

Cognitive Limitations and Long-Term Care Use in the Netherlands: Evidence from the Lifelines Cohort Study

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1. Introduction

The Dutch population is aging rapidly, with the proportion of individuals aged 65 and older increasing from 12.8% in 1990 to 20.5% in 2024 (CBS, 2024a) and projected to reach around 25% by 2050 (CBS, 2024b). This population ageing is expected to lead to an increase in the prevalence of older people with impaired cognitive abilities, through an array of different causes, including dementia, Parkinson's and stroke. The prevalence of dementia is expected to double from 261,000 in 2022 to 506,000 in 2050 (RIVM 2024), if age-specific incidence rates remain stable. Declined cognitive abilities impact many aspects of life, including financial decision making, earnings, relationships and well-being (Chandra et al., 2023; Nicholas et al., 2021; Bagnasco et al., 2025; Guo et al., 2025). Understanding these changes, and the role of healthcare systems in these changes, is crucial for public policies.

The long-term care system in the Netherlands provides comprehensive and universal coverage, for both home care and nursing home care. Furthermore, many older individuals with functional limitations receive informal care from relatives, neighbors and others (Bakx et al., 2025). Brain disease, including dementia and other causes of limited cognitive ability, is the largest contributor to total healthcare expenditures and a large share of these expenditures are on long-term care (RIVM, 2025). Understanding long-term care provision for individuals with cognitive problems, including those with severe illness like dementia and those at the earlier stages of cognitive decline, helps to understand how the long-term care system allocates resources across groups with different needs. Furthermore, comparing use rates in the Netherlands to use rates in other countries at similar stages of cognitive decline helps to understand if eligibility at low levels of need may be one of the reasons why the high-cost Dutch long-term care system is the most expensive in the world (OECD, 2025).

People with dementia, who are often at the bottom of the cognitive ability distribution, on average use much long-term care causing high expenditures on formal long-term care. In the Netherlands, expenditures on healthcare and long-term care for people with dementia covered through social insurance amounted to 74 thousand dollar in 2022 (Vektis 2025). The amount of nursing home care, home care and informal care used by people with dementia are high in all countries but differ considerably, both within Europe and between Europe and the US, as does the level of out-of-pocket costs (Lenzen et al. 2021). This suggests that differences in healthcare systems, social norms, preferences and perceptions affect how much care one receives and how the financial burden is split between care recipients, informal caregivers and the remainder of society, which contributes to the cost of publicly financed formal care through taxes and premiums.

There is less evidence about long-term care use by those at earlier stages of cognitive decline. Understanding long-term care use at this early stage is important to understand because cognitive decline is underdiagnosed (Liu et al., 2024) and thus these individuals may not receive the care they need. This may even be the case in a healthcare system with comprehensive, universal long-term care insurance like in the Netherlands.

The remainder of this chapter is structured as follows. Section 2 provides an overview of the Dutch long-term care system, Section 3 describes the data, Section 4 contains results.

2. Policy environment

Long-term care financing

The Dutch healthcare system aims to ensure affordable, accessible, and high-quality long-term care for all citizens through three universal, mandatory public financing schemes.: The Social Support Act (Wet maatschappelijke ondersteuning - Wmo) delegates the responsibility for organizing and financing assistance and social support for people living in the community to municipalities; social health insurance (Zorgverzekeringswet - Zvw) covers nursing and personal care provided at home; and social long-term care insurance (Wet langdurige zorg - Wlz) covers institutional care, including nursing homes and hospice care. There is no private long-term care insurance in the Netherlands (Bakx et al., 2025). Total long-term care expenditures amount to 4.0% of the gross domestic product in 2022, which is the highest among all countries (OECD, 2025). Social long-term care insurance is financed through a mix of general taxation and earmarked insurance premiums¹ and social health insurance is primarily financed through earmarked insurance premiums; the Social Support Act is funded through general taxation. Cost sharing is limited. Income-dependent copayments account for 6% of institutional care costs, and a deductible for home care financed through the WMO covers 4% of home care expenditures. There is no cost sharing for home care covered by social health insurance (Bakx et al., 2025).

Long-term care eligibility and cognitive impairment

Access to care under the Social Support Act is determined through an assessment of individual needs and preferences. The municipality is responsible for the evaluation of the individual's capacity for independent functioning and the extent to which their social environment can assist. If additional support is deemed necessary, the municipality is required to provide formal services. (Ministerie van Algemene Zaken, 2024).

Nursing and personal care provided at home are covered under the basic package of compulsory social health insurance. These services are exempted from the compulsory deductible. Eligibility is determined by the home care provider (Ministerie van Volksgezondheid, Welzijn en Sport, 2023a).

¹ In 2024, premiums made up 45% of the insurance fund revenue, copayments 6% and national-level general taxation 48% (Rijksoverheid 2025).

For individuals living at home with cognitive impairments, in the form of dementia or suspected early-stage dementia, case management services are covered under the basic health insurance package. A dementia case manager provides guidance, coordination, and proactive planning of care and support for the person with dementia and their family. Eligibility for case management is determined by a general practitioner or district nurse. (Ministerie van Volksgezondheid, Welzijn en Sport, 2024a).

Access to institutional care covered by social long-term care insurance requires an eligibility assessment that evaluates the need for continuous care, permanent supervision, and safety management. The assessment is carried out by an independent assessment agency. Eligibility may be granted for people with mainly physical, or psychogeriatric problems, where the latter is mainly dementia. Eligibility may be granted because of psychogeriatric problems if there is significant cognitive decline, as per DSM-5 criteria, due to a brain-related condition. This includes impairments in areas such as attention, memory, language, and executive functions, with evidence of decline compared to previous functioning. It can apply to both extensive and limited neurocognitive disorders. Although not formally required for the eligibility decision, cognitive decline may be confirmed through neuropsychological tests or other clinical assessments. (Ministerie van Volksgezondheid, Welzijn en Sport, 2024b).

To align care with the severity of cognitive decline, social long-term care insurance assigns care intensity packages (ZZPs) based on individual needs. ZZP VV5 (Protected living with intensive dementia care) and VV7 (Protected living with very intensive care with an emphasis on support) are care packages for individuals with severe physical or cognitive impairments, such as advanced dementia. It includes around-the-clock supervision, intensive personal care, nursing, and assistance with daily activities. (Ministerie van Volksgezondheid, Welzijn en Sport, 2024c).

Instead of in-kind care, individuals can opt for cash benefits, which are available in all three public financing schemes. Cash benefits enable recipients to choose their caregivers and schedule care according to their needs. It may pay for a full range of care services, including for example daily assistance and medical support, with reimbursement only for care that is provided. Cash benefit rates vary across care systems: municipalities set rates under the Social Support Act (with a national minimum), health insurers determine rates under the Health Insurance Act, and nationwide standardized rates apply under the Long-Term Care Act. (Ministerie van Volksgezondheid, Welzijn en Sport, 2023b).

Informal caregiving

Universal public long-term care insurance in the Netherlands is highly comprehensive compared to many other OECD countries. Still, informal care also plays an important role, with an estimated value of 1.4% of Gross Domestic Product compared to 2.5% of Gross Domestic Product spending on formal care for the 65+ population (Bakx et al., 2025). While most informal care is unpaid, caregivers may receive compensation through cash benefits, though only 3% of informal caregivers report (SCP 2015).

To provide temporary relief from daily caregiving tasks, caregivers may receive respite care, which may include activities for the care recipient, such as group walks or day care, with optional caregiver participation, arrangements for someone to stay with the care recipient at home, enabling the care

recipient to spend one or more days at a facility, short-term overnight stays in a care facility or with a host family (Zorg voor Beter 2024).

3. Data and Definitions

We use two data sources. The first data source is the Lifelines Cohort Study from the northern provinces of the Netherlands (Drenthe, Fryslân and Groningen) which is linked to administrative data from Statistics Netherlands available for the full Dutch population. While the Lifelines sampling procedure did not exclude nursing home residents, the number of participants who lived in a nursing home in the years in which the MMSE was administered was too small (fewer than 10) to analyze these separately. Hence, we exclude this group.

The second data set contains aggregate-level data on formal care expenditures reported by Statistics Netherlands, Healthcare Institute Netherlands, RIVM National Institute for Public Health and the Environment and is used to get a complete picture of the long-term care expenditures, including individuals with dementia living in nursing homes.

3.1 Lifelines cohort study

The first data set is used to study the relationship between cognitive decline and long-term care use is the Lifelines Cohort Study. The Lifelines Cohort Study is a multi-disciplinary prospective population-based cohort study examining in a unique three-generation design the health and health-related behaviors of 167,729 persons living in the North of the Netherlands (Sijtsma et al. 2021). It assesses the biomedical, socio-demographic, behavioral, physical and psychological factors which contribute to the health and disease of the general population, with a special focus on multi-morbidity and complex genetics. The three main advantages of the Lifelines Cohort Study data for this study are the larger sample size than e.g. the SHARE survey, the availability of a measure that is used widely to screen and diagnose cognitive disorders, and the opportunity to link the full data set to administrative records containing complementary information.

We select participants aged 65 and older for whom information was available on cognitive ability as measured by Mini-Mental State Examination (MMSE) scores from Waves 1 (2009 to 2012) and 3 (2019 to 2023) resulting in 26,960 observations. Among these, there were 2,642 participants using proxy respondents for the questionnaires. The MMSE was administered as part of the baseline clinic visit, also among respondents who used a proxy for the follow-up questionnaire. Hence, we treat the proxy respondents as regular respondents. Appendix 1 provides a detailed breakdown of the difference in cognition and background characteristics by proxy status.

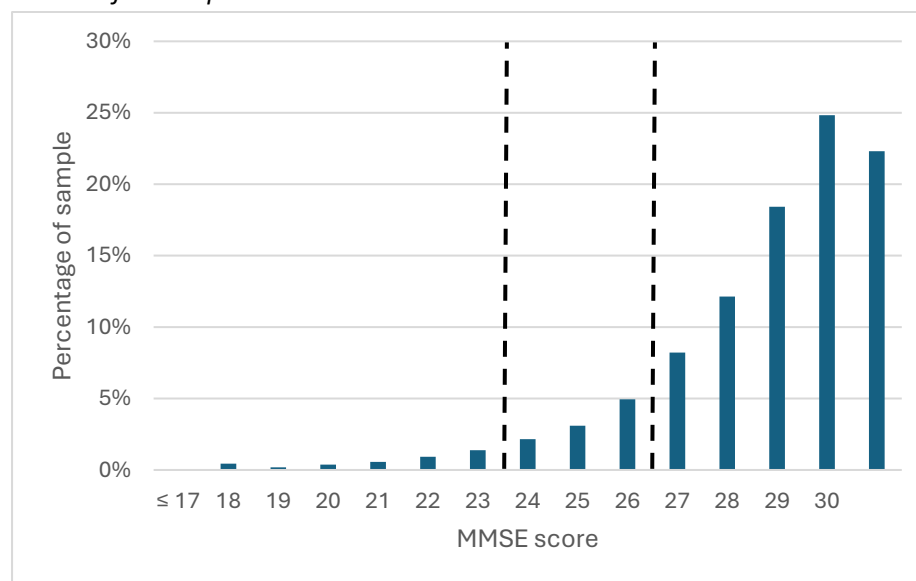
We correct for differences in demographic composition between the three northern provinces and the rest of the country by using probability weights based on age (3 categories), gender and homecare use to ensure that the Lifelines data are representative of the overall Dutch 65+ population living in the community in 2022. Furthermore, the three northern provinces are comparable to the rest of the country in terms of the institutions related to long-term care financing and organization as discussed in Section 2.

The MMSE (Folstein et al., 1975) is widely used for screening and diagnosing cognitive disorders, including dementia. The MMSE test included in the Lifelines Data assesses several cognitive domains: orientation (10 points), registration (3 points), attention and calculation (5 points), recall (3 points), and language (9 points), with a total score range of 0-30, where a higher score indicates better cognitive functioning.² Dutch general practitioner guidelines (Dieleman-bij de Vaate et al., 2020) suggest that a score under 24 is a sign of dementia, yet emphasizes that a low MMSE is not sufficient for diagnosing dementia.³ We distinguish between three groups: 1) a MMSE score of 0 to 23, 2) 24-26, and 3) 27-30.

The weighted distribution of cognitive scores in the study sample is shown in Figure 1a with two bold dashed lines denoting the cut-offs between the three cognitive impairment groups. 6.0% has a score of 0-23; 16.3% of 24-26 and 77.7% of 27 or higher. In addition, to show that cognitive impairments are strongly associated with age, we also illustrate the weighted distribution of MMSE scores over two age groups: 65-74 and 75 and older (Figure 1b).

Figure 1: Distribution of MMSE Scores

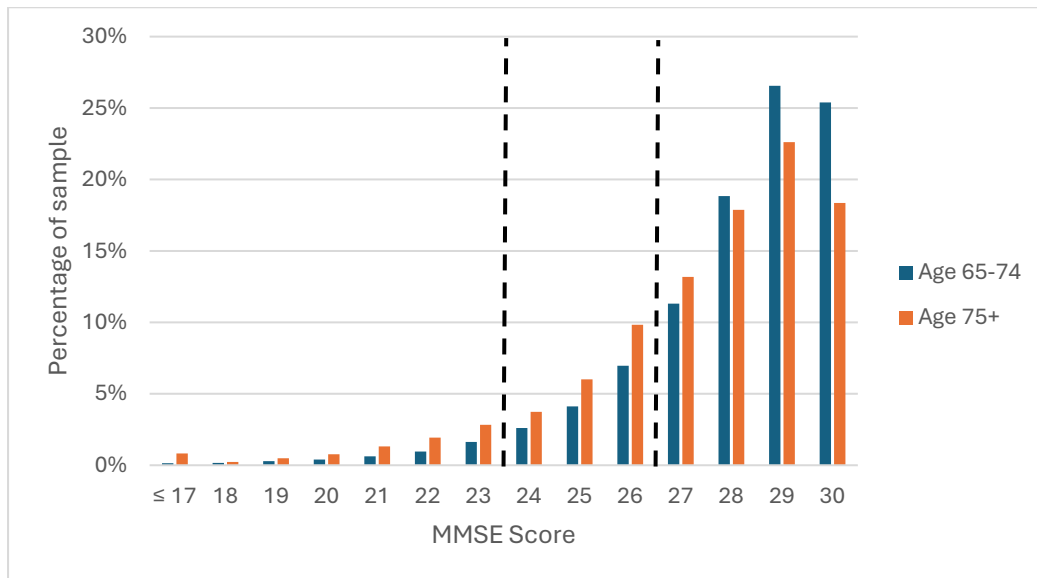
Panel a: full sample



² In contrast, the cognitive assessment in the HRS/SHARE Data consists of four tests: immediate word recall (10 points), delayed word recall (10 points), serial 7's (5 points), and date naming (4 points), for a maximum score of 29 points. This difference in maximum scores could lead to minor discrepancies when comparing cognitive impairment between the U.S. and the Netherlands. Additionally, the double recall (immediate and delayed) in the HRS/SHARE test is more complex, which may result in a greater range of variation in scores compared to the simpler recall task in the MMSE.

³ Furthermore, the MMSE score has been shown to be associated with educational attainment and language proficiency (Dieleman-bij de Vaate et al. 2020).

Panel b: by age group



Note: raw number of observations for the full sample is 26,960 (65-74 = 21,028 observations; 75+ = 5,932 observations); observations are weighted to ensure that the Lifelines data are representative of the overall Dutch 65+ population living in the community in 2022

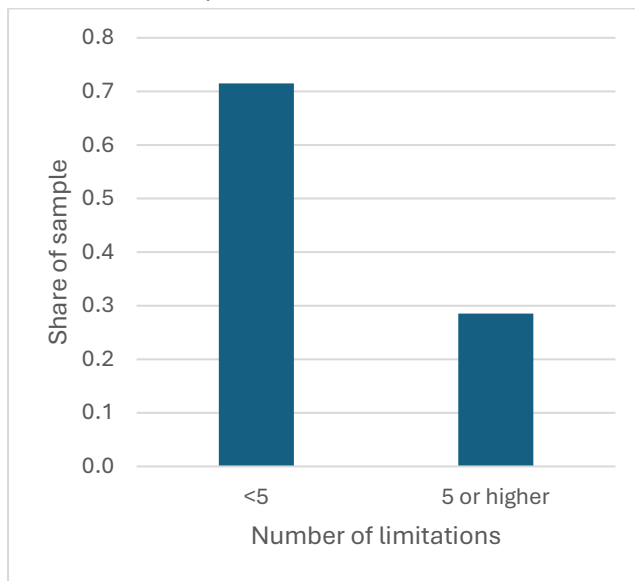
To assess the presence of functional limitations, we used the Groningen Frailty Indicator, which is a 15-item scale to assess frailty, where a score of 4 or higher indicates moderate frailty (Steverink et al. 2001; Schuurmans et al. 2004).⁴ However, in this chapter, we use a higher cut-off score of 5 to align our analyses with the analyses done in other countries. Because this was only available for a random subsample of 10,000 observations, we use a random forest model to impute functional limitations using administrative data (Appendix 2).

Figure 2a displays the weighted distribution of functional limitations, distinguishing between individuals with fewer than five limitations and those with five or more. Figure 2b provides a similar weighted analysis, further broken down by age groups. 28.5% of individuals experience five or more limitations. When examining the data by age group, we find that 38.7% of the oldest age group report five or more limitations, compared to 20.6% in the younger cohort.

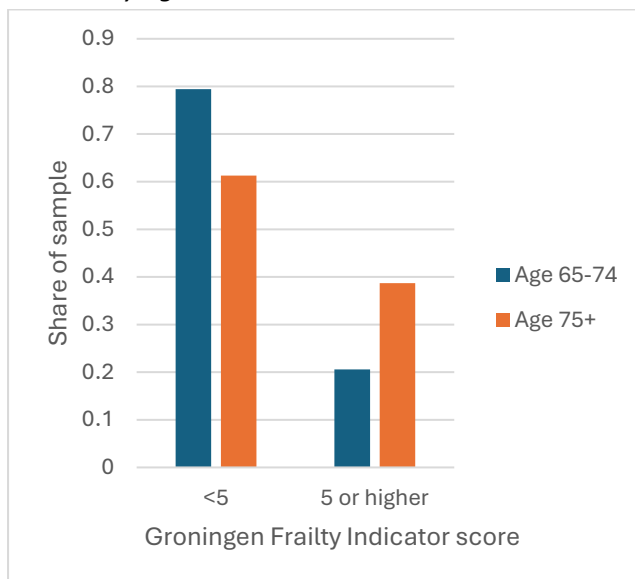
⁴ The 15 items are: being able (without help) to go shopping, being able to get dressed and undressed, being able to walk around the house or to neighbors, being able to go to the toilet, physical fitness, problems in daily life because of poor vision, problems in daily life because of being hard of hearing, having lost > 6kg in last 6 months or > 3kg in last month unwillingly, taking ≥ 4 types of medication, memory complaints, experiencing emptiness around you, missing people around you, feeling let down, feeling gloomy or depressed, feeling nervous or afraid.

Figure 2 Distribution of functional limitations as measured by the Groningen Frailty Indicator

Panel a. Full sample



Panel b. By age



Note: raw number of observations for the full sample are 26,960; observations are weighted to ensure that the Lifelines data are representative of the overall Dutch 65+ population living in the community in 2022.

Long-term care use

We analyze informal care and home care use. Information on whether a respondent received informal care was retrieved from the Lifelines data, Informal care was defined as “unpaid care because of (...) long-term disabilities and/or health problems” (...) “provided by someone close to you, such as your partner, a relative, friend etc”. Data collection for each Lifelines wave stretched multiple years and questions on informal caregiving were generally not asked at the same as the MMSE was administered. Hence, we include information on receiving informal caregiving which was collected up to 3 years before or after the MMSE was administered.

Data on home care use during the calendar year of the interview came from Statistics Netherlands. Home care consists of two types. First, it includes nursing and personal care organized and financed through social health insurance. Second, it includes domestic help, ADL or IADL assistance, transportation, home adaptations, and use of medical devices financed through the Social Support Act. Data on this second category of home care only includes person-specific care, for which the user was charged a copayment. There is no information on the amount of home care financed through the Social Security Act at the individual level, hence data on the average monthly home care hours comprised only nursing and personal care organized and financed through social long-term care insurance (Wave 1; 2009-2013) and social health insurance (wave 3; 2019-2023).⁵

We take information on education from the Lifelines data; data on sociodemographic and demographic characteristics was taken from linked administrative records: age, gender, marital status, children living at home, employment status, homeownership, household income, and wealth. Marital status (having a spouse or registered partner) and children living at home were included, as they may delay the need for formal care by providing informal support (Freedman, 1996; Arnault et al, 2019). Homeownership may provide access to resources that support independent living (McCann et al., 2012; Rouwendal & Thomése, 2010). Homeownership was coded as a binary variable, while household income and wealth were adjusted for household size and inflation. Appendix 3 contains all variable definitions.

3.2 Administrative data on long-term care expenditures

To assess the costs of formal care, we take 2019 data for the 65+ population living in the Netherlands from two sources of administrative data. First, we use Statistics Netherlands individual-level claims data on spending on institutional care covered through public long-term care insurance and on home care covered through public health insurance. Second, we take aggregate-level data from Statistics Netherlands on home care covered through the Social Support Act (CBS 2025a, 2025b).

4. Results

Descriptive statistics

Table 1 shows the joint distribution of functional limitations and cognitive ability based on the Lifelines Cohort Study data. Functional limitations and cognitive limitations are positively correlated. Most of the sample (77.7%) does not experience cognitive impairment, and the majority of individuals report fewer than five limitations. Severe cognitive impairment are less common (6.0%), and one-third of these individuals experience five or more limitations.

⁵ For Wave 1, we aggregated the total number of hours at the annual level and dividing the total annual hours by 12. For Wave 3, monthly home care hours covered through social health insurance were calculated from annual expenditures data by dividing annual expenditures by the average integral rate to estimate average yearly hours, which were then divided by 12 to obtain the average monthly hours. We used average integral rates for 2018 (€52.64/hour) and 2019 (€54.42/hour) as reported by NZa (2019); rates for other years were approximated by adjusting the 2018 rate for inflation.

Table 1. Joint distribution of cognitive impairment and functional limitations

Limitations	MMSE Score			
		0-23	24-26	27-30
	<5	1019 (3.8%)	2982 (11.1%)	15271 (56.6%)
	5+	610 (2.3%)	1401 (5.2%)	5677 (21.1%)
	Total	1629 (6.0%)	4383 (16.3%)	20948 (77.7%)
		26960 (100%)		

Note: observations are weighted to ensure that the Lifelines data are representative of the overall Dutch 65+ population living in the community in the observation year.

Table 2a presents the weighted demographic and socio-economic characteristics of four groups: individuals with no impairments (<5 limitations & MMSE score >23), those with only physical impairments (5+ limitations & MMSE score >23), those with cognitive impairments with or without physical impairments (MMSE score <24), and all respondents. Both impaired groups are older and have lower education levels compared to the non-impaired group, with those experiencing cognitive impairments showing the highest proportion of individuals with only primary education (77.8%). This group also exhibits the lowest employment rate (4.3%), average income (€27,470), and wealth (€214,607). Additionally, homeownership is least common among this group (59.9%). The physically impaired group (61.8%) and cognitive impaired group (64.1%) are roughly equally likely to have a partner.

Table 2a. Demographic and Socio-economic characteristics per impairment group

	Non-Impaired (N=18,253)	Physically Impaired (N=7,078)	Cognitively Impaired (N=1,629)	Total (N=26,960)
Characteristics	mean	mean	mean	mean
Age (years)	72.9	75.8	76.6	73.9
Female (%)	43.3%	75.9%	56.7%	52.7%
Partner (%)	78.2%	61.8%	64.1%	73.0%
Children at home (%)	4%	3%	3%	3%
Children at home (conditional)	1.3	1.2	1.2	1.2
Primary education (%)	49.2%	60.4%	77.8%	53.9%
Secondary education (%)	24.3%	21.7%	13.4%	22.9%
Higher education (%)	26.5%	17.9%	8.8%	23.2%
Work for pay (%)	11.0%	5.8%	4.3%	9.2%
Income per capita (\$)	33315	31158	27470	32395
Wealth per capita (\$)	292492	250221	214607	276670
Owner-occupied home (%)	79.8%	68.3%	59.9%	75.6%

Note: Physically impaired refers to the subsample with 5+ limitations and a MMSE score ≥ 24 ; cognitively impaired refers to the subsample with a MMSE score < 23 regardless of the functional limitations score. Observations are weighted to ensure that the Lifelines data are representative of the overall Dutch 65+ population living in the community in 2022. Amounts in euros are converted to 2023 price levels.

Table 2b highlights the use of formal care and informal care across four groups. Compared with the physically impaired group, individuals with cognitive impairment, who have an average of 3.6 limitations, more often receive informal care (48.2% versus 24.7%) and more formal care: while the share using home care is similar (43.3% versus 40.0%), individuals with cognitive impairments receive an average of 3.3 hours of home care per month (not conditional on use) versus 1.9 in the group with

physical impairments but no cognitive impairments. Furthermore, the rate of informal care receipt for the total sample is higher than the rate reported by Statistics Netherlands, which is 9.9% in 2026 (2026), suggesting we may overestimate the use of informal home care. The rate of formal home care is similar to the rate in the overall population because of the survey weights.

Table 2b. Care characteristics per impairment group

	Non-Impaired (N=18,253)	Physically Impaired (N=7,078)	Cognitively Impaired (N=1,629)	Total (N=26,960)
Care characteristics	mean	mean	mean	mean
<i>Number of limitations</i>	1.9	5.8	3.6	3.1
<i>Any care (%)</i>	23.3%	50.5%	57.1%	32.1%
<i>Any informal care (%)</i>	11.5%	24.7%	48.2%	16.4%
<i>Any formal home care (%)</i>	18.2%	40.0%	43.3%	25.4%
<i>Formal home care per month (hours; social health insurance only)</i>	0.5	1.9	3.3	1.0

Note: Physically impaired refers to the subsample with 5+ limitations and a MMSE score ≥ 24 ; cognitively impaired refers to the subsample with a MMSE score < 23 regardless of the functional limitations score. Observations are weighted to ensure that the Lifelines data are representative of the overall Dutch 65+ population living in the community in 2022. Estimates for receipt of any type of care and for informal care are based on a subset of observations for which information on informal care receipt is available and hence the share using formal care may exceed the share using any care.

Regression analyses

The probability and amount of care that individuals receive is related to impairments and other factors, such as the availability of potential informal caregivers, living conditions, and resources. We use weighted ordinary least squares regression analyses to explore the relationship between care use and impairments, as well as socio-economic and demographic characteristics (Table 3). First, we analyze the determinants of use of any care, which includes informal care and formal care. Subsequently, we analyze use of informal care and formal care and hours of home care per month separately.

Both cognitive and physical impairments are associated with increased use of long-term care, with cognitive impairments showing a stronger positive association. The use of any type of care (i.e. informal or formal care) is higher among respondents with a higher age, but lower among people who live with their partner or children and homeowners. Informal care use is higher among women and respondents who live with their partner, and is negatively associated with wealth. Formal care use and formal care hours per month are positively associated with age, and negatively with living with a partner, living with a child (formal care hours only), being highly educated, having a high income or high wealth (formal care use only) and being a homeowner.

Table 3. Regression Results

	<i>Any care</i>	<i>Informal care</i>	<i>Formal care</i>	<i>Formal home care per month (hours; social health insurance only)</i>
<i>Physically impaired^a</i>	0.115*** (0.024)	0.051* (0.025)	0.098*** (0.011)	0.891*** (0.146)
<i>Cognitively impaired^b</i>	0.209*** (0.056)	0.322*** (0.073)	0.101*** (0.020)	2.091*** (0.416)
<i>(Age - 65)</i>	0.010* (0.004)	0.003 (0.005)	0.001 (0.002)	-0.084* (0.036)
<i>(Age - 65)²</i>	0.001** (0.000)	0.000 (0.000)	0.001*** (0.000)	0.008*** (-0.002)
<i>Female</i>	-0.094 (0.051)	0.151*** (0.036)	-0.017 (0.021)	-0.165 (0.352)
<i>With partner</i>	-0.300*** (0.051)	0.099*** (0.029)	-0.206*** (0.020)	-1.356*** (0.297)
<i>Female x With partner</i>	0.181*** (0.054)	-0.050 (0.038)	0.043 (0.023)	0.171 (0.360)
<i>Any children at home</i>	-0.080** (0.027)	-0.02 (0.022)	-0.03 (0.019)	-0.458*** (0.135)
<i>Secondary education</i>	0.006 (0.026)	0.008 (0.024)	-0.009 (0.010)	-0.180 (0.123)
<i>Higher education</i>	-0.015 (0.027)	0.000 (0.023)	-0.030** (0.001)	-0.246* (0.104)
<i>Work for pay</i>	-0.028 (0.032)	0.012 (0.031)	0.015 (0.011)	0.091 (0.165)
<i>Income^c</i>	-0.025 (0.013)	-0.015 (0.010)	-0.019*** (0.006)	-0.066 (0.037)
<i>Wealth^c</i>	-0.003 (0.003)	-0.005* (0.003)	-0.005*** (0.001)	-0.029 (0.020)
<i>Owner-occupied home</i>	-0.107*** (0.025)	-0.044 (0.023)	-0.075*** (0.012)	-0.772*** (0.170)
<i>R-squared</i>	0.261	0.102	0.278	0.120
<i>Observations</i>	8752	8752	26286	26286

Note: * p<0.05, ** p<0.01, *** p<0.001. ^a Physically impaired refers to the subsample with 5+ limitations and a MMSE score ≥ 24 ; ^b cognitively impaired refers to the subsample with a MMSE score < 23 regardless of the functional limitations score; ^c Inverse hyperbolic sine transformation. Observations are weighted to ensure that the Lifelines data are representative of the overall Dutch 65+ population living in the community in 2022. Primary education is the reference group for education levels.

Costs

We estimate the distribution of long-term care expenditures across three groups by building on the approach used in Bakx et al. (2025). Using these sources, we estimate that the 65+ population used

\$8.6 billion of home care⁶ and \$18.8 billion of institutional care in 2019 (2023 price level)⁷. We combine these with the cost of informal care estimated in Bakx et al. (2025) that we also adjust for inflation to the 2023 price level: \$13.7 billion euro. The total long-term care costs are shown in Table 7.

Subsequently, we split these costs across the three groups: the non-impaired, those with physical impairments only and those with cognitive impairments. To split informal care costs and home care costs across these three groups, we use the utilization rates in Table 2b to estimate relative proportions of formal care users and informal care users that belong to each of the three groups. This shows that the non-impaired make up 45% of the informal care and 48% of the formal home care users; the physically impaired 38% (informal care) and 41% (home care); the cognitively impaired 17% (informal care) and 10% (home care), respectively. Those shares are multiplied by the total costs in the last column and shown in the first, second and third column.⁸

To split the costs of institutional care, we use information on whether a psychogeriatric condition was the main reason (*dominante grondslag*) to be eligible for a nursing home admission and whether someone was eligible for dementia care (*Zorgzwaartepakket Verpleging en Verzorging 5 or Verpleging en Verzorging 7*). The other expenditures are attributed to the group with a physical impairment only: following the eligibility criteria for institutional care (cf. Section 2 of this chapter) there is no use of institutional care by the group with no impairments.⁹ This definition of cognitively impaired differs from the definition used to calculate the cost of home care and informal care and likely includes a relatively large number of individuals with severe cognitive impairments.

Following these estimates, the cognitively impaired account for approximately 29% of total long-term care expenditures.

Table 7: cost of care

Panel A: costs in billion US dollar (2023 price level)

	<i>Non-impaired</i>	<i>Physically impaired</i>	<i>Cognitively impaired</i>	<i>Total</i>
Long-term care				
<i>Informal care</i>	6.2	5.2	2.3	13.7
<i>Home care</i>	4.2	3.6	0.9	8.7
<i>Institutional care</i>	N/A	8.9	9.9	18.8
<i>Total</i>	10.4	17.7	13.1	41.2

⁶ Total home care costs are higher than in Bakx et al. (2025) because System of Health Accounts uses a broader definition than used in that chapter.

⁷ For consistency with the definition of use, we define institutional care as all care financed through social long-term care insurance. While most recipients receive care in-kind within an institution, around 8% (2016) to 27% percent (2023) of older individuals receives this care at home or a private setting, either in-kind or as a cash benefit (CBS 2025c).

⁸ Alternatively, the allocation of home care costs may be based on hours of home care financed through social health insurance, which would yield higher expenditures on home care for the cognitively impaired (1.7 billion US dollar) and physically impaired (4.2 billion US dollar) and lower on the non-impaired (2.8 billion US dollar).

⁹ An alternative approach based on expenditures for care packages VV5 and VV7, which are for people with psychogeriatric conditions, compared to overall expenditures on all VV care packages yields a similar estimate (CBS 2025e).

Population size (in millions)	2.3	0.9	0.3	3.5
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Panel B: costs as a percentage of 2023 gross domestic product (2023 price level)

	<i>Non-impaired</i>	<i>Physically impaired</i>	<i>Cognitively impaired</i>	<i>Total</i>
Long-term care				
<i>Informal care</i>	0.5%	0.5%	0.2%	1.2%
<i>Home care</i>	0.4%	0.3%	0.1%	1.0%
<i>Institutional care</i>	N/A	0.8%	0.9%	1.7%
<i>Total</i>	0.9%	1.6%	1.2%	3.6%

Notes: data on total expenditures on home care and institutional care are for 2019; expenditures on informal care are taken from Bakx et al. (2025). All amounts are adjusted to 2023 price levels using the Consumer Price Index of Statistics Netherlands (CBS 2025f) and converted to using the average euro/dollar exchange rate for 2023 which was 1.083.

Panel B: Gross domestic product was taken from Statistics Netherlands (2025g). Items may not add up to totals due to rounding error. Physically impaired refers to the subsample with 5+ limitations and a MMSE score ≥ 24 ; cognitively impaired refers to the subsample with a MMSE score < 23 regardless of the functional limitations score. Population size (non-institutional) is extrapolated from the Lifelines data; population size (institutional) is taken from administrative records.

5. Conclusion

In this chapter, we analyze the association between cognitive impairments and long-term care use in the Netherlands. The Netherlands has universal, comprehensive public long-term care coverage in place and no formal diagnosis is required to become eligible for long-term care covered through the public programs. Hence, barriers to long-term care use for people with cognitive decline might be relatively low compared to other countries.¹⁰

The following three findings warrant further attention. First, we find that there is a strong correlation between cognitive impairment and functional limitations. In part, this correlation may also be caused because cognitive impairments may cause functional limitations, e.g. they may limit the ability to prepare and eat a full meal, to safely take a shower or bath, and dementia has been associated with a loss of motor skills (Kueper et al. 2017). Moreover, the need for outside help for a given level of functional limitations may be larger if cognitive ability is limited.

This accumulation of health problems at old age means that dealing with these health problems and their consequences in isolation is likely suboptimal: treatment of physical health problems without acknowledging cognitive limitations or vice versa may lead to less effective treatment or even iatrogenic harm, e.g. from side effects, or lower treatment adherence.

Second, the share of cognitively impaired participants increased by age, but low scores were observed in all age groups. The comparison of the cohort study data to the administrative data and dementia

¹⁰ Similarly, barriers might be low for individuals who have a Groningen Frailty Indicator score of 4 or lower and who are therefore classified as non-impaired in Table 7. Most of these individuals have some level of frailty (Appendix Figure A3) and this may explain why many of these individuals use some long-term care

prevalence estimates shows that individuals with severe cognitive impairments may have been undersampled. This undersampling is partly mitigated through weighting the observations to match the gender-specific age distribution and the rate of homecare use in the community-dwelling 65+ population. Yet, this means that the results are not generalizable to the full 65+ populations, which includes the nursing home population as well.

Third, a large percentage of those with cognitive impairments (42%) do not use any long-term care¹¹, even in a comprehensive, universal system in the Netherlands where a formal diagnosis is not needed for eligibility, co-payments are low, and there are thus low barriers to use. Further, research by the WHO shows that the share of individuals who report unmet needs is relatively low in the Netherlands.¹² Most likely, many of those with cognitive impairments manage to get by on their own, or with some help of family/others that does not qualify as informal care. Yet, the finding that many get by without long-term care use does not rule out that cognitive decline affects many aspects of life (see e.g. Bagnasco et al. 2025; Chandra et al. 2023 for examples). Hence, future research on the impact of cognitive impairment should keep a broad focus on the aspects of life that may be affected by cognitive decline.

When care is used, costs are large. Among individuals with cognitive impairment who do use long-term care, nursing home residents account for the bulk of the expenditures on in the Netherlands. Furthermore, within the total group of nursing home residents, those with dementia make up 59% suggesting that care provided in nursing homes and similar care provided in other settings is crucial for individuals with severe cognitive impairments.

Together, the findings presented in this chapter show that when comparing between groups of older persons with different levels of cognitive ability living in the community, long-term care use is strongly concentrated among those with the lowest cognitive ability. Similarly, people with dementia and other psychogeriatric disorders make up the majority of users of institutional care. Furthermore, the findings show that cognitive impairment is associated with long-term care use above and beyond the impairments that are reflected in a validated frailty score. Thus, this chapter highlights the importance of accounting for cognitive impairments when (i) seeking to explain the determinants of long-term care use in research and (ii) tailoring long-term care programs to the needs of the elderly when considering policy reforms. Furthermore, this finding highlights the need for high-quality data, in particular being able to measure cognitive ability in the population and the ability to link this information to data on long-term care use.

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¹¹ Similarly, 49% of those classified as physically impaired do not use long-term care.

¹² WHO (2022) reports that in 2019 the percentage of the population with IADL problems who perceived unmet needs was the lowest of all European countries surveyed.

Union nor the granting authority can be held responsible for them. Results based on calculations by Erasmus University using non-public microdata from Statistics Netherlands. The authors wish to acknowledge the services of the Lifelines Cohort Study, the contributing research centres delivering data to Lifelines, and all the study participants. The Lifelines initiative has been made possible by subsidy from the Dutch Ministry of Health, Welfare and Sport, the Dutch Ministry of Economic Affairs, the University Medical Center Groningen (UMCG), Groningen University and the Provinces in the North of the Netherlands (Drenthe, Friesland, Groningen).

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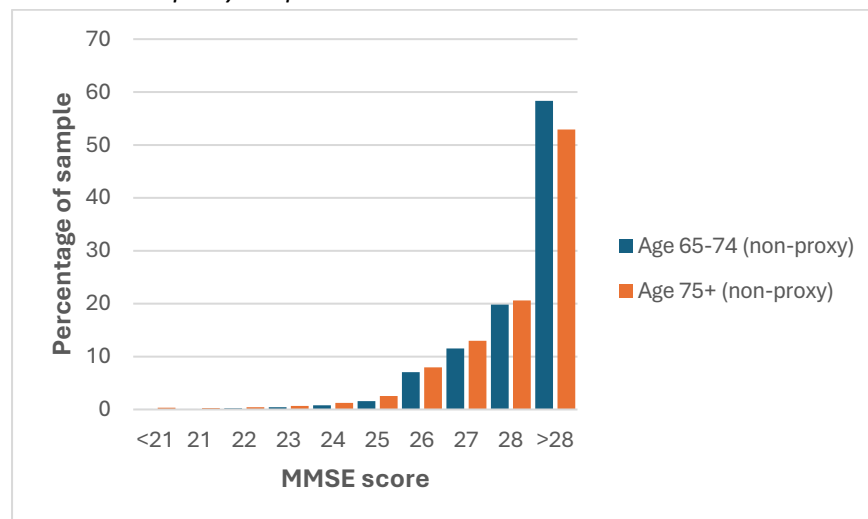
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Appendix 1: proxy respondents

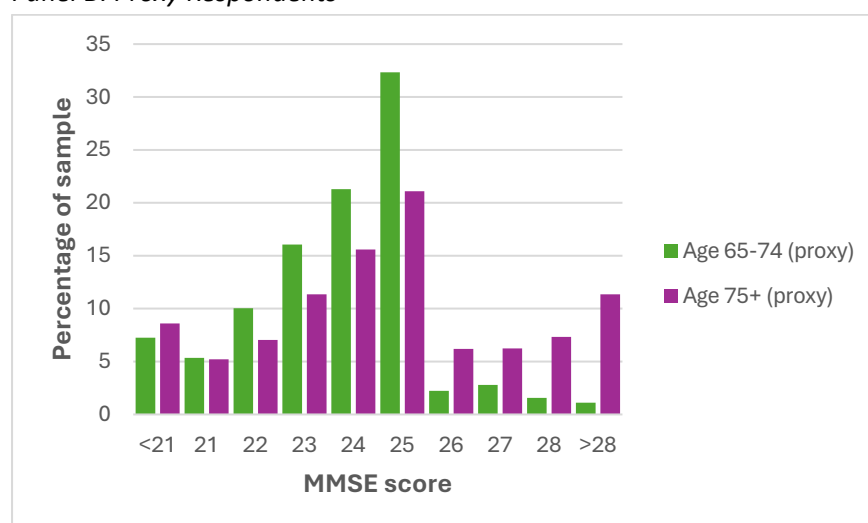
Among non-proxy respondents, the majority exhibit normal cognitive scores of 27+ (88.0%), followed by those with cognitive impairment, scoring between 24 and 26 (10.7%), and those with severe cognitive impairment with MMSE scores between 0-23 (1.3%). In contrast, proxy respondents are predominantly represented in the most cognitive impaired group with scores between 24 and 26 (47.3%) and the severely cognitive impaired group with scores between 0-23 (34.4%), with only a small proportion showing no cognitive impairment (18.3%). This distribution aligns with expectations, as proxies are more likely to assist individuals with cognitive impairments who are unable to complete surveys independently. Severe cognitive impairment is most prevalent among the oldest age groups in both non-proxy and proxy respondents, underscoring the strong association between advanced age and cognitive decline.

Figure A1 Distribution of MMSE Scores by Age (unweighted)

Panel A: Non-proxy Respondents



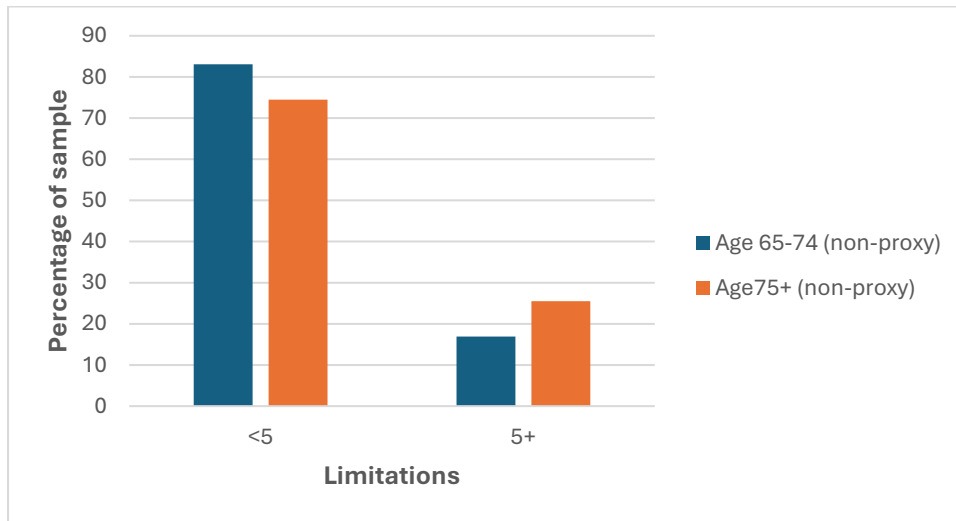
Panel B: Proxy Respondents



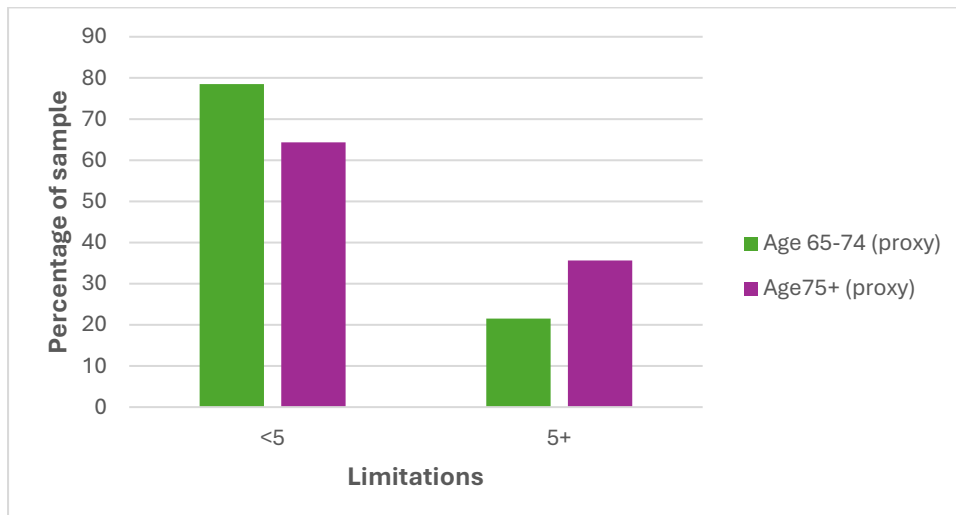
Note: raw number of observations for the full sample is 26,960; raw number of observations non-proxy respondents is 24,318 (65-74 = 11,633 observations; 75+ = 12,685 observations) and for proxy respondents 2,642 (65-74 = 897 observations; 75+ = 1,745 observations).

Figure A2. Distribution of Limitations by Age (unweighted)

Panel A: Non-proxy Respondents



Panel B: Proxy Respondents



Note: raw number of observations for the full sample is 26,960; raw number of observations non-proxy respondents is 24,318 (65-74 = 11,633 observations; 75+ = 12,685 observations) and for proxy respondents 2,642 (65-74 = 897 observations; 75+ = 1,745 observations).

Appendix 2: random forest model for functional limitations

To assess the presence of functional limitations, we used the Groningen Frailty Indicator (GFI), which is a 15-item scale ranging from 0 to 15 to assess frailty. Because this was only available for a random subsample of 10,000 observations, we use a random forest model to impute functional limitations using administrative data.

As input data, we use administrative records that are available for the full subsample for all years:

- Age in years and gender
- Indicators for 22 outpatient medication categories created by Huber et al. (2013) and used in Danesh et al. (2024) in the current year

- Indicators for 18 hospitalization categories as reported by the International Shortlist for Hospital Morbidity Tabulation in the current year
- Total hospital length of stay in days in the current year
- Total healthcare expenditures in euro in the current year
- Healthcare expenditures in euro in the current year on the categories for which a significant proportion of the sample had non-zero expenditure:
 - Medical devices and aids
 - Hospital care
 - Outpatient medication
 - General practitioner care

We apply a missForest method (Stekhoven and Buhlmann 2012) to predict whether the GFI score was 4 or higher. For this, we use R package MissForest (Morgan 2020) with the following hyperparameters: 150 trees and maximum 15 iterations. The Hyperparameters were determined using 5-fold cross validation using random subsets of 1000 observations. We take the majority vote.

We chose the missForest method after comparing a broader range of models, including OLS using (1) the full set of input data and using (2) the number of medication categories, a missForest model taking average over all trees. For this comparison, we ran 10 bootstraps on 60% subsamples for each model. For each bootstrap, 70% of the subsample was used to train the model and 30% to test it. To compare performance, we used the F1 score, which is the harmonic mean of the precision (i.e. the ratio of true positives over total predicted positives) and recall (ratio of true positives over total positives), where a positive outcome is defined as a GFI above or equal to the threshold score of 4 (Steverink et al. 2001).

Appendix 3: variable definitions

Table A1: variable definitions

Characteristics	Definition
Impairments	
Cognitive impaired	Cognitive functioning of individuals assessed by the Mini-Mental State Examination (MMSE). It is categorized into three groups: • 0-23 MMSE score: Indicates severe cognitive impairment, often associated with dementia or significant cognitive decline. In our analysis, we consider individuals in this group as cognitively impaired. • 24-26 MMSE score: Suggests mild cognitive impairment, with some difficulties in memory, attention, or problem-solving. • 27+ MMSE score: Considered normal cognitive function, with no significant impairment detected.
Functional impaired	Physical functioning of individuals assessed by the Groningen Frailty Index (GFI), which assesses physical, cognitive, social, and psychological limitations. It is categorized into two groups: • <5 limitations: Individuals with fewer than five limitations are considered to have little to no functional impairment. • 5+ limitations: Individuals with five or more limitations are classified as functionally impaired in our analysis.
Long-term care	
Home care	Formal care at home in the survey year includes: For period before 2015: Before 2015, home care in the Netherlands was provided under the Care Without Residence (ZVV) scheme, which encompassed various services for individuals living at home. The organization and financing of home care were divided among different acts: 1. The General Exceptional Medical Expenses Act (AWBZ) covered: • Personal care: includes help with daily hygiene, dressing, and mobility support. • Nursing care: includes medical and nursing assistance, such as wound care, medication administration, and chronic condition monitoring. • Individual guidance: includes one-on-one support for structuring daily life and managing conditions for individuals. • Group guidance: facilitates supervised activities to promote social interaction and maintain cognitive and physical abilities for individuals. District nursing, which encompassed both personal and nursing care, was initially covered under the AWBZ before 2015 but transitioned to the Health Insurance Act (Zvw) in 2015, making it the responsibility of health insurance providers. 2. The Social Support Act (WMO) covered: • Household care: includes assistance with household tasks (cleaning, laundry, meal preparation) for individuals unable to manage independently. For period after 2015: 1. District nursing under the Health Insurance Act for individuals requiring less intensive care (medical and personal care). District nursing relates to the following care aspects: a. Personal Care: Assistance with daily activities such as bathing, dressing, eating, and using the toilet. b. Nursing Care: Medical care including wound care, administering medication, injections, and monitoring the patient's health condition. c. Guidance: Support in organizing daily life, such as planning activities and managing household tasks. d. Self-Management Support: Promoting the patient's self-reliance by teaching them how to manage their health and well-being. e. Care Coordination: Community nurses play a central role in coordinating care, working with general practitioners, specialists, and other healthcare providers to deliver an integrated care plan. f. Needs Assessment: Community nurses determine what care is needed and to what extent, and regularly evaluate whether the care is still appropriate. g. Palliative Care: Providing comfort and support to individuals who are in the final stages of a terminal illness. District nursing in this context aims to improve the quality of life for both the patient and their family by managing symptoms,

	providing emotional support, and coordinating care with other healthcare providers. 2. Home care under the Long-Term Care Act for individuals with long-term, severe care needs (medical and personal care) VPT (Volledig Pakket Thuis): Complete Home Care Package. This form provides comprehensive care at home/ non-institutional environment through WLZ, including personal care, nursing, and domestic help. It is designed for individuals who need extensive support and wish to receive all their care services in their own home rather than in an institutional setting. MPT (Modulair Pakket Thuis): Modular Home Care Package. This option allows for a customized combination of care services based on individual needs at home/ non-institutional environment through WLZ. People can select specific modules of care, such as personal care, nursing, or assistance with household tasks, tailoring the package to fit their specific requirements. PGB (Persoonsgebonden Budget): Personal Budget. This provides individuals with a fixed amount of money that they can use to purchase care services according to their preferences at home/ non-institutional environment through WLZ. It offers flexibility in choosing and arranging care providers, allowing individuals to tailor their care to their specific needs and preferences. 3. Home care under the Social Support Act (non-medical support), coordinated and financed by municipalities. We use the categorization applied by Statistics Netherlands that is based on: Household Assistance, Support at home and aids & assistance. Household Assistance: Help with daily household tasks such as cleaning, cooking, and other domestic chores. Support at home: Guidance: Support and advice for managing daily life and activities Personal Care: Assistance with personal hygiene, dressing, and other individual care needs. Short-Term Stay: This service provides temporary accommodation for individuals needing short-term care or respite from their usual living situation. It aims to offer caregivers relief and support during periods of increased demand. Additional Individual or Household Support: Personalized support services for individuals or households. It may include financial assistance, counseling, or practical help in managing household tasks.
Informal care	Indicates if respondents received unpaid care from a family member or friend due to long-term limitations and/or health problems. This excludes unpaid care from strangers (e.g., volunteer work).
Background characteristics	
Age	The individual's age calculated based on their birth year, as of January 1st of the survey year. Only individuals aged 65 and older are included in the sample. Also, Age is centred at age 65 and included as a continuous measure along with its second order polynomial.
Sex	A binary variable indicating the individual's sex in the survey year, where 0 represents male and 1 represents female.
Partner status	Indicates whether the individual is married or in a registered partnership during the survey year.
Children status	Indicates whether an individual has children living at home during the survey year. The number of children residing in the household is also recorded.
Education	Highest attained education level classified into three levels: low, middle, and high, based on the highest level of education attained by an individual. Primary education level: - No education (did not complete primary school). - Primary education (including special needs primary education). - Lower or preparatory secondary vocational education (e.g., lts, leao, lhno, vmbo). - Junior general secondary education (e.g., mavo, (m)ulo, mbo-short, vmbo-t). Secondary education level: - Secondary vocational education or work-based learning pathway (e.g., mbo-long, mts, meao, bol, bbl, inas). - Senior general secondary education and pre-university education (e.g., havo, vwo, atheneum, gymnasium, hbs, mms). Higher education level: - Higher vocational education (e.g., hbo, hts, heao, 'kandidaats' university degree, equivalent to a bachelor's degree). - University education.
Employment	Indicates whether the individual received income from work during the survey year. This includes: Wages, salaries, bonuses, and savings schemes for employees in the private sector.

	• Wages, salaries, bonuses, and savings schemes for government employees. • Wages, salaries, bonuses, and savings schemes for directors and major shareholders not covered by employee insurance schemes. • Income attributed to the private use of a company-provided car. • Income from self-employment or freelance work, including compensation for assisting in a partner's business, after deducting work-related expenses. • Employer contributions to the income-related healthcare insurance premium (Zvw), provided until 2013, after which it was replaced by the employer-paid Zvw tax. • Foreign income from current employment.
Income	The disposable income of a household during the survey year. Disposable income is calculated as gross income minus income transfers, such as alimony, and premiums for income insurance (including social insurance contributions, national insurance, and private insurance for unemployment, disability, old age, and survivors' benefits). It excludes health insurance premiums and income and wealth taxes. Disposable income is adjusted for household size and amounts in euros are converted to 2023 price levels. Each year's calculations are based on the previous year's income (e.g., income from 2016 is used for 2017 calculations). Income is inverse hyperbolic sine transformed
Wealth	The total wealth of a household during the survey year, adjusted for household size and amounts in euros are converted to 2023 price levels. Each year's calculations are based on the previous year's wealth (e.g., total wealth from 2016 is used for 2017 calculations). Wealth is inverse hyperbolic sine transformed
Housing status	Homeownership status of private households as of January 1st of the reporting year. A value of 1 is assigned if the individual owned an owner-occupied home during the survey year. A value of 0 is assigned if the individual lived in a rental home (with or without housing allowance), an institutional household, or an unidentified household.

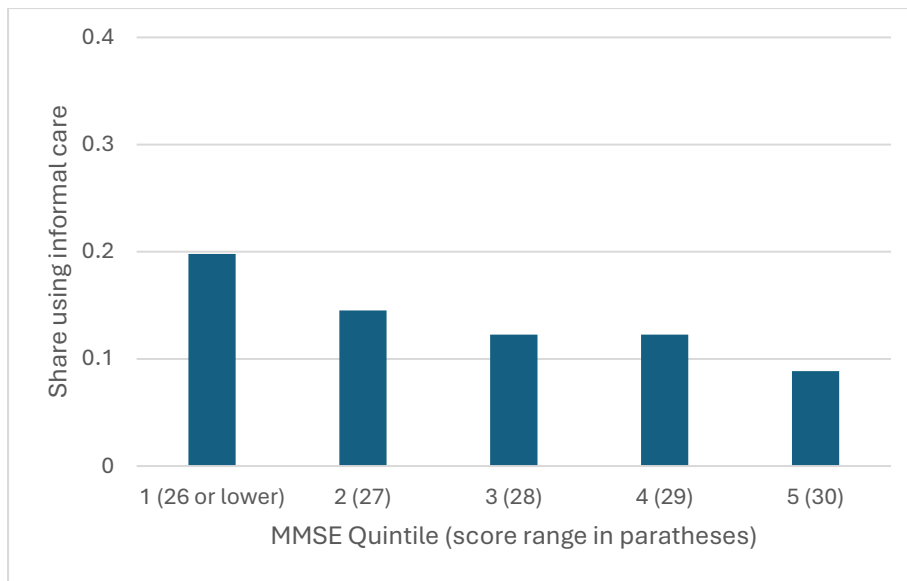
Appendix 4 Additional results

Figure A3 Care use by MMSE score

Panel A Formal home care



Panel B Informal care



Note: Observations are weighted to ensure that the Lifelines data are representative of the overall Dutch 65+ population living in the community in 2022.