regions were co-financing and implementing the reform, political support for the incumbent party at the regional level would be expected to make it easier for the regional government to implement the reform. We take advantage of the fact that some of the interviews in the 2006 wave were carried out in 2007, to assign more exactly the value of the instrumental variable `*percentage of socialist vote*' to each observation. Hence, the instrument is both theoretically relevant and empirically significant, and after running some additional analysis we find no reason to believe it impacts on the dependent variable in any other way but

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[22] We have also estimated the model including both types of benefits (caregiving allowances and home care benefits) in the same equation, as well as their interactions with the post-reform dummy. This implies that the number of endogenous variables increases from 2 to 4, and consequently, we must include 4 residual variables in the second-step equations. As Phillips (1983) has shown, an increase in the number of endogenous variables reduces the danger of omitted variable bias, but also reduces the reliability of estimations because the ratio of observation to parameter becomes smaller. Therefore, given this and the fact that the number of reliable instruments is limited, we have preferred to estimate the effect of each type of benefit by separate.

[23] Hence, regions run by the socialist party would be expected to speed up the implementation of the reform, as some previous research has documented (Costa-Font, 2010).

through the reform[24]. The second instrument we employ refers to the interaction between the percentage of the vote for the socialist party and the post-reform period ($Soc_{ct} * POST$).

In addition, we include the coverage index of public home care in 2002 and 2000, before the onset of the SAAD, to capture the effect of regional differences in the provision of formal care (see **Table A6**). The fifth instrument we draw upon refers to the proportion of women outside the labour market, which can be interpreted as a measure of the propensity to provide informal care. Finally, we define a binary variable if the individual lives in a rural area, and zero otherwise. This variable controls for formal care availability and willingness to demand formal care in rural areas compared to cities[25].

Validity of the instruments. The results of the first-stage regressions confirm the validity of our instruments. Regions with higher socialist support exhibit a lower propensity to award a caregiving allowance, but a significant and positive association to develop a network of home care support (**Table 2**). Given that we control for regional fixed effects, we conclude that the differential speeds in the implementation of the SAAD were influenced by the political support for the regional incumbent. The coverage index of public home care in 2000 and 2002 shows a negative association with the probability

[24] According to Bacigalupe et al. (2016) there is no evidence of an association between socialist support in a region and a higher investment in public healthcare services, or vice versa, a positive relationship between conservative regions and privatizations of public hospitals (i.e., Andalucia and Extremadura which are regions with left-wing governments have experienced a high decrease in health care resources between 2008 and 2013 and a moderate increase (Andalucia) or high increase (Extremadura) of privatizations. By the contrary, Murcia which has a right-wing government has experienced a moderate reduction in public health care resources and a decrease in privatized facilities).

[25] Moreno-Colom et al. (2016) state that socio-cultural factors play an important role in the expansion of professional formal care providers. These socio-cultural factors, which are especially stronger in rural environment, contribute to explain why family remains the most important group of care providers in the countryside.

of receiving a caregiver allowance and a counter effect on home care. By contrast, a higher fraction of women out of the labour force, or a higher fraction of population living in a rural area are associated with a higher probability of receiving a caregiver allowance, but a lower probability to receive home care support.

[Insert Table 2 about here]

5.4. Coordination and Spending cuts

In addition to obtaining the average effect of SAAD on hospital admissions, we are interested in two additional specification exercises, namely the effect of coordination plans and the effect of the budget cuts introduced in 2012/2013. In order to model them we introduce a triple interaction effect in the specification of both hurdles (*SAAD*POST*COORD)* which can be interpreted as the effect of coordination in addition to the effect of SAAD. In the case of budget cuts, we take advantage of the fact that the final wave of SHARE in our analysis refers to a date after the introduction of the budget cuts. Consequently, the triple interaction, *SAAD*POST*2013* identifies the effect of the spending cut in 2012. The coefficient of this term can be interpreted as the additional effect of the budget cuts on the top of the 2011 effects of the reform.

6. Results

6.1. The effect of the reform on hospital admissions.

As expected, we find evidence of a reduction of hospital admissions (HA) for those who benefit from the reform after the reform. **Table 3** reports the results for the key coefficients of the hurdle Poisson model namely the probability of a HA (external margin), the number of HA (internal margin) and the LOS resulting from the introduction of the SAAD, both for individuals benefiting from a caregiving allowance and those receiving home care (all the other coefficients are presented for the baseline case in **Table A8**). Specifically, panel A reports the baseline case for these effects; panel B presents the coordination case emphasising the effects for those regions that have implemented coordination between healthcare and social care, and finally, panel C presents the analysis of the effect of budgetary cuts implemented in the SAAD in 2013. The first-stage residuals are not significant in the first hurdle (logit), but they are in the second one (truncated Poisson). The Hausman test rejects the hypothesis of endogeneity of SAAD and SAAD * POST in the first hurdle, but accepts it for the second one. However, we keep and present the Instrumental Variables (IV) specification for both hurdles[26].

[Insert Table 3 about here]

Baseline results. Panel A in Table 3 reports the model's baseline results, with the treatment variable after the reform captured by the interaction SAAD*POST. Our results indicate that, as expected, the reform did indeed reduce HA's in both internal and external margin, as well as its LOS. Firstly, the external marginal of HA's decreased by 9.5 pp. among those receiving caregiving allowances as compared to similar beneficiaries in the pre-reform period, but it is not significant for home care beneficiaries. Second, the effect size for the number of hospital admissions and LOS is different for caregiving allowances and home care. Although the coefficient for home care exhibited a larger effect on the LOS, the coefficient of those receiving a caregiving

[26] Table A7 of the Appendix shows the results of the hurdle Poisson model without control function. Not controlling for the endogeneity of LTC benefits (caregiving allowances and home care benefits) produces an overestimation of their effects over the number of hospital admissions and LOS at hospital for the coordination case and the analysis of budgetary cuts.

allowance was larger on the number of hospital admissions. Our effect sizes indicate that the LOS for beneficiaries of caregiving allowances (home care beneficiaries) is 0.79 (0.70) times shorter than that of similar beneficiaries in the pre-reform period. The beneficiaries of caregiving allowances record an increase in the number of hospital admissions (1.13 times more than non-beneficiaries).

Among those receiving home care, we observe that the HA external margin increases by 5.2 pp, and LOS is 1.26 times that of non-home care beneficiaries. The interaction term (SAAD*POST) indicates that the number of hospital admissions (LOS) in the post-reform period is 0.90 (0.70) times that of a home care beneficiary in the pre-reform period.[27] Therefore, we can conclude that individuals receiving a caregiving allowance exhibited a higher reduction in the number of hospital admissions, and that those receiving support for home care exhibit a larger decrease in the average LOS.

When we examine the effect of all the other controls (see **Table A8** in the Appendix for the detailed results of the analysis), we find that the number of public beds per 1,000 inhabitants does not affect HA in neither the internal and external margin. A higher infection rate is negatively correlated with number of hospital admissions and hospital LOS, whilst higher satisfaction with the public healthcare system is only negatively correlated with hospital intensity. In contrast, higher public healthcare expenditure is positively correlated with hospital intensity.

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[27] We have re-estimated the model removing the infection rate and number of public bed hospitals. Instead, we have introduced the complication rate with respect to total discharges. Results of the hurdle Poisson model are robust to this change in explanatory variables. [Results are available upon request].

The role of coordination. Panel B in **Table 3** reports the combined effect of coordination[28] and LTC on HA and LOS. As in panel A, in the post-reform period, we report the HA and LOS of long-term care beneficiaries which have declined compared to the pre-reform period. The fact that the variable `coordination' is not significant in the pre-reform period might indicate that the chronic underfunding of LTC services does not allow coordination to deliver its expected effects. The interaction term *SAAD*Coordination* indicates that: (i) the number of hospital stays for beneficiaries of caregiving allowances in coordinated regions is 1.33 times higher than similar beneficiaries in non-coordinated regions, (ii) the LOS of home care beneficiaries in coordinated regions is 1.42 times that of similar beneficiaries in non-coordinated regions.

Nonetheless, the coefficient of the triple interaction *SAAD*Coord*POST* offers a different picture. First, the probability of a HA falls by 11.6 pp. among those who benefit from a caregiving allowance, and by 18.5 pp for home care in regions with coordination programmes between healthcare and LTC services. We do not find a significant effect of caregiving allowance on the hospital LOS, suggesting that coordination effects only reduce the LOS among those who are receiving home care. These results are consistent with previous finding that coordination programs were breeding ground for the implementation of the reform (SAAD), insofar as they deliver a reduction of the number of hospital admissions and LOS at hospital in the post-

[28] In addition, care coordination can entail a wide range of services such as psychogeriatric, long-stay hospitals, rehabilitation and palliative care, which have not been considered in this paper (IMSERSO, 2011).

reform period. The negative and significant sign of the *SAAD*Coord*POST* in the post-reform period reveals that the SAAD may be interpreted as the creation of links between informal caregivers and healthcare professionals in regions with coordination programs. Informal caregivers had not been considered as part of the organizational models before the SAAD.

Overall, the average hospital LOS of patients receiving home care in regions with coordination programmes after the reform has decreased by 0.67 days compared to other patients receiving home care in a region without a coordination programme. The number of hospital admissions has been reduced by 0.86 (0.79) among those receiving a caregiving allowance (home care beneficiaries) in regions with health and social care coordination programs after the reform, as compared to the rest. As in the baseline case, the residuals corresponding to the first-stage regression for the four endogenous variables are significant in the second hurdle, but not in the first one.

The effect of the 2012/2013 budgetary cuts. Finally, panel C in **Table 3** displays the effects of the austerity cuts introduced between 2012 and 2013. The interaction term *SAAD*POST (2011&2013)* indicates that the LOS for receivers of a caregiving allowance (home care) is 0.86 (0.87) times that of similar beneficiaries in the pre-reform period. Nevertheless, these reductions in HA have been partially compensated by opposite sign effects observed for *SAAD* POST*YEAR (2013)*, affecting both the LOS and the number of hospital admissions, but not the external marginal of a HA consistent with a bed-blocking effect. In fact, we find that the expected LOS of those who receive a caregiving allowances (home care) in 2013 is 1.29 (1.48) days longer than that of similar beneficiaries before that year. Finally, we also find that budgetary cuts have a significant effect on the external marginal of a HA, particularly for those who have been hospitalised at least once during the last year, where we observe a significant increase in the number of admissions (1.16 hospital admissions/year for caregiving allowances; 1.40 hospital admissions/year for home care beneficiaries)**.**

6.2 Mechanisms

In this section we revise some potential channels that help explain why an affordable access to LTC may induce reductions of hospital admissions. Previous studies that provide non-experimental estimates of the effect of long term care on HA (Weaver and Weaver, 2014 Sands et al. 2006) suggest that the effect can be explained by a closer supervision that prevents admission to hospitals which help preventing ill health. Hence, we explore four mechanisms, namely the expansion of outpatient care use and the onset of depression. We add to those mechanisms the potential opportunity costs of hospitalisation which depend on housing suitability and loneliness. All of those mechanisms can independently explain a reduction in hospitalisations.

6.3.1 Use of Outpatient Care

Another potential alternative mechanism is to find some degree of substitution of the care that would be provided otherwise in hospital. We examine the effect of a higher affordability and access to LTC on general practitioner (GP) visits. We define a binary variable '*Has visited GP*' that takes the value 1 if the individual has seen or talked to a general practitioner during last twelve months, a count variable '*Number of GP visits´* for the number of consultations to general practitioner during last 12 months. We estimate a logistic model for the probability of having visited a GP and a truncated Poisson[29] for the number of GP visits, considering as explanatory variables as in Table A9 and A10 and instrumenting *SAAD* and *SAAD*POST* as in previous section. Our findings suggest that the probability of visiting a GP during is not significantly affected by the SAAD reform, but we find that the number of GP visits in the post-reform is 1.07 times that of an individual receiving an LTC benefit (both caregiving allowance and home care benefit) in the pre-reform period. This effect we estimate amounts to an increase in 0.3% of the primary care costs (as we explain in the following section).

6.3.2 Mental health prevention

As an alternative mechanism, we evaluate the effect of the reform on the prevalence of mental health conditions which is found to reduce emergency hospitalisations (Guthrie et al, 2016). Specifically, we examine prevalence of depression and self-reported preference for being death. We define a binary variable '*Dead´* and another one for being 'Depressed´ that takes the value one if the individual has reported that he would prefer to be dead. We estimate a probit for both variables, using IV for SAAD and SAAD*POST, and observe that the probability of having suicidal thoughts decreases by 7.9 pp. (5.4 pp.) for beneficiaries of caregiving allowances (home care beneficiaries) in the post-reform period. A similar effect is found for depression in the Table A11 (-2.5 pp., although it is only significant for caregiving allowances).

6.3.3 Loneliness

[29] We have followed the same procedure described in footnote 20 to conclude that the best model is the double hurdle Poisson.

Loneliness reduction can explain a higher prevalence of a hospital admission. Indeed, Molloy et al, (2010) finds evidence suggestive that loneliness reduced hospitalisations. The latter can be captured in our dataset by non-clinical dimensions of being in hospital such as loneliness which we measure using an IV probit. We find that the probability of living alone decreases by 7.4 pp. (2.6 pp.) for beneficiaries of caregiving allowances (home care beneficiaries) in the post-reform period (see Table A11). This effect is, in turn, consistent with the fact that co-residence with the informal caregiver is a prerequisite in Spain to receive a caregiving allowance.

6.*3.4 Housing Adjustments*

Finally, another mechanism for early hospital discharge refers to the implementation of home adjustments that typically are a requirement to receive subsidised home care or caregiving support. The latter can be captured by examining the effect of a binary variable '*Adapted house´* if the household has special features that assist persons who have physical impairments or health problems and 0 otherwise as in Table A9 and A11. We estimate a probit model for the probability of living in an adapted house including the same explanatory variables as in previous regression. The probability of living in an adapted house has increased by 0.02 pp. for home care beneficiaries after the reform, but it is not significant for those receiving caregiving allowances.

6.3. Impact on hospitalization costs

As a way of synthesising our estimates, we have calculated the economic impact of the SAAD over hospital costs. To that end, we have used official data of the average length and average costs of hospital admissions by region and year from the Ministry of Health, Social Services and Immigration. Specifically, we have first computed the average cost per day as the ratio between total hospital cost and average LOS. Secondly, using calibrated weights provided by SHARE for each wave, we have obtained the population estimate of the number of beneficiaries of caregiving allowances and home care beneficiaries. Thirdly, we have applied the estimated coefficients to average length data to obtain the estimated hospital intensity (in days). Finally, we have multiplied the estimated hospital intensity by the number of beneficiaries and the average costs per day[30]. The results are shown in Table 4.

[Insert Table 4 about here]

For a better understanding of the magnitude of the results, we have compared the estimated increase or decrease in hospital costs with the official data for hospital costs in **Table 4**. The implementation of the SAAD has decreased hospital costs by 11.17%, with 4.95% from a reduction in hospital admissions and 6.22% from a reduction in the LOS. Moreover, in the subset of regions with specific coordination programmes between healthcare and social services, the SAAD has implied a reduction in hospital costs of 5.21%: with 2.75% from a reduction in the number of hospital admissions and 2.46% from a reduction in the LOS. Finally, as expected, the 2012 austerity cuts in the LTC subsidy increased costs by 5.67%, which is slightly more than the savings from coordination plans.

[Insert Table 4 about here]

[30] The procedure used to estimate changes in hospitalisation costs is similar to Holmäs et al. (2013).

7. Conclusions

This paper has drawn on quasi-experimental evidence (the introduction of the Promotion of Personal Autonomy and Care of Dependent People in Spain) to examine the effect of widening the access to LTC (resulting from the universalisation of the public subsidy after the 2007 reform which expanded the affordability of LTC) on hospital admissions (HA) (both the internal and external margin) and LOS. We find suggestive evidence of a reduction in HA and length of stay after the reform, even after controlling for the endogeneity of the reform's implementation. However, whilst the effect on HA is stronger among individuals receiving caregiving allowances, the effect on LOS is stronger amongst those receiving home care support. Our results are consistent with some potential mechanisms. For instance, we find evidence of an increase in outpatient care and housing adjustments, alongside a decrease in mental health symthoms and loneliness after the implementation of SAAD. All of these effects are consistent with different pathways for a reduction in hospital use in the literature.

Another important finding indicates that the effect of the LTC subsidy (SAAD) was stronger among regions that have a regional health and social care coordination plan in place, insofar as it provides a solution to the chronic underfunding of long term care. However, our results suggest that a significant fraction of the savings declines with the reduction of the LTC subsidy in 2012. A reduction of the subsidy, by making LTC less affordable, is found to increase the length of stay and the number of hospital admissions. Overall, our preferred estimates suggest that the implementation of the reform decreased hospital costs by 11%.

Our results face two limitations. First, our estimates capture 'hospital admissions, rather than 'avoidable hospitalisations', given that we cannot identify the latter in our data. Second, our data does not allow to identify subsequent re-admissions by patients receiving SAAD. Arguably, more patients could be treated if the LOS was shorter; hence the estimation of the subsequent costs would be conditioned by waiting lists for certain pathologies and the existence of bottlenecks in some internal services at hospitals.

Notwithstanding these constraints, our results suggest that an expansion of the access of affordable LTC may help to reduce hospital care use, and specifically, both the number of hospital admissions and the length of stay. Furthermore, they suggest that when when health and long term care at funds are allocated at the same level of government, one additional source of efficiency savings lies in taking advantage of policy coordination and integration[31].

[31] Holmås et al. (2013) investigates the effect of fining owners of long-term care institutions who prolong LOS at hospitals in Norway. Surprisingly, the study found that the stay is longer when fines are used, which is interpreted as an example of monetary incentives crowding-out intrinsic motivation.

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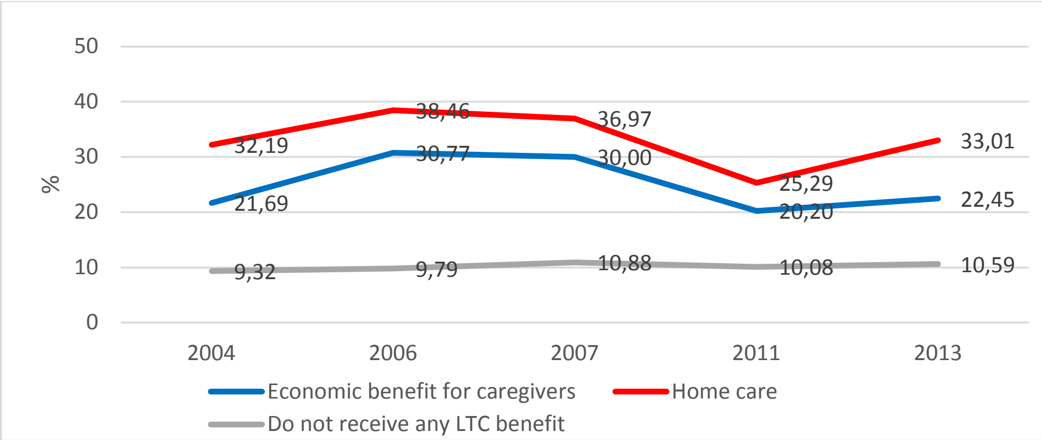
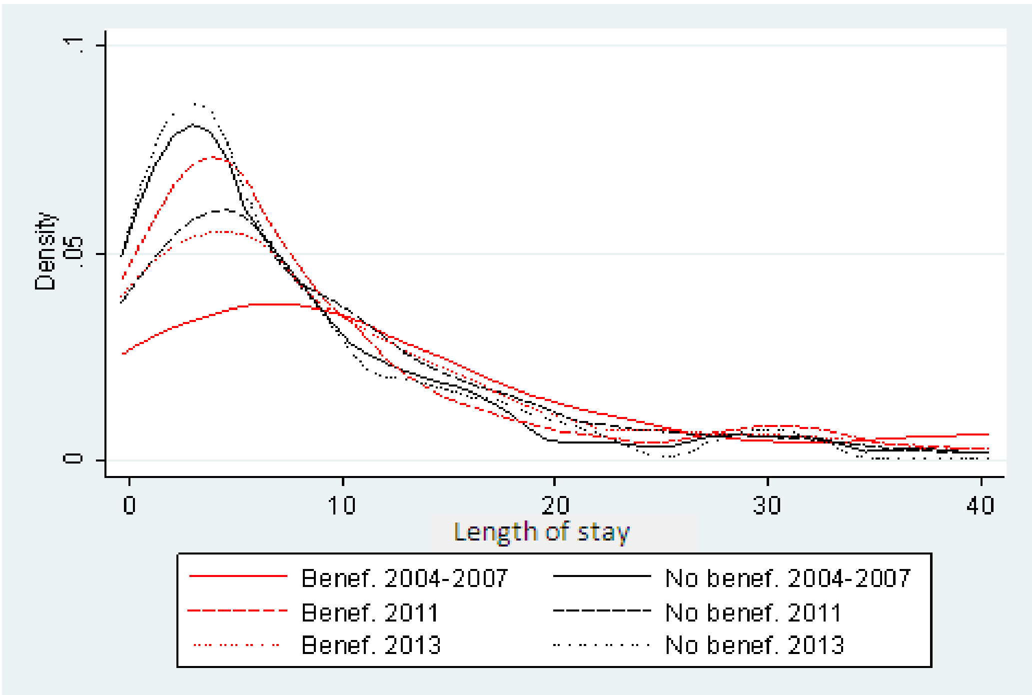
Tables and Figures

Figure 1. Percentage of hospital admissions (extensive margin) by type of subsidy 2004-2013.



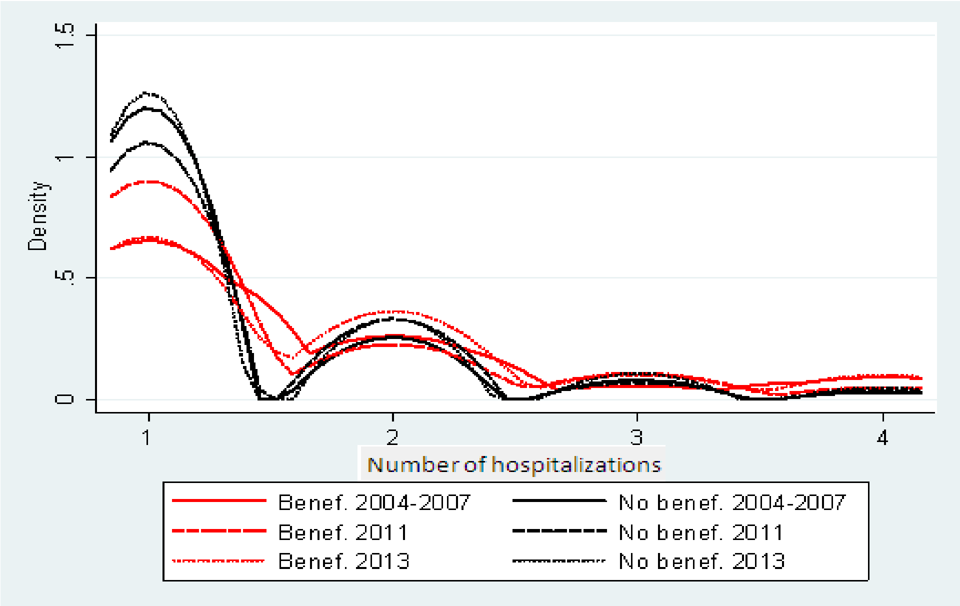
Note: This figure plots the percentage of hospitalised population by three types of individuals, namely, those who do not benefit from the reform, those who receive economic benefits (caregiving allowance), and those who receive a subsidised home care service.

Figure 2. Density function of hospital length of stay by exposure to the 2007 reform and 2012 austerity cuts



Note: Density function for the number of hospital overnights distinguishing between beneficiaries of LTC benefits and non-beneficiaries (not receiving either home care benefits or caregiving allowances). Straight lines refer to pre-reform hospitalisation for both those affected (red) and those not affected (black) by the reform. Bold dotted lines refer to the post-2007 reform, and light dotted lines refer to those affected by the 2012 reform.

Figure 3. Density function of number of hospital admissions (intensive margin) by exposure to the 2007 reform and 2012 austerity cuts



Note: Density function for the number of hospital stays distinguishing between beneficiaries of LTC benefits and non-beneficiaries (not receiving either home care benefits or caregiving allowances). Straight lines refer to pre-reform hospitalisation for both those affected (red) and those not affected (black) by the reform. Bold dotted lines refer to the post-2007 reform, and light dotted lines refer to those affected by the 2012 reform.

Table 1. Coordination between healthcare and long-term care services

Region of Spain	Name of the Programme or Agency	Period
Community of León	Plan de Atención Sociosanitario	Decree 59/2003, of 23rd January Coord=1 for all waves
Community of La Mancha	Consejería de Salud y Bienestar Social	Decree 139/2008, of 9th September Coord=1 for waves 4 and 5
Catalonia	Plan Director Sociosanitario. Programa Vida als Anys. Plan de Atención Sociosanitario 2000 Plan Director Sociosanitario 2006	Decree 242/1999, of 31st August Coord=1 for all waves
Community of Valencia	Programa Especial de la Atención Sanitaria a pacientes ancianos, a pacientes con enfermedades de larga evolución y a pacientes en situación terminal (PALET), 1995.	Coord=1 for all waves
Extremadura	Consejería de Sanidad y Dependencia	Law 1/2008, of 22nd May Coord=1 for waves 4 and 5
Navarre	Plan Foral de Atención Sociosanitaria.	Agreement of the Government of Navarre of 27th June 2000 Coord=1 for all waves
Basque Country	Consejo Vasco de Atención Sociosanitaria	Coord=1 for wave 5

Source: Jiménez-Martín et al. (2011).

Table 2. First-stage regressions

	CA	CA*POST	HB	HB*POST
Socialist support (%)	-0.045***	-0.057***	0.088**	0.097***
	(0.01)	(0.01)	(0.03)	(0.01)
Socialist support (%)*POST	-0.028*	-0.047***	0.128**	0.084**
	(0.01)	(0.01)	(0.05)	(0.02)
Home Care (2000)	-0.016**	-0.006*	0.025*	0.031**
	(0.00)	(0.00)	(0.01)	(0.01)
Home Care (2002)	-0.035**	-0.044**	0.051*	0.072***
	(0.01)	(0.02)	(0.03)	(0.02)
Fraction women at home	0.044**	0.046***	-0.023*	-0.018*
	(0.01)	(0.01)	(0.01)	(0.01)
Rural area	0.022**	0.021**	-0.016*	-0.014*
	(0.00)	(0.00)	(0.00)	(0.00)
F-test instrumental variables	234.56	154.07	160.41	150.46
F(6,14722)	(0.000)	(0.000)	(0.000)	(0.000)
N	14,766	14,766	14,766	14,766

Estimated coefficients for age, gender, marital status, level of education, self-reported health status, Katz's index, real income, real wealth, year and regional dummies are not shown. *** means significance at 1% level, ** at 5% level, * at 10% level.

Table 3. Hurdle Poisson for number (HN_i) and length of stay of hospital Admissions (HLS_i).

	CA_i			HB_i		
	H_i Logit	HN_i Trunc Poisson	HLS_i Trunc Poisson	H_i Logit	HN_i Trunc Poisson	HLS_i Trunc Poisson
A. Baseline						
SAAD	0.078***	1.134**	0.862***	0.052***	1.019	1.267***
	(0.02)	(0.04)	(0.05)	(0.01)	(0.09)	(0.02)
SAAD*POST	-0.095***	0.801**	0.791***	0.014	0.895**	0.696***
	(0.02)	(0.10)	(0.06)	(0.02)	(0.04)	(0.04)
Resid. (SAAD)	-1.009	24.160***	-17.517***	0.712	-27.375***	-6.014***
	(1.93)	(4.34)	(5.53)	(0.71)	(7.64)	(2.03)
Resid. (SAAD* POST)	-0.045	14.005***	14.251***	1.180	22.485***	4.988
	(0.79)	(3.61)	(2.26)	(1.50)	(5.77)	(4.28)
F-test residuals	0.41	63.20	56.18	0.02	61.28	48.23
(p-value)	(0.524)	(0.000)	(0.000)	(0.890)	(0.000)	(0.000)
Hausman test	19.374	295.630	217.196	2.791	278.968	591.267
(χ^2_{45}; p-value)	(0.999)	(0.000)	(0.000)	1.000	(0.000)	(0.000)
B. Coordination Plans						
SAAD	0.084***	1.779**	0.834***	0.053***	1.032	1.236***
	(0.02)	(0.25)	(0.06)	(0.01)	(0.10)	(0.02)
SAAD*POST	-0.077***	0.862***	0.818***	0.016	0.892**	0.729***
	(0.02)	(0.27)	(0.07)	(0.02)	(0.05)	(0.04)
Coordination	0.038	0.958	1.027	0.038	1.021	0.924
	(0.03)	(0.36)	(0.08)	(0.03)	(0.35)	(0.08)
Coordination* POST	-0.095***	1.154	1.102	-0.089***	1.009	0.129
	(0.03)	(0.33)	(0.08)	(0.03)	(0.32)	(0.08)
SAAD *Coord	-0.031	1.333***	1.030	-0.019	1.484	1.426***
	(0.04)	(0.36)	(0.12)	(0.03)	(0.26)	(0.07)
SAAD* Coord *POST	-0.116*	0.862***	1.120	-0.185***	0.793***	0.667***
	(0.06)	(0.01)	(0.18)	(0.02)	(0.05)	(0.17)
F-test for residuals	0.25	77.33	78.96	0.40	75.46	80.23
	(0.615)	(0.000)	(0.000)	(0.526)	(0.000)	(0.000)
C. Effect of budgetary cuts						
SAAD	0.078***	0.836	0.862***	0.052***	1.014	1.269***
	(0.02)	(0.18)	(0.05)	(0.01)	(0.09)	(0.02)
SAAD*POST(2011&2013)	-0.104*	0.887	0.864***	-0.028	0.517	0.871***
	(0.06)	(0.70)	(0.05)	(0.07)	(0.97)	(0.21)
SAAD*POST(2013)	-0.288	1.161**	1.287**	0.656	1.399***	1.484**
	(2.61)	(0.05)	(0.60)	(1.37)	(0.07)	(0.29)
F-test for residuals	0.59	87.15	80.91	0.06	84.87	87.23
	(0.443)	(0.000)	(0.000)	(0.802)	(0.000)	(0.000)
N	14,766	1,705	1,705	14,766	1,705	1,705

Notes: Logit for the first hurdle; zero truncated Poisson for the second hurdle (two alternative dependent variables). Marginal effects are shown for the first hurdle; incidence rate ratio are shown for the second hurdle. For residuals we report the estimated coefficients. Bootstrap with 100 repetitions. The first hurdle (H_i) coincides for both hurdle Poisson models.
Estimated coefficients for age, gender, marital status, level of education, self-reported health status, Katz's index, real income, real wealth, per capita public healthcare expenditure, number of public hospital beds per 1,000 inhabitants, satisfaction with public healthcare system, infection rate at hospital, year and regional dummies are not shown. *** means significance at 1% level, ** at 5% level, * at 10% level.
Baseline: F-test of residuals is distributed according to F(2,14726) for the logit model, F(2,1665) for the truncated Poisson.
Coordination case: F-test of residuals is distributed according to F(4,14724) for the logit model, F(4,1663) for the truncated Poisson.
Effect of budgetary cuts: F-test of residuals is distributed according to F(3,14725) for the logit model, F(3,1664) for the truncated Poisson.

Table 4. Estimation of the effect of the SAAD over hospital costs (Figures in euro)

	Reduction/increase in hospital costs due to			Hospital costs* 2007	(1)+(2) w/r to hospital costs %
	CA_i (1)	HB_i (2)	Total (1)+(2)		
Number of hospital admissions					
Base Case	-609,147,824 (-583,563,615, -639,605,215)	-120,235,688 (-114,464,375, -126,007,001)	-729,383,512 (-698,027,990, -765,612,216)	14,727,559,994	-4.95
Coordination	-160,527,318 (-152,822,007, -167,269,465)	-34,122,441 (-32,894,033, -35,350,849)	-194,649,758 (-185,716,040, -202,620,314)	7,063,627,888	-2.75
SAAD Effect 2013	239,468,171 (239,468,171, 250,962,643)	290,442,486 (278,824,787, 302,060,185)	529,910,657 (518,292,958, 553,022,829)	14,727,559,994	3.60
Hospital length of stay					
Base Case	-600,824,472 (-553,960,163, -638,075,589)	-314,387,318 (-296,152,854, -33,2621,782)	-915,211,790 (-850,113,017, -970,697,372)	14,727,559,994	-6.22
Coordination	No signif, -	-112,975,580 (-106,761,923, -119,189,237)	-173,439,479 (-106,761,923, -119,189,237)	7,063,627,888	-2.46
SAAD Effect 2013	233,564,656 (233,564,656, 248,746,359)	71,077,192 (67,239,024, 74,915,360)	304,641,847 (300,803,680, 323,661,719)	14,727,559,994	2.07
Total effect					
Base Case	-1,209,972,296 (-1,141,003,875, -1,264,421,049)	-434,623,006 (-408,980,249, -460,265,763)	-1,644,595,302 (-1549,984,124, -172,4686,813)	14,727,559,994	-11.17
Coordination	-160,527,318 (-150,414,097, -169,677,375)	-147,098,021 (-138,272,140, -155,923,902)	-368,089,237 (-288,686,237, -325,601,277)	7,063,627,888	-5.21
SAAD Effect 2013	473,032,827 (443231759, 502833895)	361,519,678 (344,166,733, 378,872,623)	834,552,504 (817,199,560, 881,706,518)	14,727,559,994	5.67
Consultations to General Practitioner	24,114,377 (22691629,25537125)	8,094,675 (7687440,8458935)	32,209,052 (30598559,33819505)	10,509,486,000	0.31

Confidence intervals between parenthesis
Cost data refer to Spain for the base case. For the other cases, hospital costs are computed taking into account the sum of hospital costs of the affected regions.
Data on hospital costs from the Ministry of Health, Social Issues and Immigration: http://pestadistico.inteligenciadegestion.msssi.es/publicoSNS/comun/DefaultPublico.aspx
Data on total costs associated to consultations to GP: https://www.msssi.gob.es/estadEstudios/estadisticas/sisInfSanSNS/pdf/egspGastoReal.pdf
Cost per consultation to GP from Resolution of 31st June 2006: 74 €/visit

Appendix A

Table A1. Number of days elapsed between application to the SAAD and determination of dependency level

	# days elapsed between application to the SAAD and determination of dependency level	
	Wave 4	Wave 5
Andalusia	162	167
Aragón	160	135
Asturias	269	361
Balearic Isles	223	201
Canary Islands	322	133
Cantabria	146	120
Community of León	158	100
Community of La Mancha	250	156
Catalonia	174	115
Community of Valencia	265	219
Extremadura	250	178
Galicia	270	174
Madrid	337	227
Murcia	183	-
Navarre	214	-
Basque Country	146	101
La Rioja	91	88
Ceuta Melilla	83	-
Spain	205	155

Auditor's report on economic-financial management and the application of Law 39/2006, of 14 December, on the Promotion of Personal Autonomy and Care for Dependent People. No. 977 Auditor's report on the management and control measures adopted by the Autonomous Communities for the due application of Law 39/2006, of 14 December, on the Promotion of Personal Autonomy and Care for Dependent People. No. 1035 http://www.tcu.es/tribunal-de-cuentas/es/

Table A2. Descriptive statistics for total number of hospital admissions and length of stay during the last year (mean; median between brackets; standard deviation between parenthesis)

	Wave 1 & 2	Wave 4	Wave 5
Hospital length of stay			
Non-beneficiaries	10.23 [5]	12.38 [7]	10.33 [5]
	(16.80)	(14.52)	(18.37)
Beneficiaries SAAD benefit			
Caregiving allowance (CA_i)	11.35 [4.5]	8.75 [6.5]	12.09 [10.5]
	(19.98)	(7.07)	(13.03)
Home care (HB_i)	15.36 [9.5]	11.54 [10]	11.78 [8]
	(24.75)	(13.19)	(14.81)
Total	15.33 [7]	10.75 [8]	11.82 [9]
	(24.62)	(11.81)	(14.49)
Number of hospital admissions			
Non-beneficiaries	1.70 [1]	1.80 [1]	1.60 [1]
	(1.64)	(1.72)	(1.34)
Beneficiaries SAAD benefit			
Caregiving allowance (CA_i)	2.04 [1]	1.62 [1]	2.13 [1]
	(1.88)	(1.56)	(1.72)
Home care (HB_i)	1.86 [1]	1.75 [1]	1.92 [1]
	(1.67)	(1.45)	(1.12)
Total	2.01 [1]	1.71 [1]	2.01 [1]
	(1.49)	(1.53)	(1.82)

Source: SHARE, several years.
Total number of individuals hospitalised: 1,389 for non-beneficiaries (Waves 1&2: 418; Wave 4: 344; Wave 5: 627), 185 for CB_i (Waves 1&2: 65; Wave 4: 41; Wave 5; 79), 170 for HB_i (Waves 1&2: 85; Wave 4: 45; Wave 5: 40); 355 for total beneficiaries (Waves1&2: 150; Wave 2: 86; Wave 5: 119).
Total number of observations: 13,512 for non-beneficiaries, 751 for CB_i, 503 for HB_i, 1,254 for total beneficiaries.

Table A3. Descriptive statistics for explanatory variables

	CA_i	HB_i	Any SAAD benefit	No SAAD benefit
Male	51.93	33.28	44.02	44.88
Age	65.13	77.05	70.30	67.09
	(10.03)	(10.83)	(12.01)	(11.05)
Marital status				
Married/cohabiting	72.97	58.54	66.51	77.72
Separated/divorced	4.39	2.09	3.35	2.86
Single	13.58	7.49	10.77	5.37
Widowed	7.59	31.01	18.10	12.95
Missing marital status	1.46	0.87	1.28	1.10
Education				
No schooling	25.97	31.71	28.31	18.62
Elementary	52.46	42.16	48.72	53.97
High School	6.79	5.75	6.22	9.31
College	14.78	20.38	16.75	18.10
Self-reported health				
Excellent	0.80	0.35	0.64	3.36
Good	3.33	2.26	2.87	13.89
Fair	17.44	13.59	16.03	35.82
Poor	78.43	83.80	80.46	46.93
Dependency degree				
Katz0	69.77	49.83	62.04	89.25
Katz1	13.32	21.60	16.91	6.26
Katz2	7.46	11.15	9.09	2.05
Katz3	9.45	17.42	11.96	2.44
Real wealth (€2011)	219,620	267,752	243,281	299,106
	(592,726)	(979,304)	(799,507)	(740,467)
Real income (€2011)	19,549	16,519	18,399.2	21,792
	(19,325)	(18,262)	(19,221)	(26,805)
N	751	503	1,254	13,512

Standard deviation between parenthesis.

Table A4. Regional variables

	2004	2006	2007	2011	2013
Infection rate at hospital [a]	1.16	1.19	1.18	1.26	1.32
Number of public hospital beds per 1,000 inhabitants [a]	2.22	2.15	2.30	2.42	2.53
Degree of satisfaction with public healthcare [a] (1: minimum satisfaction; 10: maximum satisfaction)	6.25	5.62	6.36	6.57	6.31
Public health expenditure per capita (€2011) [a]	1,152	1,333	1,390	1,392	1,248
Rate of medical hospital complications [b]	3.37	3.60	3.60	4.31	4.38

[a] Indicators of the National Health System (Ministry of Health, Social Services and Equality)

[b] Number of discharges which at least one complication during hospital stay, divided total number of discharges. Advanced Indicators i-CMBD

Table A5. Voting percentages to the socialist party in regional elections.

	Wave 1	Wave 2		Wave 4	Wave 5
	2004	2006	2007	2011	2013
Andalusia	51.07	51.07	51.07	48.41	39.52
Aragón	37.91	37.91	41.03	41.03	21.41
Asturias	40.30	40.30	42.04	42.04	26.45
Balearic Isles	24.60	24.60	31.75	31.75	18.94
Canary Islands	25.50	25.50	34.72	34.72	19.96
Cantabria	29.91	29.91	24.33	24.33	14.01
Community of León	36.74	36.74	37.49	37.49	37.77
Community of La Mancha	57.81	57.81	51.92	51.92	36.11
Catalonia	31.16	31.16	27.38	18.32	14.43
Community of Valencia	46.92	46.92	34.49	34.49	20.30
Extremadura	51.62	51.62	52.90	52.90	41.50
Galicia	22.20	33.64	33.64	31.02	20.61
Madrid	33.46	33.46	33.47	33.47	25.44
Murcia	34.03	34.03	31.81	31.81	23.96
Navarre	21.14	21.14	22.40	22.40	13.43
Basque Country	17.90	22.68	22.68	30.70	19.14
La Rioja	38.29	38.29	40.47	40.47	26.70
Ceuta	8.76	8.76	8.71	8.71	11.70
Melilla	11.92	11.92	18.49	18.49	8.44

Source: author's own work using http://www.congreso.es/consti/elecciones/autonomicas/

Aragón, Asturias, Balearic Isles, Canary Islands, Cantabria, Community of León, Community of La Mancha, Community of Valencia, Extremadura, Madrid, Murcia, Navarre, La Rioja, Ceuta and Melilla:

- Results from regional elections May 25th 2003 have been applied to waves 1 and wave 2 (2006).
- Results from regional elections May 27th 2007 have been applied to wave 2 (2007) and wave 4.
- Results from regional elections May 22nd 2011 have been applied to wave 5.

Andalusia:

- Results from regional elections March 14th 2004 have been applied to waves 1 and 2.
- Results from regional elections March 9th 2008 have been applied to wave 4.
- Results from regional election March 25th 2012 have been applied to wave 5.

Catalonia

- Results from regional elections November 16th 2003 have been applied to wave 1 and wave 2 (only 2006).
- Results from regional elections November 1st 2006 have been applied to wave 2 (only 2007).
- Results from regional elections November 28th 2010 have been applied to wave 1
- Results from regional elections November 25th 2012 have been applied to wave 5.

Basque Country

- Results from regional elections May 13th 2001 have been applied to wave 1.
- Results from regional elections April 17th 2005 have been applied to wave 2.
- Results from regional elections March 1st 2009 have been applied to wave 4.
- Results from regional elections October 21st 2012 have been applied to wave 5.

Galicia

- Results from regional elections October 21st 2001 have been applied to wave 1.
- Results from regional elections June 19th 2005 have been applied to wave 2.
- Results from regional elections March 1st 2009 have been applied to wave 4.
- Results from regional elections October 21st 2012 have been applied to wave 5

Table A6. Coverage index of public home care

	2000	2002
Andalusia	1.79	2.04
Aragón	2.52	2.44
Asturias	1.51	1.79
Balearic Isles	2.28	2.78
Canary Islands	1.9	1.88
Cantabria	1.51	1.55
Community of León	2.54	2.48
Community of La Mancha	2.13	2.55
Catalonia	1.23	1.3
Community of Valencia	0.78	2.16
Extremadura	4.69	4.86
Galicia	1.16	1.35
Madrid	1.98	1.89
Murcia	1.44	1.60
Navarre	3.33	3.02
Basque Country	2.3	2.85
Rioja	2.76	2.84
Ceuta	2.79	1.76
Melilla	1.82	2.07

Coverage index: ratio of number of home care beneficiaries divided by population aged 65 and over and multiplied by 100. Source: 'Las personas mayores en España´ (IMSERSO, 2000, 2002)

Table A7. Hurdle Poisson for number (HN_i) and length of stay of hospital admissions (HLS_i) without control function. Logit for the first hurdle; zero truncated Poisson for the second hurdle.
Marginal effects are shown for the first hurdle; incidence rate ratio are shown for the second hurdle.
Bootstrap with 100 repetitions. The first hurdle (H_i) coincides for both hurdle Poisson models.

	CA_i Without control function			HB_i Without control function		
	H_i	HN_i	HLS_i	H_i	HN_i	HLS_i
A. Baseline						
SAAD	0.079***	1.109**	0.912***	0.052***	1.087	1.312***
	(0.01)	(0.02)	(0.02)	(0.00)	(0.07)	(0.00)
SAAD*POST	-0.096***	0.778***	0.776***	0.015	0.874***	0.695***
	(0.01)	(0.03)	(0.02)	(0.01)	(0.01)	(0.01)
B. Coordination Plans						
SAAD	0.085***	1.815***	0.847***	0.054***	1.058	1.239***
	(0.01)	(0.18)	(0.05)	(0.00)	(0.08)	(0.00)
SAAD*POST	-0.077***	0.903***	0.878***	0.016	0.948**	0.801***
	(0.01)	(0.20)	(0.04)	(0.00)	(0.02)	(0.02)
Coordination	0.038	0.958	1.027	0.038	1.021	0.924
	(0.01)	(0.29)	(0.05)	(0.01)	(0.25)	(0.08)
Coordination* POST	-0.095***	1.154	1.102	-0.090***	1.009	0.129
	(0.02)	(0.33)	(0.05)	(0.01)	(0.25)	(0.05)
SAAD *Coord	-0.031	1.396***	1.091	-0.019	1.556	1.4296***
	(0.02)	(0.30)	(0.10)	(0.01)	(0.26)	(0.04)
SAAD* Coord *POST	-0.117*	0.914***	1.187	-0.18***	0.843***	0.724***
	(0.02)	(0.00)	(0.10)	(0.01)	(0.02)	(0.10)
C. Effect of budgetary cuts						
SAAD	0.078***	0.878	0.915***	0.052***	1.078	1.333***
	(0.01)	(0.12)	(0.03)	(0.00)	(0.05)	(0.00)
SAAD*POST(2011&2013)	-0.105*	0.906	0.924***	-0.029	0.598	0.847***
	(0.02)	(0.65)	(0.03)	(0.05)	(0.90)	(0.22)
SAAD*POST(2013)	-0.289	1.203**	1.347**	0.657	1.459***	1.556**
	(1.51)	(0.02)	(0.50)	(1.12)	(0.05)	(0.22)
N	14,766	1,705	1,705	14,766	1,705	1,705

Notes: Logit for the first hurdle; zero truncated Poisson for the second hurdle (two alternative dependent variables). Marginal effects are shown for the first hurdle; incidence rate ratios are shown for the second hurdle. For residuals we report the estimated coefficients. Bootstrap with 100 repetitions. The first hurdle (H_i) coincides for both hurdle Poisson models.
Estimated coefficients for age, gender, marital status, level of education, self-reported health status, Katz's index, real income, real wealth, per capita public healthcare expenditure, number of public hospital beds per 1,000 inhabitants, satisfaction with public healthcare system, infection rate at hospital, year and regional dummies are not shown. *** means significance at 1% level, ** at 5% level, * at 10% level.

Table A8. Hurdle Poisson with control function for hospital admissions (logit for the first hurdle; zero-truncated Poisson for the second hurdle). Full Specification.

	CA_i			HB_i		
	H_i	HN_i	HLS_i	H_i	HN_i	HLS_i
Male	0.056	1.341***	0.321***	0.050***	0.454***	0.035
	(0.04)	(0.40)	(0.11)	(0.02)	(0.16)	(0.04)
Age	-0.001	-0.092***	-0.020**	-0.002	-0.031	0.009
	(0.00)	(0.04)	(0.01)	(0.00)	(0.03)	(0.01)
Married/cohabiting	-0.006	0.082	0.282***	-0.006	-0.242**	0.151***
	(0.01)	(0.12)	(0.03)	(0.01)	(0.11)	(0.03)
Separated/divorced	-0.001	0.292	0.017	-0.034	-0.509	-0.052
	(0.03)	(0.32)	(0.09)	(0.03)	(0.33)	(0.09)
Single	0.059	2.678**	0.861***	-0.013	-0.293*	0.092**
	(0.11)	(1.14)	(0.31)	(0.02)	(0.17)	(0.05)
Missing marital status	-0.083	-2.491**	-0.283	-0.048	-0.377	0.422*
	(0.10)	(1.25)	(0.31)	(0.06)	(0.96)	(0.22)
No schooling	-0.022**	0.141	0.111***	-0.018*	0.160	0.098***
	(0.01)	(0.12)	(0.03)	(0.01)	(0.12)	(0.03)
Elementary education	-0.027	-0.528**	-0.111*	-0.006	0.081	0.047
	(0.02)	(0.22)	(0.06)	(0.01)	(0.15)	(0.04)
Secondary education	-0.038	-1.567***	-0.424***	-0.019	-0.364*	-0.067
	(0.05)	(0.51)	(0.14)	(0.02)	(0.20)	(0.05)
Health status: excellent	-0.147***	-1.176***	-1.094***	-0.171***	-1.192***	-1.057***
	(0.03)	(0.33)	(0.16)	(0.03)	(0.33)	(0.16)
Health status: good	-0.151***	-2.001**	-0.843***	-0.157***	-2.029**	-0.827***
	(0.01)	(0.99)	(0.07)	(0.01)	(0.99)	(0.07)
Health status: fair	-0.094***	-0.336***	-0.350***	-0.080***	-0.346***	-0.337***
	(0.01)	(0.10)	(0.03)	(0.01)	(0.10)	(0.03)
Dependency: Katz1	0.137	3.011***	1.159***	-0.040	-0.365	0.902***
	(0.11)	(1.13)	(0.31)	(0.10)	(1.10)	(0.30)
Dependency: Katz2	0.233	4.349**	0.773	-0.081	-0.957	0.696
	(0.16)	(1.71)	(0.47)	(0.19)	(1.99)	(0.53)
Dependency: Katz3	0.223	5.249***	1.719***	-0.159	-1.330	1.405*
	(0.18)		(0.53)	(0.25)	(0.85)	(0.72)
Real wealth (€1,000,000)	-0.001	-0.438***	-0.018	0.009	-0.157	0.041**
	(0.01)	(0.12)	(0.02)	(0.01)	(0.11)	(0.02)
Real income (€1,000 €)	-0.214	12.440***	-7.731***	0.130	-2.212	-6.251***
	(0.36)	(3.93)	(1.12)	(0.18)	(2.24)	(0.66)
Public healthcare expenditure. (1,000€)	-0.083	-2.025**	0.572***	-0.076	-1.886**	0.328***
	(0.08)	(0.91)	(0.22)	(0.08)	(0.89)	(0.22)
Infection rate	0.011	-0.997**	-0.387***	0.024	-0.918**	-0.440***
	(0.04)	(0.43)	(0.12)	(0.04)	(0.46)	(0.13)
Satisfaction with public healthcare system	0.001	0.004	-0.014***	0.001	0.002	-0.015***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)
Public beds (1,000 inhabitants)	0.005	-0.045	0.021	0.000	-0.020	0.007
	(0.02)	(0.18)	(0.05)	(0.02)	(0.18)	(0.05)
Constant		11.302***	1.294		4.892**	-0.413
		(3.14)	(0.85)		(1.98)	(0.50)
N	14,766	1,705	1,705	14,766	1,705	1,705

Notes: Logit for the first hurdle; zero truncated Poisson for the second hurdle (two alternative dependent variables). Marginal effects are shown for the first hurdle; incidence rate ratios are shown for the second hurdle. For residuals we report the estimated coefficients. Bootstrap with 100 repetitions. The first hurdle (H_i) coincides for both hurdle Poisson models.
Year and regional dummies are not shown. *** means significance at 1% level, ** at 5% level, * at 10% level.
F-test of residuals is distributed according to F(2,14726) for the logit model, F(2,1665)

Table A9 Descriptive statistics for mechanism variables

	CA_i	HB_i	Any SAAD benefit	No SAAD benefit
Depressed	53.00	58.36	54.86	35.02
Would prefer to be dead	18.64	20.56	19.38	7.48
Lives alone	10.52	22.82	16.27	11.60
Adapted house	4.13	6.45	5.18	2.78
Has visited GP during last year	42.48	53.48	47.37	38.97
Number of visits to GP	8.73	12.63	10.66	6.72
	(10.94)	(16.40)	(14.09)	(8.69)
N	751	503	1,254	13,512

Note:Standard deviation between parenthesis. 5,860 individuals have visited GP during last year: 319 receiving CA, 307 receiving HB, 626 receiving Any SAAD benefit, 5,234 not receiving SAAD benefit.

Tab A10. Visits to general practitioner. Logit for the first hurdle; zero truncated Poisson for the second hurdle. Marginal effects are shown for the first hurdle; incidence rate ratio are shown for the second hurdle. Bootstrap after 100 repetitions. Using IV for SAAD and SAAD*POST.

	CA_i		HB_i	
	$Has\ visited\ GP_i$	$Number\ of\ GP\ visits_i$	$Has\ visited\ GP_i$	$Number\ of\ GP\ visits_i$
SAAD	0.123***	1.161***	0.062*	1.279***
	(0.04)	(0.03)	(0.03)	(0.02)
	0.088			
SAAD*POST		1.074**	-0.008	1.070**
	(0.07)	(0.02)		(0.02)
			(0.06)	
Chi-square(38)	694.76	8,379.23	685.65	8,510.51
p-value	(0.000)	(0.000)	(0.000)	(0.000)
N	14,766	5,860	14,766	5,860

Notes: Logit for the first hurdle; zero truncated Poisson for the second hurdle (two alternative dependent variables). Marginal effects are shown for the first hurdle; incidence rate ratios are shown for the second hurdle. For residuals we report the estimated coefficients. Bootstrap with 100 repetitions. The first hurdle (H_i) coincides for both hurdle Poisson models. Estimated coefficients for age, gender, marital status, level of education, self-reported health status, Katz's index, real income, real wealth, year and regional dummies are not shown. *** means significance at 1% level, ** at 5% level, * at 10% level.

Table A11. Probit for the probability of being Depressed, Would prefer to be dead, Living alone and Living in adapted household. Marginal effects. Bootstrap after 100 repetitions. Using IV for SAAD and SAAD*POST.

	CA_i				HB_i			
	$Depressed_i$	$Dead\ P_i$	$Alone_i$	$Adapted_i$	$Depressed_i$	$Dead\ P_i$	$Alone_i$	$Adapted_i$
SAAD	0.163***	0.095***	0.008	0.009	0.095***	0.086***	0.034***	0.007
	(0.03)	(0.02)	(0.01)	(0.01)	(0.03)	(0.02)	(0.00)	(0.01)
SAAD*POST	-0.025***	-0.079***	-0.074***	0.001	0.032	-0.054***	-0.026***	0.020***
	(0.00)	(0.02)	(0.00)	(0.01)	(0.04)	(0.01)	(0.00)	(0.00)
Chi-square(32)	1449.44	699.20	4366.07	335.93	1416.48	656.47	4365.06	343.43
p-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	14,766	14,766	14,766	14,766	14,766	14,766	14,766	14,766

Note: Estimated coefficients for age, gender, marital status, level of education, real income, real wealth, year and regional dummies are not shown. *** means significance at 1% level, ** at 5% level, * at 10% level.