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Abstract – Population ageing is raising the demand for long-term care (LTC), leading many countries to develop publicly funded LTC systems. However, little is known about whether the benefits these systems provide help preserve the functional autonomy of the people who receive them. We use the administrative registry of the Catalan LTC system, covering 320,618 individuals aged 60 or over who entered between 2015 and 2024, and follow them for two, three, five and seven years. Because applicants are assessed and reassessed with the same standardised instrument (the BVD), we observe repeated, comparable measures of functional capacity, down to the level of individual daily-living tasks. We proceed in three steps. First, we estimate how the intensity of exposure to each benefit (informal home care, formal home care, day centre care and institutional care) is associated with death, grade deterioration and within-grade deterioration. Second, we compute life-years and deterioration-free years gained using regression-standardised survival curves. Third, we analyse the size and composition of functional decline among survivors. Greater benefit intensity is associated with lower mortality: full exposure to each benefit is associated with between 0.36 (institutional care) and 1.40 (informal home care) additional life-years over seven years, relative to no benefit. Among survivors, higher intensity is also associated with a greater probability of recorded deterioration, most markedly in institutional care. This pattern is consistent with survival-deterioration selection and with benefits responding to need, rather than with care causing decline. Losses in indoor mobility, changing body position and continence/toileting are most strongly associated with institutional care. Estimates are associations, not causal effects. The results show the value of routine functional assessment data for evaluating LTC policy in ageing societies.

JEL Classification: J14, H51, I18

Keywords: Long-Term Care, Residential Care, Home-Based Care, Functional Decline, Population ageing

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Executive summary

As populations age, a growing number of older people need help with everyday tasks such as washing, dressing or moving around the home. Many countries are building public long-term care (LTC) systems in response. Yet we still know little about what happens to people's health and autonomy once they start receiving support.

Spain's system offers a unique opportunity to find out. Everyone who applies for public LTC support is assessed with the same official scale (the BVD), which scores the loss of autonomy across ten areas of daily life, and can request a new assessment when their needs change. This gives a consistent record of how each person's functional limitations evolve over time. We used the full Catalan LTC registry, covering 320,618 people aged 60 or over who entered the system between 2015 and 2024, and followed them for up to seven years. The typical applicant is 83 years old, most are women, and most enter with moderate needs. We compared five situations: no benefit, informal home care (a cash allowance for family caregivers or telecare), formal home care, day centres and residential care.

Receiving support is associated with longer survival. Seven years after entry, about 15% of people would still be alive without any benefit, compared with close to 40% under home-based support. Receiving a benefit throughout the period is associated with between 0.4 additional years of life (residential care) and 1.4 additional years (informal home care), compared with receiving no benefit. But living longer also means more time in which autonomy can be lost. Among survivors, those receiving more support are more likely to have a recorded decline, and this is most pronounced in residential care. People supported at home remain between roughly 1.7 and 3.5 years longer without moving to a higher level of need than people in residential care. When decline happens, it is substantial and early: those whose autonomy worsens lose on average about a quarter of the BVD scale, mostly within the first two years. Difficulties moving around the home, changing body position and controlling continence are the losses most strongly associated with residential care. These are precisely the abilities whose loss makes it hard to keep living at home.

These findings carry several insights for policy. LTC benefits can extend the lives of people with care needs while supporting them through the progressive loss of autonomy. As populations age, this highlights the importance of strengthening LTC systems to meet the growing demand for care that comes with longer lives lived with care needs. Losses in mobility, changing body position and continence often trigger the move towards more intensive care, so these areas deserve particular attention in policies that aim to help people remain at home. Routinely collected assessment data are a valuable tool for understanding how care needs evolve and for designing and evaluating LTC policies. Future evaluations should also weigh survival gains against costs and look beyond autonomy, to care-related quality of life and well-being. These lessons are directly relevant to countries in Latin America and the Caribbean that are currently designing their own LTC systems.

1. Introduction

Population ageing is accelerating worldwide, increasing the number of older people living with chronic conditions and functional limitations (OECD, 2025; Aranco et al., 2022). As longevity rises, a growing share of the population experiences limitations in basic and instrumental activities of daily living (ADLs),¹ which are key determinants of long-term care (LTC) needs. Consequently, the organisation and financing of LTC systems have become increasingly important policy challenges (Blavet et al., 2026).

In response, many countries have expanded or introduced publicly funded LTC systems. Although these systems differ in their eligibility criteria, financing arrangements, and balance between home- and institution-based care, they share the common objective of providing support to people with LTC needs while promoting autonomy and offsetting the burden of caregiving (Gruber and McGarry, 2025). Public expenditure on LTC has increased steadily over the last two decades, reflecting both population ageing and growing recognition that family care alone is unlikely to meet future demand (Costa-Font and Raut, 2022).

The literature on LTC has expanded substantially over the last decade. Existing evidence has documented the effects of LTC systems on service utilisation and expenditure (Costa-Font and Raut, 2022; Costa-Font and Vilaplana-Prieto, 2023; Eggink et al., 2017; Gruber and McGarry, 2025; Kim and Lim, 2015), labour market and economic outcomes (Costa-Font and Vilaplana-Prieto, 2022a; Del Pozo-Rubio et al., 2022; Leigh, 2010; Stampini et al., 2022), and the health and healthcare utilisation of both individuals with care needs (Bakx et al., 2020; Costa-Font et al., 2018; Serrano-Alarcón et al., 2022; Sáenz et al., 2025) and informal caregivers (Bom et al., 2018; Costa-Font and Vilaplana-Prieto, 2022b; Do et al., 2015; Kim and Lim, 2015; Fabiani et al., 2024; Stampini et al., 2025). However, much less is known about whether LTC systems achieve their primary objective: preserving individuals' functional autonomy and well-being. Two factors explain this gap: the lack of specific instruments to measure care-related quality of life and well-being, and the difficulty of implementing them systematically. The first has been addressed through dedicated scales, with the ASCOT toolkit among the most widely used, particularly in small-scale interventions (Malley et al., 2012; Trukeschitz et al., 2020). However, their integration into routine assessment within public LTC systems remains limited (Malley et al., 2012; Rodríguez-Míguez and Casal, 2024). In the meantime, the functional assessments that many LTC systems already carry out to determine eligibility offer an alternative way to track how recipients' autonomy evolves.

Spain provides a particularly valuable setting to study these questions for several reasons. The Spanish population is experiencing rapid ageing, with around 30% of its population projected to be aged 65 or over by 2050 (INE, 2022). Although life expectancy is among the highest in the world, this does not necessarily translate into healthy ageing: only 44% of people aged 65 or over report being in good health, while 37% experience functional limitations and 12% report severe limitations (OECD, 2023). As a result, the demand for LTC has increased steadily over recent decades and is expected to continue growing. In response, Spain

¹ ADLs are fundamental self-care tasks that serve as key indicators of an individual's functional status and independence. ADLs are divided into basic activities, such as personal hygiene, dressing, toileting, mobility, and eating, and instrumental activities, which involve more complex tasks required for independent living (Edemekong et al., 2025).

introduced a universal, needs-based public LTC system through the 2006 Dependency Act, which became operational in 2007 and reached full implementation by 2015 (Hernández-Pizarro and Prades-Colomé, 2026).

A feature of the Spanish LTC system is that eligibility for publicly funded benefits is determined through a mandatory and standardised assessment of limitations in functional autonomy. Every applicant for LTC benefits is assessed using the *Baremo de Valoración de la Dependencia* (BVD), an instrument that measures functional autonomy across ten domains covering basic and instrumental ADLs (more details on section 2). Individuals requesting a revision of their entitlement undergo a new assessment using the same protocol, generating repeated, comparable measures of functional capacity over time. This makes it possible to examine not only whether individuals deteriorate in terms of functional autonomy, but also the magnitude of deterioration and the specific ADLs that decline.

This paper exploits an administrative setting that allows us to observe all the individuals with LTC needs who have applied for public benefits in Catalonia. Catalonia is the north-eastern region of Spain, and accounts for 16.5% of the country's total population and 16.1% of its population with LTC needs (IMSERSO, 2026). We use the complete Catalan public LTC system registry for 2015-2024, covering 320,618 individuals aged 60 or over at entry, and follow them at horizons of two, three, five and seven years after entry. Our analysis proceeds in three stages. We first classify each individual's trajectory into a hierarchy of mutually exclusive outcomes (death, functional deterioration, and stability) and estimate how the intensity of exposure to each benefit is associated with each outcome. We then estimate standardised survival curves to quantify the life-years, and years free of deterioration, gained over seven years under each benefit. Finally, we focus on the subsample who suffer a functional loss (or deterioration) and analyse how large these losses of autonomy are and which specific ADLs they affect.

Four main findings emerge. First, greater benefit intensity is associated with substantially lower mortality across all LTC benefits. These mortality reductions translate into meaningful gains in survival, with all benefits increasing expected life-years relative to receiving no benefit and the largest gains observed for community-based benefits. Second, among survivors, higher benefit intensity is also associated with a greater probability of recorded functional deterioration, consistent with a survival-deterioration selection in which longer survival is accompanied by increasing functional needs. This pattern is particularly pronounced for individuals in institutional care, where survivors experience the highest probability and magnitude of functional decline. Third, survival curves reinforce this reading: relative to institutional care, home-based benefits are associated with more time free of deterioration, especially for changes in the grade of LTC needs, whereas differences in within-grade deterioration are small. Finally, functional deterioration is not evenly distributed across domains of autonomy. The largest declines occur in personal hygiene, dressing and indoor mobility, while losses in indoor mobility, changing body position and continence/toileting are those most strongly associated with institutional care.

This paper contributes to the literature in several ways. First, it is among the first studies, following Martínez-Lacoba et al., 2025, to examine the functional trajectories of individuals after entering the Spanish LTC system, exploiting the differential effects of different benefit types using longitudinal administrative data. Second, to our knowledge, it is the first to analyse deterioration at the level of individual tasks assessed by the BVD, allowing us to identify not only whether functional autonomy declines, but also which specific capacities drive that decline. Third, by combining mortality and functional outcomes within a longitudinal framework, we

quantify the survival gains associated with different LTC benefits while documenting the functional consequences of longer survival. More broadly, the Spanish experience offers valuable evidence for countries currently expanding or designing public LTC systems.

The remainder of the paper is organised as follows. Section 2 describes the Spanish LTC system. Section 3 presents the data. Section 4 sets out the empirical strategy, Section 5 the results, and Sections 6 and 7 discuss and conclude.

2. Institutional setting

In Spain, access to publicly funded LTC is managed by the *Sistema para la Autonomía y Atención a la Dependencia* (SAAD), established through de Ley 39/2006 (BOE, 2006), also known as *Dependency Act* (Peña-Longobardo et al., 2016). The system, which began its implementation in January 2007, introduced a nationwide entitlement to LTC benefits, structured around a universal needs-based model. While nationally designed, its administration is decentralised across regions (*Comunidades Autónomas*), who have the competences on social services providing LTC, causing a certain degree of heterogeneity in the implementation (Oliva et al., 2023).

Figure 1 illustrates the pathway individuals follow inside the system. To obtain benefits for LTC, they must be eligible. Eligibility is determined by the *Baremo de Valoración de la Dependencia* (BVD), an official and validated scale to measure limitations in functional autonomy (BOE, 2011). The BVD evaluates individuals across ten domains covering their ability to perform both basic and instrumental ADLs. Each domain comprises a set of specific tasks that are weighted according to their relative importance and the level of assistance required, generating an overall dependency score. To maximise the objectivity of the assessment and minimise evaluator bias, the assessment must be supported by a prior medical report that identifies the underlying health conditions responsible for the individual's loss of autonomy (BOE, 2011). For individuals with cognitive impairment, an extended version of the assessment is applied. This version incorporates an additional module evaluating decision-making capacity and reweights the remaining domains to better reflect the functional consequences of cognitive limitations. The resulting assessment score determines the dependency grade assigned to each applicant: Grade I (moderate dependency; scores of 25–49), Grade II (severe dependency; 50–74), or Grade III (major dependency; 75–100).

Following the assessment, applicants choose among the benefits available for their grade with guidance from the local public administration in a procedure called PIA (*Plan de Atención Individualizada or Individual Care Plan*). Benefits can be broadly classified into home-based and institutional care (Hernández-Pizarro and Prades-Colomé, 2026). Home-based care includes a range of formal services and financial support to enable individuals to remain in their own homes whenever possible. Formal home care (in Spanish, *Servicio de Ayuda a Domicilio, SAD*) consists of a predefined number of hours per week of professional assistance delivered at the beneficiary's home, covering both personal care and/or household tasks. Alternatively, beneficiaries may attend a day care centre, where they receive supervision, rehabilitation and personal care during part of the day while continuing to live in the community. Another possibility is to opt for an unconditional cash benefit for informal care, intended to compensate family members or other informal caregivers for the care they provide. These allowances are relatively modest in monetary terms compared with formal care benefits,

whether provided at home or in a care facility. Telecare is also available as a remote support service that enables continuous monitoring and rapid response in emergency situations through communication devices installed in the beneficiary's home (BOE, 2026). Because telecare does not provide hands-on personal care or substitute for a caregiver, we group it with informal care in our analysis: recipients continue to rely on informal care, complemented by remote support.² Some of these benefits are mutually compatible, allowing beneficiaries to combine complementary forms of support. In practice, telecare is the benefit most frequently provided alongside other home-based services (BOE, 2013).

Institutional care includes a range of residential settings with different levels of medical and nursing support, including intermediate care facilities, nursing homes, residential care homes, and supported housing. In practice, however, residential care homes account for the vast majority of institutional care (BOE, 2013). These facilities provide accommodation, assistance with daily living and basic care. Their workforce is composed predominantly of care assistants (*gerocultores* or *nursing aides*) with limited formal clinical training, while the availability of on-site nursing care is low (Prades-Colomé, 2025).

As described above, LTC offered through the public LTC system in Spain is provided by non-medically trained professionals or relatives, regardless of the care setting. Care provision focuses on supporting the performance of ADLs, with limited (or no) provision of preventive or rehabilitation care. However, beneficiaries may also receive complementary support from healthcare services, with primary care services providing medical care alongside LTC benefits in both home- and institution-based settings.

All benefits are available for all individuals with any grade, with the exception of institutional care, which is restricted to individuals classified with Grade II or III. The intensity of support increases with the Grade of LTC needs, with higher grades entitling beneficiaries to more hours of formal care or larger cash transfers. In addition, beneficiaries contribute to the cost of care through income-related co-payments (BOE, 2013). All formal care services may be provided directly by public providers or purchased through service vouchers that allow beneficiaries to access accredited private providers. Finally, beneficiaries may move between different benefit types over time as their care needs, preferences or living arrangements evolve, subject to administrative approval.

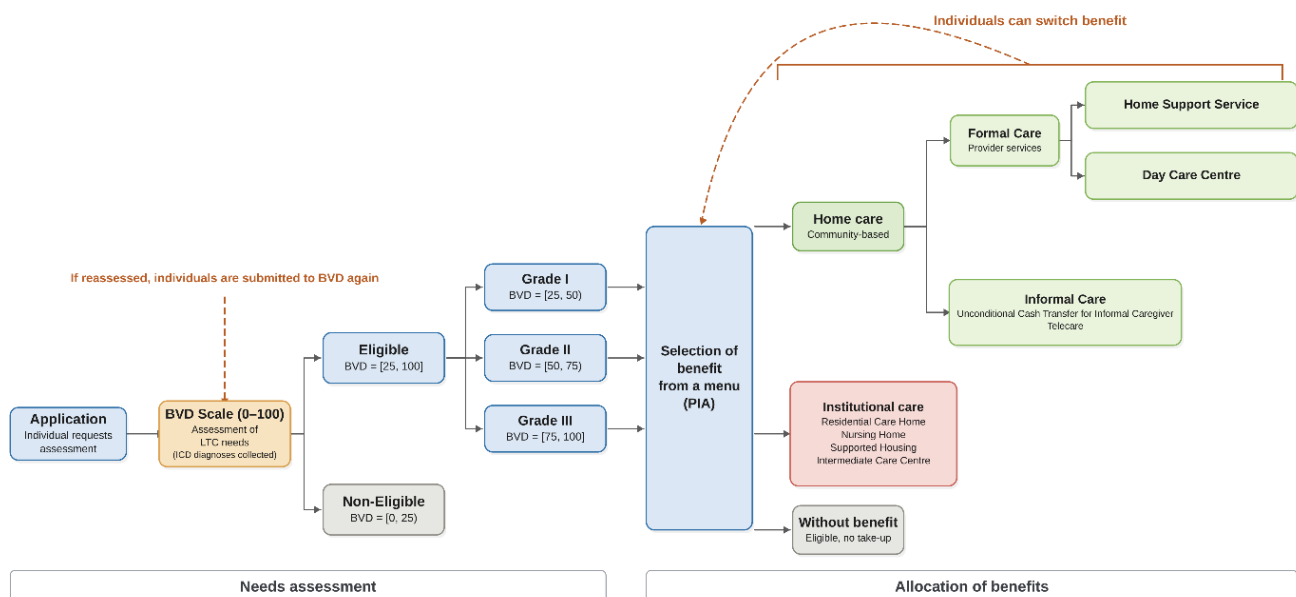
Another characteristic of the Spanish LTC System is that individuals may request a reassessment whenever they consider that their LTC needs have changed. Reassessment follows the same BVD evaluation procedure as the initial assessment and may result in a higher BVD score, leading to the assignment of a higher grade of LTC needs. In contrast, downward revisions are uncommon because the BVD is designed to assess permanent limitations in functional autonomy (BOE, 2011). Any change in the grade of LTC needs triggers a review of the individual's PIA, through which both the type and intensity of LTC benefits can be adjusted. Consequently, beneficiaries may transition between different dependency grades and benefit types over time, generating dynamic care trajectories that reflect the evolution of their functional status and LTC needs until death.³

² This classification is consistent with the recent policy trend to frame telecare as a right rather than a service (BOE, 2023).

³ The system also planned ex-officio reassessments. However, given the overload in assessments they only apply systematic reassessments to the children and young population, as they have more changes in the level of needs.

Nearly two decades after its introduction, the Spanish LTC system has become a major pillar of the Spanish welfare state (Costa-Font et al., 2022a). Existing evidence suggests that it has improved beneficiaries' well-being, particularly through better health outcomes and reductions in healthcare utilisation, including hospital admissions and primary care visits (Costa-Font et al., 2022b, 2018; Serrano-Alarcón et al., 2022). Beyond the direct effects of the benefits on the individuals, the system has generated broader social and economic benefits by creating employment in the care sector (Del Pozo-Rubio et al., 2022), increasing female labour force participation, and influencing household decisions regarding savings, informal caregiving, and retirement (Costa-Font et al., 2022b; Costa-Font and Vilaplana-Prieto, 2022a, 2017). However, these achievements coexist with persistent structural challenges. Public expenditure on LTC remains comparatively low by OECD standards (Hernández-Pizarro and Prades-Colomé, 2026), resulting in underfunding, long and persistent waiting lists, and substantial regional heterogeneity in access to services (Oliva et al., 2023; Peña-Longobardo et al., 2016). The COVID-19 pandemic further exposed structural weaknesses in the provision of care, particularly in residential facilities (Cases et al., 2023; Costa-Font et al., 2021). Moreover, although the BVD provides a nationally standardised assessment of LTC needs, ensuring horizontal equity in eligibility determination, inequalities continue to arise during benefit provision, both in the type of benefit received (in-kind services versus vouchers) (Vidiella-Martin et al., 2024), and in the extent to which assessed needs are ultimately met. Evidence suggests that unmet care needs remain particularly common among individuals with cognitive impairment (García-Gómez et al., 2015; Rodríguez-González and Rodríguez-Míguez, 2021) while co-payments continue to represent a substantial financial burden for many households (del Pozo-Rubio et al., 2019, 2017).

Figure 1. Spanish long-term care system assessment and benefit allocation process.



Note: Individuals with “No benefit” may be because of their own choice or, mostly, because of the long waiting times in the Spanish LTC System (Hernández-Pizarro and Prades-Colomé, 2026).

3. Dataset construction

We use anonymised registers of the applicants to LTC benefits in Catalonia.⁴ The dataset covers all individuals aged 60 or older who applied for LTC benefits between January 1, 2015, and December 31, 2024. It includes individual sociodemographic data linked to BVD assessments, which provide detailed information on the functional limitations in basic and instrumental ADLs, and medical diagnostic information from clinical reports. The dataset also contains information on LTC benefit (if received), including the type of benefit received and the dates of receipt.

The study sample comprises individuals satisfying the following inclusion criteria: (i) age 60 years or older at first valid BVD assessment; (ii) initial grade of LTC needs I, II, or III; and (iii) SAAD entry on or after January 1, 2015. 321,822 individuals met these three criteria. Covariates are measured at the first valid BVD assessment and held constant. These include age at entry (continuous), sex, marital status (married, including coupled individuals, versus single, including single, widowed, divorced, and separated individuals⁵), and the initial grade of LTC needs (I, II, or III). We additionally use two types of information collected during the BVD assessment: an indicator for whether the first assessment was conducted using the BVD special scale B for individuals with cognitive impairment, and fifteen binary diagnostic indicators⁶ categorising the ICD-10 diagnosis codes recorded in the medical report into major disease groups. 1,204 individuals had missing values in their diagnostics information, leaving a final sample of 320,618 individuals (99.6% of the original sample).

We then define horizon-specific samples by calendar year of entry to ensure complete observation windows (Figure 2). Individuals entering in 2015-2022 constitute the two-year horizon sample (h2, N = 231,589), those entering in 2015-2021 the three-year horizon sample (h3, N = 191,812), 2015-2019 the five-year horizon (h5, N = 130,973), and 2015-2017 the seven-year horizon (h7, N = 67,478). This restriction is particularly important given the substantial waiting times in the Catalan LTC system (around 270 days in July 2025 (IMSERO, 2025)) which would otherwise leave insufficient follow-up time to observe outcomes over shorter horizons for more recent entrants. Consequently, every individual has the theoretical possibility of completing the full follow-up window up to the administrative censoring date of December 31, 2024.

Benefits were classified in five different categories, according to the division presented in Figure 1. First, individuals who are eligible for LTC but are not receiving any benefit are classified as "No benefit". Second, individuals receiving institutional care are grouped into a separate category. The remaining three categories correspond to home-based care: Informal home care, including individuals receiving cash benefits to support informal caregiving or telecare services; Formal home care, including individuals receiving professional home support services; and Day care centre, including individuals attending these centres to receive some care. These categories reflect the main publicly funded benefit rather than the full care arrangement. In particular,

⁴ The dataset was provided by the Catalan Ministry of Social Rights and Inclusion (*Departament de Drets Socials i Inclusió de la Generalitat de Catalunya*), the administration responsible for the management of the LTC system in Catalonia (Spain).

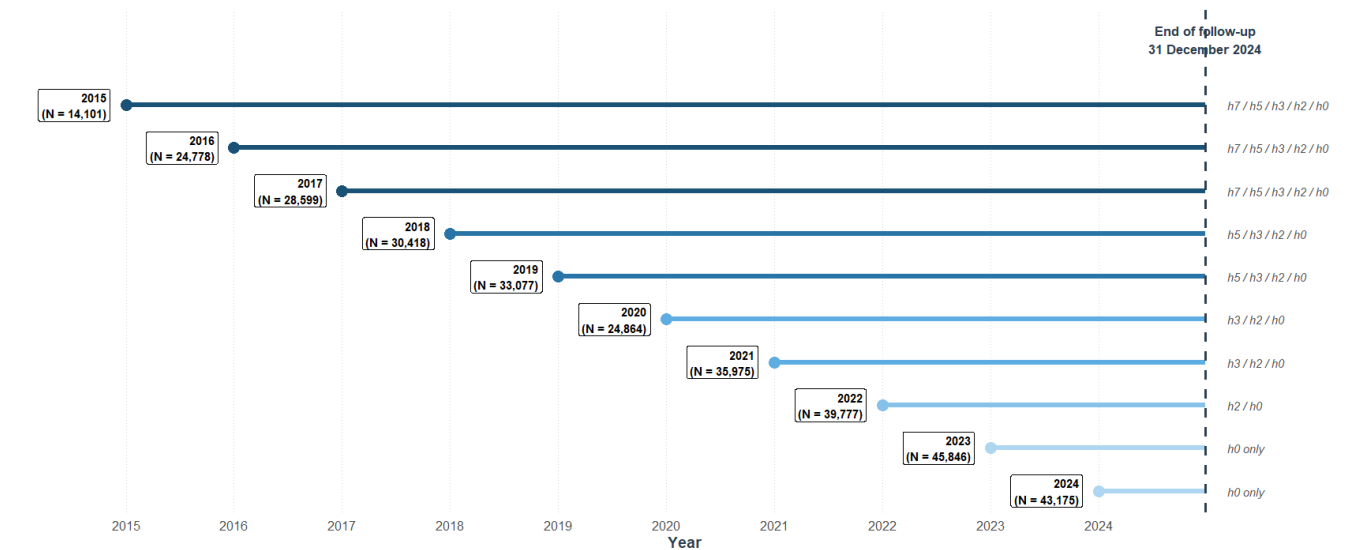
⁵ Marital status was recorded as "no information" for 28,635 (8.9%) individuals. Rather than excluding these observations, we retained them in the analysis by treating "no information" as a separate category.

⁶ Covering neurological, circulatory, digestive, musculoskeletal, endocrine-metabolic, ophthalmological, otorhinolaryngological, respiratory, genitourinary, mental health, neoplastic, paediatric, haematological, infectious, and dermatological conditions.

individuals with Grade II-III receiving formal home care or attending day care centres almost certainly also rely on informal care, as the hours covered by these services are insufficient to meet their needs (Boletín Oficial del Estado (BOE), 2023). Moreover, for informal home care, neither the intensity of care nor the identity of the caregiver can be verified in the administrative data, and part of the cash benefit may be used to hire paid caregivers, often in the undeclared labour market (Rodríguez Cabrero et al., 2022).

Benefit reception is measured as days receiving benefit divided by total days in the LTC system in $[0, T]$, ranging from 0 to 1. This continuous measure is preferred over a binary indicator because, given the waiting times and changes across benefits, individuals classified as receiving a given benefit may in fact have spent most of their time in the system on a waiting list or receiving a different benefit.

Figure 2. Year of entry in the cohort and horizon-specific samples.



Note: The number in the left box of each bar represents the total number of individuals who entered the Catalan LTC system during that year. h0/h2/h3/h5/h7 refers to the different time-horizons subsamples in the study (in years).

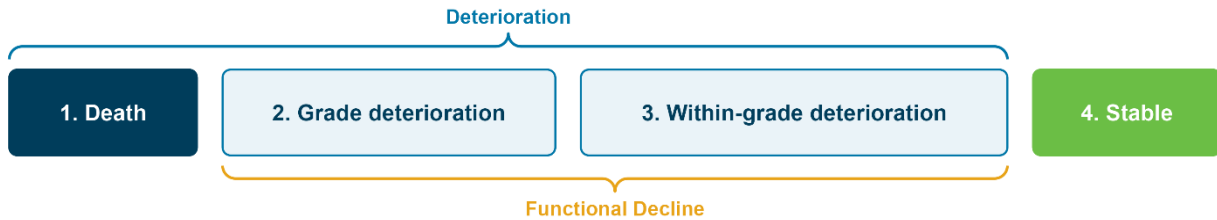
4. Methods

4.1 First analysis: Study of the evolution of the individuals with LTC needs

4.1.1 Outcome definition

Figure 3 summarises each individual's functional trajectory using a hierarchical outcome classification. For each observation horizon (2, 3, 5, and 7 years after LTC system entry), individuals are assigned to one of four mutually exclusive outcome categories according to the most severe event observed during follow-up. The four outcome categories are: (1) death; (2) grade deterioration, defined as functional decline leading to an increase in the grade of LTC needs; (3) within-grade worsening, defined as functional decline that increases the BVD score without changing the grade of LTC needs; and (4) stable, comprising individuals with no observed deterioration, including those who remain alive without reassessment.⁷ Categories (1) to (3) are collectively considered indicators of deterioration, whereas categories (2) and (3) specifically capture functional decline.

Figure 3. Classification of functional outcomes



4.1.2 Empirical strategy

Models are estimated for four different time horizons: $T = 2, 3, 5$ and 7 years after entry in the LTC system, yielding one cross-sectional observation per individual per horizon. We first estimate linear probability models (LPM) separately for each outcome and each horizon:

$$Y_i(t) = \beta_0 + \beta_1 * \text{Informal home care}_{it} + \beta_2 * \text{Formal home care}_{it} + \beta_3 * \text{Day centre care}_{it} + \beta_4 * \text{Institutional care}_{it} + \gamma * X_i + \delta_t + \varepsilon_i \quad (1)$$

where $Y_i(t)$ is the observed outcome at horizon T ($T \in 2, 3, 5, 7$). $\text{Informal home care}_{it}$, $\text{Formal home care}_{it}$, $\text{Day centre care}_{it}$ & $\text{Institutional care}_{it}$ are benefit exposure variables, defined as the share of the total days in the LTC system receiving each benefit type. X_i is the vector of baseline covariates (age at entry, sex, marital status, initial grade of LTC needs, the type of BVD scale used at first assessment,

⁷ Individuals who are reassessed and experience a very small improvement are also classified as stable, accounting for 3,560 individuals (1.8% of the sample).

and the 15 diagnostic groups indicator variables), and δ_t are year-of-entry fixed effects. To account for the ordinal nature of the functional deterioration process, outcomes are analysed using a conditional specification based on the severity hierarchy. The estimation sample is progressively restricted by excluding individuals who experienced more severe outcomes. Specifically, mortality is modelled as death versus all remaining outcomes; grade deterioration is modelled as grade deterioration versus within-grade deterioration or remaining stable, excluding deaths; and within-grade deterioration is compared only to stable individuals, excluding both deaths and grade worsening.

4.2 Second analysis: Years gained by type of benefit

To further explore how survival and functional deterioration differ across care benefits, we estimate regression-standardised survival curves (Syriopoulou et al., 2022). We restrict the analysis to the seven-year cohort (h7) and organise its follow-up into person-month records.

For each individual i and month t we record whether the event (death, grade deterioration or within-grade deterioration) occurred and the benefit in force at the start of the month. Because the four benefit types are not mutually exclusive and an individual may hold more than one simultaneously, we resolve concurrent benefits by a fixed priority: institutional care over day centre care, day centre care over formal home care, and formal home care over informal home care, and months with no active benefit form the reference category. Age, sex, marital status, initial BVD score and BVD scale used enter the model as covariates. The grade of LTC needs enters the mortality model as a time-varying covariate, whereas in the functional deterioration models it is included as a baseline covariate, measured at entry into the LTC system.

We fit a Poisson model for monthly mortality (Laird and Olivier, 1981). Writing $\widehat{\lambda}_g(t|X_i)$ for the monthly hazard predicted for individual i at month t when their benefit is fixed to g , we form the standardised survival curve by predicting this hazard for every individual in the sample under the fixed benefit g , averaging the predicted hazards across the sample at each month, and accumulating them over follow-up:

$$\widehat{S}_g(t) = \prod_{k=1}^t \left[1 - \frac{1}{n} \sum_{i=1}^n \widehat{\lambda}_g(k|X_i) \right] \quad (2)$$

In the case of grade deterioration, individuals with Grade III of LTC needs are not considered at-risk as they have the maximum possible Grade, and only the first deterioration is included for each individual and type of deterioration. We summarise the contrast between each benefit g and the no-benefit reference by the difference in restricted mean survival time (RMST) over the seven-year window. Years gained (YG), either of life (LYG) or without deterioration (YWD), are defined as the areas between the corresponding curves:

$$Y\widehat{G}_g = \int_0^7 [\widehat{S}_g(t) - \widehat{S}_{ref}(t)] dt \quad (3)$$

4.3 Third analysis: Functional deterioration among survivors

Among survivors with any deterioration (grade or within-grade), we analyse the magnitude and pattern of this functional deterioration. This subsample is constructed separately for each horizon $T \in \{2, 3, 5, 7\}$ years. The outcome in this third model is the change in BVD score between first assessment and the last reassessment within $[0, T]$: $\Delta score_{i,abs.} = score_i^T - score_i^0$. A complementary relative measure, $\Delta score_{i,rel} = \frac{\Delta score_i^T}{100 - score_i^0}$, expresses deterioration as the share of the available functional margin at entry. BVD-domain level models are also calculated, where scores are expressed as the percentage of each BVD-domain's maximum value to ensure comparability across BVD scales. The model is defined as:

$$\begin{aligned} \Delta score_{i,abs/rel} = & \alpha + \beta_1 * Informal\ home\ care_{it} + \beta_2 * Formal\ home\ care_{it} + \beta_3 * Day\ centre\ care_{it} \\ & + \beta_4 * Institutional\ care_{it} + \gamma * score_i^0 + \rho_t * months_i + \phi * X_i + \delta_t + \varepsilon_i \end{aligned} \quad (4)$$

Where $\Delta score_i$ is the increase in the BVD score (measured in absolute or relative terms), benefit exposure is measured as in model (1), $score_i^0$ is the initial BVD score, $months_i$ controls for variation in the follow-up length between reassessments, X_i is the control covariate vector (age at entry, sex, marital status, initial grade of LTC needs, the type of BVD scale used at first assessment, and the 15 diagnostic groups indicator variables), and δ_t are year-of-entry fixed effects. The model is estimated for each BVD domain and each time horizon.

5. Results

5.1 First analysis: Study of the evolution of individuals with LTC needs

5.1.1 Descriptive statistics

Table 1 presents baseline characteristics of the analytic sample at entry in the public LTC system (h0). This sample includes 320,618 individuals and has a median follow-up period of 1,406 days (3.9 years). The sample has an average age of 83.0 years (SD 7.9), is predominantly female (62.0%), and similarly divided between married (43.6%) and single (47.5%) individuals.

Regarding the level of LTC needs, average BVD score at entry is 47.0 (SD 19.0), resulting in about 59.2% of individuals classified at Grade I of LTC needs, 27.9% with Grade II and 12.9% as Grade III. Moreover, 63.4% of individuals are assessed using the special BVD scale (scale B, for cognitive deterioration cases). The most prevalent diagnoses are Musculoskeletal (65.9% of individuals), neurological (58.8%), and circulatory (51.2%).

Table 1. Baseline characteristics of the full sample (h0, N = 320,618)

Variable	%/N (SD)
Sociodemographic variables	
Age at entry (years)	83.0 (7.9)
Female	62.0%
Marital status	
Married	43.6%
single	47.5%
Level of need variables	
BVD score at entry (0-100)	47.0 (19.0)
Initial dependency grade	
Grade I	59.2%
Grade II	27.9%
Grade III	12.9%
BVD special scale B (cognitive)	63.4%
Clinical diagnoses at entry	
Neurological	58.8%
Circulatory	51.2%
Digestive	4.8%
Muscoskeletal	65.9%
Endocrine-Metabolic	25.4%
Ophthalmological	19.3%
Otorhinolaryngological	11.9%
Respiratory	18.6%
Genitourinary	24.7%
Mental Health	24.4%
Neoplastic	0.6%
Paediatric	0.1%
Haematological	13.6%
Infectious	4.6%
Dermatologic	1.0%

Note: The sum of marital status is not 100% because this variable is reported as “no information” for 8.9 % of the sample.

Table 2 documents differences in individual characteristics by benefit type received. Because home-based benefits are compatible and may be received sequentially or concurrently, the columns are not mutually exclusive, and individuals can appear under more than one benefit. Among those who received a benefit at any point, informal home care is by far the most common, reaching half the sample (50.2%), followed by institutional care (24.0%) and formal home care (23.0%), while day care centers account for a smaller share (8.7%). A quarter of individuals (25.9%) never received any benefit within their observation window. Co-reception of benefits (receiving more than one benefit) is common: individuals hold 1.55 benefit types on average in the informal home care group and up to 2.40 in the day care centre group. This group in particular almost never operates as a stand-alone arrangement, as 63.6% of individuals also receive informal home care and 45.3% later enter institutional care, indicating that it frequently serves as a transitional stage before institutionalisation. Once individuals enter institutional care, this benefit cannot be received alongside any other LTC benefit. Benefit intensity measures the share of total days covered by each benefit. Informal home

care is the most persistent benefit, covering 73.5% of observed days among its recipients, compared with 44.8% for formal home care, 38.3% for institutional care and 30.6% for day centre care. The relatively low intensity of institutional care, despite its absorbing nature, reflects its typically late entry within the care trajectory, as follow-up begins at LTC system entry. Moreover, total benefit coverage is substantially lower among institutional care than among all other groups, suggesting that a large share of their observed time in the system elapses without receiving any benefit, probably due to the existence of waiting lists to enter these facilities.

The profiles at entry differ markedly across benefit types. Individuals receiving institutional care are older, more likely to be women, and more likely to be single (mostly widowed). These characteristics follow a clear gradient across care benefits, increasing from informal home care to formal home care, day care, and finally institutional care. A very similar pattern emerges with level of LTC needs variables. Individuals receiving institutional care present the highest level of needs, with a mean BVD score of 55.6 (SD 19.5) against 42.8-47.7 elsewhere, and more than double the share of initial Grade III cases (22.2% versus 7.2-9.1% in home-based benefits).

The share of individuals who present a cognitive deterioration and are therefore assessed with the special BVD scale B is higher among individuals who have received day centre care (81.9%), closely followed by institutional care (77.6%), compared with around 61% in the home-based formal and informal groups. Observed outcomes follow the same gradient, with mortality being the highest among individuals who have received institutional care (59.2%) and lowest among the ones in informal home care (36.2%). Part of this variation likely reflects differences in time spent in the LTC system. Individuals in institutional care and day centre care have the longest observation windows (2,013 and 1,955 days on average), compared with individuals with no benefit (1,285 days) and those receiving informal care benefits (1,540 days), although the large standard deviations (868-1,102 days) indicate substantial heterogeneity within all groups. Finally, it is important to remark that the group who does not receive benefits has the shorter average length of stay in the LTC system (1,285 days), but the second highest mortality rate, at 52.5%. This group also has a very small share of deterioration, so they might be experiencing higher shocks leading to death rather than deterioration.

Table 2. Characteristics by benefit type.

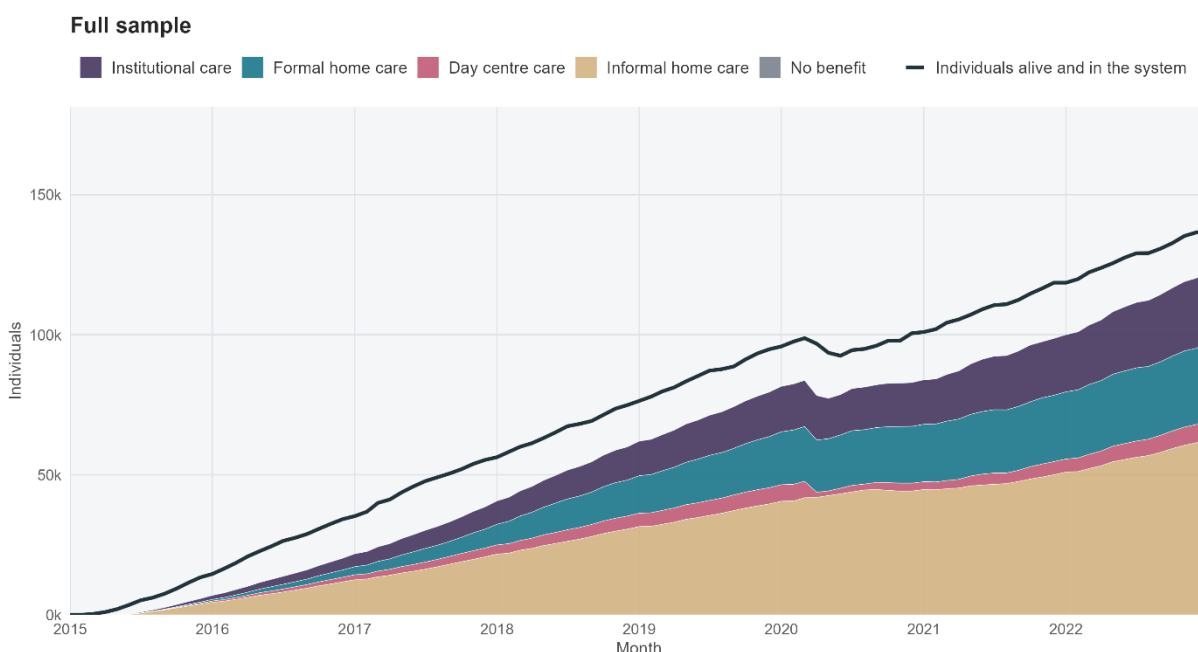
Variables	No benefit (N=82,892; 25.9%)	Informal home care (N=160,871; 50.2%)	Formal home care (N=73,893; 23.0%)	Day centre care (N=27,937; 8.7%)	Institutional care (N=77,066; 24.0%)
Benefit reception variables					
Mean n. of benefit types	0.00	1.55	1.95	2.40	1.72
Co-receipt: also receives (%)					
Informal home care	0.0%	100.0%	60.4%	63.6%	33.1%
Formal home care	0.0%	27.8%	100.0%	30.6%	22.4%
Day care centre	0.0%	11.1%	11.6%	100.0%	16.4%
Institutional care	0.0%	15.8%	23.4%	45.3%	100.0%
Share days in the system receiving the benefit, % (SD)					
Informal home care	0.0%	73.5%	33.2%	32.6%	13.4%
	(0.0%)	44.1%	(39.9%)	(38.9%)	(25.7%)
Formal home care	0.0%	12.2%	44.8%	9.4%	6.3%
	(0.0%)	(24.8%)	(29.9%)	(19.6%)	(15.4%)
Day centre care	(0.0%)	3.3%	2.9%	30.6%	3.5%
	(0.0%)	(12.5%)	(11.2%)	(26.8%)	(10.7%)
Institutional care	0.0%	4.3%	6.3%	13.6%	38.3%
	(0.0%)	(13.2%)	(15.7%)	(21.6%)	(30.0%)
Sociodemographic variables					
Age, mean (SD)	83.8 (8.1)	82.3 (7.8)	82.8 (7.4)	81.9 (7.0)	83.8 (7.4)
Female, %	58.0%	62.5%	65.9%	65.9%	66.1%
Marital status					
Married, %	38.2%	51.5%	48.1%	45.3%	34.0%
Single, %	51.5%	39.9%	44.2%	48.3%	58.5%
Level of need variables					
BVD score, mean (SD)	47.4 (20.2)	43.8 (16.8)	42.8 (16.7)	47.7 (16.7)	55.6 (19.5)
Initial grade					
Grade I	60.0%	65.8%	67.7%	55.2%	37.1%
Grade II	24.6%	26.3%	25.1%	35.7%	40.7%
Grade III	15.3%	7.9%	7.2%	9.1%	22.2%
BVD special scale B, %	60.1%	61.2%	61.7%	81.9%	77.6%
Outcomes					
Observation days, mean (SD)	1284.5	1540.4	1858.1	1954.9	2013.5
	(1101.6)	(961.9)	(868.6)	(920.4)	(904.8)
Death, %	52.5%	36.2%	45.0%	48.2%	59.2%
Grade deterioration, %	2.3%	17.6%	22.0%	28.1%	20.1%
Within-grade deter., %	1.6%	4.8%	6.1%	3.1%	0.8%

Note: The sum of marital status is not 100% because this variable is reported as “no information” for 8.9 % of the sample. Each column contains information on all the individuals who have receipt this benefit at any point.

Figure 4 shows the evolution of active LTC benefits by type alongside the number of individuals in the LTC system. As the sample includes all individuals entering the LTC system since 2015, the overall upward trend is mechanical (if the number of new entries is higher than the number of deaths). Informal home care is the most common benefit throughout the period, followed by formal home care and institutional care, while day

centre care remains relatively uncommon. The temporary decline in formal care during the COVID-19 pandemic reflects the disruption of service provision, after which the previous upward trend resumes.

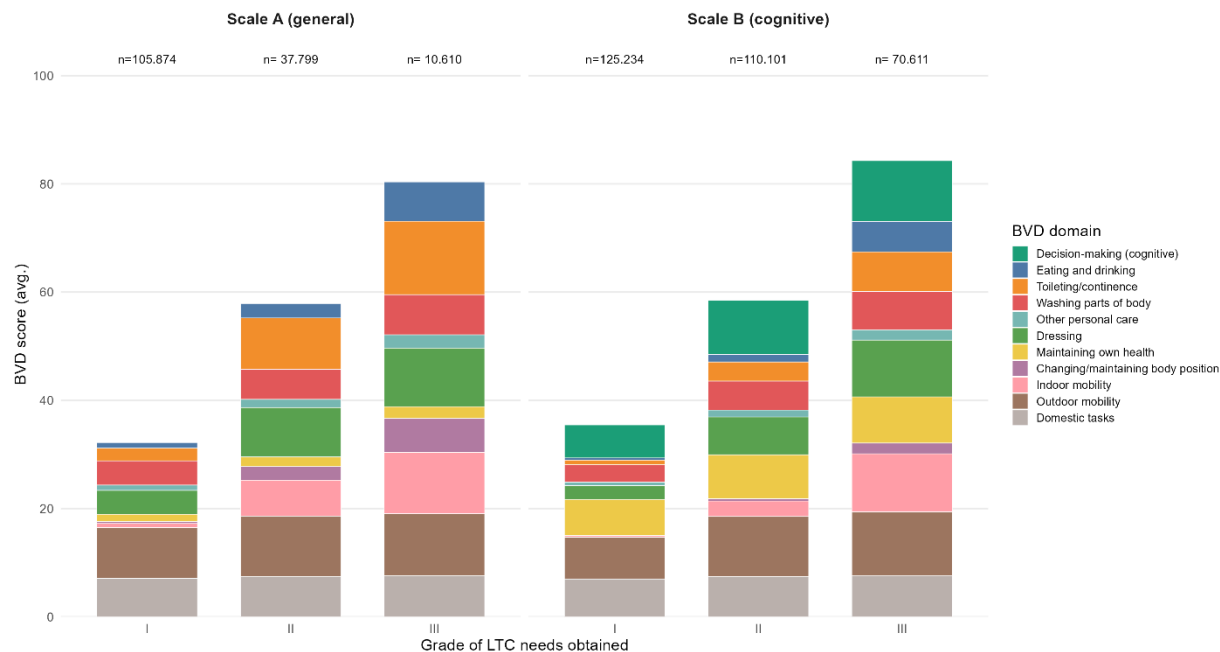
Figure 4. Evolution of active LTC benefits and individuals alive in the LTC system, 2015-2023.



Note: The figure reports the monthly number of active LTC benefits by benefit type and the number of individuals in the LTC system. Individuals may receive more than one benefit simultaneously

Figure 5 provides a more detailed decomposition of the origin of the LTC needs by exploiting the information contained in the BVD assessment. Specifically, it shows the average contribution of each assessment domain to the total BVD score, separately for the two BVD scales and by the resulting dependency grade (Grades I, II and III). For this purpose, the figure presents six columns, three for each version of the scale, displaying the mean domain scores within each grade. Tasks related to IADLs, particularly the ability to perform domestic tasks and outdoor mobility, account for a substantial share of the total score across all grades and are relatively more important among individuals in Grade I (scores between 25 and 49). As the level of LTC needs increases, domains related to basic ADLs contribute an increasingly larger share of the total score. The largest increases are observed in the loss of autonomy to perform activities related to personal hygiene, indoor mobility, and dressing, with more moderate increases in eating and drinking and washing oneself. Among individuals assessed with the cognitive impairment special scale B, the additional decision-making domain also becomes progressively more important as the grade of LTC needs increases.

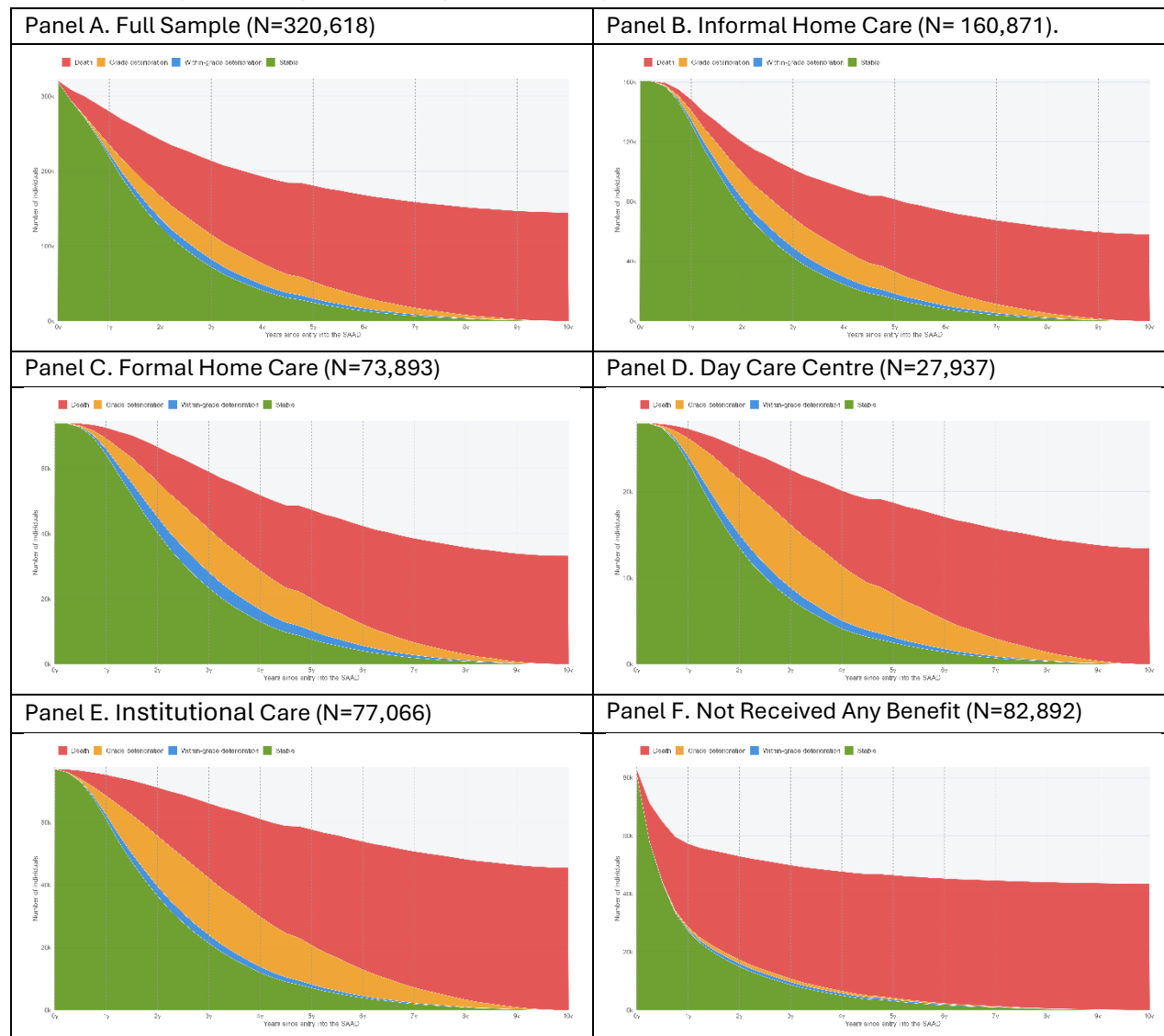
Figure 5. Average contribution of BVD assessment domains to the total score of LTC needs, by scale used and grade obtained.



Note: Assessments are grouped by assigned dependency grade (Grades I-III). Bars show the average total BVD score decomposed into the ten BVD domains covering basic and instrumental ADLs. Domain scores are expressed in absolute points and sum to the average total BVD score. Scale A (general assessment) and Scale B (special assessment for individuals with cognitive limitations) are presented separately because they use different scoring systems, as scale B incorporates a decision-making specific domain.

Finally, Figure 6 presents the distribution of outcomes by quarter since entry into the LTC system for the full sample (Panel A) and separately for individuals who received informal home care (Panel B), formal home care (Panel C), day centre care (Panel D), institutional care (Panel E), or no LTC benefits (Panel F) at any point during follow-up. As in Table 2, these benefit groups are not mutually exclusive, since home-based benefits may be received sequentially or concurrently, and individuals can therefore appear in more than one panel. Several patterns emerge. First, across all groups, the share of individuals maintaining their initial functional status declines steadily over time, while both mortality and functional deterioration become increasingly common. Over time, mortality becomes the dominant outcome, eventually surpassing functional deterioration. Second, among individuals experiencing functional deterioration, the proportion of cases involving a worsening in the grade of LTC needs increases progressively from Panels B to E, while within-grade deterioration becomes relatively less common. Individuals who receive informal and formal home care exhibit the lowest rates of functional deterioration, with a larger share of cases remaining within the same grade of LTC needs. In contrast, day centre users and, especially, individuals in institutional care experience substantially higher rates of functional deterioration, driven primarily by transitions to a higher grade, consistent with these services being targeted to individuals with more advanced care needs. Mortality also increases across benefits, reaching its highest levels among individuals in institutional care, followed by day centre users and, to a lesser extent, individuals receiving formal home care. Finally, individuals who never receive LTC benefits display relatively low rates of recorded functional deterioration but a very high mortality.

Figure 6. Quarterly follow-up since entry in the LTC system.



Note: Individuals are assigned to one subsample for each benefit type they have received (as in Table 2). Each individual contributes one observation per quarter from entry until the end of follow-up or death. The decreasing sample size over time reflects that not all individuals could be observed for the full 10-year period, as they entered the system at different times.

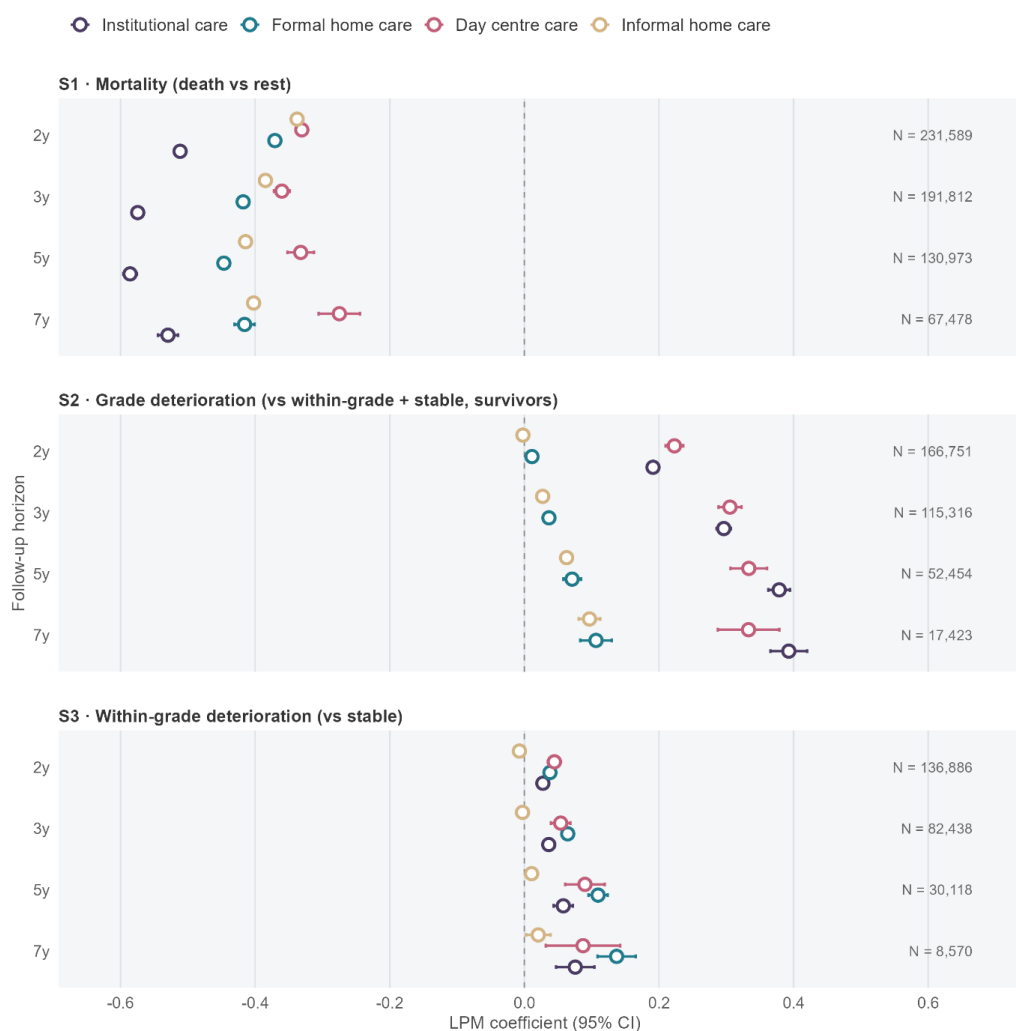
5.1.2 Results of the empirical model

Figure 7 presents the results of estimating model (1), which investigates the association between the intensity of exposure to each LTC benefit, measured as the share of days receiving each benefit over the observation window (days in the LTC system), and the probability of experiencing each of the previously defined outcomes. Results are shown separately for the four follow-up horizons (2, 3, 5 and 7 years after entry) and for the three conditional models: mortality vs. all other individuals (S1), grade deterioration among all survivors (S2), and within-grade deterioration among individuals who neither died nor worsened their grade (S3).

A clear and consistent gradient emerges across outcomes. Greater exposure to any LTC benefit is associated with a substantially lower probability of death, with the strongest association observed for institutional care, followed by formal home care, informal home care and day care. Among survivors, however, higher benefit intensity is generally associated with a greater likelihood of subsequent functional deterioration. This pattern is particularly pronounced for institutional and day centre care, whose coefficients increase steadily across follow-up horizons in the grade deterioration models. Formal and informal home care show similar smaller increases in the probabilities, and only after three years of observation for informal home care. A similar pattern is observed for within-grade deterioration, although the estimated effects are consistently smaller. Institutional care, formal home care and day centre care remain positively associated with deterioration within grade at all horizons. Informal care is slightly negative at 2 years horizon, becoming positive only at the longer follow-up horizons (5 and 7 years after entry in the LTC system).

These results should not be interpreted causally. Rather, they are consistent with a selection process operating within the population with LTC needs. Individuals with greater underlying care needs are more likely to receive intensive LTC benefits, particularly institutional care, and the most vulnerable among them are the most likely to die. Those who survive form a selected group who remain at risk for longer, which increases the opportunity to observe subsequent functional deterioration. In this sense, part of the observed deterioration reflects longer survival rather than an effect of the benefit itself. The lower mortality associated with benefit receipt should be read in the same light and not as evidence that any care setting is preferable at equal needs. Moreover, benefit receipt is not randomly timed: individuals must survive the waiting period between assessment and the start of a benefit, so those who die while waiting are counted in the no-benefit group. Part of the higher mortality observed among individuals without benefits may therefore reflect longer waiting times and selective attrition during that period, rather than a protective effect of care. Finally, the higher observed incidence of deterioration among beneficiaries may also reflect differences in reassessment patterns. Individuals who do not receive benefits (our reference group) are less likely to be reassessed, which limits the opportunity to detect changes in their functional status.

Figure 7. Forest plot of the association between benefit intensity and studied outcomes across horizons.



Note: Points represent linear probability model coefficients and horizontal bars indicate 95% confidence intervals. Benefit types are not mutually exclusive. The reference category is individuals who do not receive a benefit. Benefit intensity is measured as the share of days in the observation window during which each benefit was received. Estimates are reported separately for mortality (death vs. all remaining outcomes), grade deterioration among all survivors, and within-grade deterioration among individuals who neither died nor experienced grade deterioration. All models adjust for baseline sociodemographic characteristics (age at entry, sex, marital status), initial BVD score and type of BVD scale used, 15 diagnosis indicator groups, and year-of-entry fixed effects.

As a robustness check, we complemented this model from section with a matching estimator that conditions on initial characteristics observed. To do so, a propensity score model (kernel matching) is ran for each benefit category against the group receiving no benefit for each of our three outcomes (death, grade worsening and within-grade worsening). The propensity score includes the following matching variables, measured at the time of the LTC benefit application: sex, age, marital status, LTC needs score and grade, presence of cognitive impairment, and pre-existing diagnosis.⁸ Matching substantially improves covariate balance (Tables A1 to A4 in the Appendix). However, the substantive conclusions are unchanged. Every arrangement lowers mortality

⁸ We use these variables as they have been shown to influence the choice of benefit (Vidiella-Martin et al., 2024) and are available in the data.

risk while raising the probability of functional deterioration relative to receiving no benefit, and the same gradient emerges: survival gains are largest for the least intensive arrangements, whereas deterioration risk rises steadily with care intensity (see Figure A1 in the Appendix). This ordering across arrangements should be interpreted with caution. Matching equalises the characteristics observed at entry, but it cannot equalise along dimensions we do not observe that influence the choice of benefit, such as the availability of family support or the presence of medical/autonomy shocks. The pattern we observe should therefore not be interpreted as more intensive benefits causing deterioration, but rather as benefits responding to and managing it, with the residual gradient reflecting the unobserved frailty that matching cannot balance.

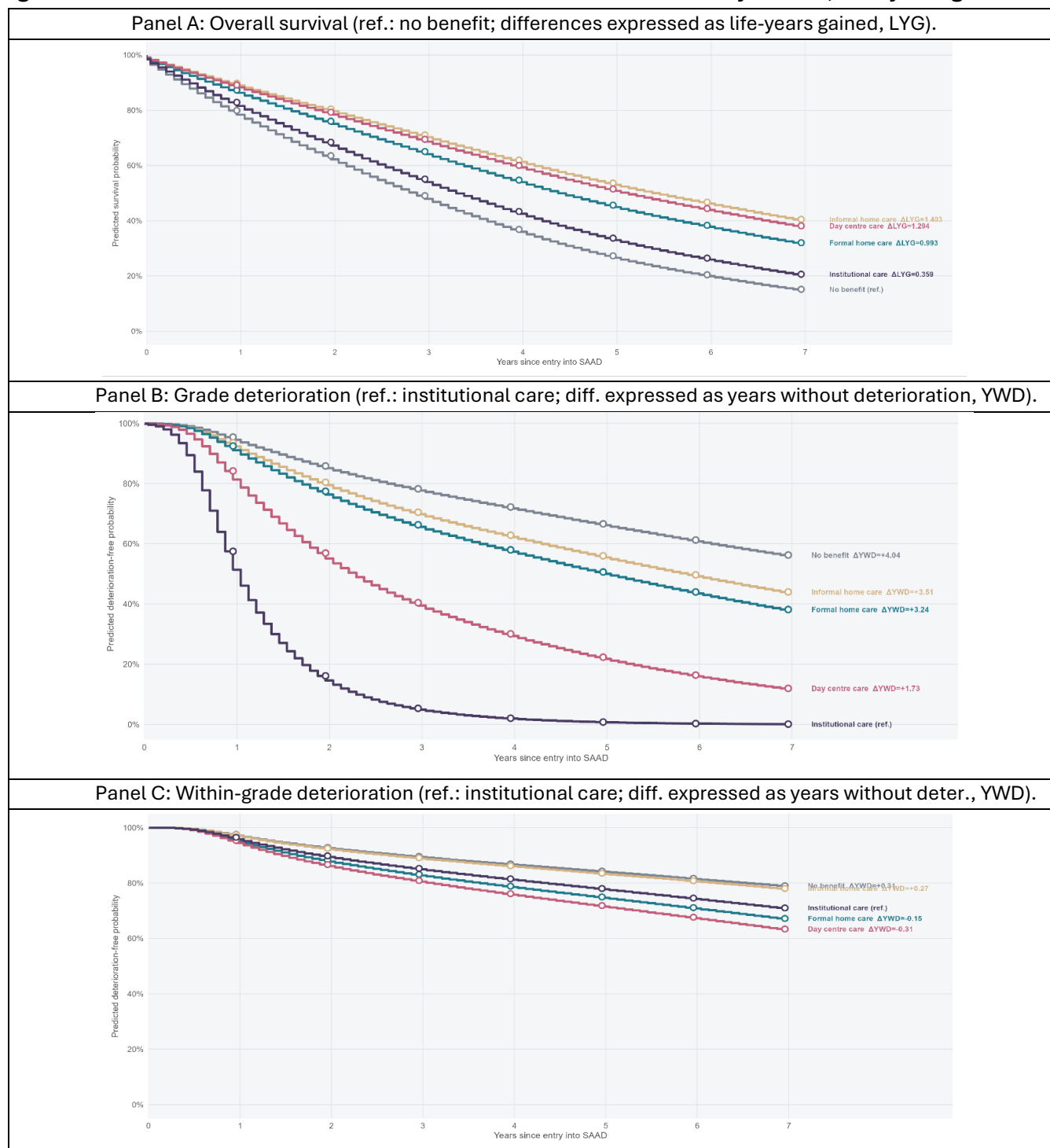
5.2 Second analysis: Years gained by type of benefit

Panel A of Figure 8 shows the survival curves by care benefit over the seven years following entry into the system. Every benefit is associated with higher survival than receiving no benefit, and the curves preserve a clear and stable ordering throughout follow-up. Survival in the no-benefit reference falls to roughly 15% by year seven, the lowest of all groups. The largest survival gains are observed for home-based benefits. Full exposure to informal home care is associated with an additional 1.40 life-years over the seven-year follow-up relative to receiving no benefit, followed by day centre care (1.29 life-years) and formal home care (0.99 life-years). These three benefits maintain standardised survival at close to 40% by year seven. Institutional care, in contrast, is associated with the smallest gain (0.36 life-years), and its survival curve remains consistently below those of the home-based benefits, converging towards the no-benefit group in later years. This pattern is consistent with the selection into care settings described above: institutional care is largely reserved for individuals with Grade II or III LTC needs and is often initiated following a substantial loss of autonomy. Even so, receiving institutional care is still associated with longer survival than receiving no LTC benefit.

Panels B and C repeat the same model for the two deterioration outcomes, now taking institutional care as the reference. For grade deterioration (Panel B), institutional care progresses to a higher grade of LTC needs faster than any other benefit, its deterioration-free curve falling to near zero by year four. Relative to institutional care, the years without grade deterioration gained are +4.04 for no benefit (as they are far less likely to be reassessed), +3.51 for informal home care, +3.24 for formal home care and +1.73 for day centre care, so home-based benefits add roughly three additional years free of grade progression over the follow-up in our models. For within-grade deterioration (Panel C) the differences are small and partly reverse: no benefit (+0.31) and informal home care (+0.27) remain marginally above institutional care, whereas formal home care (-0.15) and day centre care (-0.31) fall slightly below it.

Taken together, these results complement those of the first analysis and add insights into the survival-deterioration selection. Institutional care is associated with longer survival than receiving no benefit, yet among those who remain alive it is the setting under which grade progression is fastest, again consistent with institutional care being reserved for the highest-need individuals and initiated after a substantial loss of autonomy. Home-based benefits, by contrast, are associated with both longer survival and slower grade deterioration and, in some cases, highest share of within-grade deterioration (in formal home care and day centre care).

Figure 8. Standardised survival and deterioration-free survival curves by benefit, with years gained.



Note: Curves show standardised predicted survival under a scenario in which all individuals receive the same LTC benefit throughout follow-up, adjusting for age, sex, marital status, baseline BVD score, LTC grade and year of entry into the Spanish LTC system. Panel A: overall survival (reference: no benefit; contrast expressed as life-years gained, LYG). Panels B and C use institutional care as the reference and express contrasts as years without deterioration gained (YWD), the area between each benefit-specific curve and the reference over the seven-year follow-up. Panel A: (N= 67,478); Panel B: first grade deterioration; at-risk population restricted to entrants with Grade I-II (N = 56,480); Panel C: first within-grade deterioration (N = 67,478).

5.3 Third analysis: Functional deterioration among survivors

Having established that LTC benefits are associated with lower mortality but are associated with higher probability of functional deterioration, in the third part of the analysis we focus on the population who has experienced any kind of functional deterioration during the observation period. This comprises a subsample of 40,958 individuals at the two-year horizon (17.7% of the corresponding cross-section), 43,332 at three years (22.6%), 27,918 at five years (21.3%) and 10,693 at seven years (15.8%).

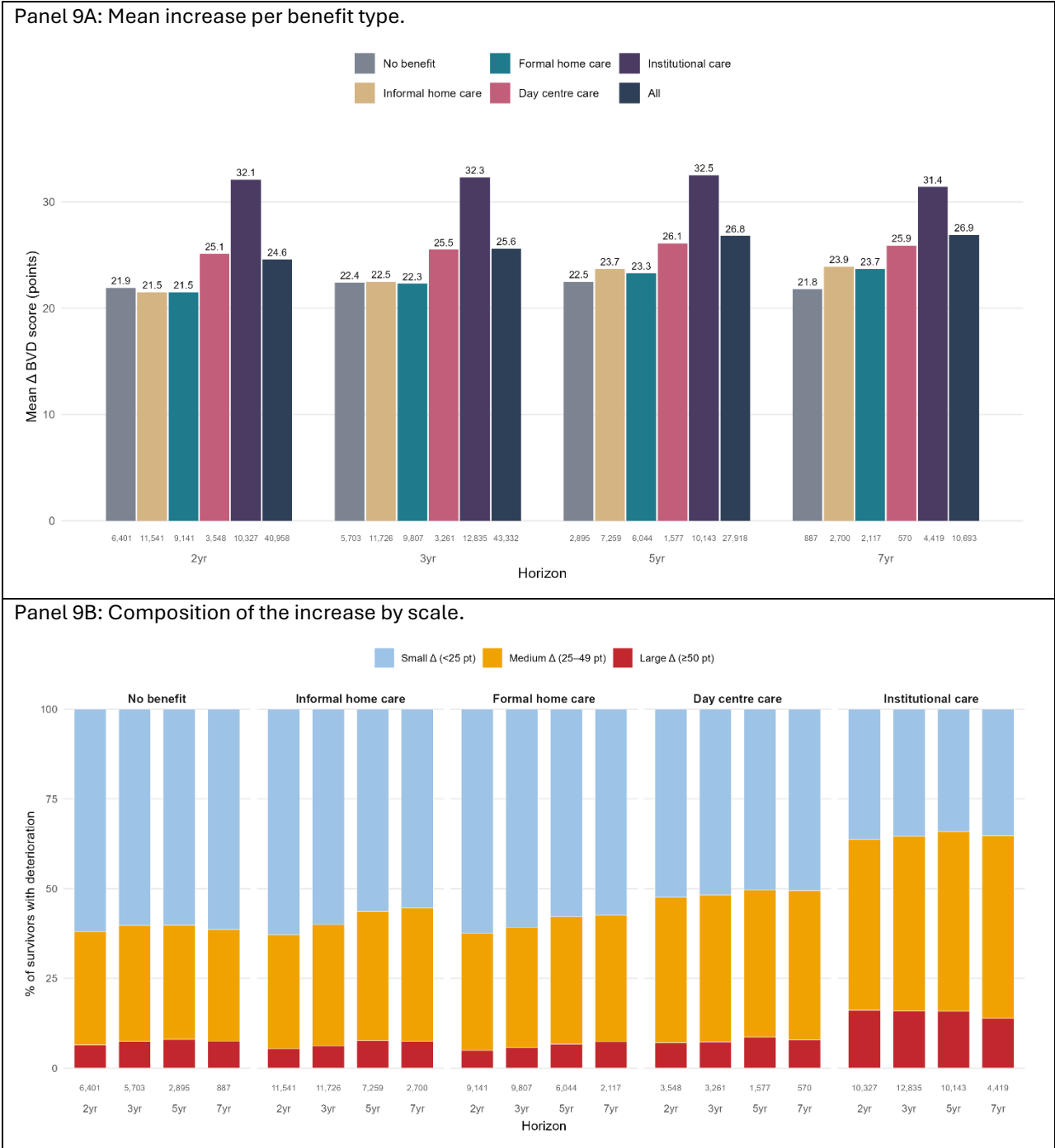
5.3.1 Descriptive statistics

Figure 9 describes the magnitude and distribution of deterioration among individuals whose BVD score worsens during follow-up, by type of LTC benefit received. As individuals may receive more than one benefit simultaneously, they are classified at each observation horizon according to the benefit appearing highest in the following hierarchy as done in the second analysis: institutional care, day centre care, formal home care, informal home care, and no active benefit.

Panel A shows that the average decline in functionality is substantial, ranging from 24.6 to 26.9 BVD points (on a 0-100 scale) depending on the observation horizon. However, the average deterioration differs markedly across care benefits. Individuals receiving formal and informal home care experience almost identical declines throughout follow-up (21.5-23.9 points), closely matched by those with no active benefit (21.8-22.5 points), although this latter group also exhibits substantially higher mortality. Day centre users occupy an intermediate position (25.1-26.1 points), while institutional care consistently records the largest deterioration, averaging around 32 points across all horizons.

Panel B further disaggregates these deteriorations into three categories according to their magnitude: mild (<25 points), moderate (25-49 points), and severe (≥ 50 points). Formal and informal home care display remarkably similar distributions, with around 56-63% of deteriorations being mild, 32-37% moderate, and only 5-8% severe. Day centre users show a different profile: although the proportion of severe deterioration remains relatively low (7.0-8.6%), they are consistently more likely to experience moderate declines, which account for around 40-42% of all deteriorations, compared with 32-37% among individuals in home care. Institutional care stands out as the setting with by far the highest concentration of severe deterioration, with 13.8-16.1% of individuals losing at least 50 BVD points, more than double the proportion observed in home care, and the lowest share of mild deteriorations. Overall, these patterns are consistent with the dynamic nature of LTC trajectories. While many individuals initially receive formal or informal home care, worsening functional limitations may lead them to transition to day care and, in the most severe cases, to institutional care. Consequently, institutional care concentrates individuals experiencing the largest declines in autonomy, whereas home-based care is predominantly associated with milder deteriorations.

Figure 9. Magnitude of the BVD score change among individuals experiencing any functional deterioration.



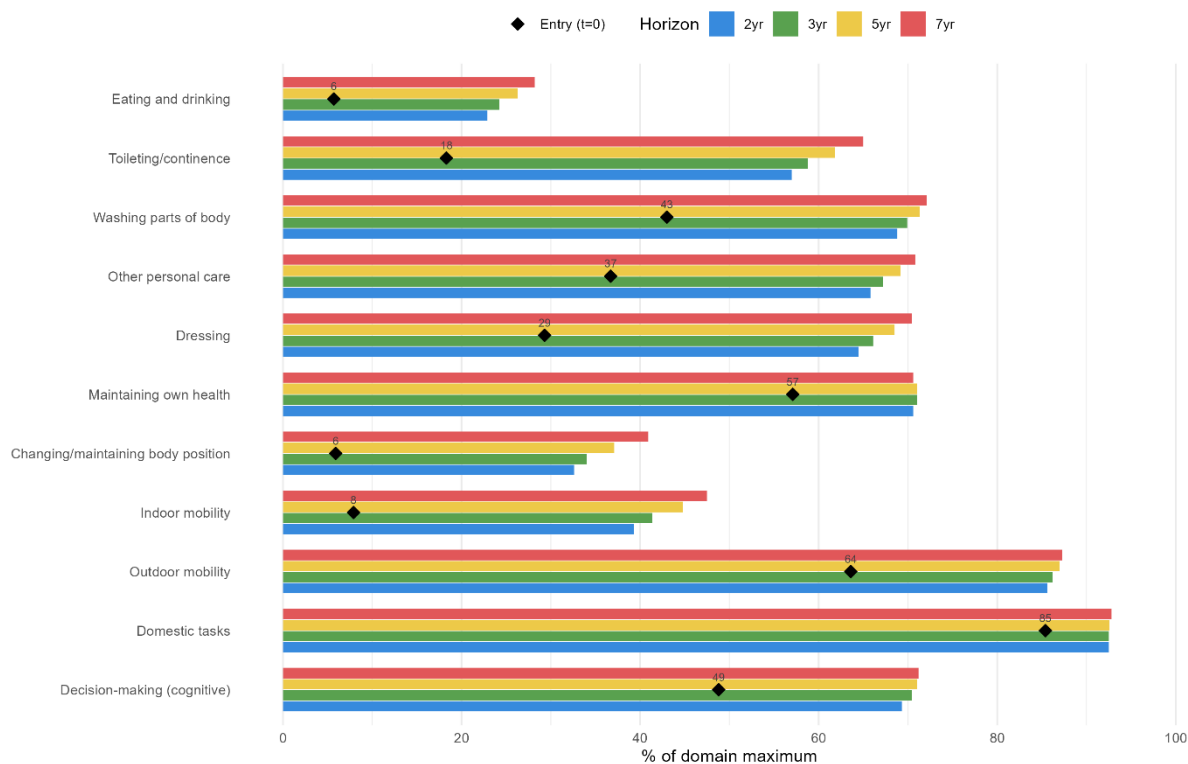
Note: As individuals may receive more than one benefit simultaneously, they are classified at each observation horizon according to the benefit appearing highest in the following hierarchy: institutional care, day centre care, formal home care, informal home care, and no active benefit. The number of BVD assessments represented by each bar is indicated at its base.

Figure 10 further explores the evolution of dependency by disaggregating the BVD into its individual domains for the subsample of individuals who experience deterioration. For each observation horizon, we retain only those individuals who deteriorate and compare their average domain scores at entry with their average scores observed at the corresponding follow-up horizon. The figure therefore displays a single point representing the

mean limitation level at entry, while each bar shows the mean limitation level observed at the corresponding observation horizon. Scores are expressed as a percentage of each domain's maximum possible value, allowing comparisons across domains with different scales.

As identified in figure 5, the initial levels of functional limitation are highly heterogeneous. Eating and drinking (5.7% of the total possible score), changing body position (5.9%), and indoor mobility (7.9%) show almost no limitations at entry, whereas domestic tasks (85.4%) and outdoor mobility (63.6%) are already close to their maximum score. Consistent with this pattern, the largest increases occur in domains where individuals initially retain the greatest functional capacity. Personal hygiene limitations rise from 18.3% at entry to 57.0% after two years and 65.0% after seven years; dressing limitations increases from 29.3% to 64.5% and 70.4%; indoor mobility from 7.9% to 39.3% and 47.5%; and eating and drinking from 5.7% to 22.9% and 28.2%. By contrast, domains that are already highly impaired at entry exhibit limited further deterioration, with domestic tasks increasing only from 85.4% to 92.8% and health maintenance remaining broadly stable around 71%, suggesting a ceiling effect. The decision-making domain (for individuals assessed using Special BVD scale B only) increases from 48.8% at entry to 69.3% after two years and then stabilises at 71.2% after seven years, showing a moderate but relatively flat trajectory compared with the continued deterioration observed in most physical self-care domains. Finally, a common pattern across all domains is that most deterioration occurs within the first two years after entering the LTC system, with only modest additional increases over subsequent follow-up.

Figure 10. Limitations level by BVD domain and horizon.



Note: N = 40,958 at the two-year horizon, 43,332 at three years, 27,918 at five years, and 10,693 at seven years. Scores are expressed as a percentage of each domain's maximum value (100% = complete functional limitation). The black dot represents the mean baseline score, and each bar the mean score at the corresponding observation horizon.

5.3.2 Results of the empirical model

Figure 11 reports OLS estimates of the third model, which investigates the association between benefit intensity (the share of days within the observation window covered by each benefit type) and the magnitude of functional deterioration among survivors who experienced deterioration. The upper panel plots the association between benefit intensity and the relative loss of functional autonomy, measured as the share of the remaining functional margin at baseline lost during follow-up, at each observation horizon. The lower panel decomposes this relative loss of autonomy by BVD domain at the two-year horizon, with each domain-specific outcome expressed as the share of the remaining functional margin in that domain at baseline.

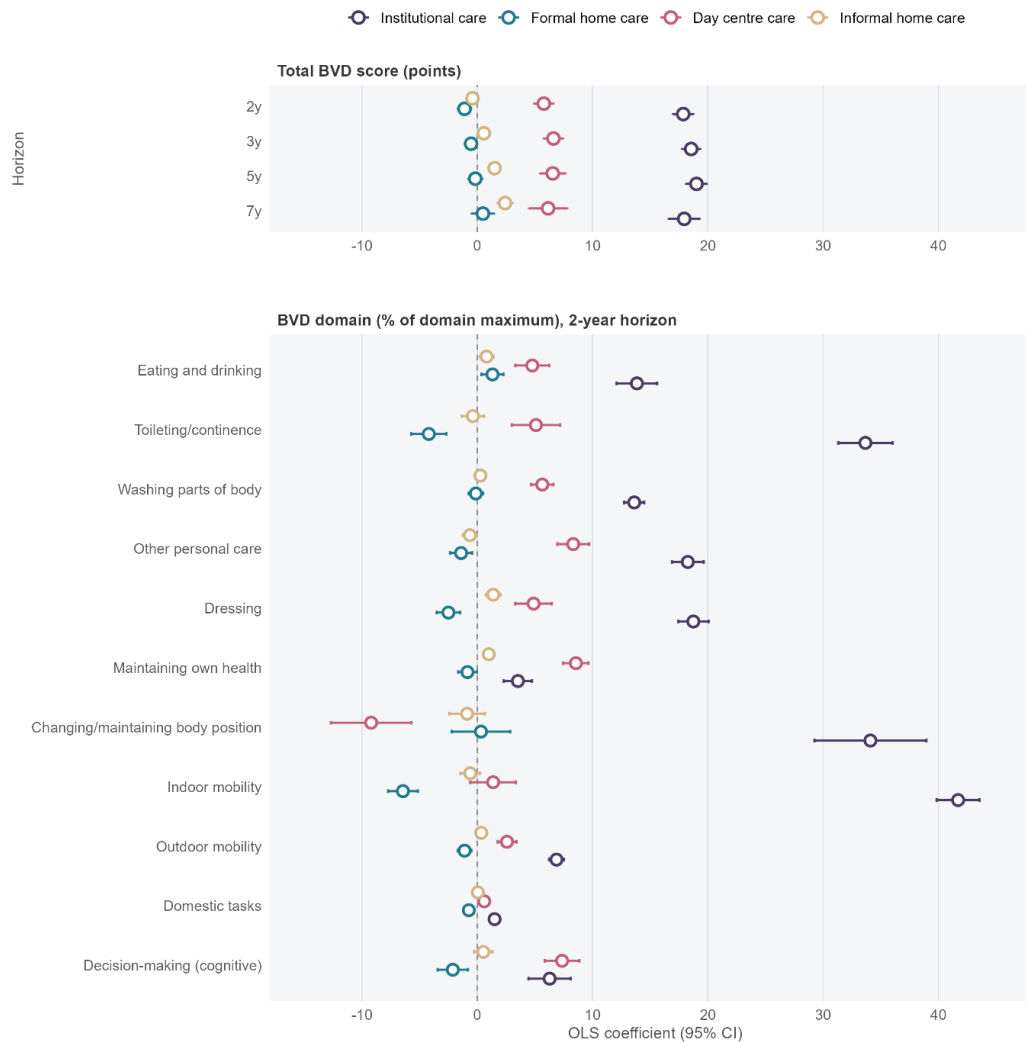
The total BVD panel (upper panel) shows a very similar ranking across all follow-up horizons. Individuals in institutional care experience by far the largest relative loss of functional autonomy. Day centre users also show a clear loss, although substantially smaller. The estimates for both institutional care and day centres remain fairly stable as the follow-up horizon increases. By contrast, individuals receiving home-based support experience only small relative losses in autonomy across all horizons. Formal home care remains close to zero throughout, while informal home care shows a slight increase over time, although the magnitude remains modest. This pattern is consistent with individuals experiencing more substantial losses in autonomy moving from home-based care to day centres or institutional care, while those remaining at home experience comparatively limited deterioration.

The domain-specific results (lower panel) show that the larger relative losses in autonomy among individuals in institutional care are concentrated in a small number of activities of daily living. The largest differences are observed for toileting and continence, changing and maintaining body position, and indoor mobility, suggesting that deterioration in these domains is most strongly associated with entry into institutional care. Smaller, but still clearly positive, relative losses in autonomy are observed for eating and drinking, washing parts of the body, and dressing. In these domains, day centre users also experience deterioration, although to a lesser extent than individuals in institutional care.

Decision-making follows a different pattern, with institutional care and day centre users showing similar (and smaller) relative losses in autonomy, while outdoor mobility also deteriorates in both groups, although somewhat more in institutional care. By contrast, individuals receiving formal or informal home-based support show very limited relative losses in autonomy across domains. Those receiving informal home care experience only modest losses, mainly in dressing and maintaining their own health, whereas those receiving formal home care show only small losses in eating and drinking. Some domains even display small negative estimates for formal home care, suggesting that maintaining a minimum level of autonomy in these activities may be necessary to continue receiving care at home. Similarly, day centre users show little or no deterioration in mobility-related domains, consistent with the fact that attending a day centre requires individuals to retain a certain degree of physical mobility.

These results should not be interpreted as causal effects of the care setting. Rather, they indicate that the deterioration leading to institutional care is concentrated in a small set of mobility- and continence-related functions, whereas individuals who remain in home-based care tend to experience comparatively smaller relative losses in functional autonomy over time.

Figure 11. Forest plot of the association between benefit intensity and relative functional deterioration: total BVD score across follow-up horizons (upper panel) and BVD domains at the two-year horizon (lower panel).



Note: OLS estimates with 95% confidence intervals. The sample is restricted to individuals who survived and experienced functional deterioration within the corresponding follow-up window (N = 40,958 at two years; 43,332 at three years; 27,918 at five years; and 10,693 at seven years). Benefit intensity is measured as the share of days within each observation window during which each benefit type was received; benefit types are not mutually exclusive. The outcome in the upper panel is the relative change in the total BVD score, measured as the share of the remaining functional margin at baseline lost during follow-up. The lower panel reports the corresponding domain-specific relative changes, with each expressed as the share of the remaining functional margin in that domain at baseline, ensuring comparability across domains and BVD scales. All models control for the baseline BVD (or domain) score, months to reassessment, age at entry, sex, marital status, BVD scale, fifteen diagnostic indicators recorded at entry, and year-of-entry fixed effects. The decision-making domain is defined only under the cognitive BVD scale (Scale B) and is therefore estimated on the corresponding subsample (N = 24,946).

6. Discussion

The results describe a system in which greater exposure to LTC benefits is consistently associated with lower mortality and longer survival. Over the seven-year follow-up, this translates into between 0.36 and 1.40 additional life-years relative to receiving no benefit, depending on the type of benefit received. At the same time, higher benefit intensity is associated with a greater probability of recorded functional deterioration among survivors. These findings are consistent with the natural progression of LTC needs and with a survival selection mechanism: as more individuals survive for longer, more remain at risk of experiencing further declines in functional autonomy. Interpreting these associations nevertheless requires separating mechanisms that the present design cannot fully disentangle but that have different policy implications.

Individuals who die cannot subsequently experience functional deterioration. Therefore, benefits that are associated with lower mortality also leave more people alive to experience future functional decline. This is particularly relevant in an LTC population, where individuals have already entered the system because their functional capacity has begun to decline. The proportion of individuals recorded as deteriorating initially increases with the length of the observation window (from 17.7% at two years to 22.6% at three), before declining at longer horizons (15.8% at seven years) as mortality progressively reduces the number of survivors. This deterioration varies considerably across care benefits, with institutional care showing the greatest observed declines in functional autonomy: taking institutional care as the reference, home-based benefits are associated with between roughly 1.7 (day centre care) to 3.5 years (informal home care) free of grade progression over the seven-year window, while the corresponding differences for within-grade deterioration remain below half a year in either direction. Institutional care, which is associated with the smallest survival gain (in absolute time), is also the setting under which grade progression is fastest, whereas home-based benefits combine the largest survival gains with the longest time free of grade progression. This pattern is again consistent with selection, since institutional care concentrates the more dependent individuals and is typically initiated after a substantial loss of autonomy.

In other words, institutional care is not allocated at random. It is restricted to individuals $BVD \geq 50$, concentrating the individuals with the highest levels of need, who require more intensive care, and it is frequently the arrangement adopted in response to functional deterioration. This selection also helps explain why institutional care yields the smallest gains in life-years (0.36) despite being associated with the largest relative reduction in mortality in the first model, and the highest share of functional deterioration. The domain-specific analysis of deterioration shows that the largest associations with declines are concentrated in indoor mobility, changing and maintaining body position, and continence/toileting, domains that are closely related to the ability to remain at home and therefore often trigger the transition towards more intensive care arrangements.

A line for future research would be to weigh the survival gains associated with each care arrangement against its cost, assigning a monetary value to the life-years gained. Such an analysis would require linking the registry to unit costs, public expenditure and private co-payments across providers and levels of government, together with causal estimates robust to selection into care settings. It would also require quality weights suited to a population living with substantial functional limitations, since these life-years cannot be treated as equivalent to full quality-adjusted life-years (QALYs).

The reassessment process itself may also contribute to these patterns. In the Spanish LTC system, reassessments are demand-driven: they occur only when individuals or their families request a review of LTC needs, typically because they perceive that functional deterioration may justify a higher grade and, consequently, higher benefits. Individuals who do not receive LTC benefits face weaker incentives and less institutional support to initiate this process, making their functional deterioration less likely to be recorded. As a result, deterioration among individuals without benefits is likely to be underestimated. This interpretation is consistent with our data. Individuals without benefits have the shortest average follow-up (1,285 days), the second-highest mortality rate (52.5%), and comparatively low recorded rates of functional deterioration. Moreover, the estimated association between institutional care and the magnitude of deterioration changes little across follow-up horizons, ranging from 17.9 to 19.0 BVD points between the two- and seven-year windows. This stability may suggest that reassessments capture deterioration once it has crossed the threshold required to prompt a review, rather than continuously tracking functional decline over time.

These results illustrate the analytical value of the information within the BVD. Disaggregating the assessment reveals that deterioration is concentrated in a limited number of functional domains. This provides a more nuanced understanding of how needs evolve after entry into the LTC system.

Our findings complement previous evidence on the relationship between LTC benefits and mortality (Hernández-Pizarro, 2016; Prades-Colomé, 2025), confirming that greater benefit intensity is associated with lower mortality. By distinguishing between different benefit types and exploiting the domain-level information contained in the BVD, we show that different care benefits are associated with distinct patterns of functional deterioration, reflecting the different care needs to which they respond.

Some limitations should be acknowledged. First, our estimates should be interpreted as associations, as neither the timing nor the intensity of benefit receipt is randomly assigned (Hernández-Pizarro et al., 2020). Second, functional status is observed only at reassessment, so not all changes in autonomy are captured, and the timing of observed deterioration may not coincide with the timing at which it actually occurred.

Future research could broaden the evaluation of LTC systems by complementing measures of functional autonomy with outcomes capturing care-related quality of life and well-being. A more detailed analysis of transitions between grades of LTC needs and benefit types, combined with causal identification strategies, would provide further insights into how care trajectories evolve over time.

7. Conclusion

Using Catalan registers from individuals who applied for public LTC benefits between 2015 and 2024, this paper provides one of the first population-wide descriptions of functional trajectories after entry into the LTC system. By exploiting repeated BVD assessments, we are able to examine how mortality, but also functional autonomy, evolves under different LTC benefits.

Greater exposure to LTC benefits is consistently associated with lower mortality, translating into between 0.36 and 1.40 additional life-years over seven years relative to receiving no benefit. Among survivors, a higher share of days receiving a benefit is also associated with a greater probability of recorded functional

deterioration, with the largest and fastest declines observed among individuals in institutional care. Domain-level analyses further show that deterioration is concentrated in indoor mobility, changing and maintaining body position, and continence/toileting.

From a policy perspective, our results indicate that LTC benefits can extend the lives of individuals with LTC needs while providing support throughout the progressive decline in functional autonomy. In the context of population ageing, this highlights the importance of strengthening LTC systems to meet the growing demand for care associated with longer lives lived with LTC needs. They also demonstrate the value of routinely collected functional assessment data for understanding how LTC needs evolve and for informing the design and evaluation of LTC policies in ageing societies.

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9. Appendix

Results of the Propensity Score Matching Analysis

This appendix reports the covariate balance achieved by the kernel matching estimator of Section 5.4 (Tables A1-A4) and the corresponding average treatment effects on the treated (Figure A1).

Table A1. Covariate balance before and after matching. Informal home care vs. no benefit (5 years horizon).

Covariate	Mortality		Grade worsening		Within-grade worsening	
	Before	After	Before	After	Before	After
Age at entry	-0.337	-0.041	-0.226	-0.121	-0.284	-0.104
Sex	0.054	-0.031	-0.149	-0.073	-0.140	-0.068
LTC needs score (BVD)	-0.240	-0.022	0.167	0.029	0.193	0.008
Cognitive impairment	-0.097	0.007	-0.115	0.012	-0.140	0.023
Dependency grade II	0.075	-0.008	0.158	0.066	0.197	0.039
Dependency grade III	-0.289	-0.021	0.029	-0.028	0.073	-0.026
Marital status: single	-0.379	-0.012	-0.639	-0.011	-0.678	-0.014
Marital status: missing	-0.052	0.003	-0.061	0.004	-0.042	0.004
Neurological	0.000	0.000	0.061	0.025	0.046	0.029
Circulatory	-0.088	-0.008	-0.003	-0.011	0.009	-0.008
Digestive	-0.011	-0.007	0.031	0.008	0.021	0.005
Osteoarticular	0.086	0.000	-0.032	-0.021	-0.025	-0.021
Endocrine-metabolic	0.074	0.002	0.066	0.017	0.062	0.009
Eye	0.045	0.002	-0.028	-0.009	-0.050	-0.009
Ear	0.013	-0.002	-0.035	-0.019	-0.034	-0.012
Respiratory	-0.034	-0.003	0.077	0.030	0.074	0.015
Nephro-urology	-0.037	-0.014	0.013	-0.020	-0.009	-0.015
Mental disorder	0.001	0.011	-0.145	0.011	-0.148	0.018
Cancer	-0.081	-0.005	-0.041	0.009	-0.042	0.004
Paediatric	0.002	0.001	0.002	0.013	0.007	0.015
Haematologic	-0.100	-0.012	0.046	0.005	0.051	0.004
Infectious	-0.047	-0.003	-0.004	-0.003	0.001	-0.011
Dermatologic	0.006	0.001	-0.003	0.009	-0.001	0.009

Notes: Standardised mean differences (SMD) between treated and control individuals for each matching covariate, before and after kernel matching, at the 5-year horizon. Each outcome uses its own conditional sample (mortality: full sample; grade worsening: survivors; within-grade worsening: individuals free of death and grade worsening), so covariate distributions and sample sizes differ across the three blocks. Grade II and grade III are indicators relative to grade I; marital status categories are relative to partnered; diagnosis groups follow the ICD-10 classification. Only the subsample at the 5 years horizon is included due to the extensive length of including the 4 different horizons, but results were similar in all cases.

Table A2. Covariate balance before and after matching. Formal home care vs. no benefit (5 years horizon).

Covariate	Mortality		Grade worsening		Within-grade worsening	
	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>
Age at entry	-0.197	-0.013	-0.010	-0.017	-0.070	-0.006
Sex	0.179	0.015	0.052	-0.014	0.096	0.006
LTC needs score (BVD)	-0.407	0.004	-0.040	0.022	-0.035	0.023
Cognitive impairment	-0.025	0.012	0.004	0.026	-0.014	0.021
Dependency grade II	-0.035	0.004	0.026	0.025	0.045	0.029
Dependency grade III	-0.365	0.001	-0.038	0.005	0.018	0.001
Marital status: single	-0.289	-0.004	-0.433	-0.022	-0.394	-0.020
Marital status: missing	-0.006	-0.004	-0.007	0.000	0.001	-0.013
Neurological	-0.058	0.008	-0.026	0.017	-0.074	0.013
Circulatory	-0.075	-0.009	0.009	0.002	-0.008	0.006
Digestive	-0.055	-0.006	-0.034	-0.009	-0.037	-0.009
Osteoarticular	0.201	0.010	0.121	-0.013	0.142	-0.001
Endocrine-metabolic	0.039	0.002	0.037	0.018	0.029	0.013
Eye	0.071	-0.002	-0.017	-0.017	-0.032	-0.009
Ear	0.048	-0.001	-0.001	-0.013	-0.015	-0.009
Respiratory	-0.046	-0.009	0.063	0.035	0.073	0.019
Nephro-urology	-0.065	-0.008	-0.012	0.000	-0.045	0.001
Mental disorder	0.129	0.017	0.019	0.017	0.044	0.019
Cancer	-0.093	-0.004	-0.062	0.009	-0.052	0.004
Paediatric	-0.002	-0.001	-0.015	0.003	-0.020	0.007
Haematologic	-0.124	-0.014	-0.013	-0.009	-0.016	-0.003
Infectious	-0.045	-0.005	-0.011	-0.004	-0.003	-0.002
Dermatologic	-0.001	-0.003	-0.025	-0.004	-0.013	-0.007

Notes: Standardised mean differences (SMD) between treated and control individuals for each matching covariate, before and after kernel matching, at the 5-year horizon. Each outcome uses its own conditional sample (mortality: full sample; grade worsening: survivors; within-grade worsening: individuals free of death and grade worsening), so covariate distributions and sample sizes differ across the three blocks. Grade II and grade III are indicators relative to grade I; marital status categories are relative to partnered; diagnosis groups follow the ICD-10 classification. Only the subsample at the 5 years horizon is included due to the extensive length of including the 4 different horizons, but results were similar in all cases.

Table A3. Covariate balance before and after matching. Day centre care vs. no benefit (5 years horizon).

Covariate	Mortality		Grade worsening		Within-grade worsening	
	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>
Age at entry	-0.363	-0.011	-0.164	-0.062	-0.145	-0.023
Sex	0.163	-0.010	-0.004	-0.030	0.009	-0.007
LTC needs score (BVD)	-0.145	0.013	0.309	-0.015	0.531	-0.001
Cognitive impairment	0.503	0.032	0.549	0.032	0.508	0.031
Dependency grade II	0.201	0.015	0.278	-0.011	0.514	-0.003
Dependency grade III	-0.286	-0.004	0.048	-0.001	0.227	0.003
Marital status: single	-0.201	-0.014	-0.390	0.000	-0.286	0.000
Marital status: missing	-0.064	-0.002	-0.070	0.004	-0.106	0.003
Neurological	0.471	0.028	0.553	0.027	0.491	0.023
Circulatory	-0.205	-0.003	-0.130	-0.020	-0.161	-0.012
Digestive	-0.053	-0.009	-0.031	-0.001	0.006	0.001
Osteoarticular	-0.018	-0.012	-0.180	-0.031	-0.170	-0.012
Endocrine-metabolic	0.046	-0.004	0.030	-0.003	0.060	0.012
Eye	-0.011	-0.014	-0.110	-0.002	-0.123	0.000
Ear	0.023	-0.009	-0.037	-0.012	-0.036	0.010
Respiratory	-0.184	-0.004	-0.070	-0.005	-0.084	-0.009
Nephro-urology	-0.114	-0.004	-0.050	-0.013	-0.067	-0.005
Mental disorder	0.094	0.004	-0.028	0.020	0.011	0.011
Cancer	-0.073	-0.005	-0.017	-0.009	0.005	-0.016
Paediatric	0.001	-0.005	-0.014	0.003	-0.027	-0.001
Haematologic	-0.201	-0.007	-0.049	-0.005	-0.080	-0.007
Infectious	-0.066	-0.002	-0.013	0.006	0.012	-0.004
Dermatologic	-0.029	0.000	-0.033	0.003	-0.048	-0.002

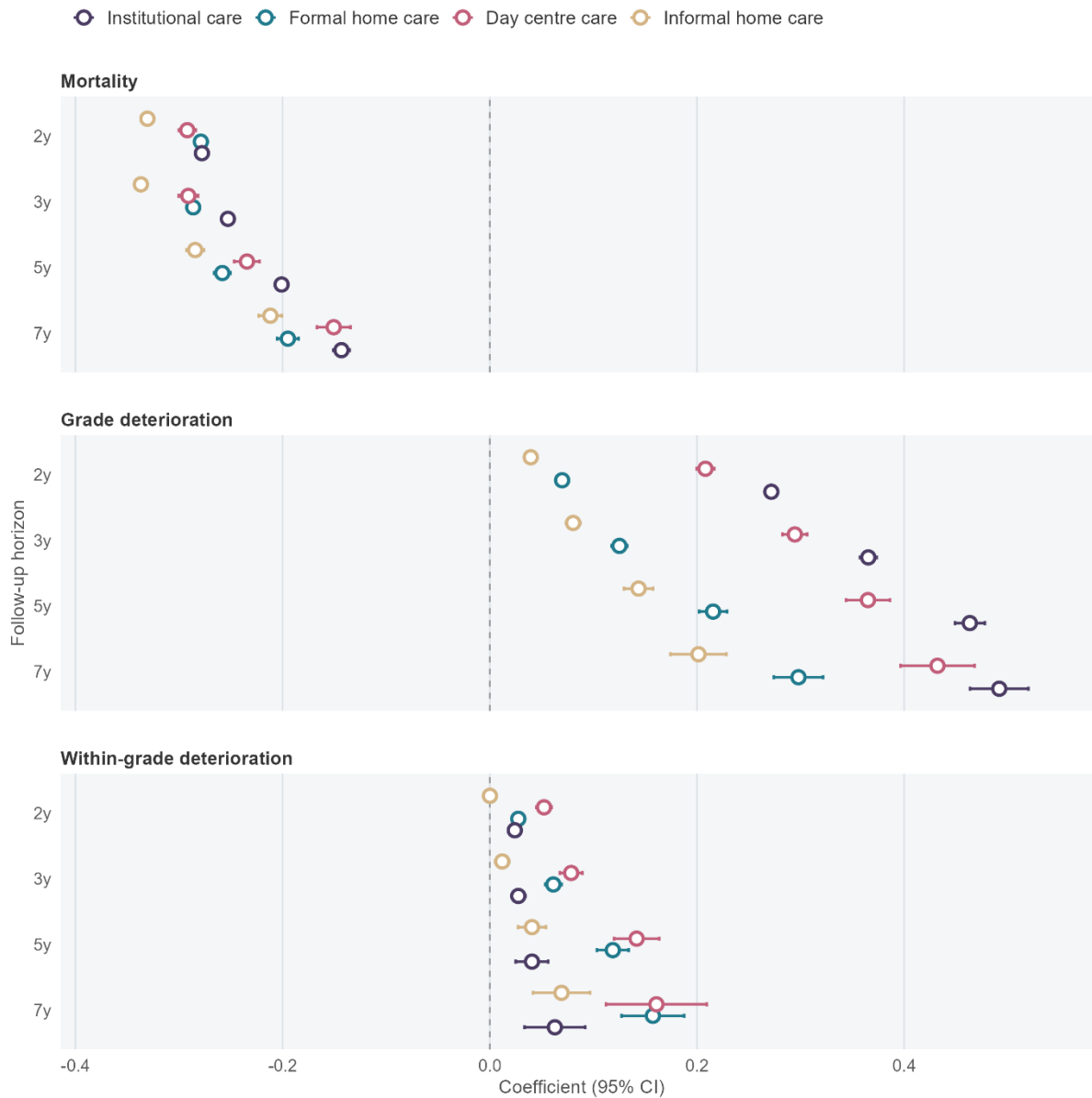
Notes: Standardised mean differences (SMD) between treated and control individuals for each matching covariate, before and after kernel matching, at the 5-year horizon. Each outcome uses its own conditional sample (mortality: full sample; grade worsening: survivors; within-grade worsening: individuals free of death and grade worsening), so covariate distributions and sample sizes differ across the three blocks. Grade II and grade III are indicators relative to grade I; marital status categories are relative to partnered; diagnosis groups follow the ICD-10 classification. Only the subsample at the 5 years horizon is included due to the extensive length of including the 4 different horizons, but results were similar in all cases.

Table A4. Covariate balance before and after matching. Institutional care vs. no benefit (5 years horizon).

Covariate	Mortality		Grade worsening		Within-grade worsening	
	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>
Age at entry	-0.087	-0.050	0.128	-0.066	0.132	0.059
Sex	0.202	0.004	0.071	0.009	0.054	0.056
LTC needs score (BVD)	0.246	-0.006	0.680	0.044	1.763	0.089
Cognitive impairment	0.445	0.008	0.487	0.007	0.628	0.089
Dependency grade II	0.334	0.012	0.520	-0.008	1.148	-0.135
Dependency grade III	0.053	-0.008	0.315	0.071	0.755	0.162
Marital status: single	0.054	-0.022	-0.119	-0.038	-0.050	0.004
Marital status: missing	-0.034	-0.003	-0.040	-0.002	-0.019	-0.016
Neurological	0.392	0.005	0.479	-0.017	0.653	0.036
Circulatory	-0.183	-0.013	-0.097	-0.024	-0.129	-0.009
Digestive	-0.036	-0.009	-0.016	-0.004	-0.013	0.010
Osteoarticular	0.000	-0.012	-0.131	-0.017	-0.221	-0.007
Endocrine-metabolic	-0.007	0.003	-0.041	0.013	-0.076	-0.007
Eye	-0.017	-0.004	-0.116	-0.005	-0.176	0.026
Ear	0.043	0.001	-0.005	0.006	-0.041	0.046
Respiratory	-0.214	-0.001	-0.098	-0.006	-0.135	-0.036
Nephro-urology	-0.066	-0.014	0.007	-0.023	-0.010	-0.016
Mental disorder	0.075	0.001	-0.052	-0.007	-0.073	-0.004
Cancer	-0.082	0.000	-0.054	-0.003	-0.052	-0.011
Paediatric	0.001	-0.001	0.004	0.014	0.015	0.049
Haematologic	-0.206	-0.006	-0.060	-0.005	-0.085	0.004
Infectious	-0.055	0.000	-0.009	-0.003	0.001	0.020
Dermatologic	-0.004	-0.002	-0.025	-0.002	-0.010	0.009

Notes: Standardised mean differences (SMD) between treated and control individuals for each matching covariate, before and after kernel matching, at the 5-year horizon. Each outcome uses its own conditional sample (mortality: full sample; grade worsening: survivors; within-grade worsening: individuals free of death and grade worsening), so covariate distributions and sample sizes differ across the three blocks. Grade II and grade III are indicators relative to grade I; marital status categories are relative to partnered; diagnosis groups follow the ICD-10 classification. Only the subsample at the 5 years horizon is included due to the extensive length of including the 4 different horizons, but results were similar in all cases.

Figure A1. Average treatment effect on the treated of each LTC benefit category, by outcome and follow-up horizon.



Notes: Each point is the average treatment effect on the treated (ATT) of receiving the corresponding LTC benefit category relative to receiving no benefit, estimated by propensity score kernel matching. Horizontal bars are 95% confidence intervals from 199 bootstrap replications, each re-estimating the propensity score. Outcomes are estimated on conditional samples following the main specification: mortality on the full sample, grade worsening among survivors, and within-grade worsening among individuals who neither died nor experienced grade worsening. Colours denote benefit categories; rows denote follow-up horizons (2, 3, 5 and 7 years).

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