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ORIGINAL PAPER

Are Austrians ageing healthily?

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Abstract
Functional ability, an important health measure—especially in aging societies—is measured through limitations in activities of daily living (ADL) and instrumental activities of daily living (IADL). We use panel data from four waves of the Survey of Health, Ageing, and Retirement in Europe (SHARE) conducted between 2011 and 2022 to analyse trends in the prevalence of functional ability in Austria and ten other European countries. Our results show a stagnation or modest decline in functional limitations among the Austrian elderly, and a clear downward trend in other European countries. These findings contrast with earlier evidence from the Austrian Health Interview Survey (ATHIS), which suggested rapidly rising disability rates—possibly reflecting survey mode effects rather than worsening functional ability. Overall, our results indicate that, at a given age, Austrians and other Europeans are experiencing increasingly healthy ageing, implying that rising longevity does not necessarily extend the period lived with disability.

Keywords Chronic limitation of activity · Ageing · Long-term care · Independent living · SHARE · Ageing in Europe · Survey mode effects

1 Introduction

The ability of individuals to perform basic tasks in daily life significantly impacts their quality of life and has important implications for the health and long-term care system. Consequently, monitoring trends and developments in this area is particu-

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larly relevant, especially in ageing societies. In 2004, the European Union adopted "healthy life expectancy without long term disability" as an important structural indicator.

Functional ability is commonly measured through limitations in *activities of daily living* (ADL) and *instrumental activities of daily living* (IADL). ADLs refer to basic self-care tasks and cover activities such as walking, bathing, feeding, toileting, dressing, and getting in and out of bed. IADLs encompass more cognitively complex tasks including shopping, housekeeping, preparing meals, and managing medication or finances, which require more cognitive abilities. Limitations in either of these activities affect the ability to live independently and indicate a need for assistance or personal care, and thus provide a crucial measure of population health in aging societies.

Given ongoing increases in life expectancy throughout Austria and Europe (OECD/European Commission 2024), a key question is whether these additional years of life are spent in good health or with functional impairments. In other words, does rising longevity imply an expansion or a compression of years lived with disability? The answer carries important policy implications: if functional limitations rise with longevity, ageing societies will face substantially higher demands for health and long-term care resources.

To address this issue, we employ harmonized panel data from the Survey of Health, Ageing and Retirement in Europe (SHARE) to analyse trends in ADL and IADL limitations from 2010 to 2022 in the population 65 + in Austria and ten other European countries. SHARE employs a consistent, face-to-face, computer-assisted personal interview format across all waves, ensuring high comparability over time and across countries. By examining both the prevalence and the number of ADL and IADL limitations, we find stagnating and even decreasing trends in the prevalence of difficulty with ADL and IADL.

In contrast, recent Austrian evidence based on the Austrian Health Interview Survey (ATHIS, a part of the European Health Interview Survey, EHIS) reported a sharp increase in ADL and IADL limitations among individuals aged 65 years and older between 2014 and 2019 (Woldemariam et al. 2024). This result would imply that a rising life expectancy would go hand in hand with rising limitations, potentially leading to a longer unhealthy phase of life and substantial additional pressure on the health care and long-term care system. However, these finding coincide with a change in survey mode—from telephone interviews (CATI) in 2014 to mainly face-to-face (CAPI) in 2019—raising concerns about possible measurement and selection effects.

The aim of this study is therefore to reassess trends in functional limitations using SHARE data, which provide a consistent methodological framework and allow for international benchmarking. By drawing on eleven years of panel data and comparing Austria to other European countries, we test whether functional limitations among older individuals have indeed increased or whether previously observed deteriorations might reflect survey artefacts.

International evidence provides a mixed picture of ADL and IADL trends. Several studies indicate a downward trend in overall limitations among older adults, attributed to advancements in technology, education and healthcare (Freedman et al. 2002, 2004; Martin and Schoeni 2014; Falk Erhag et al. 2021; Knoll et al. 2023; Verro-

poulou and Tsimbos 2017), while others show an upward trend (Ding et al. 2024). A closer look points at different trends for ADL and IADL: Declines are often stronger for IADL than for ADL (Freedman et al. 2002; Verropoulou and Tsimbos 2017), and in some cases ADL limitations remain stable (Ahrenfeldt et al. 2018; Martin et al. 2011; Heimbuch et al. 2023) or even increase (Parker et al. 2008; Fuller-Thomson et al. 2009). Nevertheless, other analyses show the opposite trend with clear ADL improvements and stagnating IADL limitations (Chatterji et al. 2015). Additionally, patterns vary across countries (Ahrenfeldt et al. 2018; Chatterji et al. 2015) and age groups. For this latter, older cohorts mainly show improvements while younger cohorts exhibit stagnation or deterioration (Martin and Schoeni 2014; Falk Erhag et al. 2021; Knoll et al. 2023; Ahrenfeldt et al. 2018; Seeman et al. 2010; Freedman et al. 2013).

While increases in limitations might be explained by changes in lifestyle and nutrition, leading to increased rates of obesity and diabetes, as well as higher survival rates due to medical progress, a close look at the data used for the analysis is crucial. Some of these inconsistencies may reflect real heterogeneity, whereas others may be caused by changes in survey mode, questionnaire items, item definition, or sample composition (OECD/European Commission 2024; Freedman et al. 2002, 2004), and may be a potential explanation for the startling increase in limitations in Austria described above, especially when looking at the data from a more long-term perspective (Gruber et al. 2024).

In light of these ambiguities, the present study contributes to the literature by providing harmonized, cross-country evidence on functional health trends in old age over more than a decade. Specifically, we test the hypothesis that limitations in ADL as well as limitations in IADL fall over time—both in Austria as well as in a sample of other European countries.

2 Methods

2.1 Data

In this study, we use SHARE, a panel data set to observe the development of ADL and IADL in Austria and other European countries for the period 2011 to 2022. SHARE is a multidisciplinary, pan-European research infrastructure collecting detailed microdata on health, socioeconomic status, family networks, and living conditions among individuals aged 50 and older (Börsch-Supan et al. 2013). Established in 2004, the survey currently covers more than 160,000 respondents across 27 European countries plus Israel. This research infrastructure has the advantage to dispose of fully comparable questionnaires across countries and time, and interview procedures have remained consistent throughout. All main interviews are conducted face-to-face[1]

[1] In case a respondent is for example because of an illness or dementia not able to answer for himself, a close relative or friend (proxy) can assist or answer the questionnaire for the respondent. In case of a proxy interview not all parts of the interview are answered. Around 5% of all SHARE interviews in wave 9 for example were interviews with a proxy alone or the respondent together with a proxy.

using computer assisted personal interviewing (CAPI). This ensures high data quality and eliminates potential biases stemming from changes in survey mode over time.

For our analysis we use data from SHARE wave 4 conducted in 2011 (SHARE-ERIC 2024a), wave 5 in 2013 (SHARE-ERIC 2024b), wave 6 in 2015 (SHARE-ERIC 2024c) and wave 9 in 2021/2022 (SHARE-ERIC 2024d), all as published in data release 9.0.0. These waves were selected for the trend analysis because both the outcome and explanatory variables are available for the entire sample. We excluded wave 7 because a large share of respondents received a retrospective life history interview rather than the standard SHARE questionnaire. Wave 8 was excluded because of the sudden termination of fieldwork in spring 2020 due to the COVID-19 pandemic.

Besides Austria, we utilize data from ten other European countries that have participated in all selected SHARE waves. These countries are Germany, Sweden, Spain, Italy, France, Denmark, Switzerland, Belgium, Czechia, and Estonia. For lack of a better name, these countries—excluding Austria—are subsumed under the term "Europe".

2.2 Sample

SHARE is a panel study; however, in each wave, refreshment samples are drawn in many countries to account for panel attrition and maintain representativeness. Only individuals aged 65 and older at the time of the interview in the respective waves are included in the present analysis.

In the Austrian sample, information regarding ADL and IADL is available for 2,504 observations in wave 4, for 2,359 in wave 5, 2,127 in wave 6, and 2,151 in wave 9. The European sample (excluding Austria) comprises of 20,225 observations in wave 4, 26,810 in wave 5, 26,262 in wave 6 and 21,735 in wave 9. As not all explanatory variables are consistently available for every observation, the estimation samples are approximately 4–5 percent smaller than the raw sample sizes reported above.

2.3 Variables

2.3.1 Dependent variables

The ADL scale in SHARE consists of 6 items of basic activities: 'Dressing, including putting on shoes and socks', 'Walking across a room', 'Bathing or showering', 'Eating, such as cutting up your food', 'Getting in or out of bed', and 'Using the toilet, including getting up or down'.

The IADL scale consists of 7 activities in total: 'Using a map to figure out how to get around 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, such as paying bills and keeping track of expenses'.

As dependent variables we use four indicators. For both ADL and IADL, we define: (i) a dummy variable 1+, which indicates, whether at least one activity is limited, and (ii) a count variable representing the number of limitations.

In SHARE, the construction of the IADL variable differs slightly from that used in Woldemariam et al. (2024). In ATHIS, the IADL index does not include the item 'Using a map to figure out how to get around in a strange place,' but includes two separate items on housework—'Doing light housework' and 'Doing heavy housework'—whereas SHARE contains only one corresponding item. Furthermore, the authors of Woldemariam et al. (2024) restrict their analysis to a binary indicator identifying individuals with at least one limitation in ADL or IADL (1+limitation) but do not consider the count variable that captures the total number of limitations.

2.3.2 Socio-demographic and other dependent variables

In the pooled model estimations, we use similar control variables like Woldemariam et al. (2024) described in the following: gender [1 = female], age group [age at time of the interview; 1 = 65–69, 2 = 70–74, 3 = 75–79, 4 = 80–84, 5 = 85 +], country of birth [1 = None-EU/None-EFTA] and education [based on ISCED coding; 1 = primary or lower (ISCED 0, 1), 2 = secondary (ISCED 2–4), 3 = tertiary (ISCED 5 and higher)], region of current residence [1 = urban area of living] and partner information [1 = Partner lives in household] as demographic and socio-economic control variables. For the other European countries' sample, the current country of living is added as additional control variable.

Health and life-style indicators are chronic illness, BMI and physical activity. The chronic illness [1 = yes] variable has been derived from the question "Do you have any long-term health problems, illness, disability or infirmity? (Including mental health problems.)". BMI is grouped in 1 = underweight (below 18.5), 2 = normal (18.5–24.9), 3 = overweight (25–29.9) and 4 = obese (30 and above). Physical activity takes the value 1 in case vigorous or moderate physical activity such as sports, housework, gardening or a job that involves physical labour has been carried out once or less than once a week.

All variables are available in all selected waves. In wave 6, questions about nutrition were only asked to respondents of the refreshment sample and are therefore not considered in our analysis.

2.4 Statistical methods

We employ logit regression models for binary outcome variables and negative binomial regression models for count outcomes such as the number of limitations in activities of daily living. A simple Poisson model for the count data was rejected by a Pearson's Chi-Squared test for overdispersion. Therefore, we use a negative binomial model, as suggested by Yau et al. (2003) and Setyawan et al.(2022). To account for possible problems of unit non response and sample attrition, calibrated cross-sectional weights for the different waves are applied (De Luca and Donni Li 2024; De Luca and Rossetti 2018). A potential bias that cannot be corrected comes from the fact that individuals in better health are generally more likely to participate in surveys (Börsch-Supan et al. 2013). All statistical analyses were conducted using Stata 14.

3 Results

Using SHARE data for Austria and other European countries, and examining both the prevalence and the number of ADL and IADL limitations, our results indicate a downward trend in such limitations over the ten years period; in particular for the European countries, a bit less so for Austria.

Table 1 presents simple descriptive distributions of ADL and IADL limitations for Austria and other European countries, without controlling for gender or age. The prevalence of individual items for both ADL and IADL limitations across different waves is detailed in the Appendix Table 3. Between 12 and 17% of the sample report at least one ADL limitation, while nearly one third report one or more IADL limitations. Table 1 shows descriptive trends over time of limitations in activities of daily living: for Austria, the prevalence of limitations as well as the number of limitations is first increasing and then falling again. Among the other European countries, the trend is more consistently negative across all indicators. While some intermediate waves show minor fluctuations, the overall pattern points toward a persistent decline in functional limitations over time. Because age, health, and disability are strongly correlated, these raw differences should be interpreted with caution.

To account for changes in the age structure of the population, Fig. 1 illustrates age-corrected predicted proportions of individuals with one or more limitations in IADL and ADL including a linear trend. The figure presents estimated predictions at the age of 75 years from weighted logit regression analyses, controlled for age in years at the time of the interview, and country; reporting predicted values by gender. The age of 75 is very close to the mean age in all waves and set to a fixed number for the reason of comparability.

Compared to Table 1 and after controlling for age, Fig. 1 reveals a clear downward trend in limitations for both Austrian men and women. Looking at the European countries, women also experience a remarkable decline, while male trends remain

Table 1 Raw data trends: share of 1 + limitations in ADL and IADL and the number of limitations in ADL and IADL in Austria and Europe over time

	Wave 4 (2011)	Wave 5 (2013)	Wave 6 (2015)	Wave 9 (2021/22)
Austria				
1+limitations in ADL	0.16	0.17	0.17	0.12
Number of limitations in ADL	0.35	0.42	0.45	0.29
1+limitations in IADL	0.28	0.27	0.30	0.24
Number of limitations in IADL	0.64	0.77	0.84	0.64
N	2,504	2,359	2,127	2,151
Europe				
1+limitations in ADL	0.20	0.20	0.19	0.16
Number of limitations in ADL	0.48	0.49	0.45	0.39
1+limitations in IADL	0.27	0.27	0.25	0.23
Number of limitations in IADL	0.71	0.77	0.70	0.61
N	20,225	26,810	26,262	21,735

Presented is the weighted mean, not age corrected

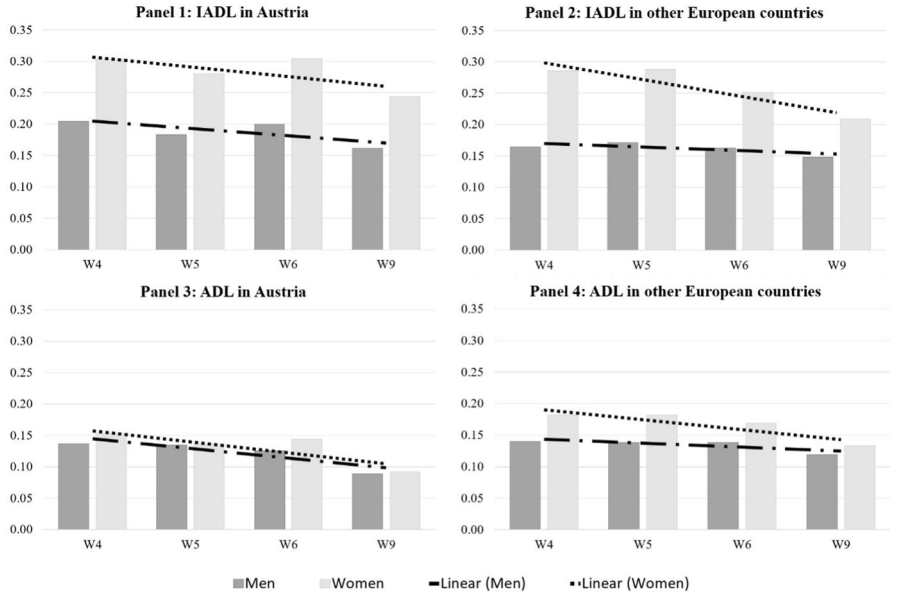


Fig. 1 Trends in limitations in IADL and ADL at the age of 75. *Notes*: The four panels present age controlled predicted shares of 1 or more limitations in IADL and ADL with linear trend. Presented are predicted margins at the age of 75 from weighted logit estimation controlled for gender, age in years at time of the interview and country of living

largely stable. The reduction is particularly strong for women in both Austria and the broader European sample.

A closer look at the numbers of Fig. 1 reveals: The share of females with at least one limitation in IADL is falling by 6 percentage points from 30.4 to 24.4% from 2011 to 2022. For males the relation is trending down from 20.5 to 16.1%. In the subsample of the other European countries selected for analysis women exhibit a strong decline by around 8 percentage points, whereas the prevalence for males goes down by only 1.6 percentage points. Concerning ADL women experience a reduction of ADL prevalence by about 5 percentage points in Austria as well as in the group of other European countries. For men the occurrence declines from 15.3 to 9.2% in Austria, which translates to a reduction of 6.1 percentage points. Again, men in the European sample undergo a minor decline by 2 percentage points. Figures 2 and 3 confirm that the overall prevalence of both ADL and IADL limitations is trending downward across all examined countries.

Table 2 presents the main results from the pooled regression models—logit estimates for the probability of experiencing one or more limitations and negative binomial estimates for the count of limitations. In addition to trend indicators, the models include controls for country of birth, area of residence (urban/rural), partner status, education, chronic illness, BMI, and physical activity, as well as age and gender.

While our primary focus is on the time trend, it is worth noting that all explanatory variables behave as expected. Age and limitations correlate positively and females are more likely to report limitations in IADL and less limitations in ADL compared

to males. Persons born outside Europe tend to experience more limitations in IADL. Living in a rural area reveals no clear effect. Persons with less formal education and without a partner face a higher risk of disability. And it is not surprising, finally, that a higher number of limitations goes along with more suffering from chronic illness, being underweight or obese and rarely engaging in physical activity. Descriptive statistics of the estimation sample and complete results can be found in Appendix Tables 4, 5 and 6. Odds ratios for the logit models and exponentiated coefficients for the negative binomial model are shown relative to the base wave 4 (2011).

Concerning the trend, in Table 2, we see that, controlling for all previously mentioned socio-demographic characteristics, the general picture suggested by descriptive statistics and age adjusted trends presented in Fig. 1 is confirmed: a partial downward trend in Austria and a clear, statistically significant decline in Europe. While there is some variation in the coefficients, only one of the twelve coefficients is significantly positive. Moreover, the general trend towards the end of the observation period remains consistently negative, with significant coefficients for ADL, but inconclusive results for IADL. Compared to the base year 2011, the odds ratios of the years 2013 and 2015 appear slightly higher than 1 but are almost everywhere (but 1 exception) statistically insignificant. The odds ratio for the latest trend variable 2021/22 is for three of four models below one in Austria. In other European countries there are stronger negative trends both for ADL and IADL, where all coefficients are negative from 2011 to 2022, which might also be due to the larger sample size in the group of other European countries. The strongest effect shows also in the European sample the last trend variable 2021/22, which supports the falling trend over time.

To sum up, our results provide evidence for a declining prevalence and intensity of functional limitations among the elderly in Europe over the last decade. For Austria, the trend is slightly weaker but nonetheless points in the same direction—suggesting that ageing populations are, on average, maintaining or even improving their functional ability over time.

4 Discussion

In this study, we use harmonized data from the Survey of Health, Ageing and Retirement in Europe (SHARE) to look at the development of ADL and IADL limitations. Consistent with the general increase in life expectancy (OECD/European Commission 2024), we observe a stagnation if not reduction in these limitations which hamper day to day life. This emerging picture of an increasingly unimpaired daily life in old age is also consistent with a general tendency towards active ageing (Steinmayr et al. 2020) and an increase of healthy life years (Weber and Loichinger 2022). For Europe, public statistics show a positive trend in healthy life years for the elderly in the long run (OECD/European Commission 2024). The somewhat weaker and blurrier results for Austria, compared to the rest of Europe, are also in line with other findings that the overall increase in healthy life expectancy has come to a stagnation in Austria for the last decade (Gruber et al. 2024).

Considering the rise in life expectancy, one might expect that additional years of life are accompanied by a longer period spent with illness or disability. But the trajec-

Table 2 Time trends in pooled sample estimation

	I	II	III	IV
	IADL 1+limitations	Number of limitations in IADL	ADL 1+limitations	Number of limitations in ADL
Austria				
Wave (base=wave 4 (2011))				
wave 5 (2013)	0.95	1.11	1.05	1.09
	[0.79,1.13]	[0.98,1.25]	[0.86,1.29]	[0.91,1.30]
wave 6 (2015)	1.19	1.22 **	1.10	1.16
	[0.99,1.43]	[1.08,1.38]	[0.89,1.36]	[0.97,1.38]
wave 9 (2021/22)	0.91	1.09	0.72 **	0.91
	[0.76,1.09]	[0.96,1.24]	[0.57,0.89]	[0.74,1.10]
N	8770	8770	8770	8770
Pseudo R^2	0.30	0.18	0.28	0.18
European countries				
Wave (base=wave 4 (2011))				
wave 5 (2013)	1.06	1.13 **	1.02	1.06
	[0.97,1.17]	[1.05,1.21]	[0.92,1.13]	[0.98,1.16]
wave 6 (2015)	0.97	1.03	0.99	1.02
	[0.88,1.07]	[0.96,1.11]	[0.89,1.10]	[0.94,1.12]
wave 9 (2021/22)	0.84 ***	0.91 *	0.78 ***	0.87 **
	[0.76,0.92]	[0.84,0.98]	[0.70,0.87]	[0.79,0.95]
N	89,617	89,617	89,617	89,617
Pseudo R^2	0.26	0.15	0.22	0.14

Columns 1 and 3 present odds ratios from weighted logit estimation with IADL 1+or ADL 1+as dependent variables. Columns 2 and 4 show exponentiated coefficients from weighted negative binomial regression with the number of limitations in IADL or ADL as dependent variables. Only time variables presented, complete estimation results presented in Table 5 and 6 in the Appendix

Exponentiated coefficients; 95% confidence intervals in brackets

*$p<0.05$, **$p<0.01$, ***$p<0.001$

tory may be different. A recent policy report (Rechel et al. 2020) highlights different scenarios of ageing—ranging from an expansion to a compression of years lived with disease and disability. Chatterji et al. (2015) argue in favour of the compression concept, suggesting that individuals are not only living longer but also spending a larger share of their lives free from disability. Importantly, chronic diseases do not necessarily or immediately translate into functional impairments. Advances in medical screening, healthcare, and treatment have likely contributed to this development, allowing individuals with chronic conditions to maintain functional independence for longer periods.

Other international studies also indicate rather decreasing trends in the prevalence of disability in the age group 65 and older for the recent years, whereas increasing developments come from earlier time periods or younger age groups. To illustrate the size of trends, we compiled results from selected studies that use somewhat comparable definitions and measures. Data from the U.S. Health and Retirement Study

(HRS) indicate a downward trend in IADL limitations among Americans aged 65 and older, declining from 42% in 2006 to 31% in 2018 (Knoll et al. 2023). For ADL, the U.S. trend is largely stagnant for individuals aged 50–64, while for those 65 and older it decreases slightly from 23.7% in 2006 to 20.2% in 2018 (Heimbuch et al. 2023). Earlier U.S. Supplements on Aging (SOA) data show an increase in any ADL limitation from 26 to 29% between 1984 and 1995 (Freedman et al. 2004).

A Chinese study based on the China Health and Retirement Longitudinal Study (CHARLS) finds increasing ADL and IADL limitations in the older population overall. However, when examining prevalence by age group, the levels remain nearly stable over time. Between 2011 and 2018, ADL (IADL) prevalence stagnates at around 7% (15%) for those aged 60–69, 12% (28%) for those aged 70–79, and approximately 28% (49%) for individuals aged 80 and older. (Ding et al. 2024).

For Europe, based on data from Statistics Sweden a study reports that the share of people aged 65–84 needing help with at least one ADL declined from 12% in 1980 to 4% in 1996, before rising again to 7% in 2004 (Parker et al. 2008). Using SHARE data from 2004 to 2013, researchers (Verropoulou and Tsimbos 2017) find a prevalence of 6% for ADL and IADL difficulties among men aged 50–64, and 14% (ADL) and 17% (IADL) among men aged 65 and older. For women, the corresponding figures are 6% (ADL) and 9% (IADL) in the younger age group, and 21% (ADL) and 32% (IADL) among those aged 65 and older. Over the 2004–2013 period, the overall trend is decreasing, with an odds ratio of 0.9, except for men aged 50–64, for whom the trend is increasing (odds ratio 1.1).

Nevertheless, these finding from SHARE stand in sharp contrast to results from the Austrian Health Interview Survey (ATHIS), conducted in 2014 and 2019, which report a marked increase in functional limitations among older adults in Austria (Woldemariam et al. 2024). The ATHIS study indicates that the prevalence of limitations in any ADL among Austrians aged 65 and older increased from 12.8 to 17.9% for men and from 19.2 to 25.7% for women. For IADL limitations, the same study shows an increase from 18.9 to 35.1% for men and from 38.2 to 50.8% for women. This translates into an increase in limitations in ADL or IADL of 32 and 94 percent respectively over a 5-year period, where limitations in single ADL or IADLs are even reported to have tripled or quadrupled. For example, difficulties with eating and drinking are reported to have tripled, while problems with using the toilet have doubled. Similarly, among IADL items, limitations in meal preparation, telephone use, and medication management more than doubled within the same short time period. These findings, which have attracted considerable attention in national media (APA 2024), imply a rapid worsening in functional health among the Austrian elderly—an interpretation that directly opposes the more stable or improving trends observed in SHARE.

What may be possible explanations for this difference between analyses based on ATHIS and those based on SHARE?

A difference may arise from the graded answer options. In contrast to SHARE, in ATHIS every limitation in daily activities can be rated with ‘No difficulty’, ‘Some difficulty’, ‘A lot difficulty’, ‘Cannot do at all/Unable to do’ and ‘Not applicable (never tried it or do not need to do it)’ (see European Commission and Eurostat 2013; European Commission and Eurostat 2020). Even the option of ‘some difficulties’ is

later considered an actual impairment. It could be that slight limitations are the only driver of the increase based on ATHIS data, that might not be reported as limitations in the SHARE data. Another study has already attributed negative health trends in Austria to mild limitations (Welsh et al. 2021). An analysis of ATHIS-data with a more nuanced approach differentiating between the severity of limitations could provide further insight. Considering the large divergence, this is possibly a contributing but not the main factor causing the different results.

A more plausible explanation is that the observed increase in ADL and IADL limitations in ATHIS is at least partly driven by mode-specific selection effects rather than true population-level changes in functional health. As the authors themselves point out (Woldemariam et al. 2024), ATHIS underwent a change in interview modes, transitioning from CATI in 2014 to a combination of CAPI and a minor share of web-based interviews in 2019. Such changes in interview modes may have—even profound—consequences on the results.

CATIs are known to suffer from particularly high non-response rates, which are not random but strongly socially patterned. Individuals who are harder to reach by phone or more likely to refuse participation—such as those with lower educational attainment, lower socioeconomic status, poorer health, or weaker institutional trust—tend to be systematically underrepresented in CATI samples. Importantly, these same characteristics are strongly associated with higher prevalence of functional limitations. A shift from CATI to CAPI therefore plausibly increases the inclusion of respondents with poorer health and higher functional impairment, even if the underlying population prevalence remains stable. Examining the prevalence of limitations in the ATHIS compared to SHARE data, the number was relatively low in the ATHIS 2014 sample, giving an additional hint into this direction. Cross-sectional samples, such as ATHIS, are particularly susceptible to undetected mode effects, since contrary to longitudinal samples no direct remedies exist to control for bias in sample attrition rates of certain subgroups.

Face-to-face CAPI interviewing reduces several barriers inherent in telephone surveys: interviewers can establish contact with individuals who would otherwise not answer or would immediately terminate a phone call; they can adapt communication to respondents with sensory, cognitive, or health-related limitations; and they can actively encourage participation among initially reluctant individuals. This is particularly relevant for ADL and IADL measures, as individuals with mobility restrictions, chronic illness, or early cognitive decline—groups with elevated risks of functional limitations—are precisely those most likely to be missed in telephone-based surveys. Consequently, the transition back to CAPI in ATHIS is likely to have altered the *composition* of the achieved sample towards groups with higher baseline probabilities of reporting ADL and IADL limitations.

This interpretation is consistent with prior methodological research (e.g. Liedl and Steiber 2024; Weeks et al. 2021; van Berkel et al. 2024; Villar et al. 2017) showing that mixed-mode interview collection affects the quality of data compared to the gold standard of face-to-face interviewing. Interview modes other than face-to-face can be problematic due to higher non-response-rates, particularly among certain subgroups of respondents, which introduces an additional—and highly selective—bias into the collected data. Especially CATIs demonstrate significant non-response bias, resulting in fewer male respondents, fewer blue-collar workers, fewer individuals with lower levels of education (Villar et al. 2017). As other studies have demonstrated significant non-response bias in phone

interviews (van Berkel et al. 2024; Villar et al. 2017), a potential representation bias in the 2014 telephone sample cannot be ruled out—but cannot be tested neither, though.

These findings underline the importance of prioritizing quality control procedures in all scientific research projects involving data collection (Halmdienst and Radhuber 2018). While face-to-face interviews are still regarded as the gold standard for scientific data collection, in some cases the costs associated with personal interviews can be prohibitively high for smaller to medium-sized research projects. However, any deviation from this gold standard may incur non-financial costs, such as increased non-response bias or mode effects, which have the potential to significantly distort research outcomes if not adequately addressed. Based on that, for general trend analysis a longer period of time may be advisable, since sampling and other interview effects may affect trends in the short run.

Limitations of the present study may arise from sample selection problems in surveys: less healthy persons are typically less likely to be interviewed. While there is a weighting procedure, this problem could be augmented as health-related sample selection is more problematic in a panel survey framework. SHARE uses refreshment samples to account for panel attrition.

5 Conclusion

Our findings indicate that, contrary to some earlier studies, age-specific limitations in activities of daily living (ADL) and instrumental activities of daily living (IADL) have stagnated or even declined among individuals aged 65 and older in Austria and selected European countries between 2010 and 2022. Such developments are fully compatible with rising life expectancy: as cohorts age, people at a given age appear to remain equally or less limited in their daily functioning over time. This is encouraging from an individual perspective, as it suggests that longer lives do not necessarily entail more years lived with functional impairments.

From a health-care and long-term-care planning perspective two additional factors must be considered when assessing the absolute need for care: the expected duration of support required per person and the demographic shift toward a larger population aged 65 and above. While our analysis does not explicitly project care expenditures, these demographic and health trends carry important public finance implications. A slower increase or even a reduction in age-specific disability prevalence implies that the growth of long-term care costs may be less steep than demographic projections alone would suggest. Nevertheless, the absolute number of older individuals requiring assistance is rising, maintaining upward pressure on health, pension, and care budgets. A comprehensive evaluation of these aspects lies beyond the scope of this paper, however balancing these effects will be critical for the fiscal sustainability of ageing societies.

Overall, our results emphasize the importance of continuously monitoring functional health using harmonized and methodologically consistent data. Reliable evidence helps to identify effective strategies that promote independence in later life and supports policymakers in designing financially sustainable care systems—ensuring that resources are allocated efficiently and care is provided where and when it is most needed.

Appendix

See Figs. 2 and 3 and Tables 3, 4, 5 and 6

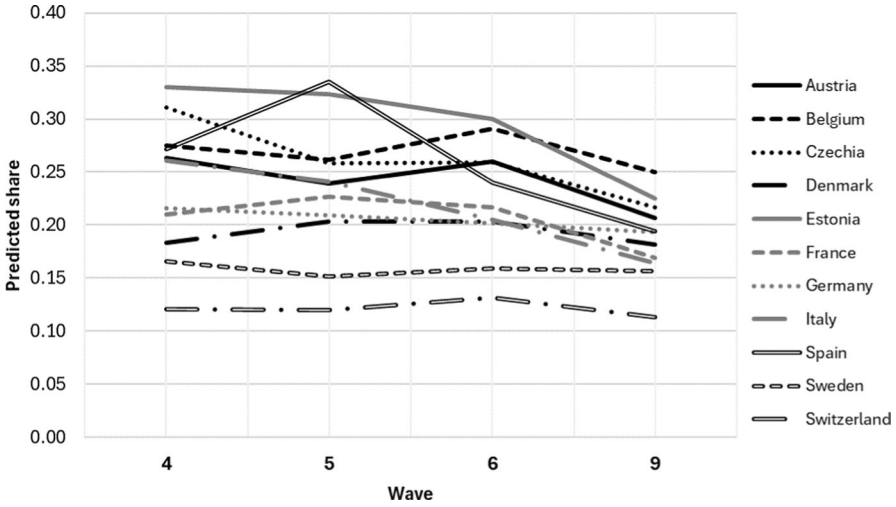


Fig. 2 Trend in limitations in IADL for all countries. *Notes*: Predicted shares at age of 75 from logit estimation by country for SHARE waves 4–9 with one or more limitations in IADL as dependent variable like Fig. 1. Estimations are weighted and it is controlled for gender and age in years

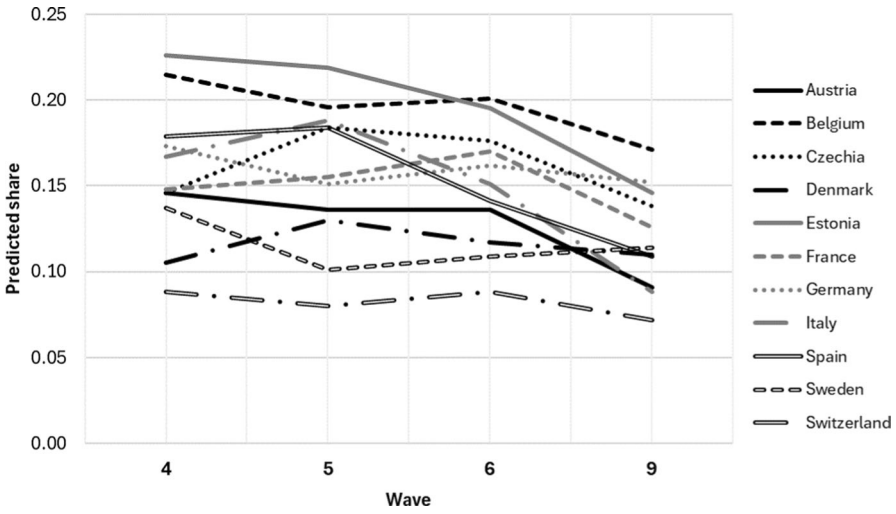


Fig. 3 Trend in limitations in ADL for all countries. *Notes*: Predicted shares at age of 75 from logit estimation by country for SHARE waves 4–9 with one or more limitations in ADL as dependent variable like Fig. 1. Estimations are weighted and it is controlled for gender and age in years

Table 3 ADL and IADL raw data: shares of individual items on limitations in ADL and IADL over time

	Austria				Other European countries			
	Wave 4 (2011)	Wave 5 (2013)	Wave 6 (2015)	Wave 9 (2021/22)	Wave 4 (2011)	Wave 5 (2013)	Wave 6 (2015)	Wave 9 (2021/22)
Activities of daily living								
Dressing, including putting on shoes and socks	0.11	0.12	0.12	0.08	0.14	0.14	0.13	0.12
Walking across a room	0.03	0.03	0.04	0.03	0.05	0.05	0.04	0.04
Bathing or showering	0.09	0.11	0.12	0.08	0.13	0.13	0.12	0.10
Eating, such as cutting up your food	0.03	0.05	0.05	0.03	0.04	0.05	0.04	0.04
Getting in or out of bed	0.06	0.06	0.06	0.03	0.06	0.07	0.06	0.05
Using the toilet, including getting up or down	0.04	0.05	0.05	0.03	0.05	0.06	0.05	0.04
Instrumental activities of daily living (*IADL*)								
Using a map to figure out how to get around in a strange place	0.13	0.17	0.17	0.14	0.14	0.15	0.13	0.10
Preparing a hot meal	0.07	0.10	0.11	0.08	0.08	0.09	0.08	0.07
Shopping for groceries	0.11	0.12	0.15	0.11	0.13	0.14	0.12	0.11
Making telephone calls	0.02	0.04	0.04	0.02	0.04	0.05	0.05	0.04
Taking medications	0.03	0.05	0.06	0.04	0.05	0.06	0.05	0.04
Doing work around the house or garden	0.21	0.20	0.22	0.18	0.19	0.20	0.18	0.17
Managing money, such as playing bills and keeping track of expenses	0.08	0.10	0.10	0.08	0.08	0.08	0.08	0.07

Weighted mean, not age corrected!

Table 4 Characteristics of the Austrian and selected European countries' estimation sample. Not weighted

	Austria				Selected European countries			
	Wave 4 (2011)	Wave 5 (2013)	Wave 6 (2015)	Wave 9 (2021/22)	Wave 4 (2011)	Wave 5 (2013)	Wave 6 (2015)	Wave 9 (2021/22)
Dependent variables								
IADL number of limitations	0.54	0.64	0.71	0.68	0.57	0.59	0.57	0.51
IADL 1+limitations (0/1)	0.25	0.24	0.27	0.25	0.24	0.23	0.23	0.21
ADL number of limitations	0.30	0.35	0.38	0.30	0.36	0.38	0.36	0.31
ADL 1+limitations (0/1)	0.14	0.15	0.15	0.12	0.17	0.16	0.16	0.14
Explanatory variables								
Gender								
Female (=1)	0.58	0.57	0.58	0.59	0.55	0.54	0.55	0.57
Age group								
Age 65–69	0.32	0.30	0.29	0.22	0.31	0.32	0.31	0.26
Age 70–74	0.32	0.33	0.28	0.24	0.27	0.26	0.25	0.27
Age 75–79	0.17	0.17	0.21	0.21	0.21	0.20	0.20	0.21
Age 80–84	0.13	0.12	0.11	0.21	0.14	0.14	0.14	0.15
Age 85+	0.07	0.09	0.11	0.12	0.08	0.09	0.10	0.11
Education								
Primary or lower	0.20	0.18	0.16	0.11	0.33	0.31	0.29	0.18
Secondary	0.57	0.58	0.59	0.61	0.51	0.50	0.51	0.57
Tertiary	0.24	0.25	0.25	0.28	0.17	0.19	0.20	0.26
Country of birth								
Non-EU/Non-EFTA (=1)	0.02	0.02	0.01	0.01	0.07	0.05	0.05	0.05
Area of living								
Rural (=1)	0.43	0.43	0.42	0.44	0.31	0.30	0.30	0.30
Partner								
No partner or not in household (=1)	0.41	0.41	0.40	0.43	0.34	0.33	0.34	0.37
Chronic illness								
Yes (=1)	0.54	0.55	0.57	0.61	0.61	0.57	0.58	0.59
BMI								
Below 18.5—underweight	0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.02
18.5–24.9—normal	0.38	0.37	0.36	0.39	0.35	0.36	0.36	0.37
25–29.9—overweight	0.41	0.42	0.41	0.39	0.42	0.42	0.42	0.40
30 and above—obese	0.19	0.20	0.22	0.20	0.21	0.1	0.21	0.22
Physical activity (*PA*)								
Once a week or less (=1)	0.34	0.31	0.27	0.25	0.35	0.35	0.33	0.33
Country of living (*current*)								
Germany					0.05	0.10	0.09	0.12
Sweden					0.07	0.10	0.11	0.10
Spain					0.09	0.13	0.13	0.06
Italy					0.10	0.10	0.12	0.13
France					0.13	0.09	0.08	0.09
Denmark					0.05	0.07	0.07	0.07
Switzerland					0.09	0.06	0.07	0.07
Belgium					0.11	0.10	0.11	0.13
Czechia					0.13	0.12	0.11	0.12
Estonia					0.18	0.13	0.13	0.14
n	2360	2281	2078	2051	18,719	25,539	25,114	20,245

Table 5 Austria pooled sample

	I	II	III	IV
	IADL 1+limitations	Number of limitations in IADL	ADL 1+limitations	Number of limitations in ADL
Wave (base = wave 4 (2011))				
Wave 5 (2013)	0.95	1.11	1.05	1.09
	[0.79,1.13]	[0.98,1.25]	[0.86,1.29]	[0.91,1.30]
Wave 6 (2015)	1.19	1.22 **	1.10	1.16
	[0.99,1.43]	[1.08,1.38]	[0.89,1.36]	[0.97,1.38]
Wave 9 (2021/22)	0.91	1.09	0.72 **	0.91
	[0.76,1.09]	[0.96,1.24]	[0.57,0.89]	[0.74,1.10]
Socioeconomic determinants				
Female	1.43 ***	1.07	0.81 *	0.79 **
	[1.25,1.65]	[0.97,1.19]	[0.68,0.95]	[0.68,0.91]
Age (base = Age 65–69)				
Age 70–74	1.52 ***	1.53 ***	1.55 ***	1.78 ***
	[1.26,1.83]	[1.30,1.80]	[1.22,1.98]	[1.40,2.27]
Age 75–79	1.97 ***	1.90 ***	1.62 ***	1.70 ***
	[1.62,2.39]	[1.61,2.24]	[1.25,2.10]	[1.34,2.17]
Age 80–84	3.41 ***	2.93 ***	3.38 ***	2.99 ***
	[2.78,4.18]	[2.50,3.43]	[2.61,4.37]	[2.37,3.76]
Age 85+	7.16 ***	4.32 ***	4.91 ***	4.04 ***
	[5.67,9.02]	[3.68,5.08]	[3.74,6.44]	[3.21,5.07]
Country of birth: non-EU/Non-EFTA	1.75 *	1.75 **	1.24	0.66
	[1.04,2.95]	[1.19,2.59]	[0.67,2.28]	[0.40,1.08]
Area of living: rural	1.07	1.09	1.03	0.97
	[0.93,1.22]	[0.99,1.20]	[0.87,1.22]	[0.84,1.11]
No partner or not in household	1.24 **	1.21 ***	1.22 *	1.22 **
	[1.08,1.43]	[1.09,1.33]	[1.03,1.44]	[1.05,1.42]
Education (base = tertiary)				
Education: primary or lower	2.39 ***	1.86 ***	1.52 **	1.67 ***
	[1.93,2.96]	[1.59,2.16]	[1.18,1.96]	[1.29,2.03]
Education: secondary	1.21 *	1.18 *	1.03	1.11
	[1.03,1.41]	[1.04,1.34]	[0.85,1.25]	[0.92,1.34]
Health				
Chronic illness: yes	5.16 ***	4.00 ***	6.07 ***	6.79 ***
	[4.45,5.98]	[3.53,4.53]	[4.92,7.50]	[5.50,8.38]
BMI (base = 18.5–24.9—normal weight)				
Below 18.5—underweight	1.74 *	1.69 ***	2.32 ***	1.87 **
	[1.11,2.72]	[1.31,2.19]	[1.42,3.77]	[1.27,2.75]
25–29.9—overweight	0.92	0.91	1.03	0.99
	[0.80,1.07]	[0.82,1.00]	[0.86,1.23]	[0.84,1.15]
30 and above—obese	1.07	0.94	1.24 *	1.13
	[0.89,1.27]	[0.83,1.06]	[1.00,1.53]	[0.95,1.35]
Physical activity: once a week or less	4.48 ***	3.93 ***	5.32 ***	5.70 ***
	[3.93,5.09]	[3.56,4.34]	[4.54,6.23]	[4.90,6.62]

Table 5 (continued)

	I	II	III	IV
	IADL 1+limitations	Number of limitations in IADL	ADL 1+limitations	Number of limitations in ADL
Observations	8,770	8,770	8,770	8,770
Pseudo R^2	0.30	0.18	0.28	0.18

Columns 1 and 3 present odds ratios from weighted logit estimation with IADL 1+or ADL 1+as dependent variables. Columns 2 and 4 show exponentiated coefficients from weighted negative binomial regression with the number of limitations in IADL or ADL as dependent variables

Exponentiated coefficients; 95% confidence intervals in brackets

*$p<0.05$, **$p<0.01$, ***$p<0.001$

Table 6 Pooled sample of other European countries

	I	II	III	IV
	IADL 1+limitations	Number of limitations in IADL	ADL 1+limitations	Number of limitations in ADL
Wave (base = wave 4 (2011))				
Wave 5 (2013)	1.06	1.13 **	1.02	1.06
	[0.97,1.17]	[1.05,1.21]	[0.92,1.13]	[0.98,1.16]
Wave 6 (2015)	0.97	1.03	0.99	1.02
	[0.88,1.07]	[0.96,1.11]	[0.89,1.10]	[0.94,1.12]
Wave 9 (2021/22)	0.84 ***	0.91 *	0.78 ***	0.87 **
	[0.76,0.92]	[0.84,0.98]	[0.70,0.87]	[0.79,0.95]
Socioeconomic determinants				
Female	1.44 ***	1.10 ***	0.97	0.91 **
	[1.35,1.54]	[1.04,1.17]	[0.91,1.05]	[0.85,0.97]
Age (base = Age 65–69)				
Age 70–74	1.30 ***	1.32 ***	1.35 ***	1.28 ***
	[1.19,1.43]	[1.20,1.45]	[1.21,1.50]	[1.15,1.42]
Age 75–79	2.04 ***	1.97 ***	1.77 ***	1.66 ***
	[1.86,2.24]	[1.80,2.15]	[1.59,1.97]	[1.50,1.85]
Age 80–84	3.37 ***	2.96 ***	2.81 ***	2.48 ***
	[3.05,3.73]	[2.72,3.22]	[2.51,3.14]	[2.23,2.76]
Age 85+	6.74 ***	4.97 ***	5.13 ***	3.80 ***
	[6.02,7.54]	[4.56,5.43]	[4.55,5.78]	[3.42,4.22]
Country of birth: Non-EU/Non-EFTA	1.12	1.16 *	0.85	0.99
	[0.92,1.37]	[1.01,1.33]	[0.68,1.07]	[0.82,1.18]
Area of living: rural	1.06	1.08 **	0.97	0.99
	[0.98,1.13]	[1.02,1.14]	[0.90,1.05]	[0.92,1.06]
No partner or not in household	1.34 ***	1.26 ***	1.32 ***	1.23 ***
	[1.26,1.44]	[1.19,1.33]	[1.23,1.43]	[1.15,1.31]
Education (base = tertiary)				
Education: primary or lower	1.90 ***	1.75 ***	1.51 ***	1.45 ***
	[1.71,2.12]	[1.59,1.92]	[1.34,1.70]	[1.29,1.62]
Education: secondary	1.40 ***	1.31 ***	1.28 ***	1.20 ***
	[1.26,1.55]	[1.20,1.43]	[1.14,1.43]	[1.08,1.34]
Health				
Chronic illness: yes	4.17 ***	3.54 ***	4.24 ***	4.22 ***
	[3.89,4.48]	[3.31,3.78]	[3.90,4.61]	[3.89,4.57]
BMI (base = 18.5–24.9—normal weight)				
Below 18.5—underweight	1.79 ***	1.46 ***	1.85 ***	1.75 ***
	[1.43,2.24]	[1.29,1.66]	[1.46,2.34]	[1.49,2.06]
25–29.9—overweight	0.94	0.83 ***	1.04	0.93 *
	[0.87,1.01]	[0.78,0.88]	[0.96,1.13]	[0.86,1.00]
30 and above—obese	1.22 ***	1.03	1.66 ***	1.35 ***
	[1.12,1.33]	[0.96,1.11]	[1.51,1.82]	[1.25,1.46]
Physical activity: once a week or less	3.81 ***	3.64 ***	3.61 ***	4.12 ***
	[3.57,4.07]	[3.43,3.85]	[3.36,3.89]	[3.84,4.41]
Country of living (base = Germany)				
Sweden	0.82 ***	0.84 ***	0.78 ***	0.82 ***

Table 6 (continued)

	I	II	III	IV
	IADL 1+limitations	Number of limitations in IADL	ADL 1+limitations	Number of limitations in ADL
	[0.74,0.92]	[0.76,0.92]	[0.69,0.88]	[0.72,0.92]
Spain	1.01	1.16 **	0.85 *	1.02
	[0.90,1.14]	[1.05,1.28]	[0.74,0.96]	[0.91,1.14]
Italy	0.79 ***	0.90 *	0.82 ***	0.86 **
	[0.71,0.88]	[0.82,0.98]	[0.73,0.92]	[0.78,0.95]
France	0.94	0.85 ***	0.94	0.86 **
	[0.85,1.05]	[0.78,0.93]	[0.84,1.05]	[0.78,0.95]
Denmark	1.08	1.05	0.80 ***	0.80 ***
	[0.96,1.21]	[0.95,1.15]	[0.70,0.91]	[0.72,0.90]
Switzerland	0.77 ***	0.71 ***	0.70 ***	0.65 ***
	[0.69,0.87]	[0.64,0.79]	[0.61,0.80]	[0.58,0.74]
Belgium	1.53 ***	1.24 ***	1.38 ***	1.11 *
	[1.40,1.68]	[1.15,1.33]	[1.25,1.53]	[1.02,1.21]
Czechia	1.27 ***	1.13 **	0.92	0.92
	[1.15,1.40]	[1.04,1.23]	[0.82,1.03]	[0.84,1.02]
Estonia	1.11 *	1.11 **	0.94	0.97
	[1.00,1.23]	[1.03,1.19]	[0.84,1.05]	[0.88,1.07]
Observations	89,617	89,617	89,617	89,617
Pseudo R^2	0.26	0.15	0.22	0.14

Columns 1 and 3 present odds ratios from weighted logit estimation with IADL 1+or ADL 1+as dependent variables. Columns 2 and 4 show exponentiated coefficients from weighted negative binomial regression with the number of limitations in IADL or ADL as dependent variables

Exponentiated coefficients; 95% confidence intervals in brackets;

*$p<0.05$, **$p<0.01$, ***$p<0.001$

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Declarations

Conflict of interest The authors declare no conflict of interest whatsoever.

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