Documento de Trabajo - 2021/12

The effect of Long-Term Care (LTC) benefits on healthcare use

Manuel Serrano-Alarcón
(Dondena Research Centre, Bocconi University and Center for Research in Economics and Health, UPF)

Helena Hernández-Pizarro
(Center for Research in Economics and Health, UPF and School of Business and Social Science, Tecnocampus UPF)

Guillem López-Casasnovas
(Center for Research in Economics and Health, UPF)

Catia Nicodemo
(Center for Research in Economics and Health and Nuffield Department of Primary Care Health Sciences, University of Oxford)

Julio 2021

fedea

The effect of Long-Term Care (LTC) benefits on healthcare use*

Manuel Serrano-Alarcón[1,2†], Helena Hernández-Pizarro[2,3], Guillem López-Casasnovas[2], Catia Nicodemo[2,4]

[1]Dondena Research Centre, Bocconi University
[2] Center for Research in Economics and Health, Universitat Pompeu Fabra
[3] School of Business and Social Science, Tecnocampus Universitat Pompeu Fabra
[4]Nuffield Department of Primary Care Health Sciences, University of Oxford

Abstract

The healthcare systems of most European countries are currently operating under extreme levels of pressure. Part of this pressure is due to a rising demand for healthcare caused by an increase in comorbidities and life expectancies amongst the populations they serve. The implementation of a good system of Long-Term Care (LTC) could reduce this pressure if it promotes preventative habits and treatment adherence, or reduces age-related risks. In this study we aim to understand the role of LTC benefits in reducing healthcare use in primary and secondary care by exploring a detailed administrative database. Results show that a monthly LTC benefit of around 412 euros could reduce avoidable hospitalizations by 60% and also unscheduled "walk-in" patient visits by a half, with the majority relating to social exclusion cases. Furthermore, LTC benefits could promote preventive healthcare, improving access to healthcare services such as cataract surgery. These findings have important policy implications for the organization of the LTC and healthcare systems, suggesting that allocating resources to LTC might not only increase the welfare of LTC beneficiaries, but also help to contain the increasing costs of healthcare.

Keywords

Long-term care, health care use, avoidable hospitalizations, non-scheduled healthcare

JEL codes

I10, I13, J14

---

* We thank participants of 7th IRDES-DAUPHINE Workshop on Applied Health Economics and Policy Evaluation, XXVIII Encuentro de Economía Pública and XXXVII Jornadas AES Economía de la Salud and all members of CRES-UPF for their valuable comments and suggestions. We would also like to thank Marc Vives and Silvia Losa and all the administrative staff and layers who enable the signature of the agreement to merge and build the dataset used in this project. We would also like to thank Cecilia Fabregas, Anna Vila and the rest of the team of Dependency at Catalan Government Department of Work, Social Affairs and Family and Anna Garcia-Altes, Elisenda Martinez Carbonell and the PADRIS team at AQuAS for the help with data. They have no responsibility over the analysis and conclusions presented in this study. MSA specially thanks Julian Perelman for his dedicated supervision. MSA was supported by a PhD Grant (PD/BD/128080/2016) from Fundação para a Ciência e a Tecnologia. CN receives funding from the Economic and Social Research Council [grant number ES/T008415/1] and from the National Institute for Health Research Applied Research Collaboration Oxford and Thames Valley at Oxford Health NHS Foundation Trust. The views expressed in this publication are those of the author(s) and not necessarily those of the NIHR. HHP and GLC acknowledge financial support from the `Obra Social La Caixa', the Agencia Estatal de Investigación (AEI) (project ECO2012-37496) and Fondo Europeo de Desarrollo Regional (FEDER)(project ECO2017-88609-R). The usual disclaimer applies.

† Corresponding author: manuel.serrano@unibocconi.it

1. Introduction

Most European healthcare systems have faced a dramatic increase in demand and associated spending in the last two decades, a situation that has been exacerbated by the COVID-19 pandemic. Part of the increase in healthcare expenditure during the last decades can be explained by population ageing and increased comorbidity and disability (Howdon and Rice, 2018; Lorenz et al., 2020). As the burden of an ageing population in healthcare systems is expected to continue (Bloom and Luca, 2016), effective and well-integrated health and social policies, including a Long Term Care (LTC) system, could soften and potentially even reduce demand for avoidable healthcare services such as emergency admissions (Rechel et al., 2009).

LTC services and benefits could reduce healthcare use in several ways. For example, formal LTC (like nursing homes), could lead to, amongst other benefits, better medication management, treatment adherence and nutrition, as well as reductions in age-related risks such as falls, infections or ulcers, leading to a reduction in health care use (Spector et al., 2013) or prevent the risk of re-admission (Costa-Font et al., 2018). On the other hand, LTC benefits could provide a higher healthcare demand, for example, through greater health-monitoring by the caregivers (Gonçalves and Weaver, 2017). However, the literature is still in his infancy and has not fully explored which type of interactions with healthcare services are the most affected by LTC, either in terms of emergency admissions, avoidable admissions for certain type of diagnoses, or access to healthcare in general. Whereas avoidable admissions might place an unnecessary burden on hospitals, more interactions with the healthcare system might actually be considered "desirable" due to its preventive function or the potential of healthcare providers to increase patient´s quality of life. Hence, an effect of LTC on *aggregate* healthcare use might not tell us much about the real effectiveness of LTC policies.

The objective of this study is to estimate the causal effects of a person receiving LTC benefits on healthcare use. We explore the effects at hospital and primary care level, by distinguishing the type of admission and main diagnosis group. We create a unique dataset combining administrative data from a representative sample of LTC benefits claimants from Catalonia (Spain), linked with primary and secondary healthcare data for the period 2009-2014. We follow the patients and their health care utilization for three years after they enter into the LTC scheme. Endogeneity makes it empirically challenging to disentangle the effect of LTC on healthcare use, since individuals with higher LTC needs are also expected to have a higher use of healthcare services. We provide a reliable estimate of the causal effect of receiving LTC benefits by exploiting exogenous variation of the Spanish LTC system. In order to be eligible for LTC benefits, claimants' LTC needs must be assessed by an examiner to whom they are assigned on a quasi-random basis. Some examiners are more prone to grant access to benefits, despite the use of a common scale to measure LTC needs, as was documented in Hernández-Pizarro et al (2020). Consequently, some claimants are more likely to receive LTC benefits. We then use this examiner "leniency" to grant LTC benefits as an instrumental variable for the receipt of LTC subsidies.

Our results show that LTC benefits have different effects across the different types of hospital admissions and primary care visits. The receipt of an LTC benefit of 412 euros per month on average reduces a set of avoidable hospitalizations by 60%. This reduction is driven especially by a reduction in emergency hospital admissions caused by injuries and poisoning, which is the fourth most common cause of admission in our sample[3]. Regarding primary care, LTC benefits decrease unscheduled "walk-in" patient visits by a half, and this effect is sustained up to 36 months. Our "back of the envelope" calculations estimate savings of 8.88 euros in these avoidable healthcare services for every 100 euros spent on LTC benefits, in addition to the value of improving quality of life, which we do not estimate. Furthermore, LTC benefits seem to increase some use of planned healthcare explained by an improvement in access to healthcare rather than by a deterioration of health, mainly planned cataracts surgery.

The literature on this topic is quite scarce due to a lack of data. In the Spanish context, Costa-Font et al (2018), using survey data and difference-in-difference techniques, find that the introduction of the Spanish LTC system reduced the probability and the total number of hospital admissions amongst the beneficiaries of homecare and caregiving allowances, as compared to before the reform. Unfortunately, they do not have patient level administrative data to disentangle the relationship between LTC and healthcare utilization. They use individual survey data on aggregate healthcare use without disentangling which type of interactions with the healthcare services (e.g. diagnoses and emergency or planned) are most affected. Finally, Hernández-Pizarro (2018) has focused on the effects of LTC benefits on mortality without exploring how the LTC services and benefits could affect healthcare use.

At the international level, we can find only three papers that use administrative data to compare the effectiveness of LTC in terms of hospitalizations and medical care costs. Two compare the relative effectiveness between home care and care in nursing homes. One of these studies, Kim and Lim (2015), using data from Korea and exploiting sharp changes in benefits around

[3] In the whole Catalan population aged 50 or older, injuries and poisoning was the 5th largest cause of admission accounting for 9.97% of the hospital admissions during the period 2009-2014. (Source: authors´ calculation based on the Hospital morbidity survey, National Statistics Institute Spain, INE)

dependency thresholds, looks at the short-term impact of formal LTC on medical expenses. They find heterogeneous effects depending on the type of care and levels of need. In particular, they find that among the most dependent, home care reduced medical expenditure when compared to nursing home care. The other study, by Bakx et al (2020), using Dutch data finds that nursing home care reduces hospitalizations as compared to home care, although they do not find a significant effect on total medical care costs. They conclude that in a LTC system like the Dutch one (which offers one of the highest public expenditure on LTC in the world), replacing nursing home care by home care might not provide cost savings, which is unlike the results previously found by Kim and Lim (2015). Finally, Feng et al (2020) studies, using difference-in-difference techniques, the effect of a pilot LTC system on hospital use in Shanghai. The introduction of such system led to a reduction in length of stay and total healthcare insurance expenditure, with estimated savings of as much as 8.6 yuan for every yuan spent in LTC benefits[4].

Our paper expands this literature in several dimensions and provides important contributions. The main contribution is that, unlike the aforementioned studies, we analyse the effect of LTC on healthcare use by type of care (hospital and primary care), whether the admission is an emergency or not, and the main diagnosis group. Distinguishing by type of admission (emergency vs planned) and diagnoses we are able to identify potentially avoidable hospitalizations and primary care visits related to LTC provision, issues that have remained unexplored in the previous literature. Hospital emergency admissions are costly and reducing them is a top priority for policymakers (Wittenberg et al., 2017). Our paper sheds light on how LTC could reduce this type of admission in detail. Furthermore, our evidence will also have implications for the recent trend towards integration and coordination between the LTC and the healthcare systems (Antunes and Moreira, 2011; Mur-Veeman et al., 2008), by identifying to policymakers exactly which type of interactions with the healthcare system are most affected by LTC. Our findings will therefore contribute to the design of a better and more efficient LTC system.

Finally, we study the effect of an LTC benefits scheme where claimants have freedom to choose a set of benefits from a portfolio available at each different level of LTC needs. This is in contrast

[4] Two studies looked at the relation between LTC and healthcare use at the local level in the UK and had somewhat different results, one finding that increasing supply of nursing home beds reduced delayed discharges from hospitals (Gaughan et al., 2015), whereas the other found that increased social care supply did not lead to a reduction in hospitalization rates (Liu et al., 2021).

to previously studied LTC systems, where the type of care offered depends on the level of functional limitations (Bakx et al., 2020; Kim and Lim, 2015).

2. Institutional setting: the Spanish Long-term care system

In December 2006, there was a big increase in LTC benefits made available in Spain with the approval of the Act 39/2006, the so-called "Dependency Act". The law established a universal LTC system, where eligibility for LTC allowances would be determined by the applicant's level of needs. In particular, LTC needs are established based on a Scale (*Baremo de Valoración de la Dependencia,* BVD) which ranges from 0 to 100, with 3 different grades of benefits: Grade I (BVD = [25, 49]), Grade II (BVD = [50, 74]), Grade III (BVD= [75, 100]). Claimants with a BVD lower than 25 are not eligible for LTC allowances. The provision and management of LTC benefits is decentralised to the regional level.

In order to be entitled to LTC benefits, claimants have to apply to the Regional Social Service Department, and their needs are then assessed by a local team of health professionals (independent from social services units). After assessment based on the Scale, the Regional Social Service Department informs the claimant about the Grade assigned. If eligible, i.e. a score greater than 24, the claimant can choose from LTC services available in their Grade[5].

LTC benefits can be either in-kind (tele-assistance, nursing home, day-care centres and home care), vouchers (linked to professional care services: home care, day-care centres and nursing homes) or cash transfers for informal caregiving. All care services are available for all grades, although the intensity of the care (hours or amount of subsidy) increase with the grades. Claimants are therefore free to choose between the above menu of benefits across all grades. As of 31th of December of 2014, in Catalonia, 61% of LTC benefits were cash benefits (54% linked to informal caregiving and 6% vouchers linked to professional care services) and 39% were in-kind (12% nursing home, 11% home care, 9% tele-assistance, 5% day-care centres and 11% home care, and 2% other autonomy promotion activities) (IMSERSO, 2015). On average, the estimated monetary value of the monthly allowances in our dataset is 163 euros for Grade I, 412 euros for Grade II and 695 euros for Grade III (Hernández-Pizarro, 2018). For more details about how the LTC system works in Spain see Hernández-Pizarro et al (2020).

[5] After the claimant is assigned to a benefit, there is a delay until she actually receives any allowance (cash or in-kind). The average delay is 5 months (Hernández-Pizarro, 2018). However, outstanding benefits may be paid back to the date she acquired the right to the benefit.

2.1. Assignment of claimants to examiners

Each claimant is assessed using the BVD by a professional who belongs to the local area's examiner team, and could be a nurse, a physiotherapist, a psychologist or a social worker. On average, each team is formed of 8 examiners. Each team is independent from the Regional Social Service Department, the authority in charge of managing the benefits. Claimants are assigned to an examiner in each specific team on a rolling basis (i.e.: based on the date each case is received). Therefore, the assignment to a particular examiner can be considered as good as random within each team of examiners at the local level. The examiner follows the official ranking scale in order to evaluate the claimant's level of dependency, and has to justify the limitations assigned with the corresponding medical diagnoses previously registered at the healthcare system (Hernández-Pizarro, 2018). This ensures that examiners follow a standardised and objective procedure in order to assign claimants to a certain Grade.

Still, there is some room for examiners to adjust the score by a few points. This may give the claimant access to a higher Grade of benefits, especially for claimants whose score is close to the threshold between two Grades. As a consequence some examiners may be more "lenient" and grant higher benefits than others (Hernández-Pizarro et al., 2020). This creates quasi-random variation in the assignment of LTC Grade, conditional on the residence of the claimant (which determines the team of examiners to which the claimant is assigned).

3. Data

We use data from the region of Catalonia, which accounts for 16% of the Spanish population, and 17% of the public LTC beneficiaries, being the region with the second most beneficiaries in Spain (IMSERSO, 2015). Our dataset consists of all individuals older than 50 who were evaluated for LTC benefits from 2009 to 2014, formed by 347,197 individuals[6]. From this group, 108,391 were linked with health-care information[7], and in this merged sample, 20,483 claimants were not entitled to any LTC benefit (BVD< 25); 33,600 were entitled to Grade I; 32,211 to Grade II; and 22,097 to Grade III.

[6] Those aged 50 or older represent 90% of the applicants during this period.
[7] To satisfy Data Protection Guarantees the merge to healthcare data was done for a sample of 108,468 claimants.

In our main analysis we decided to compare Grade II and Grade I because most of the individuals who were entitled to Grade I benefits did not actually receive any allowance during our period of observation, making them an ideal control group. In particular, among those who were entitled to Grade I (n=33,600) during the period 2009-2014, only 11% (3,744) had received any allowance by 2015 (Figure 1)[8]. On the contrary, among those who were entitled to Grade II (n=32,211) during the period 2009-2014, 87% (27,906) received at least some allowance by 2015. Therefore, when we compare those entitled to Grade II with those entitled to Grade I, we are essentially comparing those who receive a LTC allowance with those who did not receive any allowance at all despite being entitled to one of Grade I [9]. Our main sample is then formed by 65,811 individuals who were entitled to either Grade II or Grade I[10].

For hospitalizations, we have information for each claimant about their hospital admissions over the period of 2007-2017, including date, type of admission, and main diagnosis. For Primary Care (PC), we have information about all PC visits by the claimant from 2013 to 2017[11], including date, type of visit (scheduled vs non-scheduled) and main diagnosis. Therefore, for PC we use the subsample of those who were entitled to Grade II or I in 2013 or 2014 (the last year for which we have LTC Grade entitlement data). As a result, our main PC subsample consists of 18,624 individuals (7,876 entitled to Grade II, and 10,748 to Grade I).

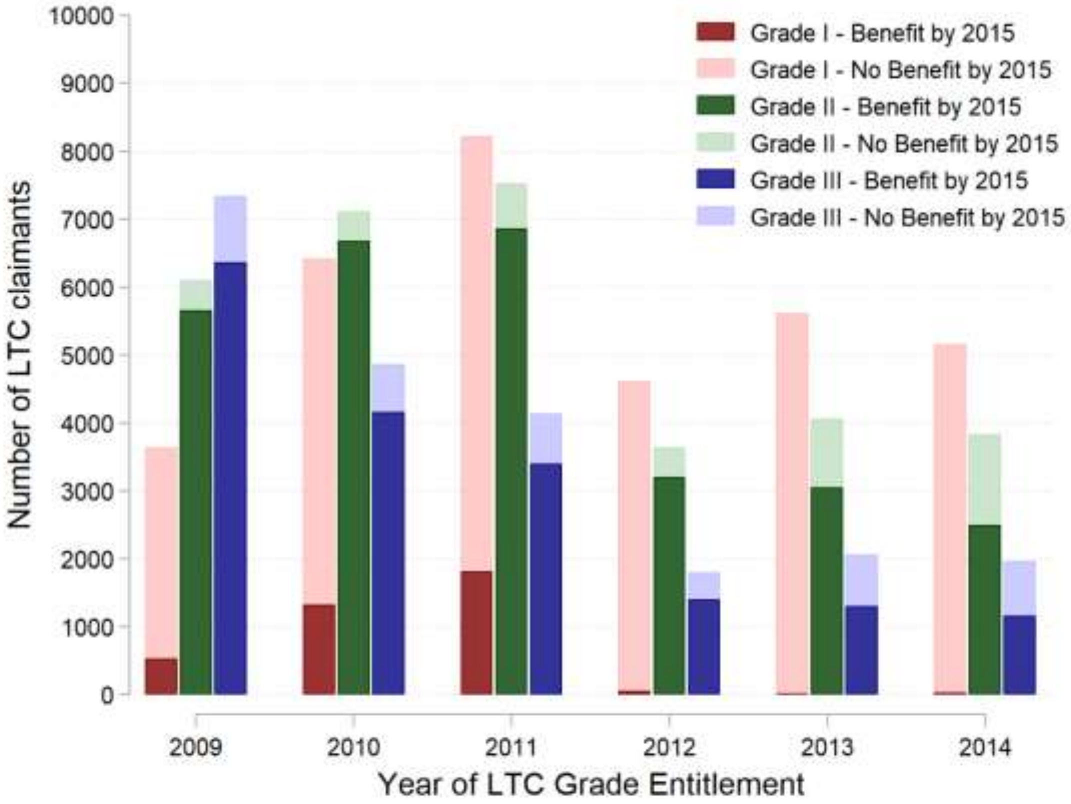
[8] The fact that most individuals entitled to a Grade I did not receive any benefit is a consequence of the timing of the implementation of the Dependency Act and several subsequent exogenous law modifications. The "Dependency Act" was gradually implemented from 2007. The first years' benefits were given to the most dependent. Grade I claimants only had a short time-span in 2011 where some received their benefits, before several law modifications postponed again their reception of any allowance for this Grade (Peña-Longobardo et al., 2016).

[9] We also decided to exclude Grade III applicants because they are more sick and with a lower life expectancy. Still, we did compare Grade III and Grade II recipients and the main results were not significant. These results are available upon request.

[10] If we compare the 65,811 claimants of our final sample of interest with all of the claimants evaluated at Catalonia between 2009 and 2014 who were assigned to Grade II or Grade I (which would be the population of interest); differences in observable characteristics, although statistically significant, are almost negligible in magnitude. More concretely, those taking part of our final sample of interest (with information about hospitalizations and the examiner) are 0.0009 years older, 0.8 pp less likely to be widowed, 1 pp less likely to be single, 1.2 pp more likely to be entitled to labour disability and have on average 0.03 more health conditions; as compared to the full population of LTC applicants entitled to Grade II or I, in period 2009-2014 (Table B1 in Appendix B).This suggests that our final subsample of 65,811 claimants is fairly representative of the population of LTC applicants at the Grades of interest.

[11] Data on Primary Care use was not available prior to 2013.

Figure 1- Number of claimants per year by LTC Grade and year of entitlement



NOTES: Bars with "darker" colours reflect claimants who were entitled to a particular Grade and had received an LTC allowance by 2015. Bars with "lighter" colours reflect claimants who were entitled to a particular Grade but had not receive any LTC allowance by 2015

3.1. Descriptive statistics

Table 1 shows a summary of descriptive statistics. Most of the claimants in our sample are women (65%), with an average age of 79 years. There are relevant differences between the two grades of dependency analysed. Grade II claimants are one year older on average and show a worse health status, with a higher average number of diagnosed health conditions by the National Health System (NHS) prior to LTC assessment (2.42 vs 2.35). On the contrary, a labour disability status is more likely to be identified in Grade 1 claimants (23% vs 19%). Despite the old age and relatively poor health of claimants, only 42% had one or more hospital admissions 24 months after LTC entitlement. Their probability of emergency hospital admission is larger than for a programmed admission (30% vs 19%). In the subsample of Primary Care, the average number of PC visits in the 24 months after LTC entitlement is 35.5, and those at Grade II have around 2 PC visits more than those at Grade I.

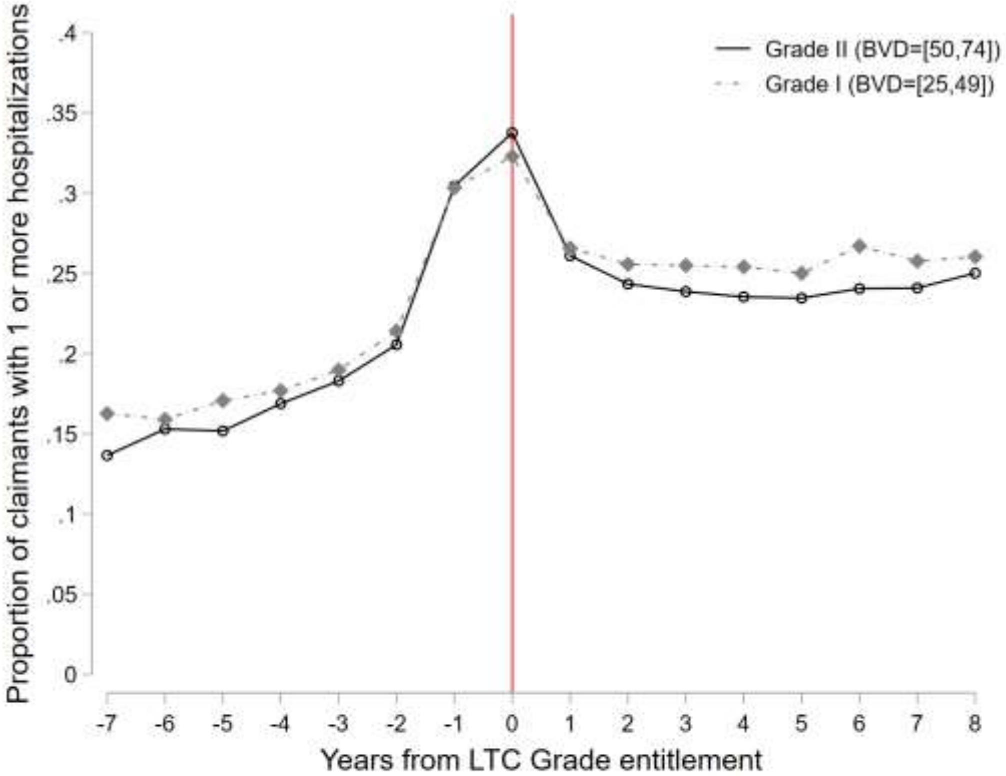
In Figure 2 we plot the proportion of individuals who have been admitted to a hospital per year, for those with Grade II vs Grade I. We can see that the probability of admission increases sharply for the two groups from two years prior to LTC Grade entitlement. This can be interpreted as a deterioration in the health status of the individuals which leads them to apply for LTC benefits. The two groups have similar trends in a large part of their pre-LTC benefit period. However, the increase in the proportion of individuals with one or more hospitalizations observed from two years prior to Grade entitlement is higher for those who were assigned Grade II. This indicates that analysing Grade II versus Grade I claimants in OLS or difference-in-difference models would give biased estimates of the effect of LTC benefits given the differences on the pre-LTC benefit hospitalization probabilities.

Table 1 – Descriptive statistics by LTC Grade entitlement.

	All		Grade II		Grade I	
	Mean	SE	Mean	SE	Mean	SE
Panel A: Sociodemographic and health variables						
Female	0.66	0.002	0.65	0.003	0.67	0.003
Age	79.17	0.037	79.96	0.053	78.42	0.052
With partner	0.50	0.002	0.48	0.003	0.51	0.003
Widow	0.42	0.002	0.43	0.003	0.41	0.003
Single	0.09	0.001	0.09	0.001	0.08	0.001
Labour disability	0.21	0.002	0.19	0.002	0.23	0.002
Number of health conditions[a]	2.38	0.004	2.42	0.005	2.35	0.005
Number of observations	n = 64,559		n = 31,494		n = 33,065	
Panel B: Probability of Hospitalization 24 months after LTC Grade entitlement						
Any hospitalization	0.42	0.002	0.41	0.003	0.42	0.003
Any emergency hospitalization	0.30	0.002	0.32	0.003	0.29	0.003
Any programmed hospitalization	0.19	0.002	0.16	0.002	0.21	0.002
Any ACSC hospitalization[b]	0.12	0.001	0.13	0.002	0.12	0.002
Any ANHAC hospitalization[c]	0.10	0.001	0.11	0.002	0.09	0.002
Number of observations	n = 51,937		n = 24,180		n = 27,757	
Panel C: Primary Care visits 24 months after LTC Grade entitlement						
PC visits	36.48	0.263	37.37	0.341	35.07	0.414
Scheduled PC visits	19.42	0.163	20.58	0.213	17.59	0.251
Non-scheduled PC visits	17.06	0.150	16.79	0.191	17.48	0.242
Number of observations	n = 14,110		n = 8,638		n=5,472	

NOTES: Panel A sample is formed of our main sample of LTC applicants who were entitled to Grade II or Grade I benefits during the period 2009-2014 and have no missing values in any of the sociodemographic and health control variables. Panel B sample is formed of those from our main sample of LTC applicants from the period 2009-2014 who survive up to 24 months after LTC Grade entitlement. Panel C sample is formed of those from our Primary Care subsample of LTC applicants from the period 2013-2014 who survive up to 24 months after LTC Grade entitlement. [a] Number of health conditions registered prior to LTC assessment from the following list of ICD9 diagnoses categories: circulatory, digestive, osteo-articular, ear, eye, respiratory, nephro-urology, mental disorder, neurological, endo-metabolic, cancer, hematologic and dermatological. [b]Ambulatory care-sensitive conditions (ACSC) hospitalizations are those whose main diagnosis is classified as an ACSC. These are diagnoses for which admissions are potentially avoidable by effective outpatient care. This includes principal diagnoses such as pneumonia, congestive heart failure, hypertension, asthma or diabetes (Spector et al., 2013). [c]Nursing Home Avoidable Conditions (ANHACs) hospitalizations are those whose main diagnoses are additional conditions that can be managed effectively in Nursing Homes through infection control, skin and wound care, medication management and an appropriate diet and are not included in ACSC (Spector et al., 2013).

Figure 2 - Probability of having one or more hospital admissions by year, with respect to the year of LTC Grade entitlement



NOTES: The sample is not constantly formed by the same number of individuals over time. As we go from year -2 backwards the sample gets smaller due to the normalization of the year of LTC Grade entitlement to year zero. For instance, a claimant with year of entitlement in 2009 will only be observed backwards until 2007 since our first year of observation for hospitalizations was 2007. The same occurs if we go forwards after LTC Grade entitlement (year zero). Additionally, the number of observations also goes down after year zero due to mortality. See Table B2 in Appendix B for more detailed information about the sample forming each year.

4. Empirical strategy

We model the probability of hospital admission within t months after a claimant was approved for either LTC Grade I or LTC Grade II as follows:

$$y_{i,t} = \beta_0 + \beta_1 Grade\ II_i + X_i\gamma + \alpha y_{i,-12} + \eta + \theta + \eta \text{ x } \theta + e_i \quad (1)$$

$Grade\ II_i$ equals 1 if individual i is entitled to Grade II, and zero if the individual is entitled to Grade I. X_i is a vector of control variables including gender, age, marital status, labour disability acknowledgement and the number of health conditions diagnosed by NHS prior to LTC assessment based on the International Classification of diseases (ICD-9). $y_{i,-12}$ is a dummy indicating any hospitalization in the 12 months prior to LTC Grade entitlement. We also include territory fixed effects, η, (based on the local team of examiners) and year fixed effects, θ, and interaction between the two (η x θ).

$y_{i,t}$ is equal to 1 if the individual has one or more admissions within t months after her entitlement to a LTC Grade, and zero if none. We consider the type of admissions to be either emergency or planned. We also group admissions by main diagnoses into two indicators: i) Ambulatory Care-Sensitive Conditions (ACSCs) which includes conditions for which admissions are potentially avoidable with effective outpatient care. This includes principal diagnoses such as pneumonia, congestive heart failure, hypertension, asthma or diabetes. ii) Nursing Home Avoidable Conditions (ANHACs) which includes as main diagnoses additional conditions that can be managed effectively in nursing homes through infection control, skin and wound care, medication management and an appropriate diet (Spector et al., 2013). This comprises, amongst others, injuries and poisoning, skin ulcers, anaemia or nutritional deficiencies. Both indicators have been used in the medical literature to study potentially avoidable hospitalizations amongst patients resident at nursing homes (Spector et al., 2013). Therefore, we assume that these hospitalizations may be sensitive not only to nursing home provision but more generally to the provision of LTC in any of its forms. Lastly, we also group admissions by main diagnoses group based on the International Classification of Diseases (ICD9).

The impact of LTC benefits is measured by β_1, which compares the health effects of being entitled to Grade II benefits vs being entitled to Grade I benefits[12]. Since, as explained in the

[12] Note that the date of interest for our analysis is the date when the claimant is entitled to receive the benefits (i.e.: acknowledgement). It is possible that there is a gap between the date that the claimant effectively receives the benefit and the date when is entitled to it, though usually this gap is not very large (around 5 months in our data). Furthermore, the benefit will cover this period retroactively. Therefore, after the date of entitlement claimants can already “count on” the subsidy.

Data section, most claimants in Grade I did not actually receive any allowance (Figure 1), β_1 actually estimates the effect of being entitled to LTC at the extensive margin (i.e. the effect of receiving a public LTC allowance with an average monetary value of 412 euros[13], vs not receiving any allowance at all despite being entitled to one of Grade I).

4.1. Dealing with endogeneity of LTC benefits. IV construction

An OLS estimation of Equation 1 will most likely provide a biased estimator of β_1. Individuals entitled to Grade II are very likely to differ in characteristics that affect the probability of hospitalization, as compared to those at Grade I. Since higher dependency Grades are allocated to individuals who have worse health statuses, those same individuals are more likely to use more healthcare services relative to those in lower Grades. To control for this endogeneity of LTC Grade entitlement, **we instrument the Grade II dummy variable with the leniency of the examiners** (i.e.: propensity to grant higher benefits). As explained in the Institutional Setting section, in order to have their LTC needs evaluated, each claimant is assigned to an examiner on a random basis, conditional on the residence of the claimant.

Therefore, exploiting this particular feature of the LTC needs evaluation, our main model is estimated as an instrumental variable two-stage least square (IV-2SLS) model, where the second-stage is Equation 1, and the first-stage is Equation 2 below:

$$Grade\ II_i = \gamma_0 + \gamma_1 Z_{i,j} + X_i\delta + \eta + \theta + \eta x\theta + u_i \quad (2)$$

Where Z_i is the leniency of examiner *j* to whom the individual *i* is assigned. The same instrument has been previously used by Hernández-Pizarro (2018) in order to estimate the causal effect of LTC benefits on mortality; and similar instruments (judge´s leniency) have been used to estimate the causal effects of incarceration (Bhuller et al., 2020; Dobbie et al., 2018).

We construct the instrument using a residualized leave-out examiner leniency measure following Dahl et al (2014) as follows:

$$Z_{i,j} = \frac{1}{n_j - 1} \sum_{k \neq i}^{n_j - 1} A_{k,j} \quad (3)$$

where *Z* represents the leave-out mean for individual i examined by examiner j; n_j represents the number of assessments carried out by examiner j, k indexes the assessment of examiner j;

[13] For comparative means this amount accounts to 64% with respect to the average period (i.e.: 2007-2017) minimum wage (€648) and 67% with respect to the average period widowhood pension (€607), the most common source of income of the LTC claimants. (Source: Spanish Ministry of Labour)

and A equals 1 if the individual is classified above the cutoff for Grade II (i.e: BVD =[50 – 74]), and zero if the individual is assigned to Grade I (i.e: BVD =[25 – 49]).

Random allocation of claimants to examiners takes place at a territorial level, therefore generating a simple leave-out mean based on the pool of examiners would bias the results. Also, the Dependency Act was implemented gradually over the years. We deal with these factors by defining the instrument $Z_{i,j}$ as the residuals from an OLS equation in which the examiner leniency leave-out mean ($A_{i,j}$) is regressed on year-by-territory fixed effects[14]. Thus, the instrument can be interpreted as the variation in examiner leniency that cannot be explained by the year-by-territory fixed effects. This provides exogenous variation in examiner leniency after controlling for differences by territory (teams) over time.[15]

4.2. The effect on Primary Care use

In order to estimate the causal effect of LTC benefits on the number of PC visits, IV methods may be problematic since the dependent variable is a count variable (Windmeijer and Santos Silva, 1997). Classic linear two-stage least squares (2SLS), or two-stage predictor substitution (2SPS) for non-linear models can provide inconsistent estimators in such settings (Terza et al 2008). In order to address this issue, we use the Two-stage Residual Inclusion (2SRI) method as proposed by Terza (2018). 2SRI provides unbiased parameter estimates for nonlinear models. This method has been widely used in settings similar to ours (Bruni et al., 2016; Grabowski et al., 2013; Nguyen and Connelly, 2014).

[14] Each territory fixed effect represents a local team of examiners. There are 14 local teams.

[15] One might have first thought to use a Regression Discontinuity design exploiting the thresholds in the BVD score that grant higher LTC benefits. However, such design cannot be used since there are strong discontinuities around the thresholds in the density function of claimants by BVD score (See Figure B1 in Appendix B). It is actually these discontinuities around the threshold that show how examiners have room to adjust the BVD around the thresholds and grant higher LTC benefits as further discussed in Hernández-Pizarro et al (2020).

Under this methodology, the predicted error of the first stage is included as a regressor in the second stage in order to account for the endogeneity of the explanatory endogenous variable, as follows[16]:

First stage: $\Pr(Grade\ II_i = 1) = f(\gamma_0 + X_i\delta + \gamma_2 Z_{i,j} + \eta + \theta + \eta x\theta + u_i)$ (4)

Predicted residuals from first stage: $\hat{u}_i = Grade\ II_i - f(\widehat{\gamma_0} + X_i\hat{\delta} + \gamma_2\widehat{Z_{i,j}} + \hat{\eta} + \hat{\theta} + \hat{\eta}x\hat{\theta})$ (5)

Second stage: $y_{i,t} = \exp(\beta_0 + \beta_1 Grade\ II_i + X_i\gamma + \eta + \theta + \eta x\theta + \alpha\hat{u}_i) + e_i$ (6)

The dependent variable $y_{i,t}$ measures the number of PC visits (scheduled, non-scheduled and by main diagnosis group) within *t* months after LTC Grade entitlement. The rest of the variables, including the examiner leniency IV ($Z_{i,j}$), are similar to those in Equations 1 and 2. The first stage parameters are estimated using a Probit model. The second stage uses a Negative Binomial model[17]. Results are presented as average marginal effects. Standard errors are clustered at the examiner level and bootstrapped (100 replications) in order to approximate the asymptotically correct standard errors (Terza, 2016).

5. Results

5.1. First stage and validity of the instrumental variable

Table 2 shows the results of the first-stage regressions from equation 2. From Panel A to D we add controls in a stepwise manner. As we can see the instrument is strongly significant (F-test=240.93) in our preferred model where we control for all covariates, past hospitalization probability and time and territory fixed effects (Panel D). Furthermore, we use different samples depending on the time after LTC benefit entitlement, as the sample gets smaller as we move further from the date of LTC entitlement due to mortality. Still, the coefficients of the instrument on the probability of Grade II entitlement remains fairly stable 36 months after Grade entitlement (Column (4)). Taking into account the distribution of the instrumental variable[18], one-standard deviation in leniency increases the probability of receiving Grade II LTC by 5.4

[16] We calculated the raw residuals of the first-stage following Terza (2018). However, other authors have suggested to use generalized residuals instead (Wooldridge, 2014). Our results (available upon request) do not change when we use generalized residuals following Gourieroux et al (1987). Actually, the raw residuals and generalized residuals have a very strong correlation in our setting (ρ = 0.999).

[17] We tested for over dispersion and the null hypothesis of no over dispersion was rejected, leading us to use a Negative Binomial model, instead of a Poisson model. Results of these tests are available upon request.

[18] The leniency IV has a zero mean as it is constructed as a residualised measure, and a standard deviation of 0.072. Figure B2 in Appendix B shows the full distribution of our instrumental variable.

percentage points. Or, being assigned to an examiner in the 75th percentile of the leniency distribution increases your probability of receiving a Grade II LTC benefit by 7.2 pp compared to being assigned to an examiner in the 25th percentile of the leniency distribution. Indeed, the probability of being entitled to a Grade II LTC benefit monotonically increases with the leniency values (Figure B2 in Appendix B). Thus, the instrument strongly predicts the endogenous variable (i.e.: LTC Grade II entitlement), and the effects are sizable.

Aside from the first stage, the validity of our empirical strategy requires the instrument (i.e.: examiner leniency) to not be correlated with the error term of the second stage (Equation 1). This implies two conditions. First, that the instrument is as good as randomly assigned conditional on the control variables and time and territory fixed effects. The second condition is the exclusion restriction. In Appendix A, we discuss how both conditions are very likely to hold in our setting. Lastly, with heterogeneous effects of the LTC benefits, and in order to interpret our 2SLS estimates as the Local Average Treatment Effect (LATE), the monotonicity assumption must also hold (Angrist and Pischke, 2008). We test for this assumption in Appendix A.

Our 2SLS results shall be interpreted then as the LATE. That is, the average causal effect of being entitled to LTC benefits for the applicants whose LTC Grade entitlement was affected by the leniency of the examiner that they were assigned to (i.e.: compliers).[19]

[19] On the other hand, the 2SRI estimates can be interpreted as the Average Treatment Effect (ATE) on our claimants sample (Terza et al., 2008). Although LATE (average effect on compliers) and ATE (average effect on our sample of claimants) are not directly comparable, results on the first-stage by subsample can show us how much different compliers are, as compared to the average claimant in our sample, with respect to observable characteristics. Following Maestas et al (2013), dividing the first-stage coefficient of each subsample (based on observable characteristics) by the first-stage coefficient of the full sample, we can get the relative likelihood that compliers have a particular characteristic with respect to the average claimant in our sample (see Panel A of Table A2 in Appendix A). This shows that compliers are not very different from the rest of the claimants in our sample, at least in terms of observable characteristics. In particular, compliers are 4% more likely to be female, 6% more likely to be 80 or older and 2% less likely to have a labour disability status and 1% more likely to have 3 or more comorbidities.

Table 2- First stage regressions. Coefficients of examiner leniency on the Probability of being entitled to Grade II (vs Grade I).

	Time after LTC entitlement			
	Baseline	12 months	24 months	36 months
	(1)	(2)	(3)	(4)
Panel A: No controls				
Examiner Leniency	0.7026***	0.7196***	0.7454***	0.7459***
	(0.0645)	(0.0676)	(0.0693)	(0.0700)
F-test (on IV)	118.57	113.38	115.62	113.62
Panel B: Adds Territory FE + Time FE + (Territory FE x Time FE)				
Examiner Leniency	0.7057***	0.7220***	0.7466***	0.7471***
	(0.046)	(0.0478)	(0.0518)	(0.0506)
F-test (on IV)	234.96	228.06	207.39	218.29
Panel C: Adds Demographic and Health Controls				
Examiner Leniency	0.7217***	0.7343***	0.7558***	0.7553***
	(0.0468)	(0.0484)	(0.0517)	(0.0505)
F-test (on IV)	238.09	229.83	213.77	223.44
Panel D: Adds any hospitalization 12 months before Grade entitlement				
Examiner Leniency	0.7251***	0.7373***	0.7588***	0.7582***
	(0.0467)	(0.0485)	(0.0518)	(0.0507)
F-test (on IV)	240.93	230.83	214.39	223.43
Y mean (Grade II)	0.4878	0.4768	0.4656	0.4538
Observations	64,550	58,054	51,937	45,959

NOTES: All estimates come from OLS regressions. Column (1) corresponds to the sample of individuals observed at the time of Grade entitlement (i.e.: baseline). Column (2) (3) and (4) correspond to the sample of individuals who are observed up to 12, 24 and 36 months after LTC Grade entitlement, respectively. Robust standard errors clustered at examiner level in parenthesis. There are 114 examiners. *** p<0.01, ** p<0.05, * p<0.1

5.2. Effect of the LTC benefits on hospital admissions

Table 3 shows the results of estimating Equation 1 by both OLS and IV-2SLS for the probability of any hospital admission within 24 months after LTC Grade entitlement. Our preferred model is the IV-2SLS in Column (4) where all the controls are included, and endogeneity is accounted for. While we do not find a significant effect on the probability of being admitted to a hospital, although the coefficients are negative, we find that LTC benefits increase the probability of a programmed hospitalization by 5 pp (p<0.1), and decreases the probability of emergency hospitalization (although not significantly in our preferred specification).

When we group hospitalization by main diagnoses, and focus on potentially avoidable hospitalizations, coefficients turn negative in the IV-2SLS specifications. For the case of ANHAC hospitalizations, the entitlement to an LTC benefit significantly decreases the probability of hospitalization for this group of conditions by 6.4 pp. These are sizable effects since they represent a 64% reduction with respect to the mean probability (Table 1). This reduction is driven by a significant drop of 6.7 pp in the probability of emergency admission due to Injuries and Poisoning (Table B3, Appendix B), which are the fourth leading cause of hospitalization in our sample (Table B4, Appendix B).

On the other hand, the increase in the probability of planned hospital admissions seems to be driven by an increase in the probability in admissions due to Injuries and Poisoning (+1.8 pp, p-value<0.1) and to a larger extent to Nervous System conditions (+4.5 pp, p-value<0.1). Note that in the latter category up to 79% of admissions are due to Cataract surgery, a very common procedure at old ages.[20]

On Figure 3, we plot the IV estimates with the full sets of controls by 6, 12, 18, 24, 30 and 36 months to see if the results by type of hospital admission hold over time. The positive effect on the probability of any programmed hospitalizations seems to increase over time. 36 months after LTC Grade entitlement, those at Grade II are 7 pp more likely to have had a programmed hospitalization. On the other hand, although the coefficient on emergency admissions is negative, it does not reach significance over the 36 months. Lastly, the reduction on the probability of ANHAC hospital admission starts from 18 months after LTC Grade entitlement, and remains strongly significant up to 36 months.

[20] Looking solely at hospital admissions due to Cataracts (ICD-9: 366), we find a significant increase in the probability of hospitalization by 4.7 pp (p-value < 0.01), 24 months after LTC Grade II entitlement.

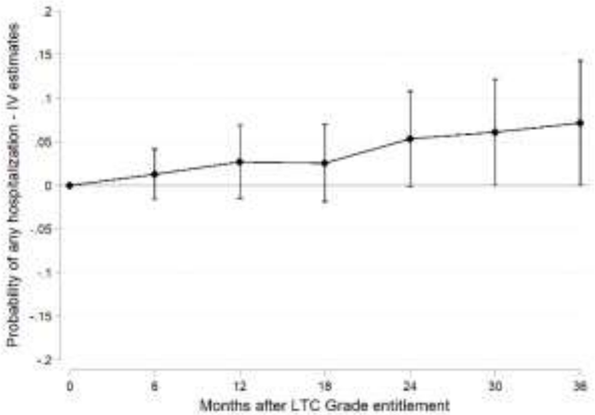
Table 3- Coefficients of being entitled to Grade II (vs Grade I) on the probability of hospitalization 24 months after LTC Grade entitlement. OLS vs IV-2SLS

	(1)	(2)	(3)	(4)
Dependent variable: Any hospitalization				
OLS	-0.00791*	-0.00901**	-0.0110**	-0.0160***
	(0.005)	(0.005)	(0.005)	(0.004)
IV -2SLS	-0.0485	-0.0513	-0.0371	-0.0116
	(0.064)	(0.034)	(0.032)	(0.031)
Dependent variable: Any programmed hospitalization				
OLS	-0.0498***	-0.0503***	-0.0452***	-0.0421***
	(0.003)	(0.003)	(0.003)	(0.003)
IV -2SLS	0.0531	0.0523*	0.0533*	0.0497*
	(0.038)	(0.029)	(0.029)	(0.027)
Dependent variable: Any emergency hospitalization				
OLS	0.0318***	0.0316***	0.0257***	0.0166***
	(0.005)	(0.005)	(0.005)	(0.005)
IV -2SLS	-0.0793	-0.0821***	-0.0655**	-0.0340
	(0.068)	(0.032)	(0.031)	(0.029)
Dependent variable: Any ACSC hospitalization				
OLS	0.0127***	0.0114***	0.00779**	0.00672**
	(0.003)	(0.003)	(0.003)	(0.003)
IV - 2SLS	-0.0278	-0.0290	-0.0197	-0.0171
	(0.030)	(0.026)	(0.026)	(0.024)
Dependent variable: Any ANHAC hospitalization				
OLS	0.0208***	0.0219***	0.0204***	0.0192***
	(0.003)	(0.003)	(0.003)	(0.003)
IV -2SLS	-0.0712**	-0.0710***	-0.0679***	-0.0642***
	(0.033)	(0.022)	(0.023)	(0.023)
Observations	52544	52,544	51,937	51,937
Covariates	No	No	Yes	Yes
Any hospitalization in prior 12 months	No	No	No	Yes
Territory FE , Year FE, Territory FE x Year FE	No	Yes	Yes	Yes

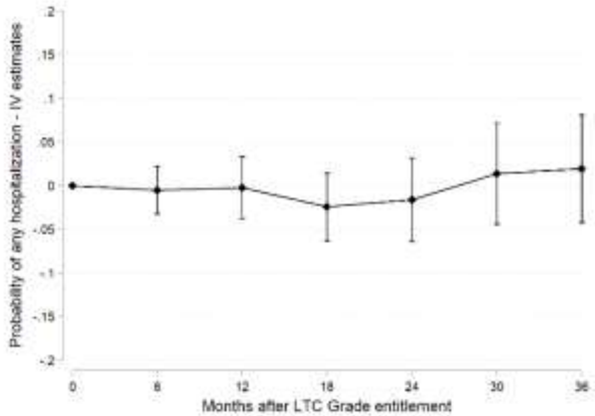
NOTES: Each column and line represents the coefficients of a different regression. Standard errors clustered at examiner level in parenthesis. There are 114 examiners. *** p<0.01, ** p<0.05, * p<0.1.

Figure 3- IV-2SLS Coefficients of effect of being entitled to Grade II (vs Grade I) on the probability of hospitalization after t months, by type of hospitalization

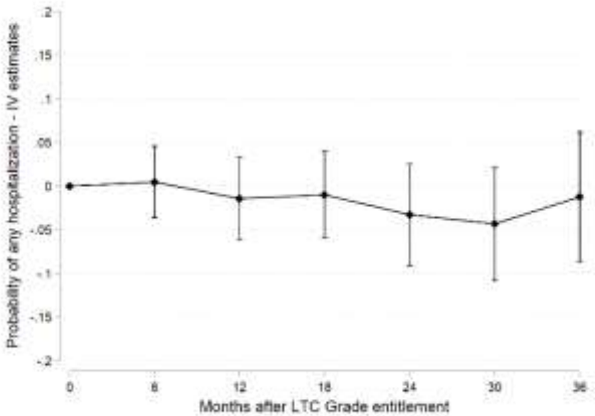
a) Any programmed hospitalization



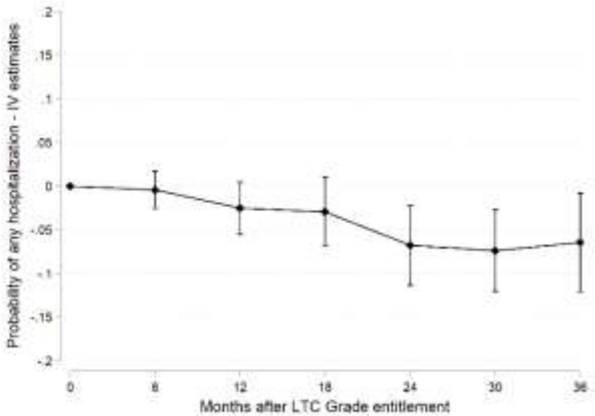
c) Any ACSC hospitalization



b) Any emergency hospitalization



d) Any ANHAC hospitalization



NOTES: IV-2SLS Coefficients (and 95% Confidence Intervals) of being entitled to Grade II on the (cumulative) probability of any hospitalization after 6, 12, 18, 24, 30 and 36 months. Number of observations at each 6-month period: 6 (n= 61,239), 12 (n= 58,054), 18 (n= 55,030), 24 (n= 51,937), 30 (n= 48,902), 36 (n= 45,959). Results from the model with the full set of demographic and health controls, any hospitalization 12 months before Grade entitlement and territory and year fixed effects. Standard errors clustered at examiner level. There are 114 examiners.

5.3. Effect of the LTC benefits on Primary Care visits

In Table 4 we estimate the effects of LTC benefits on PC use. 2SRI results, which control for endogeneity, show that the receipt of Grade II LTC benefits decreases by 9 the number of non-scheduled visits24 months after LTC Grade entitlement. This equates to a 50% reduction when compared to the mean (Table 1). Looking at this effect over time in Figure 4 the effect of Grade II benefits consistently decreases the number of non-scheduled PC visits up to 36 months after entitlement. On the other hand, it does not seem to significantly affect planned PC visits.

Lastly, we look at the effect on visits by main diagnoses group, based on the International Classification of Diseases (ICD-9) in Table B5 of Appendix B. The reduction in non-scheduled visits is driven by the reduction in the category "Factors influencing Health Status and Contact with Health Services". This category is the leading cause of PC visits, accounting for 22% of the total PC visits (Table B6, Appendix B), and is mostly formed of visits due to housing, household and economic circumstances on the one hand, and due to the long-term use of anticoagulants on the other hand[21].

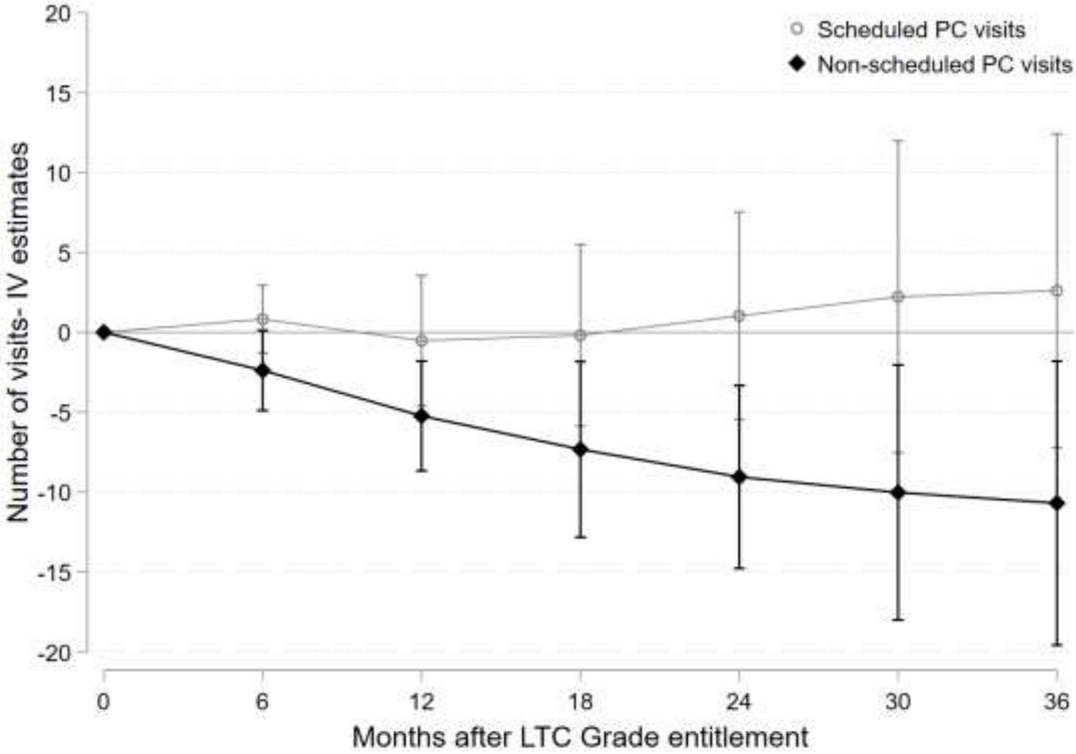
[21] If we further disaggregate the factors influencing Health Status disease group into smaller ones, we see that the drop in these non-scheduled visits is driven by a drop of 1.7 visits (p-value < 0.05) due to "housing, household and economic circumstances (ICD-9 = V.60) and 1.5 visits (p-value <0.05) due to "long-term use of anticoagulants" (ICD-9 = V58.6).

Table 4- Coefficients of being entitled to Grade II (vs Grade I) on the number of PC visits 24 months after LTC Grade entitlement. Negative Binomial vs 2SRI

	(1)	(2)	(3)
Dependent variable: PC visits			
Negative Binomial	-2.307***	-2.807***	-3.366***
	(0.666)	(0.635)	(0.636)
2SRI	-10.81*	-9.572	-7.405
	(6.221)	(6.082)	(5.200)
Dependent variable: Scheduled PC visits			
Negative Binomial	-3.040***	-3.333***	-3.606***
	(0.433)	(0.416)	(0.424)
2SRI	0.481	0.262	1.031
	(3.381)	(3.323)	(3.313)
Dependent variable: Non-scheduled PC visits			
Negative Binomial	0.689*	0.421	0.123
	(0.388)	(0.335)	(0.333)
2SRI	-11.86***	-10.54***	-9.057***
	(3.948)	(3.853)	(2.921)
Observations	14,119	14,119	14,110
Covariates	No	No	Yes
Region FE, Year FE, Region x Year FE	No	Yes	Yes

NOTES: Each column and line represents the coefficients of a different regression. 2SRI coefficients are calculated as marginal effects. First stage coefficients for the Primary Care sample are reported in Table B7 in Appendix B. Standard errors clustered at examiner level in parenthesis. 2SRI standard errors were estimated using bootstrapping (100 replications). There are 75 examiners. *** p<0.01, ** p<0.05, * p<0.1.

Figure 4 - 2SRI coefficients of effect of being entitled to Grade II (vs Grade I) on the number of PC visits. Marginal Effects



NOTES: 2SRI coefficients (and 95% Confidence Intervals) of being entitled to Grade II (vs Grade I) on the number of PC visits after 6, 12, 18, 24, 30 and 36 months. Number of observations at each 6-month period: 6 (n= 17,231), 12 (n= 16,161), 18 (n= 15,104), 24 (n= 14,104), 30 (n= 13,120), 36 (n= 12,281). 2SRI coefficients are calculated as marginal effects. Results from the model with the full set of demographic and health controls, and territory and year fixed effects. Standard errors clustered at examiner level, estimated using bootstrapping (100 replications). There are 75 examiners.

6. Robustness checks

6.1. Attrition due to mortality

As previously found in Hernández-Pizarro (2018), LTC Grade eligibility also affects the mortality of claimants. In particular, for our main sample where we focus on hospitalizations, those entitled to Grade II LTC had around a 14 pp lower probability of death compared to Grade I (Table B8 in Appendix B)[22]. We expect that if LTC reduces mortality, those who prolong their life due to the LTC benefits in the Grade II group are those at marginally worse health. Equally, those who die in the Grade I group and were not entitled to Grade II benefits, are expected to be those in worst health amongst the Grade I population. As a consequence there may be a differential attrition in the Grade I group that makes the average health of those remaining in the Grade I group relatively better to that of the Grade II group over time. Hence, as long as better health is associated with less healthcare use, our estimates on the reduction of healthcare use (i.e. ANHAC hospitalizations and non-scheduled PC visits) might be underestimated. In order to address this issue we carry out two robustness checks.

First, we run the same estimations on the effect of LTC benefits on healthcare use over time (as in Figures 3 and 4) but always using the balanced subsample of those who survived up to 36 months after LTC entitlement, when the attrition due to mortality reaches its maximum of 28% in the hospitalization sample (34% in the PC sample). If our results are biased by selective attrition, estimates of the balanced subsample should significantly differ from those of our original sample, where attrition is lower. However, estimates hardly change for the outcomes where we found significant effects (Figure B3 and Figure B4, Appendix B). For probability of ANHAC hospitalizations and non-scheduled PC visits balanced sample estimates are slightly smaller when compared to the original sample. This suggests that when we use the balanced sample (which is affected by the highest attrition) the estimation is indeed altered by selective attrition of those with more healthcare use in the control group. As a consequence, the LTC effect seems to be slightly reduced. So, if anything, our main results would be underestimating the negative effects of LTC on ANHAC hospitalizations and non-scheduled visits due to selective

[22] For the PC subsample there is also a significant effect of LTC Grade II entitlement that reduces the probability of death by around 11 pp, 36 months after entitlement. Mortality within 36 months (i.e. attrition) is also associated with being male, age, not having labour disability and having any hospitalization 12 months prior to LTC entitlement in both the hospitalizations sample and the PC subsample (Table B8 in Appendix B)

mortality. On the other hand, the estimates on programmed hospitalizations remain completely unaltered.

Second, for the case of hospitalizations we also use a multinomial model where we incorporate attrition due to death as one of the outcomes, following Grabowski et al (2013). The dependent variable has three categories: i) at least one hospitalization, ii) death and iii) nor hospitalization nor death. To address endogeneity of LTC Grade entitlement we use a 2SRI model with a first stage Probit model for the probability of LTC Grade II, and a second stage multinomial model. We report marginal effects for the probability of hospitalization and compare it with the original model results (Figure B5, Appendix B). Our main results for ANHAC hospitalization and programmed hospitalizations remain significant.[23] All in all, our results are robust to potential selective attrition due to mortality.

6.2. Grade I vs non-entitled to LTC benefit. The "acknowledgement effect"

As explained in the Data section, most of claimants entitled to Grade I (89%) *did not* actually receive any benefit during our period of analysis. Hence, comparing those at Grade I (BVD=25-49) with those who were not entitled to LTC benefit (BVD=0-24) means essentially looking at the effect of entitlement and recognition of Grade I dependency, instead of the receipt of benefits. We may think of this as a sort of "acknowledgment effect". That is, the fact that an individual is granted a higher level of dependency might acknowledge to their relatives his real level of LTC needs. Relatives may then provide more (or better) care on an informal ground. This "acknowledgement effect" might have both direct effects on healthcare use but also indirectly through an improvement in health. Results in Table B9 in Appendix B show, however, that being entitled to Grade I (and actually not receiving any additional benefit) has no effect on hospital and primary care use. This suggests that there is no such thing as an "acknowledgement effect" in our context, or at least not large enough to explain the impact of LTC benefits on healthcare use.

[23] This second robustness check for mortality could not be done for PC visits since our outcome variable is continuous (i.e.: number of visits) and not binary (i.e.: probability of hospitalization).

6.3. The effect of the "extensive margin" of LTC benefits

As explained in the Data section, our analysis relies on the fact that while most claimants entitled to Grade II (87%) received the benefit; the large majority of claimants entitled to Grade I (89%) *did not* receive any benefit during our period of analysis. As an additional robustness check, we use this restricted sample where our "Grade II" group consists of those who were entitled to Grade II and *did receive* the benefit, and the "Grade I" group those who were entitled to Grade I and *did not receive* any benefit. This will show us whether our results are actually driven by the causal effect of receiving LTC benefits at the extensive margin (receive vs non-receive). This slightly contrasts with the initial specification, which captures not only the extensive margin effect (receiving LTC benefits vs not receiving), but also might capture some of the intensive margin effect (receive higher vs lower benefit) since the "control" group also contained 11% of Grade I claimants who *did receive* the LTC benefits. When utilizing this restricted sample our main results remain unchanged, suggesting that indeed our results are driven by the comparison of those receiving a LTC benefit vs those that did not received any benefit (Figure B6 and Figure B7 in Appendix B)

6.4. The effect of LTC benefits on the extensive margin of hospital demand

So far, we have only analysed the effect of LTC benefit on the extensive margin of hospitalization (i.e. hospital admission probability). The main reason to focus on the extensive margin is that despite our sample being very old and functionally dependent it is still rare for them to have more than one hospitalization. For instance, 24 months after LTC entitlement, only around 20% of the sample had 2 or more hospitalizations, and 6% and 13% have 2 or more programmed and emergency hospitalizations respectively (Figure B8 in Appendix B). Still, we have carried out the same estimations as above but using as the dependent variable the number of hospitalizations, using a 2SRI model (as in the case of Primary Care visits). Results are very similar to those for hospitalization probability; i.e. Grade II LTC benefit largely decreases ANHAC hospitalizations and seems to increase programmed hospitalizations (Figure B9 in Appendix B).

7. Discussion and conclusion

Our results show that LTC benefits have significant causal effects on healthcare use. However, such effects are not homogenous across the type of hospital admissions and PC visits. When looking at hospital admissions, our results point to a **reduction in avoidable admissions**. Our results provide a more detailed analysis than previous literature, which finds a reduction in overall hospitalizations (Costa-Font et al., 2018). While the probability to be admitted to hospital seems to be affected by LTC subsidies, when we distinguish by the type of admission and diagnoses, we find that the reduction comes amongst a group of avoidable admissions. In particular, we find a large reduction (of more than 60%, compared to the mean), in Nursing Home Avoidable Conditions (ANHACs); which are diagnoses identified by the medical literature as potentially avoidable with appropriate care in nursing homes. This effect seems to be driven by a reduction in emergency hospital admissions due to Injuries and Poisoning, which is the fourth highest cause of admissions in our sample. These are hospitalizations particularly sensitive to the presence of a carer, who can prevent falls or unintended poisoning that might occur due to deteriorating physical and cognitive abilities of the dependent elderly. These results highlight the role of **LTC as a preventive care tool.**

Regarding PC use, previous research has pointed towards PC care being both a complement (Costa-Font et al., 2018; Gonçalves and Weaver, 2017) and a substitute of LTC (Forder et al., 2019). Our results lean towards a substitution relationship. **LTC benefits significantly decrease the number of non-scheduled PC visits** through the 36-month period after LTC entitlement was granted. This reduction accounts for as much as 50% of the mean number of non-scheduled PC visits. This seems to be driven by a reduction in PC visits associated with "housing, household and economic circumstances", which could be considered as those relating to social exclusion of the patients. These results prove that **LTC benefits can be a tool to contain the pressure on Primary Care services.** LTC benefits also reduced PC visits due to long-term use of anticoagulants; showing that LTC may ease the burden on PC by reducing their involvement in the periodic management of anticoagulant treatments used by the elderly population.[24]

LTC benefits will not only expectedly increase quality of life and life expectancy of the recipient but also provide savings to the healthcare system. Our "back of the envelope" calculations show an estimated reduction in healthcare costs of €878 within 24 months after entitlement to LTC benefits due to a reduction in avoidable healthcare use (i.e.: hospitalizations due to injuries and

[24] In our sample, the PC visits associated to "long-term use of anticoagulants" (ICD-9 = V58.61) account for as much as 7.1% of the total of PC visits.

poisoning and non-scheduled primary care visits). **That is, every €100 spent in LTC benefits saves €8.88 in avoidable healthcare costs** (€4.30 in hospital care and €4.58 in primary care).[25] This would imply an elasticity of around -0.09 of healthcare costs with respect to LTC spending.

On the other hand, LTC benefits seem to increase some healthcare use such as programmed cataract surgeries. Two reasons lead us to think that this increase in health care use is a result of improved healthcare access and better disease management, rather than a sign of worsening health. First, it is driven by planned visits and admissions rather than emergency ones. Second, the process by which cataracts develops can be considered exogenous and independent of LTC benefits. The role of caregivers in recommending and facilitating the access to healthcare services has been discussed before (Gonçalves and Weaver, 2017; Torbica et al., 2015).

In sum, these results show that there are significant interdependencies between the LTC and healthcare systems, although their direction and size depend on the type of diagnoses and whether the healthcare utilization is caused by emergencies or not. This has important policy implications for the organization of the LTC and healthcare systems, especially as the aim to reduce overall costs is balanced with the aim to guarantee the quality of care. Our results confirm that there is scope to increase the efficiency of resource allocation between LTC and healthcare systems. As an example, the fact that LTC largely prevents the use of non-scheduled PC visits associated with social exclusion indicates that a re-allocation of resources towards LTC might not only increase the welfare of the LTC recipient but also decrease the pressure on Primary Care facilities, freeing up space for other healthcare users. This is just one of several interesting interdependencies between LTC benefits and healthcare that we found in this study which should be taken into account when organizing the LTC and healthcare systems in a more integrated manner.

[25] Our "back of the envelope" calculations of the healthcare cost savings are explained in Table B10 in Appendix B.

References

Angrist J. D. and J. S. Pischke, 2008. Mostly Harmless Econometrics : An Empiricist ' s Companion. Massachusettts I nstitute Technol. London Sch. Econ. 290. https://doi.org/10.1017/CBO9781107415324.004

Antunes, V., Moreira, J.P., 2011. Approaches to developing integrated care in Europe: a systematic literature review. J. Manag. Mark. Healthc. 4, 129–135.

Bakx, P., Wouterse, B., van Doorslaer, E., Wong, A., 2020. Better off at home? Effects of nursing home eligibility on costs, hospitalizations and survival. J. Health Econ. 73, 102354.

Bhuller, M., Dahl, G.B., Løken, K. V., Mogstad, M., 2020. Incarceration, recidivism, and employment. J. Polit. Econ. https://doi.org/10.1086/705330

Bloom, D.E., Luca, D.L., 2016. The global demography of aging: facts, explanations, future, in: Handbook of the Economics of Population Aging. Elsevier, pp. 3–56.

Bruni, M.L., Mammi, I., Ugolini, C., 2016. Does the extension of primary care practice opening hours reduce the use of emergency services? J. Health Econ. 50, 144–155.

Costa-Font, J., Jimenez-Martin, S., Vilaplana, C., 2018. Does long-term care subsidization reduce hospital admissions and utilization? J. Health Econ. 58, 43–66.

Dahl, G.B., Kostøl, A.R., Mogstad, M., 2014. Family welfare cultures. Q. J. Econ. 129, 1711–1752.

Dobbie, W., Goldin, J., Yang, C.S., 2018. The Effects of Pretrial Detention on Conviction, Future Crime, and Employment: Evidence from Randomly Assigned Judges†. Am. Econ. Rev. https://doi.org/10.1257/aer.20161503

Feng, J., Wang, Z., Yu, Y., 2020. Does Long-Term Care Insurance Reduce Hospital Utilization and Medical Expenditures? Evidence from China. Soc. Sci. Med. 113081.

Forder, J., Gousia, K., Saloniki, E.-C., 2019. The impact of long-term care on primary care doctor consultations for people over 75 years. Eur. J. Heal. Econ. 20, 375–387.

Gaughan, J., Gravelle, H., Siciliani, L., 2015. Testing the bed-blocking hypothesis: Does nursing and care home supply reduce delayed hospital discharges? Health Econ. 24, 32–44.

Gonçalves, J., Weaver, F., 2017. Effects of formal home care on hospitalizations and doctor visits. Int. J. Heal. Econ. Manag. 17, 203–233.

Gourieroux, C., Monfort, A., Renault, E., Trognon, A., 1987. Generalised residuals. J. Econom. 34, 5–32.

Grabowski, D.C., Feng, Z., Hirth, R., Rahman, M., Mor, V., 2013. Effect of nursing home ownership on the quality of post-acute care: An instrumental variables approach. J. Health Econ. 32, 12–21.

Hernández-Pizarro, H., 2018. The Effect of Long-Term Care Benefits on Mortality. Working. Paper.

Hernández-Pizarro, H.M., Nicodemo, C., Casasnovas, G.L., 2020. Discontinuous system of allowances: The response of prosocial health-care professionals. J. Public Econ. 190, 104248.

Howdon, D., Rice, N., 2018. Health care expenditures, age, proximity to death and morbidity: Implications for an ageing population. J. Health Econ. 57, 60–74.

IMSERSO, 2015. Información Estaística del Sistema para la Autonomía y Atención a la Dependencia [WWW Document]. URL https://www.imserso.es/imserso_01/documentacion/estadisticas/info_d/estadisticas/est_inf/inf_gp/2014/index.htm (accessed 9.14.20).

Kim, H.B., Lim, W., 2015. Long-term care insurance, informal care, and medical expenditures. J. Public Econ. https://doi.org/10.1016/j.jpubeco.2014.12.004

Liu, D., Pace, M.L., Goddard, M., Jacobs, R., Wittenberg, R., Mason, A., 2021. Investigating the relationship between social care supply and healthcare utilization by older people in England. Health Econ. 30, 36–54.

Lorenz, N., Ihle, P., Breyer, F., 2020. Aging and Health Care Expenditures: A Non-Parametric Approach.

Maestas, N., Mullen, K.J., Strand, A., 2013. Does disability insurance receipt discourage work? Using examiner assignment to estimate causal effects of SSDI receipt. Am. Econ. Rev. 103, 1797–1829.

Mur-Veeman, I., Van Raak, A., Paulus, A., 2008. Comparing integrated care policy in Europe: does policy matter? Health Policy (New. York). 85, 172–183.

Nguyen, H.T., Connelly, L.B., 2014. The effect of unpaid caregiving intensity on labour force participation: Results from a multinomial endogenous treatment model. Soc. Sci. Med. 100, 115–122.

Peña-Longobardo, L.M., Oliva-Moreno, J., García-Armesto, S., Hernández-Quevedo, C., 2016. The Spanish long-term care system in transition: Ten years since the 2006 Dependency Act. Health Policy (New. York). https://doi.org/10.1016/j.healthpol.2016.08.012

Rechel, B., Doyle, Y., Grundy, E., McKee, M., Organization, W.H., 2009. How can health systems respond to population ageing. Copenhagen: WHO Regional Office for Europe.

Spector, W.D., Limcangco, R., Williams, C., Rhodes, W., Hurd, D., 2013. Potentially avoidable hospitalizations for elderly long-stay residents in nursing homes. Med. Care 673–681.

Terza, J., 2016. A Practitioners Guide to Implementing the Two-Stage Residual Inclusion Method in Stata, in: 2016 Stata Conference. Stata Users Group.

Terza, J. V, 2018. Two-stage residual inclusion estimation in health services research and health economics. Health Serv. Res. 53, 1890–1899.

Terza, J. V, Basu, A., Rathouz, P.J., 2008. Two-stage residual inclusion estimation: addressing endogeneity in health econometric modeling. J. Health Econ. 27, 531–543.

Torbica, A., Calciolari, S., Fattore, G., 2015. Does informal care impact utilization of healthcare services? Evidence from a longitudinal study of stroke patients. Soc. Sci. Med. 124, 29–38.

Windmeijer, F.A.G., Santos Silva, J.M.C., 1997. Endogeneity in count data models: an application to demand for health care. J. Appl. Econom. 12, 281–294.

Wittenberg, R., Sharpin, L., McCormick, B., Hurst, J., 2017. The ageing society and emergency hospital admissions. Health Policy (New. York). 121, 923–928.

Wooldridge, J.M., 2014. Quasi-maximum likelihood estimation and testing for nonlinear models with endogenous explanatory variables. J. Econom. 182, 226–234.

Appendix A

A.1. Random assignment and exclusion restriction

Although the random assignment condition is not directly testable, if the instrument is as good as randomly assigned, the assignment of claimants to different judges should be random once we control for territory and period variation as discussed in the Institutional Setting section. In Table A1 we test for the random assignment of examiners. In Column (1) and (2) we can see that our control variables strongly predict the probability of receiving the Grade II LTC benefit , both without and with year and territory fixed effects (F-tests of joint significance of 45.63 and 66.79 respectively). Furthermore 7 out of 8 of our control variables are statistically significantly associated with the probability of receiving LTC benefit. This indicates that individuals assigned to Grade II are significantly different to those assigned to Grade I.

Using the same variables, although they do not significantly predict leniency in the simple model without fixed effects (Column (3), F-test=1.02), they do significantly jointly predict leniency when including time and territory fixed effects (Column (4), F-test=5.77). However, only the first year lag of hospitalization probability is significant. This coefficient is of the opposite sign to that of the probability of Grade, i.e. being hospitalised in the previous year is negatively associated with the leniency of the assigned examiner. Moreover the coefficient is very close to zero: being hospitalised in the year prior to the entitlement only decreases examiner´s leniency by 0.04 standard deviations. Furthermore, when we add control variables in a stepwise manner to the first-stage regression, the coefficients of the IV (examiner leniency) remain strongly significant and stable along the different specifications (from Panel A to Panel D in Table 2). This is also an indirect test for random assignment since the coefficient of examiner leniency would significantly change if covariates were correlated with examiner leniency. In any case, since we control for the past hospitalization probability in our preferred model, we remain confident that conditional on our controls, there is not expectable selection on unobservables. Thus, all of this evidence supports the validity of our instrument.

The exclusion restriction condition implies that the examiner should only affect future hospital outcomes through the entitlement of higher LTC benefits. Even though this condition is not directly testable, since examiners only meet the claimant during the one-hour assessment, and the BVD score outcome is only reported some time afterwards, it is very unlikely that an examiner can directly or indirectly affect future hospitalizations.

Table A1- Test for random assignment of examiners. Estimates from OLS regressions

	(1)	(2)	(3)	(4)
VARIABLES	Prob (Grade II)	Prob (Grade II)	Leniency	Leniency
Female	-0.0297***	-0.0376***	0.0014	0.0014
	(0.005)	(0.005)	(0.001)	(0.001)
Age	0.0041***	0.0043***	-0.0001	-0.0001
	(0.000)	(0.000)	(0.000)	(0.000)
Widow	0.0106**	0.0051	-0.0002	-0.0002
	(0.005)	(0.005)	(0.001)	(0.001)
Single	0.0485***	0.0422***	0.0004	0.0004
	(0.008)	(0.008)	(0.002)	(0.001)
Labour disability	-0.0319***	-0.0238***	0.0012	0.0011
	(0.007)	(0.006)	(0.002)	(0.001)
Number of health conditions (ICD-9)	0.0162***	0.0219***	-0.0015	-0.0017
	(0.003)	(0.002)	(0.001)	(0.001)
Any hospitalization 12 months before Grade entitlement	0.0090***	0.0321***	-0.0006	-0.0026***
	(0.002)	(0.005)	(0.000)	(0.001)
Any hosp. 13 to 24 months before Grade entitlement	-0.0090***	-0.0290***	-0.0001	0.0002
	(0.002)	(0.005)	(0.000)	(0.001)
Observations	64,584	64,584	64,584	64,584
R-squared	0.010	0.039	0.001	0.001
Territory FE , Year FE, Territory x Year FE	No	Yes	No	Yes
F test	45.63	66.79	1.025	5.778
p-value	0	0	0.430	0

NOTES: The dependent variable in Columns (1) and (2) is a binary variable indicating whether the individual is entitled to Grade II. The dependent variable in Columns (3) and (4) is examiner´s leniency. The 4 models are estimated by OLS. The base category for civil status is having a partner. Robust standard errors clustered at examiner level in parenthesis. There are 114 examiners. P-values are adjusted for multiple test using the Benjamini and Hochberg (1995) method. *** p<0.01, ** p<0.05, * p<0.1

A.2. Monotonicity assumption

The monotonicity assumption implies that claimants assigned to Grade II by a less lenient examiner will always be entitled to Grade II by a more lenient examiner. There are two testable implications for this assumption (Bhuller et al., 2020; Hernández-Pizarro, 2018).

The first one is that the first-stage of any subsample should be non-negative. To test for this we estimate the first-stage over different subsamples based on our demographic and control groups (i.e.: sex, age, marital status, labour disability and number of comorbidities), while continuing to use the leniency IV of the full sample. Results show that the IV first-stage coefficients are positive and strongly significant across all subsamples, in accordance with the monotonicity assumption (Panel A, Table A2).

A second testable implication is that if an examiner is lenient with one group (i.e. women), she must also be lenient with the other group (i.e. men). To test this implication we use the so-called reverse sample instrument (Bhuller et al., 2020). For each of the above subsamples we construct the leniency IV based on the individuals that do not belong to that subsample. For instance, for the women subsample, we calculate the leniency based on the assessments done solely to men. First-stages continue to be positive and significant across all subsamples, in line with the monotonicity assumption (Panel B, Table A2).

Table A2- Monotonicity assumption checks

	By gender		By age		By marital status		By labour disability		By number of comorbidities	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	female	male	80 or older	79 or younger	With partner	no partner	Yes	No	3 or more	2 or less
					Panel A- Baseline instrument					
Examiner Leniency	0.793***	0.699***	0.808***	0.718***	0.763***	0.770***	0.747***	0.762***	0.764***	0.749***
	(0.054)	(0.062)	(0.058)	(0.064)	(0.060)	(0.055)	(0.074)	(0.056)	(0.071)	(0.053)
F test (on IV)	212.2	127.1	195.9	125.2	160.1	194.7	102.3	183.3	115.4	201
Relative likelihood [a]	1.04	0.92	1.06	0.95	1.01	1.01	0.98	1.01	1.01	0.99
					Panel B- Reverse-sample instrument					
Examiner Leniency	0.544***	0.635***	0.579***	0.578***	0.655***	0.613***	0.660***	0.330***	0.579***	0.490***
	(0.066)	(0.065)	(0.071)	(0.072)	(0.064)	(0.067)	(0.077)	(0.055)	(0.082)	(0.060)
F test (on IV)	66.84	96.27	66.87	64.87	103.8	83.45	72.52	35.94	50.44	66.42
Y mean (Grade II)	0.459	0.480	0.489	0.438	0.452	0.479	0.436	0.476	0.480	0.454
Observations	36,063	15,874	28,297	23,640	25,783	26,154	13,249	38,688	23,077	28,860

NOTES: Each column and Panel represents the coefficients of a different regression. We use the sample of individuals entitled to Grade II or Grade I benefits observed up to 24 months after LTC Grade entitlement. Robust standard errors clustered at examiner level in parenthesis. Panel A reports the first-stage results for the corresponding subsample using the leniency IV of the full sample. Panel B reports the first-stage results for the corresponding subsample using the reverse sample IV. For instance, for the women subsample, we calculate the reverse sample IV based only on the assessments done to men. The same logic applies for the rest of the subsamples. [a] The relative likelihood is calculated by dividing the first-stage coefficient of examiner leniency of the corresponding subsample by the first stage coefficient of the full sample (i.e.: 0.7588 [Table 2, panel D, column 3]), following Maestas et al (2013). There are 114 examiners. *** p<0.01, ** p<0.05, * p<0.1.

Appendix B

Table B1 - Test of representativeness of our final sample of interest: Coefficients of the Linear Probability Model (LPM) of the probability of taking part of the final subsample

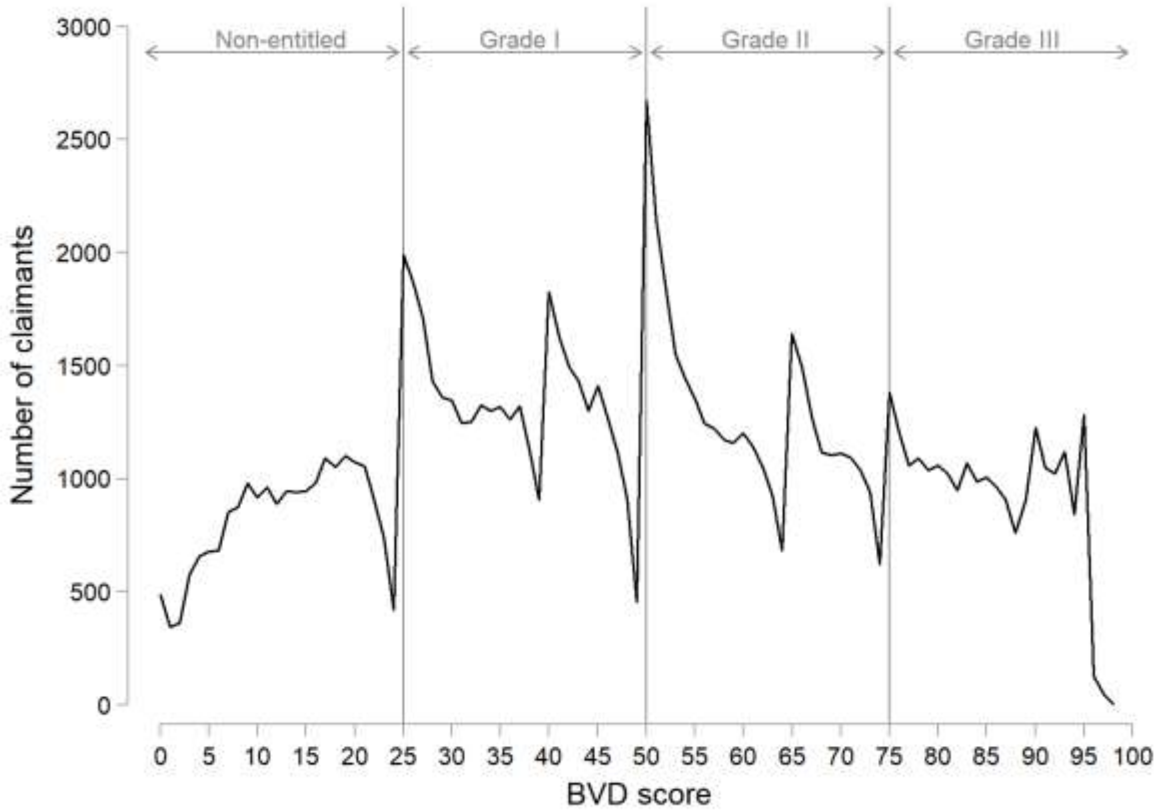
VARIABLES	(1) Prob (Final subsample)
Female	-0.00472*
	(0.002)
Age	0.000942***
	(0.000)
Widow	-0.00790***
	(0.003)
Single	-0.00996**
	(0.004)
Labour disabilities	0.0120***
	(0.003)
Number of health conditions (ICD-9)	0.0334***
	(0.001)
Observations	193,243
R-squared	0.005

NOTES: The sample of this regression is formed of all claimants entitled to Grade II or Grade I in Catalonia during the period 2009-2014 with information in all explanatory variables. The dependent variable is a binary variable indicating whether the individual takes part of our final sample with information on hospitalizations and the examiner. Coefficients should be interpreted as the increase in the probability of taking part of our final sample of interest (with information about hospitalizations and the examiner) associated with each variable. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table B2 - Number of individuals observed each year before and after LTC Grade entitlement (Grade II or Grade I).

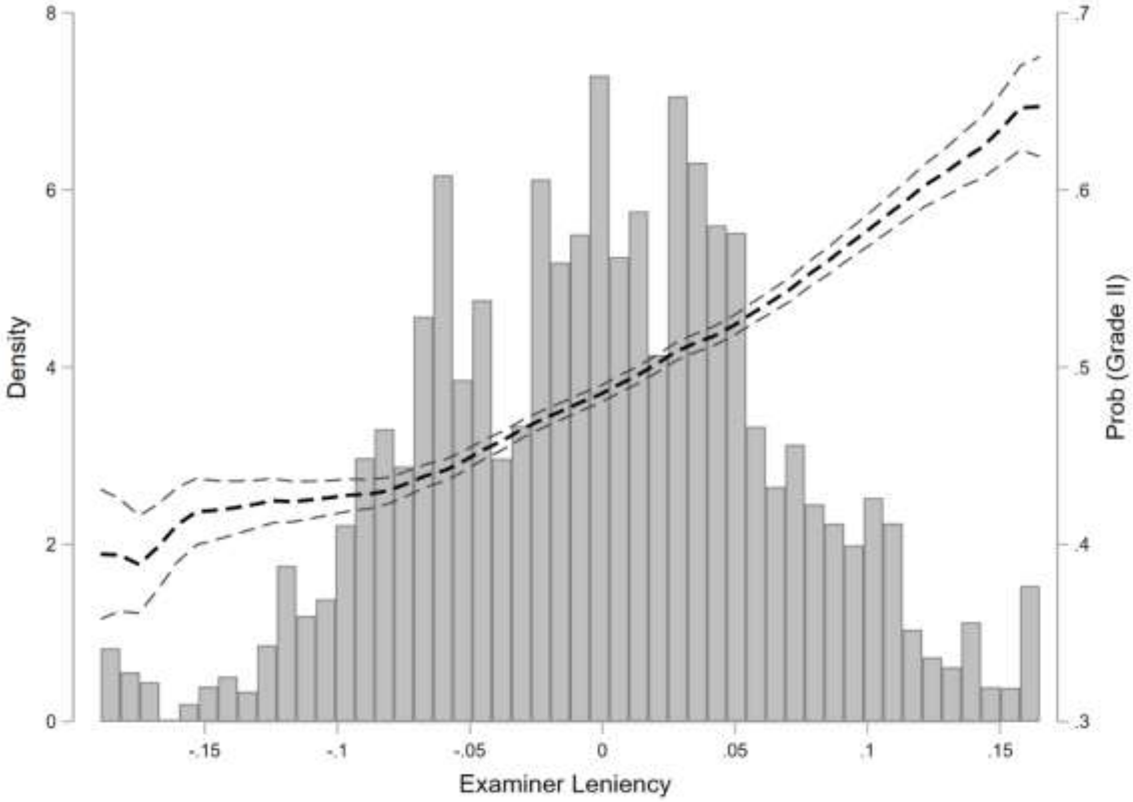
Years from LTC Grade entitlement	Includes individuals with LTC Grade entitlement within period:	Individuals forming the sample		Individuals actually observed (counting mortality)		
		n	% with respect to baseline	n	% with respect to baseline	Attrition due to mortality
-7	2014	8,972	14%	8,972	14%	
-6	2013-2014	18,628	28%	18,628	28%	
-5	2012-2014	26,865	41%	26,865	41%	
-4	2011-2014	42,584	65%	42,584	65%	
-3	2010-2014	56,087	85%	56,087	85%	
-2	2009-2014	65,811	100%	65,811	100%	
-1	2009-2014	65,811	100%	65,811	100%	
0	2009-2014	65,811	100%	62,333	95%	5%
1	2009-2014	65,811	100%	56,005	85%	15%
2	2009-2014	65,811	100%	49,847	76%	24%
3	2009-2014	65,811	100%	43,974	67%	33%
4	2009-2013	56,839	86%	33,769	51%	41%
5	2009-2012	47,183	72%	24,920	38%	47%
6	2009-2011	38,946	59%	18,079	27%	54%
7	2009-2010	23,227	35%	9,252	14%	60%
8	2009	9,724	15%	3,202	5%	67%

Figure B1 - Density graphs of claimants per BVD score (2009-2014)



NOTES: Sample formed by 108,391 claimants from the period 2009-2014 for whom we have information on hospital admissions. Up to mid-2012, each Grade was subdivided into two levels. Grade I level 1 (BVD = 25-39), Grade I level 2 (BVD = 40 – 49); Grade II level 1 (BVD = 50-64), Grade II level 2 (BVD = 65 – 74); Grade III level 1 (BVD = 25-39), Grade III level 2 (BVD = 40 – 49). However the differences in the value of LTC benefits between level 1 and level 2 of each Grade were much smaller than the differences between Grades. From mid-2012, the two levels within each Grade were combined, and the value of the LTC benefits they were entitled to was the same within each Grade (Hernández-Pizarro et al., 2020)

Figure B2- Distribution of examiner Leniency and First-stage



NOTES: This figure plots the probability of Grade II entitlement against our instrument of examiner leniency, constructed as a leave-out mean, for our main sample of interest formed by 65,811 individuals who were entitled to either Grade II or Grade. See IV construction section for details on how the Examiner Leniency instrument was constructed. The grey histogram bars represent the density of examiner leniency instrument (mean=0, standard deviation= 0.072). Top and bottom 1% of the examiner leniency distribution were excluded from the graph for illustrating purposes. The black solid line plots a local polynomial regression of Grade II entitlement on examiner leniency, with 95% Confidence Intervals (dashed lines).

Table B3 - Coefficients of the effect of being entitled to Grade II (vs Grade I) on the probability of hospitalization 24 months after LTC Grade entitlement, by diagnosis group. IV-2SLS model

Diagnosis group	(1) Any	(2) Programmed	(3) Emergency
Infectious (ICD-9 = 001-139)	-0.0005	0.0001	0.0001
	(0.007)	(0.002)	(0.007)
Neoplasms (ICD-9 = 140-239)	0.0108	0.0062	0.00935
	(0.013)	(0.014)	(0.005)
Endocrine and Nutritional(ICD-9 =240-279)	0.0110	0.0071	0.0044
	(0.009)	(0.004)	(0.009)
Blood (ICD-9 = 280-289)	0.00387	-0.0019	0.00767
	(0.007)	(0.003)	(0.008)
Mental (ICD-9 = 290-319)	0.00120	-0.0021	0.0031
	(0.007)	(0.002)	(0.007)
Nervous system (ICD-9= 320-389)	0.0412	0.0450*	0.0013
	(0.018)	(0.017)	(0.007)
Circulatory system (ICD-9 = 390-459)	0.0128	-0.0033	0.0064
	(0.022)	(0.012)	(0.021)
Respiratory system (ICD-9 = 460-519)	-0.0048	-0.0098	-0.0019
	(0.020)	(0.008)	(0.019)
Digestive System (ICD-9 = 520-579)	-0.0198	-0.0071	-0.0114
	(0.018)	(0.011)	(0.015)
Genitourinary System (ICD-9 = 580-629)	-0.0344*	-0.0112	-0.0279
	(0.014)	(0.009)	(0.012)
Skin diseases (ICD-9 = 680-709)	-0.0008	0.0016	-0.0027
	(0.006)	(0.003)	(0.006)
Musculoskeletal system (ICD-9 = 710-739)	0.0004	0.0039	-0.0026
	(0.013)	(0.012)	(0.007)
Symptoms, signs and ill-defined (ICD-9 = 780-799)	0.00455	0.0059	-0.0005
	(0.018)	(0.004)	(0.017)
Injuries and poisoning (ICD-9 = 800-999)	-0.0613**	0.0187*	-0.0677**
	(0.019)	(0.007)	(0.021)
Factor influencing health status (ICD-9 = V01-V89)	0.00201	0.0005	0.0028
	(0.006)	(0.006)	(0.002)
Observations	51,979	51,979	51,979

NOTES: Coefficients from IV-2SLS model with the full set of demographic and health controls, any hospitalization 12 months before Grade entitlement and territory and year fixed effects. Each column and line represents the coefficients of a different regression. Standard errors clustered at examiner level in parentheses. There are 114 examiner. p<0.1*** p<0.01, ** p<0.05, * p<0.1 P-values are adjusted for multiple test using the Benjamini and Hochberg (1995) method. Results are similar when using alternative time frames of 30 and 36 months after LTC entitlement (available upon request).

Table B4 - Hospitalizations by main diagnosis group for the hospitalizations sample

Main diagnosis group	Number of hospitalizations	%
Circulatory system (ICD-9 = 390-459)	54,647	21.16
Respiratory system (ICD-9 = 460-519)	45,395	17.57
Nervous system (ICD-9= 320-389)	34,003	13.16
Injuries and poisoning (ICD-9 = 800-999)	27,471	10.64
Digestive System (ICD-9 = 520-579)	22,882	8.86
Genitourinary System (ICD-9 = 580-629)	16,175	6.26
Neoplasms (ICD-9 = 140-239)	15,822	6.13
Musculoskeletal system (ICD-9 = 710-739)	11,640	4.51
Symptoms, signs and ill-defined (ICD-9 = 780-799)	9,686	3.75
Endocrine and Nutritional(ICD-9 =240-279)	5,245	2.03
Infectious (ICD-9 = 001-139)	3,585	1.39
Mental (ICD-9 = 290-319)	3,357	1.3
Factor influencing health status (ICD-9 = V01-V89)	3,122	1.21
Blood (ICD-9 = 280-289)	2,667	1.03
Skin diseases (ICD-9 = 680-709)	2,401	0.93
Others	202	0.08
TOTAL	258,300	100

NOTES: Number of hospitalizations during the period 2007-2017 for our main hospitalization sample (i.e. claimants entitled to Grade II or Grade I between 2009-2014, n= 65,811 at baseline)

Table B5 - Coefficients of the effect of being entitled to Grade II (vs Grade I) on the number of visits 24 months after LTC Grade entitlement by main diagnoses group. 2SRI model

Diagnosis group	(1) Any	(2) Scheduled	(3) Non-scheduled
Infectious (ICD-9 = 001-139)	0.0198	0.100	-0.0861
	(0.178)	(0.112)	(0.112)
Neoplasms (ICD-9 = 140-239)	2.117	1.126	0.866
	(1.092)	(0.551)	(0.619)
Endocrine and Nutritional(ICD-9 =240-279)	-0.217	-0.255	0.0793
	(1.426)	(0.816)	(0.732)
Blood (ICD-9 = 280-289)	-0.230	-0.0839	-0.181
	(0.570)	(0.427)	(0.197)
Mental (ICD-9 = 290-319)	0.114	0.292	-0.278
	(0.663)	(0.457)	(0.315)
Nervous system (ICD-9= 320-389)	0.246	0.395	-0.215
	(0.560)	(0.346)	(0.320)
Circulatory system (ICD-9 = 390-459)	-1.104	1.293	-2.766
	(2.441)	(1.365)	(1.326)
Respiratory system (ICD-9 = 460-519)	0.550	0.463	0.303
	(1.223)	(0.549)	(0.751)
Digestive System (ICD-9 = 520-579)	-0.589	-0.325	-0.233
	(0.524)	(0.409)	(0.203)
Genitourinary System (ICD-9 = 580-629)	-0.409	0.234	-0.614
	(1.225)	(0.543)	(0.822)
Skin diseases (ICD-9 = 680-709)	-1.250	-0.870	-0.367
	(0.709)	(0.514)	(0.269)
Musculoskeletal system (ICD-9 = 710-739)	0.960	0.769	0.234
	(0.581)	(0.379)	(0.293)
Symptoms, signs and ill-defined (ICD-9 = 780-799)	-0.224	0.125	-0.407
	(0.547)	(0.327)	(0.322)
Injuries and poisoning (ICD-9 = 800-999)	0.815	0.968	-0.353
	(0.946)	(0.706)	(0.319)
Factor influencing health status (ICD-9 = V01-V89)	-6.384	-2.587	-3.932**
	(2.529)	(1.571)	(1.241)
Observations	14,110	14,110	14,110

NOTES: Coefficients from 2SRI model with the full set of demographic and health controls, and territory and year fixed effects. 2SRI coefficients are calculated as marginal effects. Each column and line represents the coefficients of a different regression. Standard errors clustered at examiner level in parentheses, estimated using bootstrapping (100 replications). There are 75 examiners. p<0.1*** p<0.01, ** p<0.05, * p<0.1 P-values are adjusted for multiple test using the Benjamini and Hochberg (1995) method. Results are similar when using alternative time frames of 30 and 36 months after LTC entitlement (available upon request).

Table B6- PC visits by main diagnosis group for the Primary Care subsample

	Number of PC visits	%
Factor influencing health status (ICD-9 = V01-V89)	316,900	22.04
Circulatory system (ICD-9 = 390-459)	300,175	20.88
Endocrine and Nutritional (ICD-9 =240-279)	134,984	9.39
Genitourinary System (ICD-9 = 580-629)	86,946	6.05
Respiratory system (ICD-9 = 460-519)	78,787	5.48
Symptoms, signs and ill-defined (ICD-9 = 780-799)	69,786	4.85
Neoplasms (ICD-9 = 140-239)	64,767	4.5
Mental (ICD-9 = 290-319)	61,373	4.27
Nervous system (ICD-9= 320-389)	58,380	4.06
Injuries and poisoning (ICD-9 =800-999)	56,955	3.96
Musculoskeletal system (ICD-9 = 710-739)	56,073	3.9
Others	48,357	3.36
Skin diseases (ICD-9 = 680-709)	37,499	2.61
Digestive System (ICD-9 = 520-579)	29,682	2.06
Blood (ICD-9 = 280-289)	27,447	1.91
Infectious (ICD-9 = 001-139)	9,631	0.67
TOTAL	1,437,742	20

NOTES: Number of hospitalizations during the period 2013-2017 for our Primary Care subsample (i.e. claimants entitled to Grade II or Grade I in 2013 or 2014, n= 18,624 at baseline).

Table B7 - First stage regressions for Primary Care sample. Coefficients of examiner leniency on the Probability of being entitled to Grade II

	Time after LTC entitlement			
	Baseline	12 months	24 months	36 months
	(1)	(2)	(3)	(4)
Panel A: No controls				
Examiner Leniency	0.5838***	0.6262***	0.6532***	0.6536***
	(0.1127)	(0.1111)	(0.1141)	(0.1144)
F-test (on IV)	26.82	31.75	32.77	32.63
Panel B: Adds Territory FE + Time FE + (Territory FE x Time FE)				
Examiner Leniency	0.5926***	0.6330***	0.6596***	0.6619***
	(0.0577)	(0.0554)	(0.0611)	(0.0624)
F-test (on IV)	105.25	130.33	116.22	111.89
Panel C: Adds Demographic and Health Controls				
Examiner Leniency	0.6092***	0.6475***	0.6749***	0.6768***
	(0.0589)	(0.0572)	(0.0619)	(0.0632)
F-test (on IV)	106.7	127.91	118.45	114.14
Y mean (Grade II)	0.423	0.4032	0.3878	0.3755
Observations	18606	16161	14104	12181

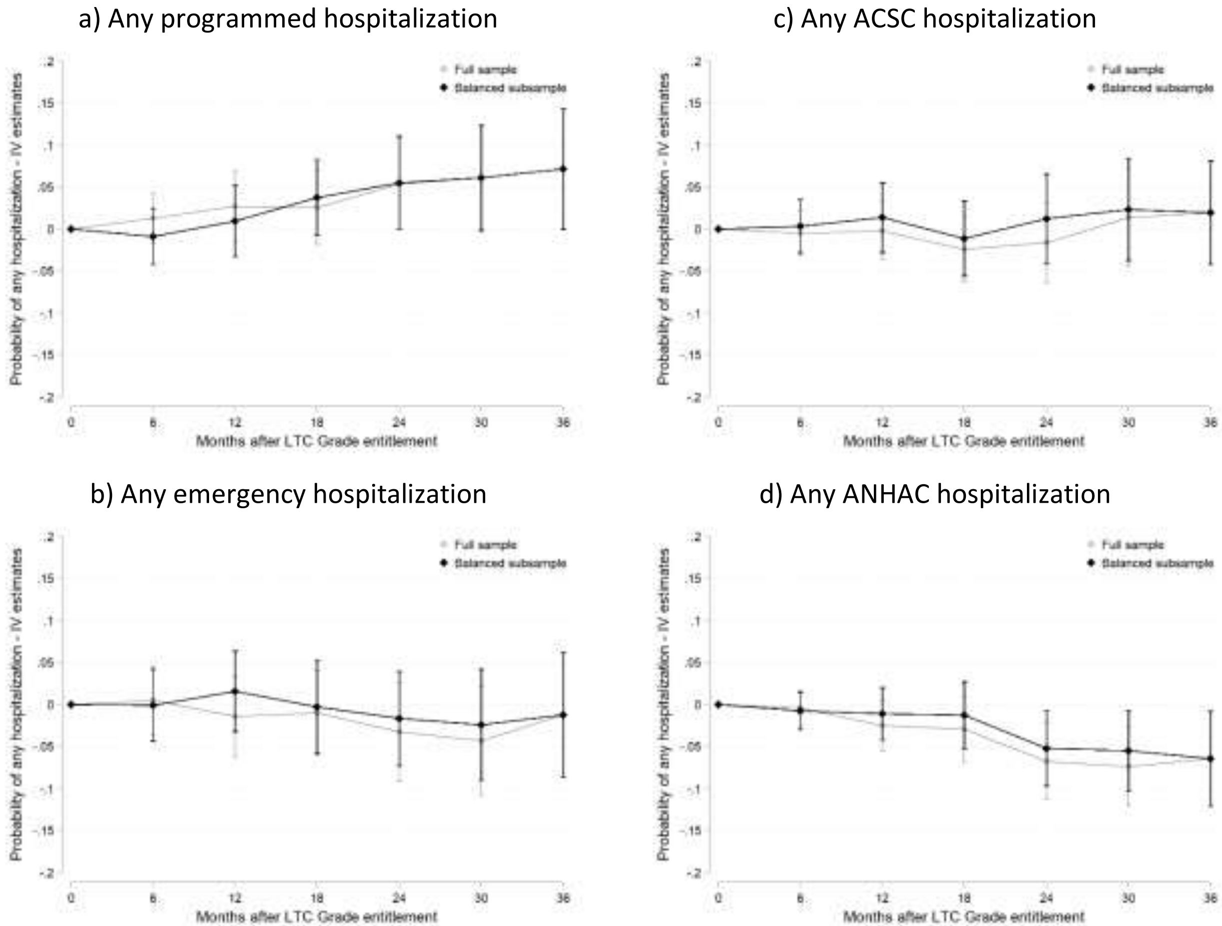
NOTES: All estimates come from OLS regressions. Column (1) corresponds to the sample of individuals in the Primary Care sample observed at the time of Grade entitlement (i.e. baseline). Column (2) (3) and (4) correspond to the sample of individuals in the Primary care sample who are observed up to 12, 24 and 36 months after LTC Grade entitlement, respectively. Robust standard errors clustered at examiner level in parenthesis. There are 75 examiners. *** p<0.01, ** p<0.05, * p<0.1

Table B8 - Effect of LTC benefits of mortality and determinants of mortality (i.e: attrition). IV-2SLS model

Dependent variable: Death within 36 months VARIABLES	(1) Hospitalization sample[a]	(2) Primary Care subsample[b]
Grade II (vs Grade I)	-0.137***	-0.110*
	(0.031)	(0.064)
Female	-0.164***	-0.183***
	(0.004)	(0.008)
Age	0.00801***	0.0101***
	(0.000)	(0.000)
Widow	-0.00110	0.00615
	(0.005)	(0.007)
Single	0.0250***	-0.00329
	(0.007)	(0.013)
Labour disabilities	-0.243***	-0.178***
	(0.005)	(0.007)
Number of health conditions (ICD-9)	0.00199	-0.00369
	(0.002)	(0.004)
Any hospitalization 12 months before Grade entitlement	0.0971***	0.0927***
	(0.004)	(0.008)
Observations	64,550	18,451
R-squared	0.087	0.078
Region FE	Yes	Yes
Year FE	Yes	Yes
Region x Year FE	Yes	Yes

NOTES: Results of the IV-2SLS model with the dependent variable being the probability of death within 36 months after LTC Grade entitlement. Standard errors clustered at examiner level in parenthesis. There are 114 examiners in the Hospitalization sample and 75 examiners in the Primary Care sample. *** p<0.01, ** p<0.05, * p<0.1. [a]Column 1 reports results using the hospitalizations sample (i.e.: claimants entitled to LTC Grade II or I during 2009-2014). [b]Column 2 reports results using the PC subsample (i.e.: claimants entitled to LTC Grade II or I during 2013-2014).

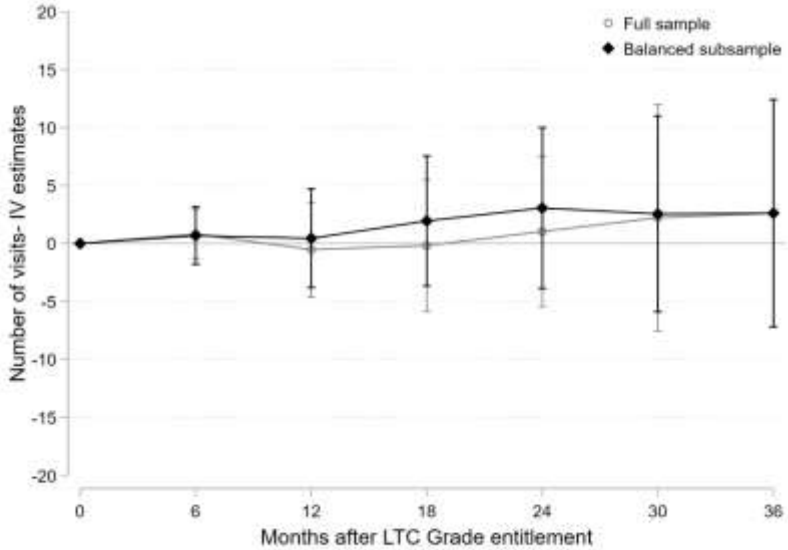
Figure B3 - Selective mortality robustness check 1 (I): Balanced subsample vs Full sample. IV-2SLS estimates for probability of hospitalization



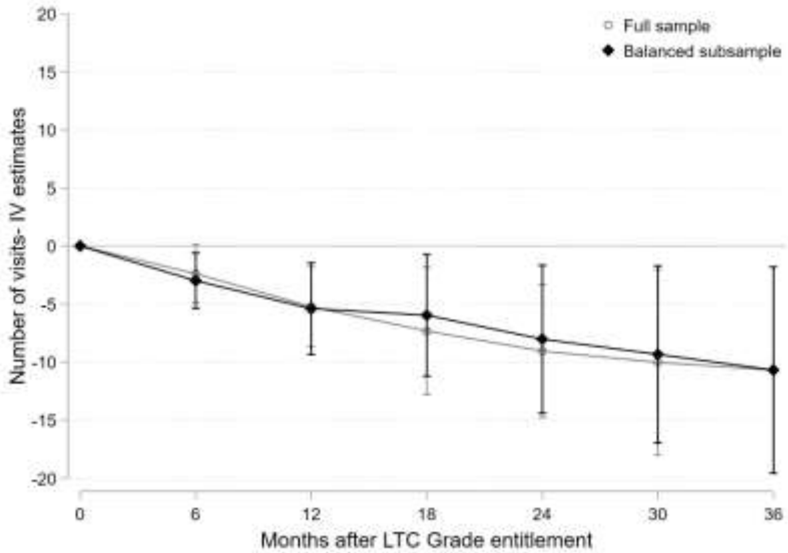
NOTES: IV-2SLS Coefficients (and 95% Confidence Intervals) of being entitled to Grade II on the (cumulative) probability of any hospitalization after 6, 12, 18, 24, 30 and 36 months. Results from the model with the full set of demographic and health controls, any hospitalization 12 months before Grade entitlement and territory and year fixed effects. Standard errors clustered at examiner level. There are 114 examiners. “Full sample” is formed of the claimants who survive up to each 6-month time period, as in Figure 3 (6 months, n= 61,239; 12 months, n= 58,054; 18 months, n= 55,030; 24 months, n=51,937; 30 months, n= 48,902; 36 months, n= 45,959). “Balanced subsample” is constantly formed of the same claimants who survive up to 36 months after LTC entitlement (n= 45,959).

Figure B4 - Selective mortality robustness check 1 (II): Balanced subsample vs Full sample. 2SRI estimates for number of PC visits

a) Scheduled PC visits



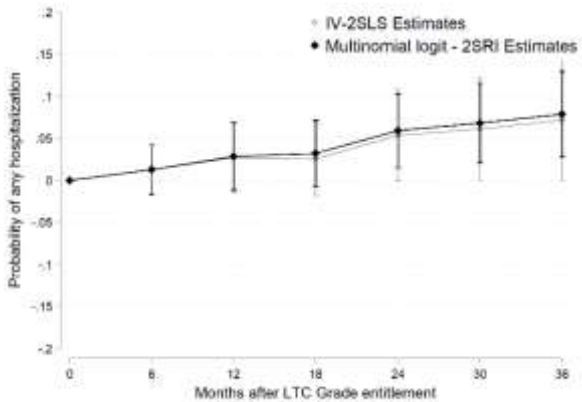
b) Non-scheduled PC visits



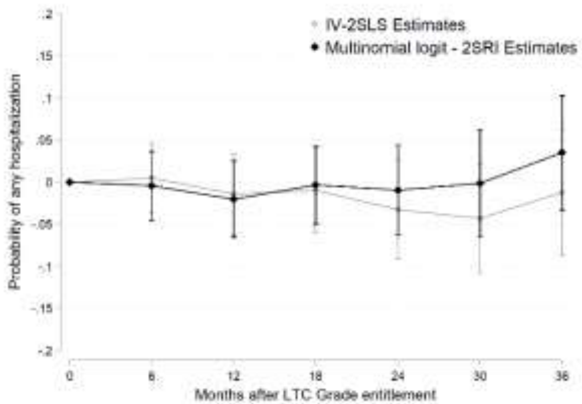
NOTES: 2SRI coefficients (and 95% Confidence Intervals) of being entitled to Grade II on the number of PC visits after 6, 12, 18, 24, 30 and 36 months. 2SRI coefficients are calculated as marginal effects. Results from the model with the full set of demographic and health controls, and territory and year fixed effects. Standard errors clustered at examiner level, estimated using bootstrapping (100 replications). There are 75 examiners. "Full sample" is formed of the claimants who survive up to each 6-month time period as in Figure 4 (6 months, n= 17,231; 12 months, n= 16,161; 18 months, n= 15,104; 24 months, n= 14,104; 30 months, n= 13,120; 36 months, n= 12,281). "Balanced subsample" is constantly formed of the same claimants who survive up to 36 months after LTC entitlement (n= 12,200).

Figure B5 - Selective mortality robustness check 2: 2SRI – Multinomial logit model

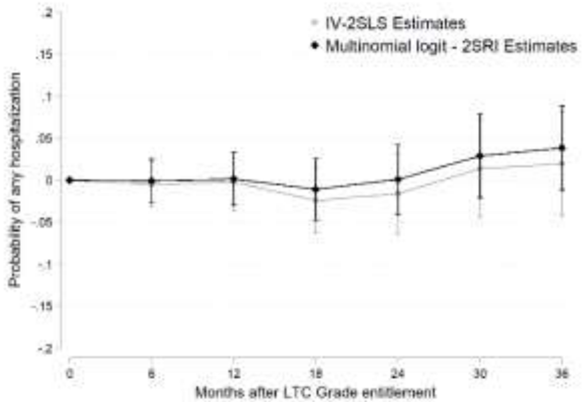
a) Any programmed hospitalization



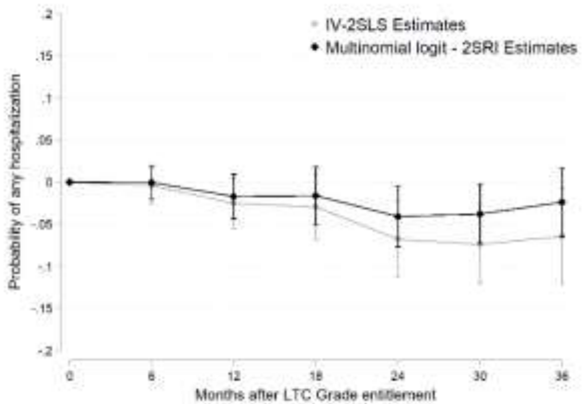
b) Any emergency hospitalization



c) Any ACSC hospitalization



d) Any ANHAC hospitalization



NOTES**:** **"**IV-2SLS Estimates" reports results of the main model as in Figure 3: coefficients (and 95% Confidence Intervals) of being entitled to Grade II on the (cumulative) probability of any hospitalization after 6, 12, 18, 24, 30 and 36 months. Number of observations for **"**IV-2SLS Estimates" at each 6-month period: 6 (n= 61,239), 12 (n= 58,054), 18 (n= 55,030), 24 (n= 51,937), 30 (n= 48,902), 36 (n= 45,959). "Multinomial logit – 2SRI" reports the marginal effects on the probability of any hospitalization for the 2SRI model with the second stage being a multinomial logit with 3 outcome categories: i) at least one hospitalization, ii) death and iii) nor hospitalization nor death. Number of observations for "Multinomial logit – 2SRI Estimates" is constant over time (n = 64,550). Standard errors clustered at examiner level. There are 114 examiners.

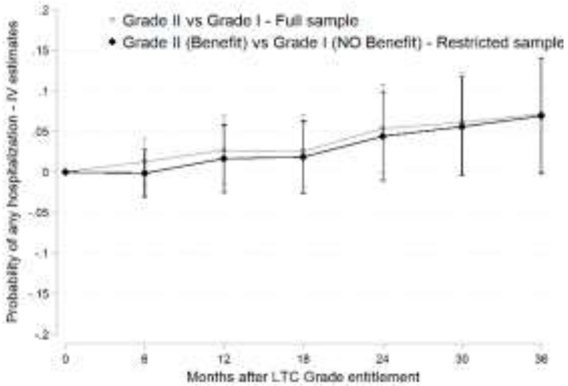
Table B9 - "Acknowledgement effect" robustness check. Effect of being entitled to Grade I (vs non-entitled to LTC benefits) on the probability of hospitalization and number of PC visits 24 months after LTC Grade entitlement

	Probability of any hospitalization (IV-2SLS)					Number of Primary Care visits (2SRI)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Any	Programmed	Emergency	ACSC	ANHAC	All	Scheduled	Non-scheduled
Panel A: Second stage								
Grade I vs non-entitled to LTC benefits	-0.0285	0.0208	-0.0236	-0.0144	-0.00836	0.487	-1.899	2.193
	(0.026)	(0.019)	(0.026)	(0.020)	(0.014)	(5.682)	(3.838)	(2.775)
Panel B: First stage								
Examiner Leniency			0.8404***				0.6187***	
			(0.0342)				(0.0838)	
F-test (on IV)			605.22				54.54	
Y mean (Grade I)			0.605				0.566	
Observations	45,853	45,853	45,853	45,853	45,853	15,256	15,256	15,256
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Any hospitalization in prior 12 months	Yes	Yes	Yes	Yes	Yes	No	No	No
Region x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

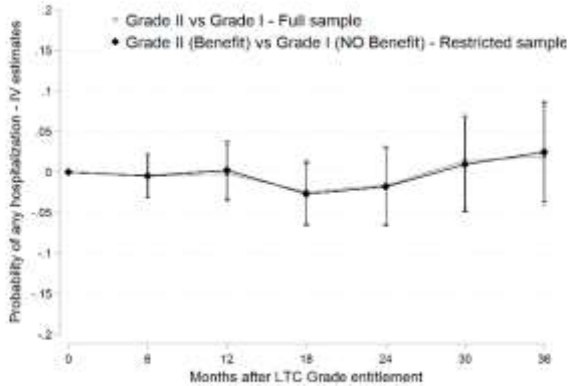
NOTE: Panel B reports the coefficient of the effect of being entitled a LTC benefit of Grade I (BVD = 25-49) vs not being entitled to any LTC benefits (BVD = 0-24). Each column reports results from a different regression. Panel A reports the result of the first-stage of the effect of examiner leniency (instrumental variable) on the probability of being entitled to a benefit of Grade I. Columns (1) to (5) report results from the instrumental variable two-stage least square (IV-2SLS) model, being the dependent variable the probability of any hospitalization by the category of the corresponding column. Sample used in columns (1) to (5) include individuals entitled to LTC benefit Grade I or non-entitled to LTC benefits in the period 2009-2014. Columns (6) to (8) report results from the Two-stage Residual Inclusion (2SRI), being the dependent variable the number of Primary Care visits by the category of the corresponding column. 2SRI coefficients are calculated as marginal effects. Sample used in columns (6) to (8) include individuals entitled to LTC benefit Grade I or non-entitled to LTC benefits in the period 2013-2014. Standard errors clustered at examiner level in parenthesis. There are 114 examiners in the Hospitalization sample (Columns 1 to 5) and 75 examiners in the Primary Care sample (Columns 6 to 8). 2SRI standard errors (Columns 6 to 8) were estimated using bootstrapping (100 replications). *** p<0.01, ** p<0.05, * p<0.1

Figure B6 - Restricted sample robustness check (I): Entitled to Grade II (received benefit) vs entitled to Grade I (did not receive any benefit). IV-2SLS coefficients on the probability of hospitalization

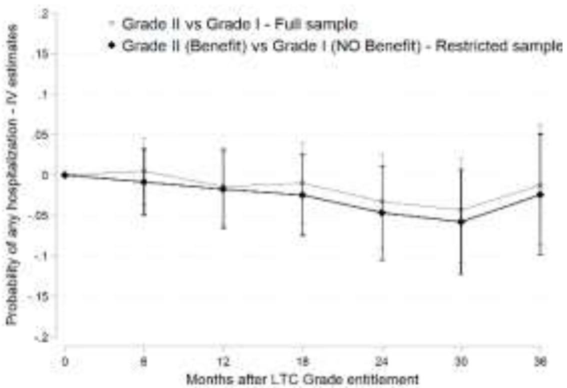
a) Any programmed hospitalization



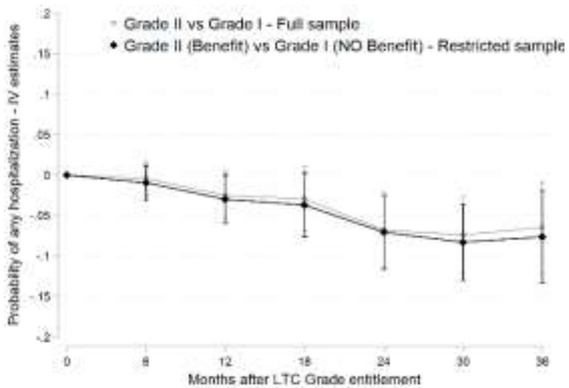
c) Any ACSC hospitalization



b) Any emergency hospitalization



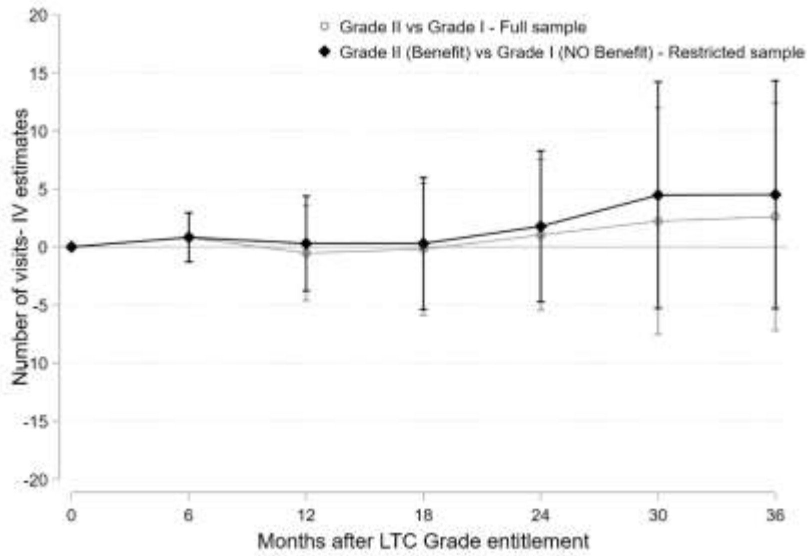
d) Any ANHAC hospitalization



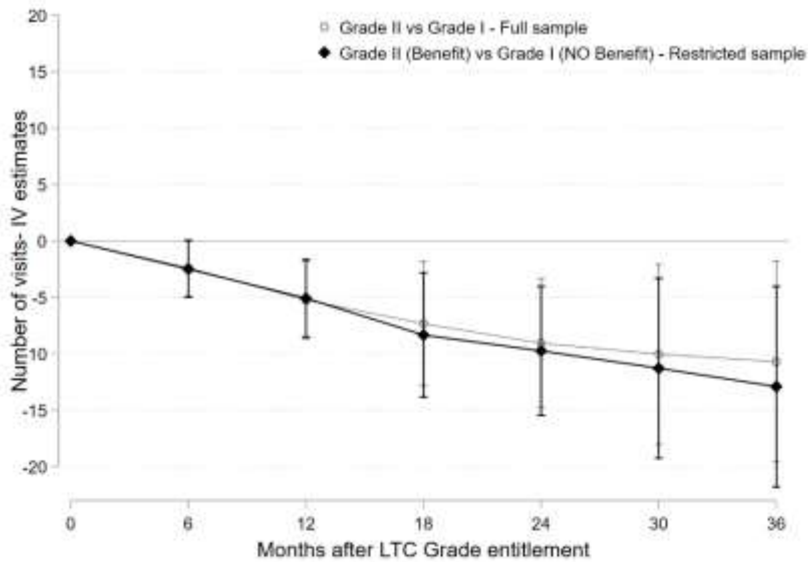
NOTES: IV-2SLS Coefficients (and 95% Confidence Intervals) of being entitled to Grade II on the (cumulative) probability of any hospitalization after 6, 12, 18, 24, 30 and 36 months. Results from the model with the full set of demographic and health controls, any hospitalization 12 months before Grade entitlement and territory and year fixed effects. Standard errors clustered at examiner level (114 examiners). “Full sample” is formed of the main hospital sample (i.e. those entitled to Grade II vs those entitled to Grade I). Number of obs. at each 6-month period: 6 (n= 61,239), 12 (n= 58,054), 18 (n= 55,030), 24 (n= 51,937), 30 (n= 48,902), 36 (n= 45,959). “Restricted sample” is formed of claimants entitled to Grade II who received any benefit and those of Grade I who *did not* receive any benefit. Number of observations at each 6-month period: 6 (n= 54,961), 12 (n= 52,182), 18 (n= 49,448), 24 (n= 46,605), 30 (n= 43,813), 36 (n= 41,107)

Figure B7 - Restricted sample robustness check (II): Entitled to Grade II (received benefit) vs entitled to Grade I (did not receive any benefit). 2SRI coefficients on the number of PC visits

a) Scheduled PC visits

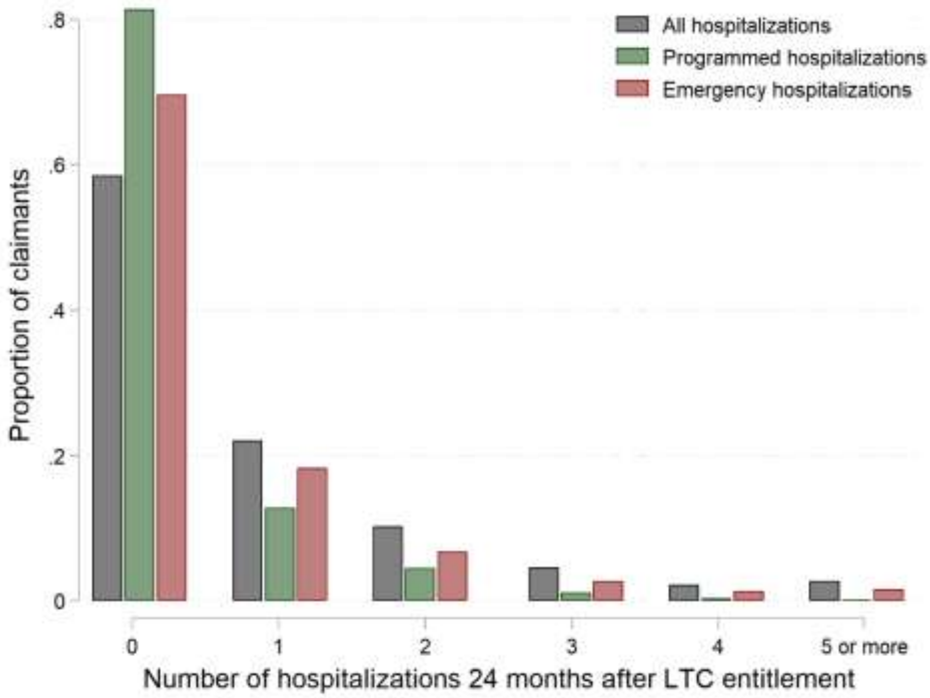


b) Non-scheduled PC visits



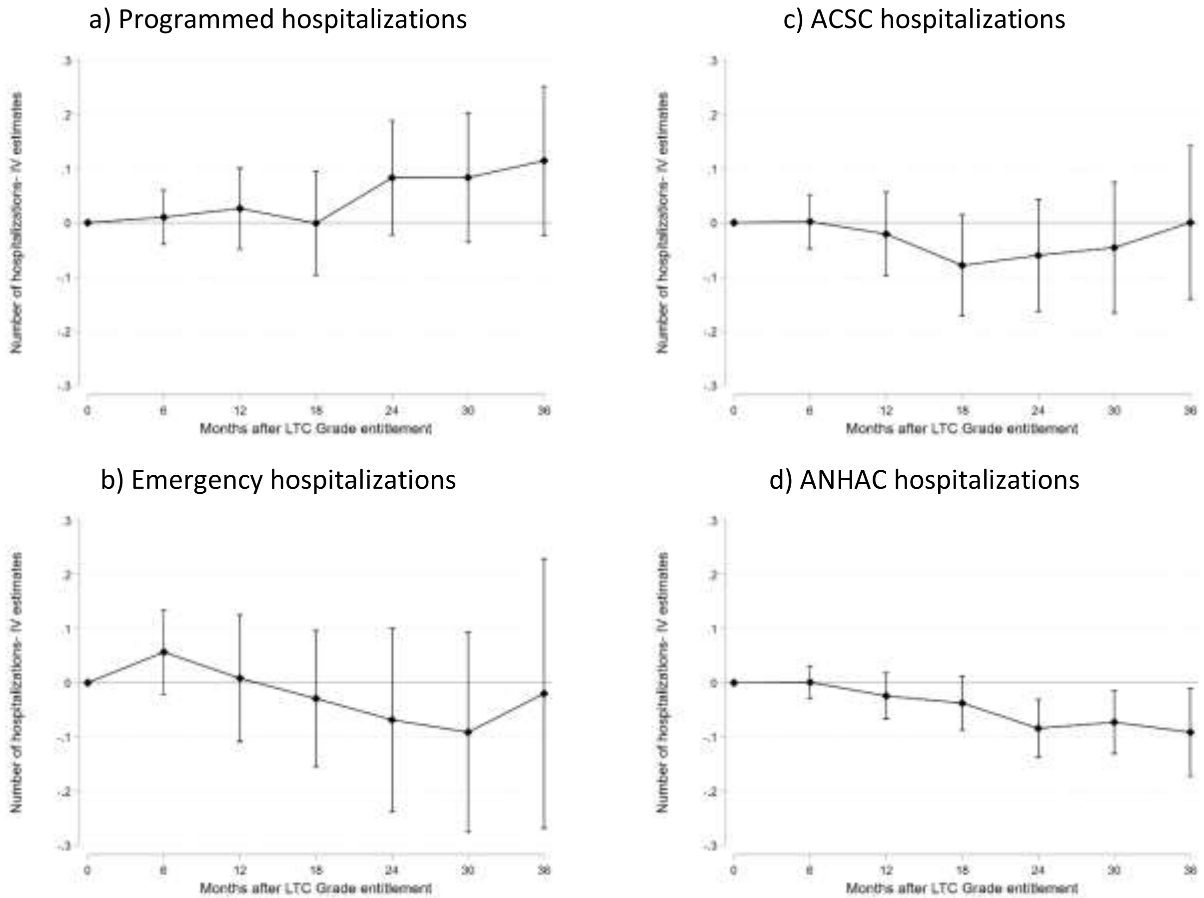
NOTES: 2SRI coefficients (and 95% Confidence Intervals) of being entitled to Grade II on the number of PC visits after 6, 12, 18, 24, 30 and 36 months. 2SRI coefficients are calculated as marginal effects. Results from the model with the full set of demographic and health controls, and territory and year fixed effects. Standard errors clustered at examiner level, estimated using bootstrapping (100 replications). There are 75 examiners. "Full sample" is formed of the main PC sample (i.e.: those entitled to Grade II vs those entitled to Grade I). Number of observations at each 6-month period: 6 (n= 17,231), 12 (n= 16,161), 18 (n= 15,104), 24 (n= 14,104), 30 (n= 13,120), 36 (n= 12,281). "Restricted sample" is formed of claimants entitled to Grade II who received any benefit and those of Grade I who did not receive any benefit. Number of observations at each 6-month period: 6 (n= 15,479), 12 (n= 14,599), 18 (n= 13,693), 24 (n= 12,813), 30 (n= 11,930), 36 (n= 11,077).

Figure B8 - Distribution of claimants (entitled to Grade II or Grade I) per number of hospitalizations 24 months after LTC entitlement



NOTES: n = 51,937 (Grade II: 24,180; Grade I: 27,757)

Figure B9 - Extensive margin of hospital demand robustness check (I): 2SRI coefficients on the number of hospitalizations



NOTES: 2SRI coefficients (and 95% Confidence Intervals) of being entitled to Grade II (vs Grade I) on the number of hospitalizations after 6, 12, 18, 24, 30 and 36 months. Number of observations at each 6-month period: 6 (n= 61,239), 12 (n= 58,054), 18 (n= 55,030), 24 (n= 51,937), 30 (n= 48,902), 36 (n= 45,959). 2SRI coefficients are calculated as marginal effects. Results from the model with the full set of demographic and health controls, any hospitalization 12 months before Grade entitlement and territory and year fixed effects. Standard errors clustered at examiner level, estimated using bootstrapping (100 replications). There are 114 examiners.

Table B10 - Estimated healthcare cost saving due to Grade II LTC benefits

	Unit cost[a]	Effect 24 months after LTC entitlement	Cost savings in 24 months [b]	Cost savings per month	Cost savings per 100 € in LTC benefits[c]
Hospitalizations					
(Injuries and Poisoning, ICD-9 = 800 - 999)	5,964 €	- 0.061 percentage points	425.65 €	17.74 €	4.30 €
Primary care					
(Non-scheduled visits)	50 €	- 9.057 visits	452.85 €	18.87 €	4.58 €
Total			878.50 €	36.60 €	8.88 €

NOTES: [a]Hospitalization unit cost comes from the average cost of hospitalizations for those aged 50 or more with a main diagnoses of Injuries and Poisoning (ICD-9 = 800 – 999) from the hospitals that form the Spanish Network of Hospital Costs, for the year 2017 (Source: *Red Española de Costes Hospitalarios* https://www.rechosp.org/rech/faces/es/jsf/index.jsp). The non-scheduled Primary care visit unit cost is derived from the public price of a non-emergency doctor visit in Primary care of the Catalan Health Service (Source: https://salutweb.gencat.cat/web/.content/_departament/decicions-i-actuacions-rellevancia-juridica/normativa-en-curs-d-elaboracio/preuspublics/Doc0.pdf). [b]The cost savings in 24 months multiplies the unit cost by the effect 24 months after LTC entitlement. For the case of hospitalizations due to Injuries and Poisoning, since the effect is measured by a reduction in the probability of hospitalization, we take into account that the average number of hospitalizations of this category among those who had at least one was 1.17. Then, the cost savings is calculated as follows: €5,965 x (-0.061 percentage points in probability of hospitalization) x 1.17 average hospitalizations = €425.65. [c]In order to calculate the cost saving per € spent in LTC benefits we divided the healthcare cost savings per month by the estimated monthly monetary value of Grade II LTC benefits (€412) and multiplied by 100.