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Abstract

Population ageing and declining availability of informal care are increasing unmet long- term care (LTC) needs across Europe. While previous studies document associations between unmet LTC needs and adverse health outcomes, evidence on their relationship with healthcare access remains limited. This paper examines the relationship between unmet LTC needs and healthcare access among older Europeans, conceptualising LTC as an enabling input that supports daily activities, instrumental tasks, and mobility. Using data from Waves 8 and 9 of the Survey of Health, Ageing and Retirement in Europe (SHARE), combined with both waves of the SHARE Corona Survey, I focus on individuals aged 65 and over with functional limitations. To address potential endogeneity, I use an instrumental-variable strategy based on variation in informal care availability. The IV estimates suggest that unmet LTC needs are associated with substantially lower use of healthcare services, consistent with potential spillover effects from LTC provision into the healthcare system. These findings suggest that strengthening LTC services may improve equity in healthcare access and help prevent delayed treatment and avoidable health deterioration that ultimately increases pressure on healthcare systems.

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Introduction

Europe is experiencing a rapid demographic transition that is placing increasing pressure on welfare systems and public finances, with particularly strong implications for the organization and sustainability of long-term care (LTC) systems. Population ageing and rising disability prevalence among older adults are expected to substantially increase demand for LTC services, potentially exacerbating disparities in access and leading to a growing share of unmet LTC needs among the elderly (García-Gómez et al., 2015). Even in countries with relatively developed formal care systems, families have traditionally played a central role in supporting older adults (Van den Berg et al., 2004; Gannon & Davin, 2010; Di Novi et al., 2015; Brenna & Di Novi, 2016). Informal care, most often supplied by adult children, has long represented a key source of assistance for frail elderly individuals, functioning both as a substitute for and complement to formal LTC services (Van Houtven & Norton, 2004, 2008; Bolin et al., 2008). However, this model is increasingly under strain. The gradual weakening of family ties, together with rising female labour force participation and changing household structures, has reduced the availability of informal caregivers across much of Europe (Carrieri et al., 2017; Spasova et al., 2018). At the same time, demographic change is sharply increasing the elderly dependency ratio, further constraining the potential supply of both formal and informal care. By 2050, more than two-thirds of European countries are projected to reach an elderly dependency ratio exceeding 50%, implying fewer than two working-age individuals per person aged 65 and over (Eurostat, 2019; see Figure 1A in the Appendix). Mediterranean countries are expected to experience some of the most pronounced demographic pressures, with Italy, Greece, and Portugal projected to reach dependency ratios above 65%. These same countries are characterized by relatively low public investment in LTC services and limited coverage for those who are non-self-sufficient. Figure 2A in the Appendix illustrates LTC expenditure (including both health and social care) as a percentage of GDP across OECD countries (OECD, 2023).[1] While countries such as the Netherlands, Norway, Sweden, and Denmark allocate between 3 and 4.5 percent of GDP to LTC spending, Southern and Eastern European countries typically devote around 1 percent or less. This combination of rapid population ageing, limited formal LTC provision, and declining informal care availability raises concerns about a growing prevalence of unmet LTC needs among older adults.

LTC is an essential component of social welfare systems and refers to services provided to individuals with reduced physical or cognitive functional capacity who require sustained assistance with everyday activities. It includes both personal care related to activities of daily living (ADLs), such as dressing and bathing, and lower-intensity support for instrumental activities of daily living (IADLs), including household tasks (Colombo et al., 2011). Although LTC is not age-specific, recipients are predominantly aged 65 and over. Gaps in provision may have important consequences not only for older adults' health and well-being. In particular, when functional limitations are not adequately supported, older individuals may face binding mobility and

[1] The OECD distinguishes between health-related and social LTC expenditures. The former includes palliative, nursing, and personal care, as well as services supporting care at home, while the latter covers home help, residential care, and other services primarily assisting with activities of daily living (Colombo et al., 2011).

organisational constraints that increase the effective cost of accessing healthcare, even in the presence of medical need. While a substantial literature links unmet LTC needs to adverse health outcomes, including increased morbidity and mortality (Momtaz et al., 2012; Marrero et al., 2019; Song & Sun, 2023; Huang et al., 2024), far less is known about their implications for access to healthcare services. Although older adults are typically intensive users of healthcare (Brandao et al., 2022), their healthcare access depends not only on medical need but also on functional capacity. Barriers such as limited mobility, transportation constraints, and difficulties in accessing and navigating healthcare information may increase the non-monetary costs of healthcare use (Zhang et al., 2022). Therefore, when LTC needs are unmet, the absence of practical assistance can prevent individuals from translating clinical need into effective healthcare utilisation. Within this framework, LTC can be conceptualized as an enabling factor that supports older adults with functional limitations in accessing healthcare services (Andersen & Newman, 1973).[2] In this perspective, LTC encompasses not only assistance with basic daily activities but also instrumental and organisational support, such as transportation, accompaniment, or help with coordinating appointments, that enables individuals with functional limitations to translate health needs into realized healthcare utilisation. More broadly, LTC, by reducing organisational and mobility-related frictions, lowers the non-monetary costs associated with seeking care.

Despite the relevance of the mechanisms outlined above, empirical evidence on the role of unmet LTC needs as a barrier to healthcare access remains limited. This paper provides new evidence on the relationship between unmet LTC needs and healthcare access among older Europeans. Using data from waves 8 and 9 of the Survey of Health, Ageing and Retirement in Europe (SHARE), combined with information from both waves of the SHARE Corona Survey, the analysis focuses on hospital admissions, influenza vaccination, and GP contacts as indicators of healthcare access spanning services with progressively higher mobility and organisational requirements. An instrumental-variable strategy based on variation in informal care availability is used to address the potential endogeneity of unmet LTC needs.

The IV estimates suggest that unmet LTC needs are associated with lower effective healthcare access among older adults, with larger point estimates for services requiring greater organisational and mobility support, such as hospital admissions and preventive care, and smaller point estimates for lower-intensity services such as GP contacts. This gradient across services provides evidence consistent with LTC functioning as an enabling input that reduces non-monetary barriers to healthcare access. These findings suggest that gaps in LTC provision may generate distortions in healthcare utilisation by preventing high-need individuals from translating medical need into realized access. Strengthening LTC systems may therefore improve both equity and allocative efficiency in ageing healthcare systems.

[2] The behavioral model developed by Andersen and Newman (1973) conceptualizes healthcare utilisation as the result of predisposing, enabling, and need factors. Although health needs are central, empirical evidence shows that utilisation is also shaped by non-need-related determinants. Within this framework, LTC can be interpreted as an enabling factor that supports access to healthcare services for individuals with functional limitations.

This paper contributes to several strands of the literature. First, it shifts the focus from the health consequences of unmet LTC needs to their potential role as a barrier to healthcare access. Second, it contributes to the economics of ageing by conceptualizing LTC as an enabling input that may reduce the non-monetary costs of seeking care, thereby clarifying the mechanisms linking functional limitations to realized healthcare utilisation. Third, it provides new evidence on the relationship between unmet LTC needs and access to healthcare services with different mobility and organisational requirements. Finally, by documenting a gradient in IV estimates across services, the analysis highlights how gaps in LTC provision may distort healthcare utilisation and generate allocative inefficiencies in ageing systems.

The remainder of the paper is organized as follows. Section 2 describes the data, Section 3 introduces the main variables, Section 4 outlines the empirical strategy, Section 5 presents the results, and Section 6 concludes.

2. Data

The data used in this study come from Waves 8 and 9 of SHARE and the SHARE Corona Survey (first and second wave). SHARE is a biannual, cross-national, and longitudinal research project that collects data on individuals aged 50 and older and their younger partners. Supervised by the Munich Research Institute for the Economics of Aging (MEA), SHARE is the most comprehensive European survey on ageing. It is organized into modules, each identified by two letters, which gather detailed information on various aspects, including health status and socioeconomic characteristics of individuals over 50 in Europe (Börsch-Supan et al., 2013).[3]

Both Waves 8 and 9 of the SHARE survey were conducted using computer-assisted personal interviews (CAPI) based on a standardized questionnaire. Wave 8 took place between October 2019 and March 2020 but was suspended due to the COVID-19 pandemic and the associated restrictions, which made face-to-face interviews impractical. Between June and September 2020, a sub-sample of Wave 8 (approximately 70% of the original sample) was re-interviewed via computer-assisted telephone interviews (CATI) to collect additional information on participants' living conditions during the pandemic (first wave of the SHARE Corona Survey). The data gathered provide a comprehensive overview of COVID-19's impact on the adult and elderly population, including information on COVID-19 infections, life changes during lockdown, physical and mental health, medical treatments, social networks, and economic changes caused by the pandemic. The same sub-sample was re-interviewed a year later, from June to August 2021, for the second wave of the SHARE Corona Survey. Finally, Wave 9 of SHARE was conducted between October 2021 and October 2022.

[3] The analysis is restricted to SHARE Wave 8, the two SHARE Corona Survey waves, and SHARE Wave 9 in order to exploit the most recent harmonized information available on social networks, unmet LTC needs, and healthcare utilisation.

The sample comprises 9,086 individuals aged 65 and older with LTC needs arising from limitations in ADL, IADL, or mobility, drawn from 25 European countries participating in SHARE: Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, and Switzerland.[4] ADLs capture basic self-care activities, IADLs refer to instrumental tasks related to independent living, and mobility limitations reflect difficulties in walking, postural changes, and handling objects.

3. Key variables

3.1 Unmet LTC needs (treatment variable)

A key challenge in accurately measuring unmet LTC needs (the "treatment variable") is the lack of a universally accepted definition. Typically, needs are assessed based on the level of ill-health, with unmet needs defined as the failure to receive available and effective treatment that could improve health (Vlachantoni et al., 2011; Smith & Connolly, 2020). Following this approach, I define unmet LTC needs using three dimensions commonly employed in geriatric research: ADL/ IADL limitations and mobility (LaPlante et al., 2004; Vlachantoni et al., 2011; Smith & Connolly, 2020; Calderón-Jaramillo & Zueras, 2023). Individuals reporting any of these functional limitations are considered to have an objective need for LTC. LTC is here broadly defined as any assistance with ADL, IADL, or mobility limitations, irrespective of whether care is provided formally or informally. I then create a binary indicator equal to one if the individual reports not receiving help for at least one of these limitations, and zero otherwise. In SHARE Wave 8, this is captured by the question: "Thinking about the activities that you have problems with, does anyone ever help you with these activities, including your partner or other people in your household?" Respondents answering "No" are classified as having unmet LTC needs, reflecting a lack of support (García-Gómez et al., 2015).

3.2 Healthcare utilisation (outcome variables)

To examine whether unmet LTC needs are associated with lower healthcare utilisation, and whether effects differ across services with increasing mobility and organisational requirements, I examine three outcomes collected in SHARE Wave 9: primary care (GP contacts), preventive care (influenza vaccination), and hospital access. Outcomes are based on self-reported information from the SHARE healthcare utilisation module referring to the twelve months preceding the interview.

Among healthcare services, primary care is considered a key component. In particular, GPs are often the initial point of contact for older adults within the healthcare system and play a pivotal role in managing care needs, acting as essential gatekeepers for both physical and psychological health conditions (Mohan et al.,

[4] Although the survey also included Israel, this country was excluded from the analysis as it is not part of Europe. In addition, the Netherlands were omitted due to missing data in the variables of interest.

2019). Access to primary care is measured using responses on the total number of contacts (by telephone or other means) with a medical doctor during the past year and, conditional on any contact, on how many of these were with a GP, excluding dentist and emergency visits. Based on these items, I construct a dummy indicator equal to one if the respondent reports any GP contact over the previous year, and zero otherwise.[5]

Preventive care is proxied by an indicator for having received an influenza vaccination in the last year. In SHARE, respondents are asked: "In the last year, did you have a flu vaccination?" (1 = Yes, 0 = No). Based on this item, I construct a binary indicator equal to one if the respondent reports having received a flu vaccination in the previous year, and zero otherwise. Influenza poses a significant health risk for older adults, who are particularly vulnerable to serious complications, hospitalizations, and mortality due to age-related immune decline and the high prevalence of comorbidities. Vaccination therefore represents a key form of preventive care in this population, as it reduces the risk of severe infections, complications, hospitalizations, and deaths (Smetana et al., 2018).

Finally, I use an indicator of hospital access that is captured by a dummy variable indicating whether respondents report any overnight hospital stay during the past year, based on the question: "During the last twelve months, have you been in a hospital overnight? Please consider stays in medical, surgical, psychiatric or in any other specialised wards", taking value one for affirmative responses and zero otherwise.

Throughout the analysis, GP contacts, influenza vaccination, and hospital care are considered as services that differ in the organisational and mobility requirements needed to access care. GP contacts generally involve limited requirements, including remote contacts, while influenza vaccination and hospital care require increasing levels of coordination and resources. This framework allows an assessment of whether unmet LTC needs are associated with differential access across services characterized by increasing organisational demands.

4. Empirical Strategies

To estimate the relationship between unmet LTC needs and older adults' healthcare access, I adopt two empirical strategies.

Let H_{it} denote individual healthcare access for respondent i, measured in SHARE Wave 9 and referring to the twelve months preceding the interview (conducted between October 2021 and October 2022). Let $U_{i,0}$ denote a proxy for unmet LTC needs measured in Wave 8 (during the period October 2019-March 2020).

The model assumes that:

[5] Binary outcomes are well suited to capture access barriers at the extensive margin, which are likely to be the most sensitive (or more sensitive) to unmet LTC needs.

$$H_{it} = \beta_0 + \beta_1 U_{i0} + \varepsilon_i \quad \text{for } i = 1, \dots, n \qquad (1)$$

where β_0 and β_1 are unknown parameters and ε_i is an error term capturing the effect of all the other variables influencing older adults' healthcare access.

I consider two alternative strategies to estimate β_1 using these data. The first, discussed in the next section, relies on ordinary least squares (OLS) and on the availability of a sufficiently abundant set of control variables to ensure that the conditional independence assumption holds. The second, discussed in Subsection 4.4, adopts an instrumental variables (IV) strategy based on the additional information provided by a plausibly valid instrument.

4.1 The conditional independence assumption

The relationship in equation (1) is likely to suffer from omitted variable bias, as other factors affecting older adults' healthcare access, captured by the error term ε_i may be correlated with unmet LTC needs. If some of these factors are observable, such as demographic or socioeconomic characteristics, they can be included as additional controls on the right-hand side of equation (1). Formally, the error term can be decomposed as $\varepsilon_i = \beta_2' \mathrm{X}_{i0} + e_i$, where X_{i0} is a vector of observed control variables (measured in Wave 8, during the period October 2019-March 2020), β_2 is a vector of unknown parameters, and e_i is an error term capturing unobserved factors. Under the assumption that e_i is uncorrelated with unmet LTC needs conditional on X_{i0}, equation (1) can be consistently estimated using OLS. This yields the following estimable specification:

$$H_{it} = \beta_0 + \beta_1 U_{i0} + \beta_2' \mathrm{X}_{i0} + e_i, \; i = 1, \dots, n \qquad (2)$$

where H_{it} denotes individuals' healthcare access, U_{i0} is an indicator of unmet LTC needs and X_{i0} is a vector of individual characteristics. The error term e_i captures unobserved factors affecting individuals' healthcare access.

A useful interpretation of this specification is that older adults' healthcare access reflects both observed characteristics and unobserved health-related heterogeneity that may be time-invariant or slow-moving. By measuring unmet LTC needs and healthcare access in different periods, the empirical design mitigates concerns related to reverse causality and simultaneity. The inclusion of an abundant set of controls aims to account for observable sources of heterogeneity that jointly affect unmet LTC needs and subsequent healthcare access. Under the assumption that, conditional on the observed covariates, unmet LTC needs are uncorrelated with the unobserved component of the error term, the coefficient β_1 can be interpreted as the causal effect of unmet LTC needs on elderly healthcare access and can be consistently estimated using OLS. The interpretation and estimation of β_1 nevertheless crucially depend on assumptions regarding the relationship between unmet LTC needs, observed covariates, and unobserved determinants of healthcare access. If unmet LTC needs remain

correlated with unobserved factors, such as latent health conditions even after conditioning on the available controls, the OLS estimator may be biased and inconsistent, thereby motivating the instrumental variables strategy introduced in Subsection 4.4.

4.2 Choice of control variables

The validity of the OLS strategy outlined in the previous section relies on the appropriate selection of control variables included in X_{i0}. The model takes into account a rich set of individual demographics, socioeconomic, and health-related characteristics, all drawn from Wave 8 of SHARE.

Demographic controls include the respondent's sex (0 = male, 1 = female) and age. Educational attainment is classified according to the International Standard Classification of Education (ISCED) and grouped into three categories: (i) low education (no educational certificate, primary education, or lower secondary education); (ii) medium education (upper secondary education or high school graduation); and (iii) high education (tertiary or postgraduate education). Marital status is categorized as living with a spouse or partner in the same household versus living alone. Income information is based on total annual household income, calculated by summing all income components reported in the questionnaire net of income taxes and social or national insurance contributions. These components primarily include labour income, public pensions, and income from assets. Household income is divided into quintiles. In addition, the model includes a binary indicator equal to one if the respondent reports having private health insurance or insurance coverage for LTC, based on information available in SHARE, and zero otherwise. These variables capture potential financial protection and access to complementary care arrangements that may affect both LTC needs and healthcare access.

The model further controls for physical, mental and cognitive health. Physical health was measured using self-assessed health (SAH), based on a standard single-item question widely employed in empirical research (see, e.g., Di Novi et al., 2024). Respondents rated their general health as excellent, very good, good, fair, or poor. Given the ordinal nature of this measure (O'Donnell et al., 2008), SAH was dichotomized, with fair or poor coded as 1 and excellent, very good, or good coded as 0. Mental health was assessed using the EURO-D scale, developed and validated by the EURODEP Concerted Action Programme. The EURO-D comprises 12 dichotomous items capturing depressive and psychological symptoms, including depression, pessimism, suicidal ideation, guilt, sleep disturbances, loss of interest, irritability, reduced appetite, fatigue, concentration difficulties, anhedonia, and tearfulness. Each item is equally weighted and coded as 0 (symptom absent) or 1 (symptom present). The resulting composite score ranges from 0 to 12, with higher values indicating poorer mental health. Cognitive health was measured using episodic memory, a key component of the cognitive domain. In the SHARE dataset, this indicator is based on immediate and delayed word recall tests involving a list of ten common words. In the immediate recall task, respondents are asked to remember as many words as possible within one minute immediately after hearing the list, while in the delayed recall task they are asked

to recall the words after a series of unrelated interview questions. Each correctly recalled word is assigned one point, and the episodic memory score is obtained by summing the number of words recalled in the immediate and delayed tasks, yielding a range from 0 to 20, with higher values indicating better cognitive functioning (Bloomberg et al., 2023; Bonsang et al., 2012). Since higher values of the episodic memory score reflect better cognitive performance, the measure was reversed so that higher values correspond to poorer cognitive health, in accordance with the other health indicators used in the analysis. Finally, a composite health index was constructed using a polychoric factor analysis, combining SAH, EURO-D, and cognitive health. This approach serves to mitigate potential multicollinearity arising from the simultaneous inclusion of correlated health measures. The resulting index was normalized to range between 0 and 1, with higher values indicating poorer health.

Finally, all specifications include country fixed effects to account for unobserved heterogeneity across countries and interview months.

A full description of the variables used in the analysis is provided in Table 1.

[Table 1 about here]

4.3 Relaxing the conditional independence assumption

Although the elderly's unmet LTC needs and healthcare access are measured using different waves of the SHARE survey, conducted at distinct points in time, thereby minimizing the risk of reverse causality, it remains necessary to take account of factors that may introduce endogeneity into the relationship between these variables, potentially biasing the results. The self-reported indicator of unmet LTC needs is likely to be an imperfect proxy for actual LTC needs, which creates an errors-in-variables problem. Specifically, this may induce a correlation between the observed unmet LTC needs and the structural error e_i complicating the identification of the causal effect of unmet LTC needs on elderly healthcare access. Additional endogeneity may arise if the set of control variables included in X_{i0} omits factors that are difficult to observe or measure but affect both individuals' healthcare access and unmet LTC needs, such as unmeasured health shocks. To address these potential endogeneity issues, I adopt an IV strategy by specifying a "triangular" system of two regression equations. The first equation is the "structural" regression (2), the second equation (3) is the "first stage" regression, where the error term u_i is now assumed to be potentially correlated with the error term e_i even after controlling for the observed covariates X_{i0}.

$$U_{i0} = \gamma_0 + \gamma_1 z_i + \gamma_2' X_{i0} + u_i,\ i = 1, \dots, n \qquad (3)$$

where z_i is the candidate instrument, the γ parameters are unknown, and u_i is an error term potentially correlated with the structural error e_i in the equation (2). The parameters of interest in this system are the

causal effect β_1 of unmet LTC needs on healthcare access and the coefficient γ_1 of the instrument on unmet LTC needs, while all other coefficients are treated as nuisance parameters. Substituting the first-stage regression into the structural regression gives the "reduced-form" equation:

$$H_{it} = \delta_0 + \delta_1 z_i + \delta_2' X_{i0} + v_i,\ i = 1, \dots, n \qquad (4)$$

where $\delta_0 = \beta_0 + \beta_1\gamma_0$, $\delta_1 = \beta_1\gamma_1$, $\delta_2 = \beta_2 + \beta_1\gamma_2$, and $v_i = \beta_1 u_i + \varepsilon_i$. If β_1 and γ_1 have the same sign, then $\delta_1 > 0$, while if either β_1 or γ_1 is zero, then $\delta_1 = 0$. Further, $\beta_1 = \delta_1/\gamma_1$ whenever $\gamma_1 \neq 0$.

According to the IV literature (see, for example, Angrist & Lavy, 1999; Chernozhukov & Hansen, 2008), the first stage and reduced-form regressions provide important information about the validity of the instrument: for instance, if $\delta_1 = 0$, this implies that $\beta_1 = 0$. The causal effect β_1 can be identified and estimated consistently if the instrument z_i is both relevant (sufficiently correlated with unmet LTC needs) and exogenous (uncorrelated with the structural error e_i). With a single endogenous regressor and a single instrument, the model is just-identified and the IV estimate of β_1 coincides with the familiar two-stage least squares (2SLS) estimator (Angrist & Imbens, 1995).

4.4 Exclusion Restrictions

As a source of identification, I exploit information from Wave 8 of SHARE on respondents' adult children.

Despite ongoing demographic change and defamilialization across Europe, a substantial share of LTC continues to be provided informally, primarily by spouses when present and, more prominently, by adult children, who remain the main caregivers for elderly parents. Children's support plays a central role in meeting parental care needs and shaping overall care demand (Brugiavini et al., 2022; Barigozzi et al., 2020; Brenna & Di Novi, 2016; Di Novi et al., 2015).

Figure 3A in the Appendix reports the distribution of informal and formal caregivers (i.e., paid professional home care or assistance due to physical or mental limitations) across European macro-regions using SHARE Wave 8 data. Countries are grouped into Northern Europe (Denmark, Finland, Sweden), Continental Europe (Austria, Belgium, France, Germany, Luxembourg, Switzerland, the Czech Republic, Slovenia), Southern Europe (Cyprus, Greece, Italy, Malta, Spain), Eastern Europe (Bulgaria, Croatia, Hungary, Poland, Romania, Slovakia), and Baltic Europe (Estonia, Latvia, Lithuania).[6] Across all macro-regions, more than 50% of older individuals in need of LTC due to disabilities or functional limitations report receiving regular assistance (daily or weekly) from adult children, with shares exceeding 60% in Southern, Eastern, and Baltic Europe.

To estimate the effect within an IV framework, I use variation in the potential availability of informal care from adult children, treating this variation as plausibly exogenous conditional on the identifying assumptions.

[6] Baltic countries are treated separately due to their distinct historical and socio-economic trajectories.

Specifically, Wave 8 of SHARE includes a module on respondents' personal social networks. Each respondent can name up to seven individuals considered confidants. The module collects information on the respondent's relationship with these confidants (children, relatives, friends, and neighbours), as well as additional characteristics of each network member (gender, degree of kinship, and geographic proximity). Using information from the social network module, I identify children whom respondents consider "confidants." Following Bonsang (2009), I construct an index of informal care availability based on two binary indicators: (i) children's geographic proximity, equal to one if the respondent names at least one child among their close contacts who lives in the same household or building, and zero otherwise; and (ii) the presence of a daughter in the close network, equal to one if the respondent names at least one daughter among their close contacts, and zero otherwise. Respondents without children are assigned zero on both indicators and retained in the baseline sample.[7] Both indicators capture dimensions of potential informal care availability, since geographic distance represents an important cost of caregiving and daughters are substantially more likely than sons to provide assistance with daily activities. To enhance instrument relevance and reduce attenuation from measurement error, I combine these categorical indicators into a continuous index using polychoric factor analysis (Olsson, 1979). Since both variables load on a common latent construct (the availability of informal care) I extract the first factor from their polychoric correlation matrix and standardize the resulting score to range between 0 and 1, with higher values indicating greater availability of informal care. Relative to using multiple binary instruments, this approach efficiently aggregates complementary sources of variation and yields a stronger first-stage relationship with unmet LTC needs (Lubotsky & Wittenberg, 2006).

The instrument is intended to capture potential informal care availability rather than realised caregiving. Importantly, the SHARE social-network module identifies close confidants rather than actual caregivers. While network nomination may reflect endogenous relationship selection, the instrument is designed to proxy the availability of family members who are sufficiently embedded in the respondent's social environment to provide support if needed. SHARE also records whether respondents have at least one daughter among all their offspring, irrespective of whether she is nominated in the close network. I do not use this measure in the baseline instrument because it captures offspring gender composition rather than potential support within the respondent's close network and displays a substantially weaker first-stage association with unmet LTC needs. Instead, the baseline index combines the presence of a daughter in the close network with children's geographical proximity. Nevertheless, both components may be correlated with unobserved determinants of healthcare utilisation or may affect utilisation through channels not captured by the unmet-needs indicator. I therefore assess the sensitivity of the IV estimates to potential violations of the exclusion restriction using the plausible-exogeneity approach proposed by Conley et al. (2012), applied to the composite instrument. The results are reported in Appendix Table A.2.

[7] As a sensitivity check, I exclude respondents without children and reconstruct the informal-care availability index on the restricted sample. The resulting first stage and IV estimates are virtually unchanged, indicating that the baseline findings are not driven by coding childless respondents as zero (see Table A1 in the Appendix).

The analysis is restricted to individuals aged 65 and older with objectively defined functional limitations (ADL, IADL, and mobility impairments). The sample is characterised by a high prevalence of functional deficits: 97.4% report at least one mobility limitation, 37.8% at least one IADL limitation, and 18.2% at least one ADL limitation. In this population, access to healthcare is shaped not only by medical need but also by non-monetary barriers related to mobility and organisational capacity. Unmet LTC needs therefore capture the absence of effective support in overcoming these constraints. The availability of informal care from adult children reduces the non-monetary costs of accessing care by providing transportation, accompaniment, and assistance with administrative tasks. Importantly, these activities constitute the enabling function of LTC itself. To the extent that children facilitate appointment scheduling or coordination, such actions operate precisely through the mechanism of alleviating functional and organisational barriers. In this sense, these forms of support represent the channel through which LTC enables healthcare access, rather than an independent pathway directly affecting healthcare utilisation. The identifying assumption is that, conditional on observed health and socioeconomic characteristics, the instrument affects healthcare utilisation primarily through variation in effective LTC support rather than through an independent behavioural channel.

5. Results

Table 2 presents summary statistics, reporting sample means and standard deviations for all variables included in the model. Approximately 60 percent of the study sample (34 percent male, mean age 75) report unmet LTC needs, defined as experiencing at least one disability or functional limitation without receiving any formal or informal care. In the full sample, 18 percent of respondents report at least one hospital admission, 53 percent received an influenza vaccination, and 87 percent had at least one GP contact in the 12 months preceding the interview. Comparing subsamples by unmet LTC status indicates some observable differences: individuals with unmet LTC needs are on average slightly younger, more likely to be male, and exhibit lower rates of hospital admissions and influenza vaccination, while GP contact rates are broadly similar across groups.

[Table 2 about here]

5.1 Baseline model

Table 3 reports OLS and IV estimates of the relationship between unmet LTC needs and healthcare access. The OLS estimates, which rely on selection on observables, indicate a negative association with hospital admissions (-0.034) and smaller, statistically insignificant associations with GP contacts and influenza vaccination.

[Table 3 about here]

The IV estimates use variation in unmet LTC needs induced by the continuous informal care availability index. Because the instrument is continuous, under relevance, exclusion, and monotonicity, the 2SLS coefficient identifies a weighted average of local treatment effects for individuals whose unmet-needs status responds to changes in the instrument. It should therefore be interpreted as a LATE-type parameter rather than as the average treatment effect for the full population.[8] The first-stage coefficient is large, negative (-0.091), and highly statistically significant, showing that greater potential availability of informal care is associated with substantially lower unmet LTC needs. This result is consistent with the caregiving literature and with adult children, particularly daughters and those living nearby, playing an important role in mitigating care deficits among older adults. The corresponding first-stage F-statistic equals 39.4, well above the conventional threshold of 10 used to detect weak instruments (Stock et al., 2002). The IV point estimate is largest for hospital admissions (-0.344), slightly smaller for influenza vaccination (-0.317), and smaller for GP contacts (-0.195), which is statistically significant only at the 10 percent level. This gradient is consistent with LTC functioning primarily as an enabling input for healthcare services with higher organisational and mobility requirements, such as hospital care and preventive services, while utilisation of low-intensity services such as GP contacts appears comparatively resilient to LTC constraints.

Arguably the OLS correlations likely reflect the interaction of two opposing forces. On the one hand, unmet LTC needs may create practical barriers and thereby reduce access. On the other hand, latent medical need, capturing residual selection on underlying health, raises both the likelihood of experiencing unmet LTC needs and the demand for healthcare. Even after conditioning on a rich set of observed health controls, individuals with unmet LTC needs may exhibit greater unobserved medical need, which tends to attenuate OLS estimates, particularly for lower intensity services. As a result, OLS coefficients may combine a negative access component with a positive selection component driven by unobserved health, leading to attenuation toward zero; consistent with this interpretation, the OLS coefficient for hospital admissions is smaller in magnitude than the corresponding IV estimate, despite remaining statistically significant. Overall, these findings suggest that OLS estimates may understate the relationship between unmet LTC needs and healthcare access because unobserved medical need simultaneously increases care deficits and healthcare demand. If the IV assumptions hold, the IV estimates imply substantially larger access effects, particularly for high intensity services. This pattern is consistent with unmet LTC needs acting as a binding constraint on healthcare utilisation and with LTC and healthcare functioning as complementary inputs in the production of effective medical care among older adults.

5.2 Sensitivity checks

[8] With a continuous instrument and a binary treatment, monotonicity requires that increases in potential informal care availability weakly reduce the probability of unmet LTC needs for each individual. The 2SLS estimand is a weighted average of the local treatment effects associated with changes along the support of the instrument. It therefore pertains to individuals whose unmet-needs status is responsive to variation in informal-care availability, rather than to the full sample.

As stated above, healthcare access indicators come from SHARE Wave 9. The data were collected between October 2021 and October 2022 and cover the twelve months preceding each interview, corresponding approximately to the period October 2020-October 2021, when the COVID-19 pandemic was still ongoing. During this period, healthcare facilities, hospitals in particular, were, in many countries, heavily affected by the COVID-19 crisis, with substantial numbers of infections and deaths. These circumstances may have influenced individuals' perceptions of healthcare services that, in several cases, faced significant challenges in protecting dependent older adults during the early phases of the pandemic (Di Novi and Santos, 2023; Achou et al., 2022). Although COVID-19 vaccines were developed and rolled out rapidly starting in early 2021, particularly among high-risk groups, concerns about contagion are likely to have persisted throughout much of the observation window despite vaccination. As a result, any reductions in healthcare utilisation observed during this period may partly reflect infection-related avoidance behaviour among frailer individuals, such as older adults, in addition to potential structural barriers associated with unmet LTC needs. To assess the robustness of the estimates to this potentially confounding channel, I leverage information from both waves of the SHARE Corona Survey, which explicitly elicited whether respondents had forgone medical treatment due to fear of COVID-19 infection. I construct a binary indicator equal to one for individuals reporting pandemic-related healthcare avoidance in either wave and exclude these respondents from the estimation sample. This restriction yields a subsample of 7,042 observations in which infection-related fear is unlikely to be the dominant driver of foregone care, thereby facilitating a cleaner identification of the relationship between unmet LTC needs and healthcare access. Re-estimating the baseline specifications on this restricted sample produces coefficients on unmet LTC needs that are qualitatively unchanged relative to the main results. Effect magnitudes and statistical significance remain broadly comparable, indicating that the baseline findings are not primarily driven by pandemic-induced avoidance behaviour (see Table 4).

[Table 4 about here]

As an additional robustness check, I also consider COVID-19 vaccination as an alternative healthcare access outcome, using information from the second wave of the SHARE Corona Survey (June–August 2021). I construct a binary indicator equal to one for respondents who either report having received at least one COVID-19 vaccination or state that they already have a vaccination appointment scheduled, and zero otherwise. Overall, 85% of respondents had either been vaccinated or had already scheduled a vaccination appointment (see Table 2). COVID-19 vaccines were delivered through large-scale public campaigns and often provided via low-threshold modalities, including mobile units and targeted outreach to vulnerable populations. Table 5 reports the results.

[Table 5 about here]

Consistent with selection on latent health, the OLS estimates show a positive and statistically significant association between unmet LTC needs and COVID-19 vaccination. This pattern likely reflects the prioritization of vaccination among individuals with pre-existing health conditions and clinical frailty (such as

those with chronic diseases or compromised immune systems), who were vaccinated earlier and at higher rates. To the extent that these underlying health conditions are imperfectly observed in the data and correlated with unmet LTC needs, the OLS estimates may capture residual selection on health rather than a causal effect. In contrast, the IV estimate turns negative, although it is not statistically significant. Notably, the absence of a statistically significant IV effect does not contradict the previous findings. Rather, it is consistent with COVID-19 vaccination being comparatively less dependent on LTC support, given the extensive public provision of vaccination services during the pandemic, which aimed to reduce access barriers for older and vulnerable individuals.

Another additional robustness check concerns the definition of unmet LTC needs. As discussed in Section 3.1, measuring unmet LTC needs is not straightforward, as the adequacy of LTC provision depends on how support is defined and quantified. To assess the robustness of the results to alternative definitions, I construct a different indicator of unmet LTC needs. Specifically, among respondents reporting difficulties with ADL, IADL, or mobility, I use information from SHARE on the frequency of formal or informal support received (daily, weekly, monthly, or occasionally). To avoid classifying sporadic assistance as sufficient, I define regular LTC care using a minimum threshold of at least weekly support. I then construct a binary variable equal to one for individuals who do not receive care at least weekly. This approach ensures that occasional assistance is not considered adequate in meeting LTC needs. Table 6 reports the corresponding OLS and IV estimates. According to this definition, approximately 86% of the sample experience unmet LTC needs.

[Table 6 about here]

The IV results closely mirror the baseline findings, with IV estimates indicating that the absence of regular LTC support is associated with lower hospital admissions and influenza vaccination uptake, while the effect on GP contacts is smaller in magnitude and statistically significant at the 10 percent level only. In contrast, the corresponding OLS estimates are small and statistically insignificant across outcomes. This divergence suggests that OLS correlations are affected by residual selection on underlying health and care arrangements, so that OLS estimates are attenuated relative to the IV effects. Once again, the first-stage coefficient is large, negative (-0.063), and highly statistically significant, showing that greater potential availability of informal care is associated with substantially lower unmet LTC needs. The first-stage F-statistic equals 32.35, well above conventional weak-instrument thresholds, supporting the strength of the instrument in this alternative specification. Overall, the results indicate that the findings are not sensitive to the construction of unmet LTC needs and are consistent with the interpretation of LTC as an enabling input that facilitates access to healthcare services requiring organisational support and mobility.

Another potential concern relates to the construction of the instrument, specifically the variable indicating whether the respondent has at least one child among their close network who resides in the same household or building. One might argue that this measure could be endogenous if adult children choose to live in proximity precisely because their parents experience disability or frailty. To address this concern, I assess whether

children's proximity is systematically associated with older adults' functional limitations. Appendix Table A.3 reports both unconditional and conditional OLS correlations between children's proximity and the number of ADL, IADL, and mobility limitations, estimated with and without the full set of demographics, socioeconomic, and country fixed effects.

In bivariate specifications, ADL limitations are not significantly associated with children's proximity, whereas IADL and mobility limitations display small but positive and statistically significant correlations. However, once the full set of controls is included (namely age, gender, family size, marital status, education, income quintiles, and country fixed effects), the associations with IADL and mobility limitations are no longer statistically significant. By contrast, ADL limitations become negatively associated with children's proximity in the controlled specification. Since ADLs capture more severe disability, this pattern does not support the hypothesis that children systematically move closer to parents experiencing worse baseline health. Overall, the evidence suggests limited residential sorting based on observable functional limitations within the selected sample of older individuals with LTC needs.

I also re-estimate the baseline IV model using, as an alternative instrument, a binary indicator equal to one if the respondent names at least one daughter among their close contacts, rather than the composite index of informal care availability described in Subsection 4.4. This specification relies on the well-documented gender gradient in informal caregiving, under the assumption that the presence of a daughter in the close network affects unmet LTC needs through greater potential availability of informal care but is not directly related to the respondent's underlying disability status. Table 7 reports the results.

[Table 7 about here]

The first-stage coefficient on the instrument is negative (-0.036), as in the baseline specification, and statistically significant at the 1 percent level, showing that the presence of a daughter among close contacts is associated with a lower probability of unmet LTC needs. The corresponding F-statistic equals 12.87, indicating that the instrument remains relevant, although less closely correlated with unmet LTC needs compared to the baseline specification. Consistent with the reduced instrument strength, the IV estimates become less precise. Nevertheless, the point estimates remain negative across outcomes. The effect on hospital admissions remains statistically significant, and the coefficient on GP contacts is significant at the 10 percent level, as in the baseline specification. By contrast, the coefficient for influenza vaccination is no longer statistically significant, reflecting wider confidence intervals under the weaker instrument. Overall, these results provide additional support for the baseline findings.

To further evaluate the sensitivity of the IV results to small violations of the exclusion restriction, I implement the plausible exogeneity framework of Conley, et al. (2012) and report Union-of-Confidence Intervals (UCI) bounds in Appendix Table A.2.

Finally, as a further robustness check, I re-estimate the baseline models including the number of ADL, IADL, and mobility limitations measured in Wave 8 (see Table 8). The baseline specification restricts the sample to individuals aged 65 and older with at least one limitation in ADL, IADL, or mobility, thereby focusing on older adults with objectively defined LTC needs. Within this population, however, the intensity of functional impairment varies. The number of ADL, IADL, and mobility limitations is not included in the baseline specification because the sample is already restricted to individuals with at least one functional limitation and the model controls for a comprehensive health index capturing baseline health heterogeneity. Including detailed counts of functional limitations in the main specification would substantially tighten the conditioning set and may absorb variation closely related to the emergence of unmet needs. For this reason, these measures are introduced as an additional robustness check rather than as baseline controls.[9]

[Table 8 about here]

The estimates remain qualitatively unchanged. In particular, the IV coefficients preserve their sign and magnitude and continue to indicate a negative IV estimate for unmet LTC needs on healthcare utilisation outcomes, suggesting that the main findings are not driven by residual variation in the intensity of functional limitations within the selected sample.

6. Concluding Remarks

This study examines the relationship between unmet LTC needs and healthcare access among older adults in Europe, a context that is particularly informative given the rapid demographic ageing experienced across the continent. As populations age, the traditional role of the family as the primary provider of care has progressively weakened. Demographic change, the erosion of family-based care arrangements, and the substantial increase in female labour force participation have jointly reduced the availability of informal caregiving. At the same time, rising care needs are placing increasing pressure on formal LTC systems that, in many European countries, are characterised by relatively low levels of public investment and limited coverage for non-self-sufficiency. In these contexts, reliance on private resources in later life becomes increasingly important, potentially rendering formal LTC services financially inaccessible for a substantial share of the older population. According to the OECD (2024), the cost of formal LTC represents a large proportion of older adults' disposable income in most European countries, with pronounced cross-country variation (Studies, 2024). While out-of-pocket costs are kept below 5% of median income in Northern European countries such as Finland and Denmark, they can exceed 100% in countries including Croatia, Poland, Italy, and Estonia. In

[9] Mobility limitations were measured using SHARE item H048, which records difficulties in ten physical functioning tasks (walking 100 meters, sitting for two hours, getting up from a chair after sitting for long periods, climbing several flights of stairs, climbing one flight of stairs, stooping/kneeling/crouching, reaching above shoulder level, pushing or pulling large objects, lifting or carrying weights over 5 kilos, picking up a small coin). ADL and IADL limitations were assessed using PH049, capturing difficulties in six basic self-care activities (dressing, walking across a room, bathing or showering, eating, getting in or out of bed, using the toilet) and nine instrumental activities necessary for independent living (using a map in a strange place, preparing a hot meal, shopping for groceries, making telephone calls, taking medications, doing work around the house or garden, managing money, leaving the house independently and accessing transportation services, doing personal laundry). All measures refer to the number of reported difficulties.

these settings, high costs often result in unmet care needs or push older individuals into poverty. Such disparities risk amplifying socioeconomic inequalities in access to essential support, particularly where public LTC coverage is limited, and contribute to a growing prevalence of unmet LTC needs among older adults.

Using data from SHARE Waves 8 and 9 combined with the SHARE Corona Survey and using an instrumental-variable strategy based on the availability of informal care to address potential endogeneity, this paper provides evidence consistent with potential spillover effects of shortcomings in LTC provision on the healthcare system. Specifically, the IV estimates suggest that unmet LTC needs are associated with lower access to healthcare services, with larger point estimates for hospital care and preventive services and a comparatively smaller point estimate for lower-intensity services such as GP contacts. These results are consistent with LTC functioning as an enabling input for older adults with functional limitations, facilitating mobility, coordination, and continuity across care settings. In the absence of adequate LTC support, disruptions at any stage of the healthcare pathway can translate into barriers to healthcare utilisation.

The findings are consistent with the inverse care law originally formulated by Hart (1971). The estimates are consistent with the possibility that, when LTC needs remain unmet, individuals with greater disability and higher medical needs are less able to access healthcare services, generating a form of double disadvantage. To the extent that the estimates capture access barriers, gaps in LTC provision may reinforce inequalities in healthcare utilisation. Strengthening LTC provision may therefore help mitigate these spillover effects and improve equity in healthcare access, while also reducing delayed treatment and avoidable health deterioration that would place additional strain on healthcare systems. Taken together, these results suggest that LTC provision may contribute to more effective and equitable healthcare delivery in ageing societies.

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TABLES

Table 1. Definition of Variables

Variable	*Definition*	*Coding / Range*	*Reference category / Notes*
Unmet LTC needs	Indicator equal to one if respondent who reports at least one limitation in ADL, IADL, or mobility and does not receive help.	0/1	Needs met
No regular care	Indicator equal to one if respondent reports ≥1 limitation in ADL, IADL, or mobility and does not receive formal or informal care at least weekly.	0/1	Receives care at least weekly
Informal care availability index (instrument)	Polychoric factor index based on (i) having at least one child living in the same house/building and (ii) gender of designated child (daughter = 1, son = 0). First factor extracted and normalized.	0-1	Higher values = greater availability
Sex	Respondent's biological sex.	0/1	Male
Age	Respondent's age at interview.	Years	—
Education (ISCED)	Educational attainment grouped into low (no certificate/primary/lower secondary), medium (upper secondary/high	0/1 Low/Medium/High	Low

	school), and high (tertiary/postgraduate).		
Marital status	Living with spouse/partner in same household versus living alone.	0/1	Living alone
Household income quintiles	Total annual household income (net of taxes and contributions), aggregated across all sources and divided into quintiles.	Q1-Q5	Q1 (lowest)
Private health/LTC insurance	Indicator equal to one if respondent reports private health insurance or LTC coverage.	0/1	No insurance
Composite health index	Polychoric factor index of SAH, EURO-D, and episodic memory; normalized between 0 and 1 with higher values indicating poorer health.	0-1	—
ADL limitations	Number of ADL limitations	Count (0-6)	
IADL limitations	Number of IADL limitations	Count (0-9)	
Mobility limitations	Number of mobility limitations	Count (0-10)	
GP contacts	Indicator equal to one if respondent reports any general practitioner visit in past 12 months.	0/1	No contact
Influenza vaccination	Indicator equal to one if respondent received a flu vaccination in past year.	0/1	Not vaccinated
Hospitalized	Indicator equal to one if respondent reports any	0/1	No stay

	overnight hospital stay in past 12 months.		
COVID-19 vaccination	Indicator equal to one if respondent reports having received at least one COVID-19 vaccine dose or having a vaccination appointment scheduled (SHARE Corona wave 2).	0/1	Not vaccinated and no appointment scheduled
Pandemic-related healthcare avoidance	Indicator equal to one if respondent reports having forgone medical treatment due to fear of COVID-19 infection in either wave of the SHARE Corona Survey.	0/1	Respondents reporting COVID-19-related healthcare avoidance are excluded from the restricted sample in the sensitivity test.
Country fixed effects	Full set of country dummies capturing unobserved cross-country heterogeneity.	0/1	—

Notes: Control variables, health measures, the indicators of unmet LTC needs and the informal care availability index are drawn from SHARE Wave 8. Healthcare access outcomes (GP contacts, influenza vaccination, hospital stay) are drawn from SHARE Wave 9 and refer to the 12 months preceding the interview. ADL = Activities of Daily Living; IADL = Instrumental Activities of Daily Living. Unmet LTC needs indicators are defined conditional on reporting at least one functional limitation. Household income is computed net of taxes and social contributions and entered as quintiles. The informal care availability index is constructed via polychoric factor analysis of children's geographic proximity and gender and normalized to [0,1]. The composite health index is obtained via polychoric factor analysis and normalized to [0,1].

Table 2 – panel a) - Summary Statistics

Variable	*Mean (Std. Dev.)*
Hospitalized (dummy)	0.176 (0.381)
Influenza vaccination (dummy)	0.528 (0.499)
GP contacts (dummy)	0.875 (0.331)
COVID-19 vaccination (dummy)	0.853 (0.354)
Pandemic-related healthcare avoidance (dummy)	0.225 (0.418)
Unmet LTC need (dummy)	0.604 (0.489)
No regular care (dummy)	0.856 (0.351)
Age (years)	75.199 (6.724)
Male (dummy)	0.344 (0.475)
Family size	1.857(0.864)
Single (dummy)	0.409 (0.492)
Medium education (dummy)	0.407 (0.491)
Higher education (dummy)	0.193 (0.394)
Composite health index	0.409 (0.151)
Informal care	0.323 (0.343)
Private health/LTC insurance (dummy)	0.604 (0.489)
ADL limitations	0.346 (0.942)
IADL limitations	0.763 (1.560
Mobility Limitations	3.137 (2.277)
Income quintiles	
Income Q1 (lowest)	0.233
Income Q2	0.25
Income Q3	0.191
Income Q4	0.186
Income Q5 (highest)	0.141
Country dummies (sample shares)	
Austria	0.050
Germany	0.062
Sweden	0.029
Spain	0.035
Italy	0.064
France	0.060

Denmark	0.028
Greece	0.094
Switzerland	0.043
Belgium	0.052
Czech Republic	0.073
Poland	0.057
Luxembourg	0.018
Hungary	0.015
Slovenia	0.003
Estonia	0.105
Croatia	0.041
Lithuania	0.036
Bulgaria	0.020
Cyprus	0.009
Finland	0.021
Latvia	0.024
Malta	0.011
Romania	0.032
Slovakia	0.018
Number of observations	9,086

Table 2 - panel b - Summary Statistics by Unmet LTC Needs

Variable	***Unmet LTC needs = 0*** ***Mean (Std. Dev.)***	***Unmet LTC needs = 1*** ***Mean (Std. Dev.)***
Hospitalized (dummy)	0.209 (0.407)	0.155 (0.362)
Influenza vaccination (dummy)	0.540 (0.498)	0.520 (0.500)
GP contacts (dummy)	0.885 (0.320)	0.869 (0.338)
COVID-19 vaccination (dummy)	0.838 (0.369)	0.864 (0.343)
Pandemic-related healthcare avoidance (dummy)	0.233 (0.423)	0.22 (0.414)
Age (years)	76.824 (7.054)	74.131 (6.274)
Male (dummy)	0.312 (0.463)	0.365 (0.482)
Family size	1.884 (0.880)	1.839 (0.852)
Single (dummy)	0.411 (0.492)	0.408 (0.491)

Medium education (dummy)	0.381 (0.486)	0.424 (0.494)
Higher education (dummy)	0.175 (0.380)	0.204 (0.403)
Composite health index	0.449 (0.161)	0.383 (0.137)
Private health/LTC insurance (dummy)	0.594 (0.491)	0.611 (0.488)
ADL limitations	0.301 (0.459)	0.103 (0.304)
IADL limitations	0.632 (0.482)	0.212 (0.409)
Mobility Limitations	0.970 (0.171)	0.977 (0.150)
Income quintiles		
Income Q1 (lowest)	0.242	0.227
Income Q2	0.249	0.250
Income Q3	0.201	0.185
Income Q4	0.175	0.193
Income Q5 (highest)	0.134	0.145
Country dummies (sample shares)		
Austria	0.049	0.051
Germany	0.079	0.051
Sweden	0.021	0.034
Spain	0.039	0.032
Italy	0.058	0.068
France	0.057	0.062
Denmark	0.024	0.030
Greece	0.079	0.104
Switzerland	0.044	0.042
Belgium	0.062	0.044
Czech Republic	0.096	0.058
Poland	0.035	0.071
Luxembourg	0.016	0.019
Hungary	0.020	0.012
Slovenia	0.002	0.003
Estonia	0.123	0.093
Croatia	0.037	0.043
Lithuania	0.031	0.040
Bulgaria	0.018	0.022
Cyprus	0.007	0.011
Finland	0.016	0.024
Latvia	0.024	0.024

Malta	0.014	0.010
Romania	0.031	0.033
Slovakia	0.019	0.017
Number of observations	3,602	5,484

Notes. Values are reported separately for the two subsamples defined by unmet_need = 0 and unmet_need = 1. For binary and continuous variables, entries are mean (standard deviation). For income quintiles and country dummies, entries are sample shares, consistent with Table 2 in the paper.

Table 3. Unmet LTC needs and healthcare utilisation: OLS and IV estimates

Outcome	*OLS: Unmet need*	*IV: Unmet need*	*Reduced form: (child index)*	*First-stage (child index)*	*KP F*	*N*
Hospital admission	-0.034*** (0.009)	-0.344** (0.141)	0.031** (0.012)	-0.091*** (0.014)	39.40	9,086
Influenza vaccination	-0.016 (0.010)	-0.317** (0.159)	0.029** (0.014)	-0.091*** (0.014)	39.40	9,086
GP contacts	-0.010 (0.007)	-0.195* (0.114)	0.018* (0.010)	-0.091*** (0.014)	39.40	9,086

Notes: Robust standard errors in brackets. All specifications include the full set of controls (age, gender, household size, marital status, education, income quintiles, country fixed effects, health index, and insurance coverage). Unmet need is instrumented using the informal care availability index. Kleibergen–Paap rk Wald F-statistics reported. ***, ** , * denote significance at the 1% , 5% and 10% levels, respectively.

Table 4 (Sensitivity Test). Unmet LTC needs and healthcare access: OLS and IV estimates (excluding respondents afraid of infection)

Outcome	*OLS: Unmet need*	*IV: Unmet need*	*First-stage (child index)*	*KP F*	*N*
Hospital admission	-0.028*** (0.010)	-0.382** (0.161)	-0.092*** (0.016)	31.43	7,042
Influenza vaccination	-0.020* (0.011)	-0.429** (0.185)	-0.092*** (0.016)	31.43	7,042
GP contacts	-0.011 (0.009)	-0.228* (0.134)	-0.092*** (0.016)	31.43	7,042

Notes: Robust standard errors in brackets. Sensitivity sample excludes respondents who report forgoing medical treatment due to fear of COVID-19 infection (pandemic-related healthcare avoidance = 1). All specifications include the full set of controls (age, gender, household size, marital status, education, income quintiles, country fixed effects, health index, and insurance coverage). Unmet need is instrumented using the informal care availability index. Kleibergen–Paap rk Wald F-statistics reported. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Table 5 (Sensitivity Test). COVID-19 vaccination as alternative healthcare access outcome

Outcome	*OLS: Unmet need*	*IV: Unmet need*	*First-stage (child index)*	*KP F*	*N*
COVID-19 vaccination	0.021*** (0.007)	-0.060 (0.111)	-0.091*** (0.014)	39.40	9,086

Notes: Robust standard errors in brackets. All specifications include the full set of controls (age, gender, household size, marital status, education, income quintiles, country fixed effects, health index, and insurance coverage). Unmet need is instrumented using the informal care availability index. Kleibergen–Paap rk Wald F-statistic reported. *** p<0.01, ** p<0.05, * p<0.10.

Table 6 (Sensitivity Test). No regular care and healthcare access

Outcome	*OLS: No regular care*	*IV: No regular care*	*First-stage (child index)*	*KP F*	*N*
Hospital admission	-0.011 (0.012)	-0.500** (0.210)	-0.063*** (0.011)	32.35	9,086
Influenza vaccination	0.006 (0.014)	-0.461** (0.235)	-0.063*** (0.011)	32.35	9,086
GP contacts	-0.001 (0.010)	-0.283* (0.167)	-0.063*** (0.011)	32.35	9,086

Notes: Robust standard errors in brackets. All specifications include the full set of controls (age, gender, household size, marital status, education, income quintiles, country fixed effects, health index, and insurance coverage). No regular care is instrumented using the informal care availability index. Kleibergen–Paap rk Wald F-statistics reported. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 7 (Sensitivity Test). Alternative instrument (Child female network): Unmet LTC needs and healthcare utilisation

Outcome	*OLS: Unmet need*	*IV: Unmet need (child female network)*	*First-stage (child female network)*	*KP F*	*N*
Hospital admission	-0.034*** (0.009)	-0.335** (0.142)	-0.036*** (0.010)	12.87	9,086
Influenza vaccination	-0.016 (0.010)	-0.428 (0.290)	-0.036*** (0.010)	12.87	9,086
GP contacts	-0.010 (0.007)	-0.386* (0.220)	-0.036*** (0.010)	12.87	9,086

Notes: Robust standard errors are reported in brackets. All specifications include the full set of controls (age, gender, household size, marital status, education, income quintiles, country fixed effects, health index, and insurance coverage). Unmet LTC needs are instrumented using a dummy indicator for whether the designated network child is female (1 = daughter). Kleibergen–Paap rk Wald F-statistics are reported. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. OLS estimates are taken from the baseline specifications (Table 3) and remain unchanged when only the instrument is varied.

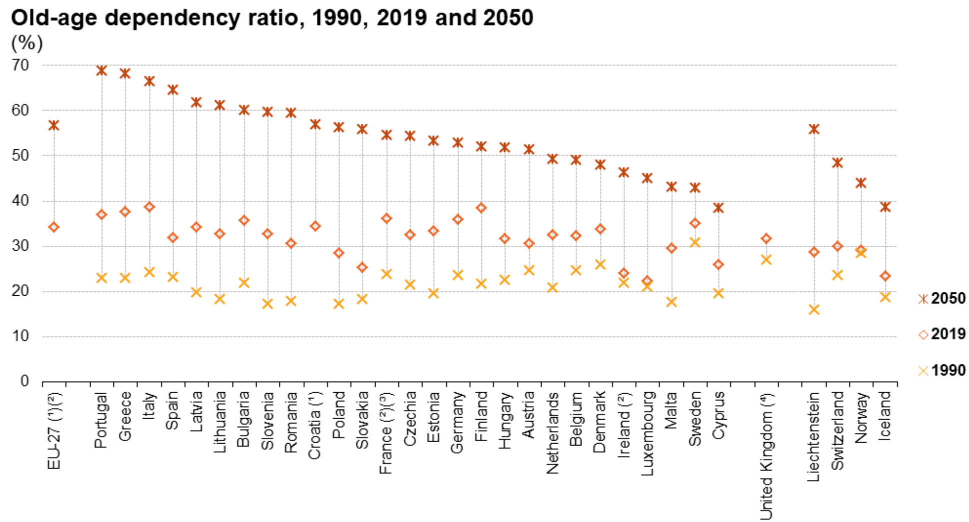
Table 8. Unmet LTC needs and healthcare utilisation: additional controls for functional limitations

Outcome	*OLS: Unmet need*	*IV: Unmet need*	*First-stage (child index)*	*KP F*	*N*
Hospital admission	-0.016* (0.009)	-0.348** (0.148)	-0.086*** (0.014)	40.68	9,086
Influenza vaccination	-0.017 (0.011)	-0.323** (0.165)	-0.086*** (0.014)	40.68	9,086
GP contacts	-0.009 (0.008)	-0.191 (0.120)	-0.086*** (0.014)	40.68	9,086

Notes: Robust standard errors in brackets. All specifications include the full set of controls (age, gender, household size, marital status, education, income quintiles, country fixed effects, health index, and insurance coverage, number of ADL, IADL, and mobility limitations) and additionally control for the number of ADL, IADL, and mobility limitations. Unmet need is instrumented using the informal care availability index. Kleibergen–Paap rk Wald F-statistics reported. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

APPENDIX

Figure 1A



Note: the old-age dependency ratio is calculated as the number of people aged ≥65 years divided by the number of people aged 20-64 years, expressed as a percentage. 2050: population according to the 2019 projections, baseline variant (EUROPOP2019).

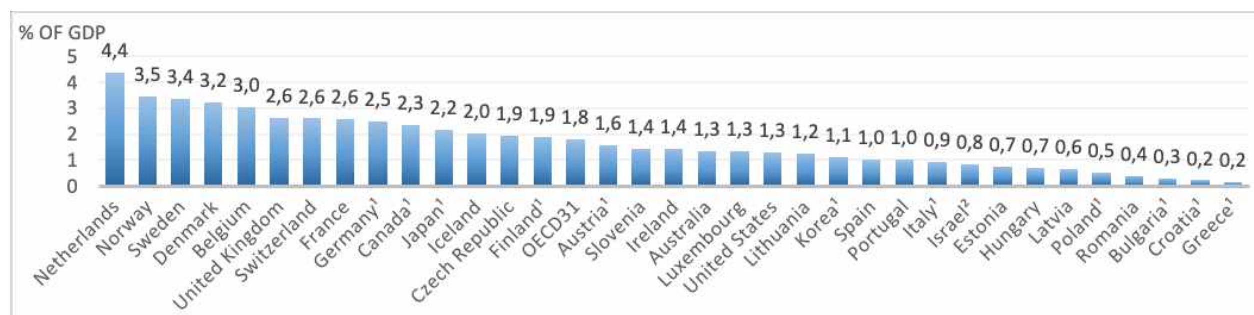
(¹) 1990: not available.
(²) 2019: estimates and/or provisional.
(³) 1990: excludes French overseas territories.
(⁴) 2050: not available.

Source: Eurostat (online data codes: demo_pjanind and proj_19ndbi)

Source: Eurostat

Figure 2A

Total long-term care spending as a share of GDP, 2021 (or nearest year)

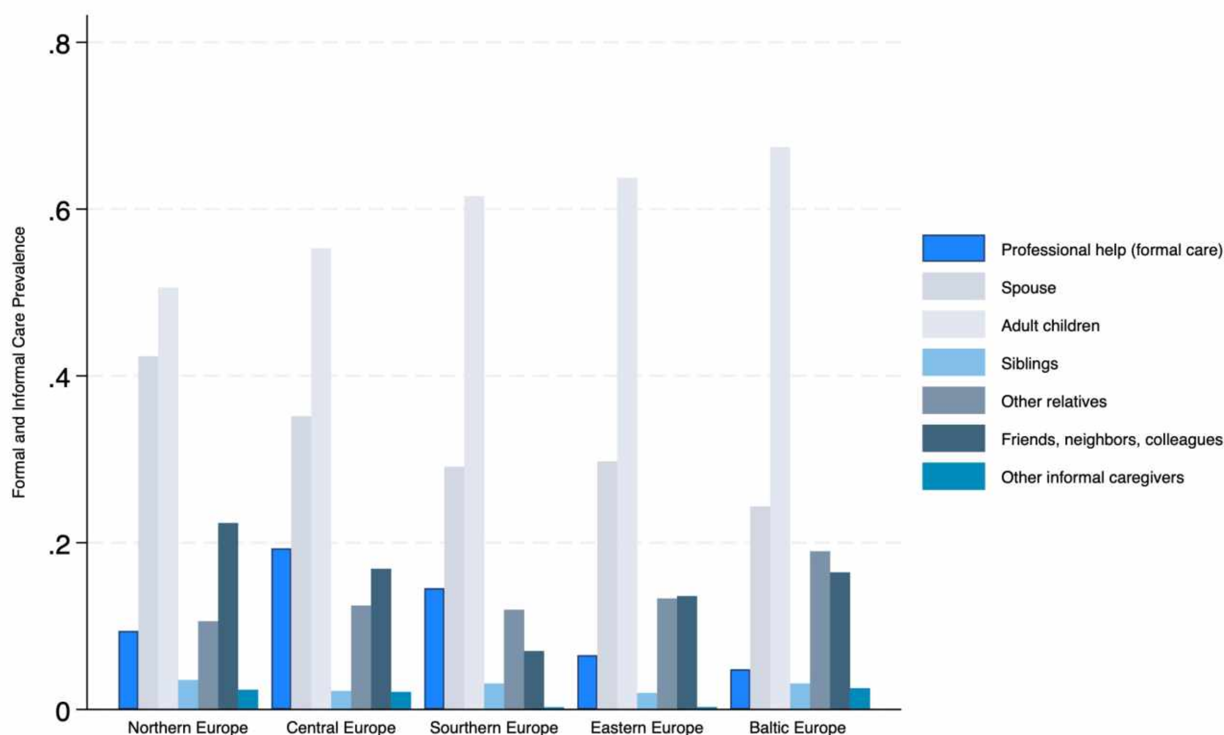


1. Countries not reporting spending for LTC (social). In many countries this component is therefore missing from total LTC, but in some countries, it is partly included under LTC (health).
2. Country not reporting spending for LTC (health).

Source: OECD Health Statistics 2023.

Figure 3A

The Prevalence of Formal and Informal Caregivers in Europe



Source: Data processed from SHARE, Wave 8.

Supplementary Analyses - restricted sample of respondents with at least one child

Because the informal care availability index is based on children's characteristics, we additionally restrict the sample to respondents with at least one child. The estimates remain broadly consistent with the baseline specification.

Table A1. Unmet LTC needs and healthcare utilisation: restricted sample of respondents with at least one child

Outcome	*OLS: Unmet need*	*IV: Unmet need*	*First-stage (child index)*	*KP F*	*N*
Hospital admission	-0.030*** (0.009)	-0.359*** (0.138)	-0.096*** (0.015)	41.11	8,466
Influenza vaccination	-0.015 (0.010)	-0.302* (0.155)	-0.096*** (0.015)	41.11	8,466
GP contacts	-0.009 (0.008)	-0.160 (0.110)	-0.096*** (0.015)	41.11	8,466

Notes: Robust standard errors in brackets. The sample is restricted to respondents with at least one living child. Individuals without children are excluded from the analysis. All specifications include age, gender, household size, marital status, education, income quintiles, country fixed effects, health index, and insurance coverage. Unmet need is instrumented using the child-based informal care availability index. Kleibergen–Paap rk Wald F-statistics reported. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Plausible Exogeneity

There may be concerns regarding the strict exogeneity of the instrument used in the baseline IV specification. The identifying assumption is that the availability of informal care from adult children affects healthcare utilisation primarily through its impact on unmet LTC needs. LTC includes assistance with ADL, IADL, and mobility support; organising appointments, arranging transportation, and navigating healthcare systems constitute integral components of LTC assistance and therefore operate within the LTC channel itself. Nevertheless, children's proximity and gender may be correlated with latent characteristics, such as preventive orientation, health beliefs, or risk attitudes, that are not fully observed in the data and may directly influence healthcare utilisation. To assess the sensitivity of the IV estimates to small deviations from strict exogeneity arising from such channels, I adopt the plausible exogeneity framework proposed by Conley et al. (2012) and implement the Union-of-Confidence Intervals (UCI) approach. Let γ denote the residual direct effect of the instrument on the healthcare outcome, conditional on unmet LTC needs and covariates.

For influenza vaccination, I assume that any residual direct effect of children's availability, operating independently of LTC provision, is plausibly non-negative. If children exhibit stronger preventive orientation or specific health beliefs, they may encourage their parents to use preventive services such as influenza vaccination. Accordingly, I impose a one-sided restriction ($\gamma \geq 0$) for this outcome. By contrast, for hospital admissions and GP contacts, the direction of a potential residual direct effect is theoretically ambiguous. Adult children may encourage healthcare use through greater health awareness and monitoring, but they may also substitute for certain forms of care in less severe situations, thereby reducing hospital utilisation and GP contacts. For these outcomes, I therefore adopt a two-sided specification allowing γ to vary symmetrically around zero. To assess robustness, I allow γ to vary within ranges calibrated to 5%, 10%, or 20% of the absolute reduced-form coefficient (RF-based calibration).

The results indicate that the negative IV estimate for unmet LTC needs on hospital admissions remains statistically different from zero across all calibrations under the two-sided specification. The bounds remain entirely below zero even when allowing deviations of up to 20% of the reduced-form effect. For influenza vaccination, the lower bound remains negative, but the UCI includes zero at all reported calibrations. A similar pattern emerges for GP contacts: the lower bound remains negative, while the UCI includes zero at all reported calibrations. These findings are consistent with the possibility that preventive and primary care utilisation are partly influenced by intergenerational preferences, health beliefs, or encouragement mechanisms operating outside the LTC channel.

Overall, the plausible exogeneity analysis supports the robustness of the hospital results while indicating that preventive and primary care services are more sensitive to small residual direct effects of the instrument. This pattern is consistent with the theoretical framework, in which LTC operates primarily as an enabling input for healthcare services requiring greater coordination and mobility.

Table A.2. Conley UCI Bounds

Outcome	*Calibration*	*Lower Bound*	*Upper Bound*
Hospital admission (two-sided)			
	RF 5%	-0.639	-0.053
	RF 10%	-0.658	-0.038
	RF 20%	-0.697	-0.007
Influenza vaccination (one-sided γ ≥ 0)			
	RF 5%	-0.628	0.009
	RF 10%	-0.628	0.023
	RF 20%	-0.628	0.052
GP contacts (two-sided)			
	RF 5%	-0.428	0.037
	RF 10%	-0.439	0.046
	RF 20%	-0.460	0.064

Notes: Bounds are computed using the Union-of-Confidence-Intervals (UCI) approach of Conley et al. (2012). Let γ denote the residual direct effect of the instrument on the healthcare outcome. For each RF calibration, γ is allowed to vary within a range corresponding to 5%, 10%, or 20% of the absolute reduced-form coefficient. For influenza vaccination, the admissible range is one-sided and non-negative ($\gamma \geq 0$); for hospital admissions and GP contacts, it is symmetric around zero.

Supplementary Analyses – residential sorting

Table A3 (residential sorting). Children's Proximity and Baseline Functional Limitations

Dependent variable: Child lives in the same household/building						
ADL limitations	-0.000	-0.011**				
	(0.005)	(0.005)				
IADL limitations			0.02***	0.004		
			(0.003)	(0.003)		
Mobility limitations					0.014***	0.001
					(0.002)	(0.002)
Controls included	No	Yes	No	Yes	No	Yes
R-squared	0.000	0.119	0.006	0.119	0.006	0.119
Observations	9,086	9,086	9,086	9,086	9,086	9,086

Notes: OLS estimates. Dependent variable: Child lives in same household/building. Robust standard errors in brackets. Controls include age, gender, family size, marital status, education, income quintiles, and country fixed effects. *** p<0.01, ** p<0.05, * p<0.10.

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