The effect of becoming an intensive family caregiver on cognitive functioning: a matched difference-in-differences analysis in Europe

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Abstract

Background: With increasing life expectancy, cognitive decline becomes a common experience in later life. At the same time, older adults are increasingly taking up caregiving roles. Previous studies suggest a decline in mental health upon becoming an intensive daily caregiver, but evidence on the links between providing informal care and cognitive functioning is mixed. Filling this gap, we examine the effects of becoming an intensive caregiver on cognitive trajectories using a counterfactual design.

Methods: We draw on eight waves (2004-2022) of the Survey of Health, Ageing and Retirement in Europe (SHARE), using longitudinal information on 136,543 observations from 34,257 individuals aged 50+ in 25 countries. Respondents who started intensive (i.e., daily) caregiving (N = 11,419 individuals, the treatment group) are matched with non-caregivers (N = 22,838 individuals, the control group) using Propensity Score Matching. Difference-in-differences models are applied to estimate the effect of caregiving on a composite score of four cognitive tests (memory, verbal fluency and numeracy).

Results: About one in three adults aged 50 takes up intensive caregiving. Cognitive functioning decreased for both groups, with caregivers experiencing a steeper decline around the caregiving onset. Stratified analyses show that men with migration background experience the largest decline when becoming caregivers.

Conclusions: Our results evidence an acceleration of cognitive decline around the onset of caregiving in later life. Stratified results point at unequal impacts. Our findings highlight the need for policies and support programs targeting individuals at risk of becoming caregivers around the caregiving onset.

Introduction

As populations are becoming older, cognitive decline and dementia have emerged as a pressing public health challenge. These conditions are leading contributors to dependency, disability, and mortality worldwide (European Commission, 2018; Livingston et al., 2024). In terms of economic impact, the global cost of dementia and related caregiving reached approximately €1.16 trillion in 2019 (Wimo et al., 2023). Future projections expect the number of dementia cases to rise to 152 million by 2050; nearly a threefold increase from 2019 (Nichols et al., 2022). Given the lack of affordable or widely accessible cures, prevention and early intervention remain the most viable strategies for reducing the individual and societal burden of cognitive decline (Livingston et al., 2024).

The increasing share of older adults in European societies also entails a growing number of individuals in need of care (Calderón-Jaramillo & Zueras, 2023). The majority of this care is provided by informal caregivers, mostly family members (Verbakel, 2018), and the importance of family members for covering care needs has been projected to increase (Pickard et al., 2007), while the caregiver-care receiver ratio is shrinking (Ribeiro et al., 2021). Most governments have developed policies to provide support individuals in need for care, such as cash benefits (Da Roit & Le Bihan, 2010) or subsidized home-based care services (Genet et al., 2011). Yet, most families are usually left with a considerable share of responsibility for the various caregiving tasks (Brandt et al., 2009). Starting to care for a family member has ramifications in many other aspects of the life-course given competing demands, such as employment, social life or health outcomes (Bauer & Sousa-Poza, 2015). Particularly regarding health, a large focus has been put on the consequences of becoming a caregiver on mental health outcomes such as depression, anxiety and caregiving impact (Brandt & Kaschowitz, 2024; Lacey et al., 2024; Wahrendorf et al., 2025). A review on studies estimating

the causal effect of informal caregiving on health highlighted that individuals providing intensive care experienced negative mental health effects (Bom et al., 2019). With regard to physical health outcomes, the results are less clear, however, seemingly depending on caregiving intensity (Bom & Stöckel, 2021). Yet the implications for cognitive functioning remain unclear, with a few studies suggesting accelerated declines in memory and executive function when becoming a caregiver? (Su, 2023; Vitaliano et al., 2011; Yuan & Grühn, 2021), while others do not (Bertogg et al., 2025). However, many of these studies were largely based on North American, British or Chinese cohorts, relying on observational designs that lacked adequate causal identification.

A small but growing body of literature investigating the link between unpaid family caregiving and cognitive functioning offers mixed results (Elayoubi et al., 2023). Existing longitudinal studies show that intensive family caregiving is associated with greater declines in memory, processing speed, and executive function (De Vugt et al., 2006; Vitaliano et al., 2011). These studies attribute cognitive declines to chronic stress, elevated cortisol, inflammation, sleep disruption, and depressive symptoms, which have bene repeatedly linked to accelerated cognitive decline (Moretta et al., 2017; Tangestani Fard & Stough, 2019). Conversely, other studies suggest that light to moderate caregiving might also entail cognitive stimulation (e.g., planning, multitasking, social engagement) that results in preserved or even improved cognitive functioning (Bertrand et al., 2012; Caputo et al., 2024; Yuan & Grühn, 2021).

A more general outlook on unpaid family care – including childcare and grandchild care – suggests a protective effect of engaging in childcare in mid-life (Leist et al., 2013; Ice et al, 2020), or grandchild care in later life (Arpino & Bordone, 2014). Yet, while some of these studies rely on longitudinal data or retrospective information on previous unpaid care

involvement, selection into caregiving based on cognitive abilities is often not accounted for. Whether, and to what degree providing unpaid informal care in later life is associated with trajectories of cognitive aging remains an open empirical question. The first contribution of our study is thus to approximate a more robust estimate of a potential impact of becoming a caregiver in later life on trajectories of cognitive functioning around and beyond the caregiving experience. Based on previous literature, we focus on the transition into intensive caregiving, which we define as providing help or support with activities of daily living (such as getting around, getting to dress and food intake) or instrumental activities of daily living (such as shopping ,housework and transportation) on a composite score comprising various dimensions of cognitive functioning.

Moreover, several studies highlighting the positive aspects of unpaid family care have only relied on women (e.g., Ice et al., 2020; Leist et al, 2013). As with other consequences of unpaid informal care (), the cognitive impacts, too, may be gendered and socially stratified. Particularly, the role of having a migration background remains under-explored. Furthermore, given that both caregiving and migration experiences are deeply shaped by gender roles, examining the intersection of gender and migration background in this association is essential (Brandt & Kaschowitz, 2024): studies applying intersectional approaches in the U.S. found that the effect of family caregiving on psychological health differs across gender and racial identities (Brady et al., 2024). Likewise, migration studies show significant gender differences in how age at migration and cultural integration affect cognitive aging (Mack et al., 2025). Despite these conflicting results, no study to date has offered causal evidence from a European context, where variation in welfare regimes and formal care provision may alter both the stressors and the cognitive demands experienced by family caregivers.

Understanding the dual pathways through which caregiving onset might affect cognitive functioning trajectories is critical. Such association could be explained through negative mechanisms such as chronic psychological distress and allostatic load. Caregivers often report higher depression and anxiety (Lacey et al., 2024; Wahrendorf et al., 2025), which impairs attention and memory consolidation (Moretta et al., 2017; Vitaliano et al., 2009). Additionally, sleep disturbances, which are common among caregivers, further degrade executive function (Moretta et al., 2017). Conversely, caregiving requires tasks that may potentially enhance cognitive reserve, such as planning and multitasking (Bertrand et al., 2012; Mayeda et al., 2020). Likewise, social interaction through support groups and intergenerational family networks may also protect against cognitive decline (Alonso-Perez et al., 2024; Bertogg & Leist, 2021), although this pathway may differ by migration background (Xu et al., 2018). To date, however, no study in Europe has investigated how family caregiving may affect cognitive functioning using a design that allows for causal inference.

In response to these gaps, we leverage eight waves (2004–2022) of the Survey of Health, Ageing and Retirement in Europe (SHARE) to estimate the causal impact of family caregiving onset on cognitive functioning among adults aged 50+. By matching new caregivers to non-caregivers and applying a difference-in-differences (diff-in-diff) framework, we isolate the effect of assuming family caregiving duties from both individual fixed effects and common temporal trends. Our analysis further examines whether diversity characteristics such as gender and migration background modify this effect. Thus, we provide the first European causal evidence on how stepping into family caregiving roles shapes cognitive trajectories.

Method

Data and sample

We used data from eight waves (2004–2022) of the Survey of Health, Ageing and Retirement in Europe (SHARE), a longitudinal panel of older adults in 28 European countries and Israel (Börsch-Supan et al., 2013). Our initial sample comprised all respondents who participated in at least two consecutive waves and were aged 50+ at their first interview (n = 144,454). A total of n = 20,753 individuals provided caregiving during the observation period of which n = x,xxx providing intensive (that is, in-the household, or daily outside-the-household) care. To capture transitions into caregiving, we excluded 3,086 participants with less than two waves of data on caregiving and n = 6,016 respondents who were caregivers at baseline. This led to a sample of n = 11,651 incident caregivers who reported caregiving for the first time during follow-up waves. For each incident caregiver, we defined the wave in which caregiving was first reported as t = 0 and numbered all preceding waves (t = −1, −2, …) and subsequent waves (t = 1, 2, …). Given the limited number of observations per individual (average of 3.4), we restricted the observations up until t = ±5. A comparison group of non-caregivers was drawn from respondents who never reported providing family care across all waves (N = x,xxx respondents with n=xx,xxx person-year observations).

Cognitive functioning assessment

We used four validated tests available in SHARE: immediate word recall (0–10 words), delayed word recall (0–10 words, see Ren et al., 2024), verbal fluency (number of animals named in one minute, Ardila et al., 2006), and numeracy (count of correct answers to a five-item numerical reasoning task, comprising subtractions and percentage identification tasks). Because item-level missingness did not exceed 5% for any test across all selected person-year observations we imputed missing cognitive items using multiple imputation by chained equations (MICE) with ten imputations; the imputation model included all baseline covariates, the caregiving indicator, and the available other? cognitive items. To obtain a single composite

measure of cognitive functioning, we conducted principal component analysis (PCA) for all imputed values separately by wave (Alonso-Perez et al., 2024). PCA revealed one component solution, with an Eigenvalue greater than 1, explaining over 60% of the total variance and with a positive sign for all observed variables in all waves. Kaiser–Meyer–Olkin (KMO) values of >0.74 confirmed the adequacy of a single index. The final composite score ranges from “” to “” and has a mean of “” and a standard deviation of “”, whereby higher scores reflecting better levels of cognitive functioning.

Measuring Caregiving

Intensive family caregiving was defined as providing personal care to an adult family member daily during at least three consecutive months. SHARE allows to distinguish between care outside and inside the respondent’s household, as well as by intensity of caregiving, or the relationship with the care-receiver. Care provided outside of the respondents’ household was captured as follows: “*In the last twelve months, have you personally given any kind of help to a family member from outside the household?*”, followed by the questions “*Was this help with personal care (e.g., dressing, bathing or showering, eating, getting in or out of bed or using the toilet)?*” and “*How often did you provide this care?*”, followed by five answering options (“Almost daily”, “Almost weekly”, “Almost monthly”, and “Less often”). Care provided inside the respondent’s household was asked with the following question “*Is there someone living in this household whom you have helped regularly during the last twelve months with personal care, such as washing, getting out of bed, or dressing? (By regularly we mean daily or almost daily during at least three months”*.

Both initial screening questions regarding the provision of care could be answered with two options (0 = No; 1 = Yes). Provision of care outside the respondents’ household was dichotomized into intensive and non-intensive care, using “Almost daily” care as a threshold,

to keep the intensity of inside- and outside-household care comparable. Our analysis thus only considers observations that were characterized by either care provided inside the household, or daily personal care provided outside of the household. We only selected caregiving for family members. For incident caregivers, caregiving status was coded as 0 for all $t < 0$ and as 1 for all $t \geq 0$; for matched controls, the "caregiver" indicator remained 0 at every wave. This coding allowed us to identify the precise onset of caregiving and to compare cognitive trajectories before, during and after onset.

Covariates

To account for potential confounding, we measured a set of baseline characteristics at $t = -1$ (that is, the survey wave before the onset of intensive caregiving) for both incident caregivers and non-caregiver candidates (remind the reader again: how were t0 and t-1 identified for non-caregivers?). These confounders comprise sociodemographic covariates, socio-economic characteristic, information on the living conditions and respondents' health. Socio-demographic confounders included age at baseline (continuous), sex (male/female), migration background (yes/no), and a respondent's marital status measured with four categories (married or cohabiting, never married, divorced, or widowed). Socio-economic factures included educational attainment (low/middle/high, obtained from ISCED, combining ISCED categories 1+2, 3+4 and 5+6 to represent "primary or lower secondary", "upper secondary" and "tertiary" educational degrees), and employment status (employed, retired, unemployed, permanently sick, homemaker, or other). Living conditions include household size measured as a dichotomous variable (living alone or with others) and number of biological children (0/≥1). Baseline health and well-being comprised the number of self-reported chronic conditions, the number of functional limitations (instrumental activities of daily living - IADL), self-rated health (five-point Likert scale, the number depressive symptoms (EURO-D, capped

at 4), quality of life (CASP-12), sleep problems (yes/no), and maximum grip strength (kilograms).

Analytical Strategy

Propensity Score Matching

We applied Propensity Score Matching (PSM) to identify matched controls who did not provide caregiving but whose observable characteristics led to similar probabilities of becoming caregivers. As a first step, we calculated the probability of becoming a caregiver with a logistic regression based on individual characteristics at baseline ($t = -1$) as predictors. The propensity score was calculated on age at baseline, sex, migration background, education (measured with three groups see above), employment, marital status, number of children, functional limitations, number of chronic diseases and the total number of observations a respondent participated in (waves). Moreover, a respondent's country was used as exact matching, whereby matched pairs of treated and untreated respondents had to be from the same country. As a second step, we used the calculated probability to match both groups with the *kmatch* procedure in Stata (Jann, 2017), using a nearest-neighbour matching algorithm (1:2, without replacement). Once PSM was complete, we assigned the onset time from each caregiver to the corresponding matched non-caregiver in each of the observed waves.

Difference-in-differences

Our primary analytic strategy was a difference-in-differences (diff-in-diff) model with individual and relative-time fixed effects. Specifically, we estimated:

$$Y_{it} = \alpha_{it} + \gamma_t + \beta Care_{it} + \epsilon_{it} \quad (1)$$

where Y_{it} is the cognitive for individual *i* at time *t*, α_{it} denotes person-level fixed effects, γ_t indicates indicators for each time *t*, and $Care_{it}$ equals 1 if individual *i* was a

caregiver at or after *t* = 0, and 0 otherwise. Standard errors ϵ_{it} were clustered at the individual level to adjust for within-person correlation over time. Model 1 did not include covariates; Model 2 included the sociodemographic covariates and Model 3 included the sociodemographic and health covariates. To visually inspect cognitive trajectories in the caregiving and no-caregiving groups before and after onset, and thus assess the parallel trends assumption, we plotted raw outcome trajectories over time using fractional polynomial modelling with fifth-degree polynomials (Bloomberg et al., 2025). Figure 1 shows that pre-onset slopes were nearly identical. We also ran stratified diff-in-diff models by sex and migration background, and tested interaction terms between the caregiving indicator and each subgroup.

Finally, to characterize the timing and slope of cognitive functioning changes in greater detail, we also estimated a piecewise mixed-effects model (Bloomberg et al., 2025; Lacey et al., 2024). We defined three time segments: pre-caregiving onset (*t* = -5 to *t* = -1), caregiving onset (*t* = -1 to *t* = 0) and post-caregiving onset (*t* = 0 to *t* = 5). The model took the form:

$$Y_{it} = \beta_0 + b_i + \beta_1 TimePre_{it} + \beta_2 Onset_{it} + \beta_3 TimePost_{it} + \delta_1(Care_i \times TimePre_{it}) + \delta_2(Care_i \times Onset_{it}) + \delta_3(Care_i \times TimePost_{it}) + \epsilon_{it} \quad (2)$$

where β_0 is the fixed intercept and b_i the random intercept. Interaction terms between each time spline and the caregiver indicator permitted differential slopes and intercept shifts (δ_1 - δ_3) for caregivers relative to controls. All statistical procedures were carried out in Stata© 17 (StataCorp, College Station, TX), using two-sided tests with α = 0.05.

Results

Descriptive statistics

Table 1 provides the descriptive statistics of the study sample, with a comparison between caregivers and matched non-caregivers. Means and proportions at baseline (*t* = −1)

were well balanced across nearly all variables (say quickly, how many non-caregivers were never used for matching?). The mean age was 67.3 (SD = 9.9) years among caregivers and 67.3 (SD = 10.3) among controls. Females constituted 61.4% of caregivers and 60.4% of controls, while migration background was present in 8.9% for caregivers and 8.8% for non-caregivers. Both groups were balanced in the distribution of family composition (marital status, household size and childlessness), education, occupation, employment status and living area. Regarding health outcomes, prevalences were fairly similar between caregivers and non-caregivers, including the cognitive functioning composite variable (16.01 and 15.97, respectively).

Table 1. Descriptive statistics of the study sample, by treatment status (caregivers and matched non-caregivers).

Variables	**Caregivers (N = 11,419)**		**Matched non-caregivers (N = 22,838)**		
	N	%	N	%	p-value
Sex					0.078
Male	19,077	38.6%	32,091	39.6%	
Female	30,327	61.4%	48,890	60.4%	
Migration background					0.420
No	45,016	91.1%	73,894	91.2%	
Yes	4,388	8.9%	7,087	8.8%	
Age group					0.154
50-59 years	10,965	22.2%	13,139	16.2%	
60-69 years	18,390	37.2%	29,930	37.0%	
70-79 years	13,955	28.2%	27,000	33.3%	
80-90 years	6,094	12.3%	10,912	13.5%	
Marital status					<0.001
Married and living with partner/spouse	41,036	83.1%	69,186	85.4%	
Registered partnership	708	1.4%	905	1.1%	
Married and living apart	321	0.6%	549	0.7%	
Never married	1,608	3.3%	1,348	1.7%	
Divorced	1,928	3.9%	2,387	2.9%	
Widowed	3,803	7.7%	6,605	8.2%	
Education					0.136
Low education	10,946	22.2%	17,636	21.8%	
Medium education	18,679	37.9%	30,611	37.8%	

High education	19,714	40.0%	32,733	40.4%	
Latest occupational status					0.064
White-collar high-skill	3,300	32.8%	4,912	33.5%	
White-collar low-skill	3,093	30.8%	4,420	30.1%	
Blue-collar high-skill	1,604	15.9%	2,483	16.9%	
Blue-collar low-skill	2,061	20.5%	2,858	19.5%	
Household size					<0.001
Living alone	4,396	8.9%	6,549	8.1%	
Cohabiting	45,008	91.1%	74,432	91.9%	
Biological children					<0.001
No	2,351	8.4%	2,687	6.1%	
Yes	25,552	91.6%	41,725	93.9%	
Living area					0.136
Urban	20,045	66.3%	31,916	65.8%	
Rural	10,182	33.7%	16,591	34.2%	
Employment					<0.001
Retired	29,798	60.6%	52,948	65.7%	
Employed	10,989	22.3%	15,121	18.8%	
Unemployed	1,111	2.3%	1,352	1.7%	
Permanently sick	1,524	3.1%	1,869	2.3%	
Homemaker	5,131	10.4%	8,322	10.3%	
Other	647	1.3%	957	1.2%	
Body mass index (M ± SD)	26.96	5.14	26.84	5.19	<0.001
Instrumental activities of daily living (M ± SD)	0.44	1.29	0.43	1.33	0.033
Number of chronic conditions (M ± SD)	1.89	1.62	1.84	1.57	<0.001
Self-rated health (M ± SD)	3.21	1.05	3.16	1.03	<0.001
Maximum grip strength (kg) (M ± SD)	32.34	11.01	32.49	11.23	0.030
Sleep problems (M ± SD)	0.37	0.50	0.33	0.49	<0.001
Depression symptoms (EURO-D) (M ± SD)	2.64	2.29	2.28	2.18	<0.001
Well-being (CASP-12) (M ± SD)	37.18	6.16	37.87	6.11	<0.001
Overall cognitive functioning (M ± SD)	16.01	5.30	15.97	5.25	0.186
Memory test 1 - immediate recall (M ± SD)	5.29	1.81	5.26	1.78	0.097
Memory test 2? - delayed recall (M ± SD)	3.92	2.17	3.89	2.14	0.021
Fluency test (M ± SD)	20.36	7.83	20.35	7.82	0.707
Numeracy test (M ± SD)	3.37	1.12	3.38	1.12	0.026

Data shown are N (%) unless otherwise indicated. Abbreviations: EURO-D = European depression scale; CASP-12 = Control, Autonomy, Self-realization, and Pleasure scale. Case numbers refer to person-year observations.

Trajectories of cognitive functioning before, around and after becoming an intensive caregiver

Figure 1 depicts the means of cognitive functioning before, during and after the caregiving onset for both caregivers and matched controls (bivariate comparisons after Propensity Score Matching?). In the pre-onset period (t = −5 to t = −1), both groups exhibited nearly parallel trajectories, with pronounced declines at t = -2. Preliminary visual inspection confirmed the parallel trends assumption, a prerequisite for conducting a diff-in-diff analysis. During caregiving onset (t = −1 to t = 0), caregivers experienced a marked decline relative to the control group, which remained on the pre-existing trend. In the post caregiving onset period (t = 1 to t = 5), both caregivers and controls experienced stable cognitive functioning trajectories; however, caregivers exhibited statistically significant lower scores at least till 3 waves after the onset.

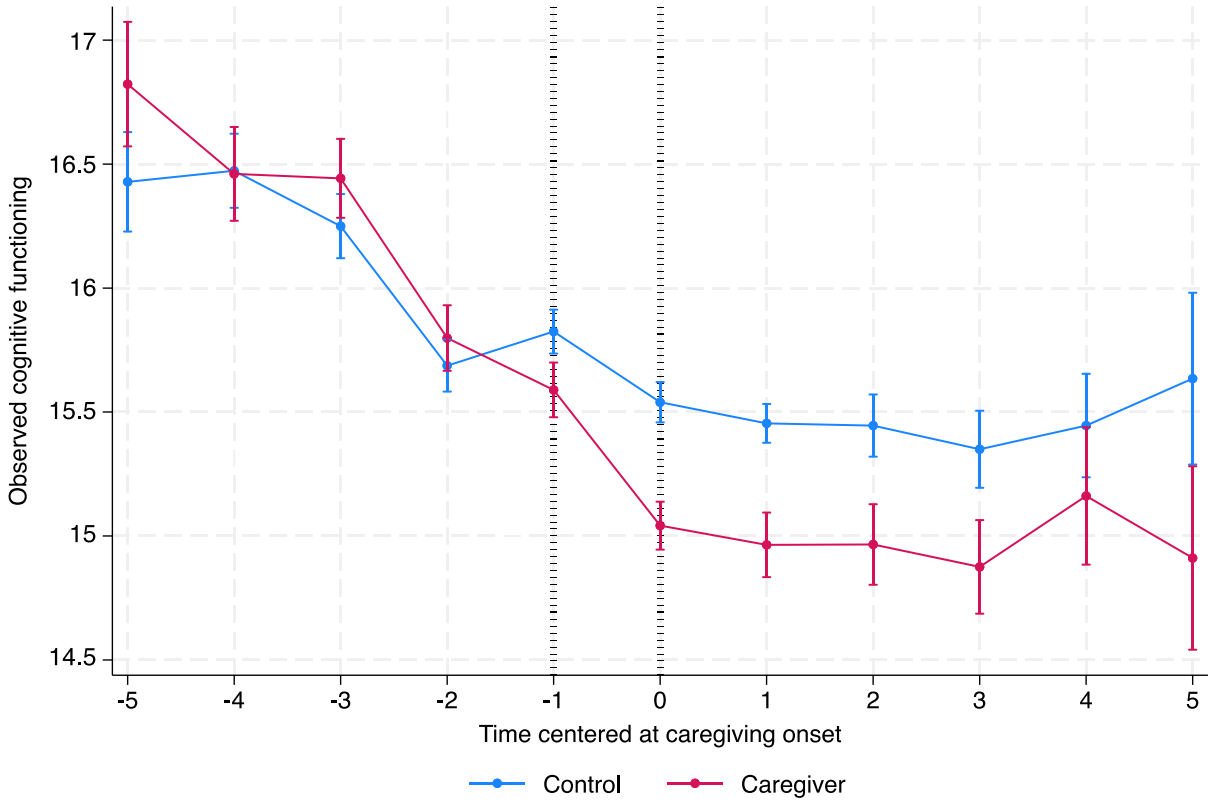

Figure 1. Trajectories of observed cognitive functioning fitted with local polynomial regressions, for both matched controls and caregivers.

Difference-in-Differences Estimates

Table 2 presents the diff-in-diff results for models 1-3, in the form of average treatment effects of the treated (ATET). The unadjusted Model 1 draws on comparisons between treatment and control groups. It indicates a significant negative effect of becoming a caregiver on cognitive functioning. The magnitude of -0.097 corresponds to a *greater loss in cognitive functioning with* of a tenth of a standard deviation for those who become intensive caregivers and those who do not.

The significant negative effect persists in Model 2, after adding the covariates. The magnitude of the effect becomes even greater. In the fully adjusted Model 3, which also comprises…, caregiving onset was associated with an average treatment effect of −0.349 (95% CI: -0.421 to -0.216; p < 0.001). In substantive terms, this means that the average decline in cognitive functioning around caregiving onset for caregivers is 0.35 standard deviations greater relative to the average decline for the matched controls.

Table 2. Difference-in-differences estimates of the effect of caregiving onset on cognitive functioning.

	Model 1		Model 2		Model 3	
	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI
ATET	-0.097**	(-0.221, -0.031)	-0.252***	(-0.326, -0.178)	-0.349***	(-0.421, -0.216)

Standard errors are clustered at the individual level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Abbreviations; ATET = Average Treatment Effect for the Treated, CI = Confidence Interval.

Intersectionality in Caregiving Effects?

Figure 2 depicts the stratified diff-in-diff models by sex and migration background, complemented with models testing interaction terms between the caregiving indicator and each subgroup (immigrant, vs. born in the country), separate by gender. Coefficient estimates can be obtained from Table 2.

Women (Panel B) displayed higher cognitive functioning levels than men (Panel A) across both groups immigrants and respondents born the country of the interview in the control group (the dashed lines). Among those becoming a caregiver, more nuanced patterns emerge, suggesting intersectional consequences of caregiving onset by gender and migrations background. Among those who become caregivers, we find an initial cognitive advantage among women as compared to men, which diminishes over time. Levels converge around the onset of caregiving for native populations, and around 2 years or one survey wave before the onset of intensive caregiving for immigrant populations. Another striking gender difference is that the group of those becoming caregivers exhibit on average higher levels of cognitive functioning in the male populations (both immigrant and native) while they exhibit a lower level of cognitive functioning in the female populations. Comparing immigrant and native groups, we find a steeper decline among immigrant men around caregiving than for native men, and a greater recovery several years after the onset of caregiving among native women than among immigrant women.,

To sum up, caregivers experienced a cognitive decline after the role uptake in all subgroups, which contrasts with the more stable trajectories of their matched controls. However, only for male subgroups, the parallel trends assumption was met, enabling a causal interpretation. Among men, a significant interaction term ($\beta = -0.05$, $p = 0.03$) indicates that caregiving causally accelerated cognitive decline specifically for those with a migration background. For women, cognitive decline began before caregiving onset. This finding holds for both immigrant and native women but is more pronounced among immigrant women. Two explanations can be found for these patterns. First, due to gender role socialization, women asked or expected to serve as first, or main, caregivers more often than men. This may lead to greater exhaustion of temporal resources and buffering capacities before the

caregiving episode reaches the status of “intensive caregiving”. Secondly, women start to become caregivers earlier in their lives (Ophir et al. 2022) and are more responsive to non-

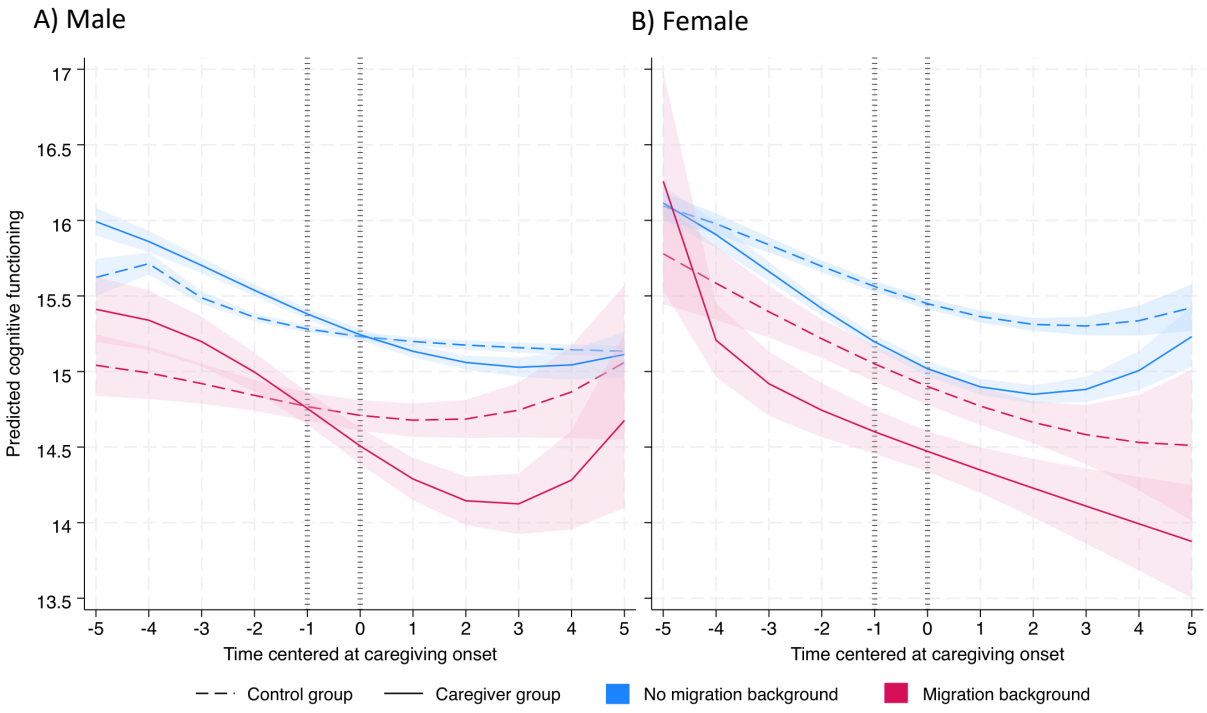

Figure 2. Trajectories of predicted cognitive functioning before and after caregiving onset, stratified by sex and migration background. Results obtained from the stratified diff-in-diff models.

intensive caregiving needs in their social networks than men. Since most healthcare needs increase sporadically, leading from light support to moderate and intensive support over several years, our findings may reflect the fact that women have become caregivers in the broader sense already before the pass the threshold to intensive caregiving selected for our analysis.

Piecewise Mixed-Effects Model

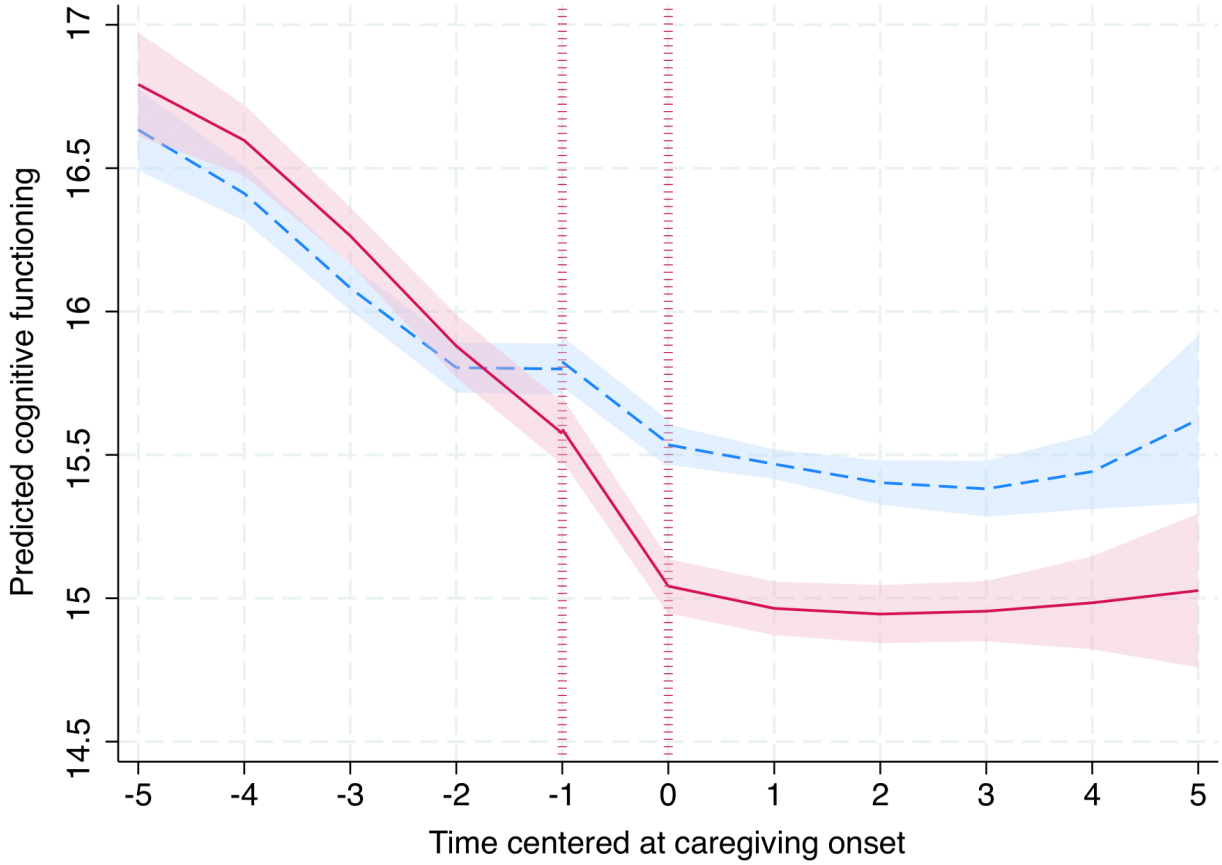

Figure 3. Results of cognitive trajectories for caregivers and matched controls obtained from piecewise mixed models. Caregivers are depicted in red with solid lines, whereas matched controls are depicted in blue with dashed lines.

Results from the piecewise mixed-effects model (Figure 3) corroborate the diff-in-diff findings. Among caregivers, the pre-onset slope (t = −5 to −1) was β_pre = −0.02 per wave (p = 0.08), indicating a non-significant, gradual decline similar to controls. The immediate onset change at t = 0 was β_onset = −0.15 (p < 0.001), reflecting a discrete drop in cognitive score. The post-onset slope (t = 0 to +5) was β_post = −0.05 per wave (p < 0.01), compared to controls' β_post-control = −0.02 (p = 0.12), confirming accelerated decline among caregivers.

Discussion

Based on data from a large, representative cohort of Europeans aged 50+, we found that becoming a family caregiver is causally associated with a statistically significant decline in

cognitive functioning. The cognitive functioning of caregivers decreased more sharply during the caregiving onset and remained at a fairly stable level yet below that of matched non-caregivers after the onset. These patterns persisted in secondary analyses and were most pronounced among women and individuals with a migration background. Hence, our study provides robust evidence of the causal negative effect of caregiving onset on cognitive trajectories.

Our results align with earlier longitudinal studies reporting caregiver cognitive declines, particularly in intensive caregiving contexts (Elayoubi et al., 2023; Su, 2023; Vitaliano et al., 2011; Vitaliano et al., 2009). However, previous work often lacked a rigorous causal design. By employing a difference-in-differences approach with a propensity score matching, we minimized confounding from time-invariant individual characteristics affecting both selection into (intensive) caregiving and cognitive trajectories. Su's analysis of Chinese data found a similar association between caregiving and cognitive decline, but did not rule out selection bias owing to differential health at baseline (Su, 2023). Our diff-in-diff framework demonstrates that, even after accounting for pre-existing individual fixed effects and national-level time patterns, caregivers exhibit a unique cognitive decline around the onset of intensive care.

Counter to recent extensions of the cognitive reserve framework, suggesting that unpaid family caregiving and family roles may act as cognitively stimulating factors (Cabeza et al., 2018), our study did not find evidence for a protective factors of caregiving against cognitive decline. This opens up new research questions but also allows several tentative explanations. First, cognitive benefits may rather arise from low/moderate caregiving or engagement (Bertrand et al., 2012; Caputo et al., 2024; Yuan & Grühn, 2021), or unpaid family care that is combined with employment (Bertogg & Leist). Focusing on intensive caregiving

(i.e., almost daily, or cohabiting caregiving), which has repeatedly been linked to greater mental health risk and stress responses, we found a robust e negative effect of intensive caregiving. Similar to earlier studies emphasizing on the role of caregiving intensity setting thresholds for various negative outcomes, our study, too, corroborates the existence of such a threshold. Second, stressors associated with time-intensive nature of caregiving seems may surpass protective effects arising from mild stimulation, resulting in an overall negative cognitive impact. Such stressors may come from the caregiving demands itself, but also from the environment in which caregiving is conducted. Especially, being a solo caregiver (as is more often the case among women; see Bertogg & Strauss, 2020), lacking support from a family network, or the particularities of the long-term care system in a given country), may exacerbate stressors. These interpretations are corroborated by our findings that immigrant women and men seem to be more strongly affected by stressors. Moreover, due to language constraints or lacking knowledge, immigrant older adults may be less aware about potential formal support offers, such as caregiver allowances, or respite care. e caregiving environments in many European countries, especially in Southern and Eastern Europe, are characterized by a limited formal long-term care infrastructure, and little support to informal caregivers. This may amplify stress and time burdens to the point that they outweigh any cognitive stimulation (Schmitz et al., 2024). Finally, the adverse effects appear most pronounced immediately after caregiving onset, a period often marked by emotional adjustment. Theoretically, the negative impact of becoming a caregiver on mental health and well-being can be split into two components: the “family effect” (Bobinac, 2010) suggests that worries about a close family member’s health may be a driver of decrease in well-being and increase in mental health problems. Specifically, rather than “caring for” someone, which consumes resources such as time, and health, “caring about” someone may be equally stressful. In line with prior research,

the observed cognitive decline may thus be mediated by increased depressive symptoms and sleep disturbances (Bolin et al., 2008; van de Straat et al., 2021), both of which impair memory consolidation, attention, and executive function (Wennberg et al., 2017). Our supplementary analyses show that depressive symptoms and sleep problems spike during the caregiving transition (Figures S1–S3), providing further support for these as potential causal pathways. Together, these findings suggest that caregiving's cognitive consequences are context-dependent, varying with intensity, social support, and systemic conditions.

Our stratified findings echo an intersectional perspective (Brady et al., 2024), showing that women and non-migrant individuals have the highest cognitive functioning levels. More importantly, men with a migration background showed a clear cognitive decline during and after the caregiving onset, a pattern not observed in other subgroups. Migrant caregivers may face language barriers, reduced social networks, and precarious socioeconomic status, exacerbating stress and limiting coping resources (Caputo et al. 2024). Female caregivers, especially non-migrants, displayed smaller non-significant effects, potentially reflecting more robust social support or differing caregiving roles (e.g., emotional versus instrumental care). The absence of parallel trends among women indicates that pre-existing disadvantages, potentially linked to cumulative caregiving roles and structural inequalities (Brandt & Kaschowitz, 2024), may already be shaping their cognitive trajectories before formal caregiving begins.

Limitations and Avenues for Future Research

First, intensive caregiving may start already before becoming a daily caregiver (the ref from above): our estimate is thus conservative in the sense that it only captures the extreme form of caregiving. This was to make sure to keep caregiving load for inside-household and outside-household caregiving comparable. Second, the caregiving experience (including the

various stressors associated with it, ranging from worries and anxieties to stress and sleeping problems or physical health risks) is very diverse, depending on the relationship with the care receivers. While we were able to show that our results are xxx for spousal and intergenerational (upward) caregiving, other caregiver-care receiver relationships should be studied (e.g., care provided to siblings, disabled children, friends, or neighbors). Third, while our rationale mentions various mechanisms speaking in favors of both protective and risk factors for cognitive health, we are unable to test these mechanisms. Finally, Europe is a good example with its diversity in health lifestyles (particularly, nutrition), kinship networks, and social support behaviors and welfare systems. SHARE is an excellent data resource to study cognitive trajectories across different cultural and political contexts, not least due to harmonized cognitive measures. However, a comparison with further contexts would be desirable.

Conclusion

In this matched longitudinal diff-in-diff analysis, becoming a family caregiver was causally associated with an accelerated decline in cognitive functioning among older Europeans. The onset of caregiving created a distinct decrease in cognitive functioning, followed by a stable post-onset level below non-caregivers. Male caregivers with a migration background were particularly vulnerable. These findings underscore the need for targeted public health interventions such as psychological support and policies that preserve caregivers' cognitive reserve to promote healthy ageing among those uptaking family caregiving roles.

References

Alonso-Perez, E., Heisig, J. P., Kreyenfeld, M., Gellert, P., & O'Sullivan, J. L. (2024). Intersectional Inequalities in the Transition to Grandparenthood and Cognitive Functioning: A Longitudinal Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, *79*(7), gbae088.

Bauer, J. M., & Sousa-Poza, A. (2015). Impacts of informal caregiving on caregiver employment, health, and family. *Journal of population Ageing*, *8*, 113-145.

Bertogg, A., & Leist, A. K. (2021). Partnership and cognitive aging in Europe: Mediating factors and social stratification. *The Journals of Gerontology: Series B*, *76*(6), 1173-1185.

Bertogg, A., Präg, P., & Raiber, K. (2025). Dynamics of later-life caregiving and health. Insights from biomarker data and cognitive tests. *Social Science Research*, *131*, 103205.

Bertrand, R. M., Saczynski, J. S., Mezzacappa, C., Hulse, M., Ensrud, K., & Fredman, L. (2012). Caregiving and cognitive function in older women: evidence for the healthy caregiver hypothesis. *J Aging Health*, *24*(1), 48-66. https://doi.org/10.1177/0898264311421367

Bloomberg, M., Bu, F., Fancourt, D., & Steptoe, A. (2025). Trajectories of loneliness, social isolation, and depressive symptoms before and after onset of pain in middle-aged and older adults. *eClinicalMedicine*.

Bolin, K., Lindgren, B., & Lundborg, P. (2008). Informal and formal care among single-living elderly in Europe. *Health economics*, *17*(3), 393-409. https://onlinelibrary.wiley.com/doi/epdf/10.1002/hec.1275

Bom, J., Bakx, P., Schut, F., & Van Doorslaer, E. (2019). The impact of informal caregiving for older adults on the health of various types of caregivers: a systematic review. *The Gerontologist*, *59*(5), e629-e642.

Bom, J., & Stöckel, J. (2021). Is the grass greener on the other side? The health impact of providing informal care in the UK and the Netherlands. *Social Science & Medicine*, *269*, 113562.

Börsch-Supan, A., Brandt, M., Hunkler, C., Kneip, T., Korbmacher, J., Malter, F., Schaan, B., Stuck, S., & Zuber, S. (2013). Data resource profile: the Survey of Health, Ageing and Retirement in Europe (SHARE). *International journal of epidemiology*, *42*(4), 992-1001. https://doi.org/10.1093/ije/dyt088

Brady, S., Patskanick, T., & Coughlin, J. F. (2024). An intersectional approach to understanding the psychological health effects of combining work and parental caregiving. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, *79*(6), gbae042.

Brandt, M., Deindl, C., Haberkern, K., & Szydlik, M. (2009). Geben und Nehmen zwischen Generationen: Der Austausch von Geld und Zeit in Europa. In *50plus in Deutschland und Europa: Ergebnisse des Survey of Health, Ageing and Retirement in Europe* (pp. 95-114). Springer.

Brandt, M., & Kaschowitz, J. (2024). Care and wellbeing across Europe–a research frame for studying migrant families. *Ethnic and Racial Studies*, 1-19.

Cabeza, R., Albert, M., Belleville, S., Craik, F. I., Duarte, A., Grady, C. L., Lindenberger, U., Nyberg, L., Park, D. C., & Reuter-Lorenz, P. A. (2018). Maintenance, reserve and compensation: the cognitive neuroscience of healthy ageing. *Nature Reviews Neuroscience*, *19*(11), 701-710.

Calderón-Jaramillo, M., & Zueras, P. (2023). Cared and uncared populations: understanding unmet care needs of older adults (65+) across different social care systems in Europe. *European Journal of Ageing*, *20*(1), 11.

Caputo, J., Cagney, K. A., & Waite, L. (2024). Keeping us young? Grandchild caregiving and older adults' cognitive functioning. *Journal of marriage and family*, *86*(3), 633-654.

Da Roit, B., & Le Bihan, B. (2010). Similar and yet so different: cash-for-care in six European countries' long-term care policies. *The Milbank Quarterly*, *88*(3), 286-309.

De Vugt, M. E., Jolles, J., Van Osch, L., Stevens, F., Aalten, P., Lousberg, R., & Verhey, F. R. (2006). Cognitive functioning in spousal caregivers of dementia patients: findings from the prospective MAASBED study. *Age and Ageing*, *35*(2), 160-166.

Elayoubi, J., Nelson, M. E., Mu, C. X., Haley, W. E., Wadley, V. G., Clay, O. J., Crowe, M., Cushman, M., Grant, J. S., & Roth, D. L. (2023). The role of caregiving in cognitive function and change: The REGARDS study. *Psychology and aging*, *38*(7), 712.

European Commission. (2018). The 2018 ageing report: economic and budgetary projections for the EU member states (2016–2070). *Institutional Paper No. 79. Luxembourg: Publications Office of the European Union*.

Genet, N., Boerma, W. G., Kringos, D. S., Bouman, A., Francke, A. L., Fagerström, C., Melchiorre, M. G., Greco, C., & Devillé, W. (2011). Home care in Europe: a systematic literature review. *BMC health services research*, *11*(1), 207.

Jann, B. (2017). KMATCH: Stata module for multivariate-distance and propensity-score matching.

Lacey, R. E., Xue, B., Di Gessa, G., Lu, W., & McMunn, A. (2024). Mental and physical health changes around transitions into unpaid caregiving in the UK: a longitudinal, propensity score analysis. *The Lancet Public Health*, *9*(1), e16-e25.

Livingston, G., Huntley, J., Liu, K. Y., Costafreda, S. G., Selbæk, G., Alladi, S., Ames, D., Banerjee, S., Burns, A., & Brayne, C. (2024). Dementia prevention, intervention, and care: 2024 report of the Lancet standing Commission. *The lancet*, *404*(10452), 572-628.

Mack, M., Scarampi, C., Joly-Burra, E., Zuber, S., de Freitas, C., Teixeira, R., & Kliegel, M. (2025). Enhancing mental health and cognitive function in older adults: a Swiss perspective on public health interventions and stigma mitigation strategies informed by a desk review. *Swiss Psychology Open: the official journal of the Swiss Psychological Society*, *5*(1).

Mayeda, E. R., Mobley, T. M., Weiss, R. E., Murchland, A. R., Berkman, L. F., & Sabbath, E. L. (2020). Association of work-family experience with mid-and late-life memory decline in US women. *Neurology*, *95*(23), e3072-e3080.

Moretta, P., Masotta, O., Crispino, E., Castronovo, G., Ruvolo, S., Montalbano, C., Loreto, V., Trojano, L., & Estraneo, A. (2017). Psychological distress is associated with altered cognitive functioning in family caregivers of patients with disorders of consciousness. *Brain injury*, *31*(8), 1088-1093.

Nichols, E., Steinmetz, J. D., Vollset, S. E., Fukutaki, K., Chalek, J., Abd-Allah, F., Abdoli, A., Abualhasan, A., Abu-Gharbieh, E., & Akram, T. T. (2022). Estimation of the global prevalence of dementia in 2019 and forecasted prevalence in 2050: an analysis for the Global Burden of Disease Study 2019. *The Lancet Public Health*, *7*(2), e105-e125.

Pickard, L., Wittenberg, R., Comas-Herrera, A., King, D., & Malley, J. (2007). Care by spouses, care by children: projections of informal care for older people in England to 2031. *Social policy and society*, *6*(3), 353-366.

Ribeiro, O., Araujo, L., Figueiredo, D., Paul, C., & Teixeira, L. (2021). The caregiver support ratio in Europe: estimating the future of potentially (Un) available caregivers. Healthcare,

Schmitz, A., Quashie, N. T., Wagner, M., & Kaschowitz, J. (2024). Inequalities in caregiving strain during the COVID-19 pandemic: conceptual framework and review of the empirical evidence. *International Journal of Care and Caring*, *8*(2), 351-364.

Su, Q. (2023). Impact of caregiving on cognitive functioning: Evidence from the China health and retirement longitudinal study. *The Journals of Gerontology: Series B*, *78*(11), 1796-1804.

Tangestani Fard, M., & Stough, C. (2019). A review and hypothesized model of the mechanisms that underpin the relationship between inflammation and cognition in the elderly. *Frontiers in aging neuroscience*, *11*, 56.

van de Straat, V., Willems, B., & Bracke, P. (2021). Care to sleep? Daily caregiving and sleep problems in an ageing European population. *Health Sociology Review*, *30*(2), 204-217.

Verbakel, E. (2018). How to understand informal caregiving patterns in Europe? The role of formal long-term care provisions and family care norms. *Scandinavian journal of public health*, *46*(4), 436-447.

Vitaliano, P. P., Murphy, M., Young, H. M., Echeverria, D., & Borson, S. (2011). Does caring for a spouse with dementia promote cognitive decline? A hypothesis and proposed mechanisms. *Journal of the American Geriatrics Society*, *59*(5), 900-908.

Vitaliano, P. P., Zhang, J., Young, H. M., Caswell, L. W., Scanlan, J. M., & Echeverria, D. (2009). Depressed mood mediates decline in cognitive processing speed in caregivers. *Gerontologist*, *49*(1), 12-22. https://doi.org/10.1093/geront/gnp004

Wahrendorf, M., McMunn, A., Xue, B., Schaps, V., Deindl, C., Di Gessa, G., & Lacey, R. E. (2025). Mental health trajectories of men and women who start providing personal care: European findings from SHARE using propensity score matching. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, gbaf053.

Wennberg, A. M., Wu, M. N., Rosenberg, P. B., & Spira, A. P. (2017). Sleep disturbance, cognitive decline, and dementia: a review. Seminars in neurology,

Wimo, A., Seeher, K., Cataldi, R., Cyhlarova, E., Dielemann, J. L., Frisell, O., Guerchet, M., Jönsson, L., Malaha, A. K., & Nichols, E. (2023). The worldwide costs of dementia in 2019. *Alzheimer's & dementia*, *19*(7), 2865-2873.

Xu, H., Vorderstrasse, A. A., McConnell, E. S., Dupre, M. E., Østbye, T., & Wu, B. (2018). Migration and cognitive function: a conceptual framework for Global Health Research. *Global Health Research and Policy*, *3*(1), 34.

Yuan, J., & Grühn, D. (2021). Time effects of informal caregiving on cognitive function and well-being: Evidence from ELSA. *The Gerontologist*, *61*(3), 341-351.

Supplementary Material

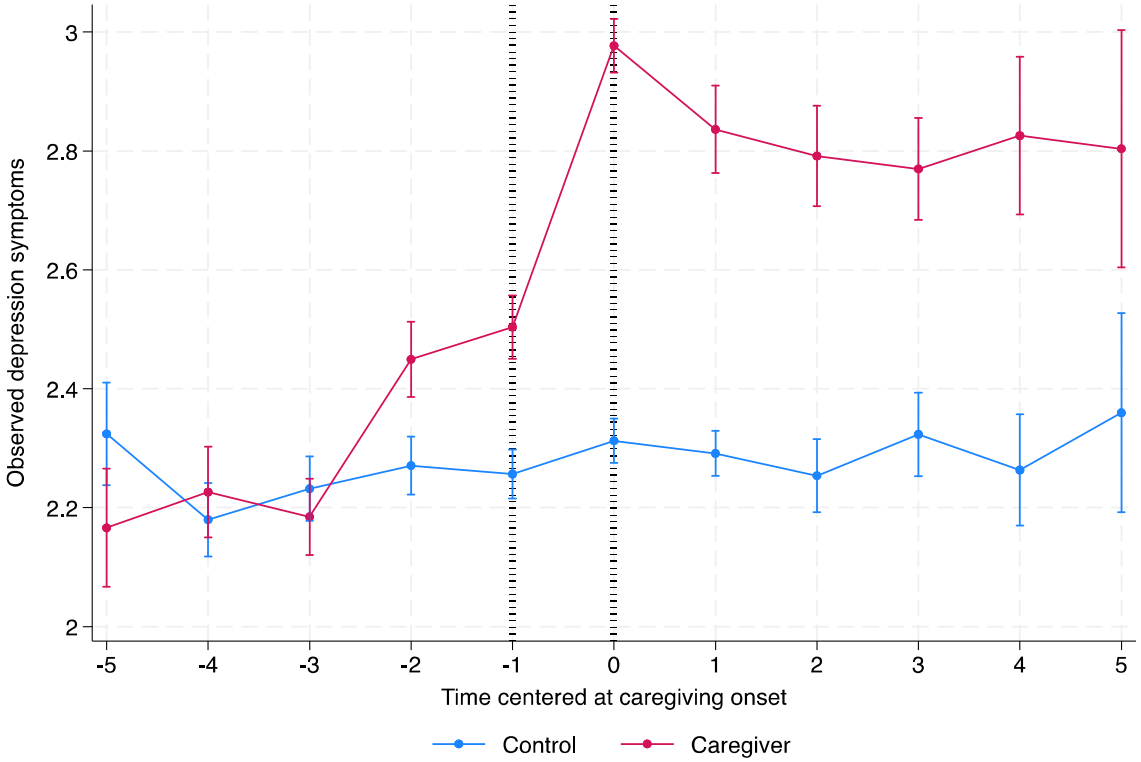

Figure S1. Observed depressive symptoms before and after the caregiving onset. Analysis stratified by caregiving status.

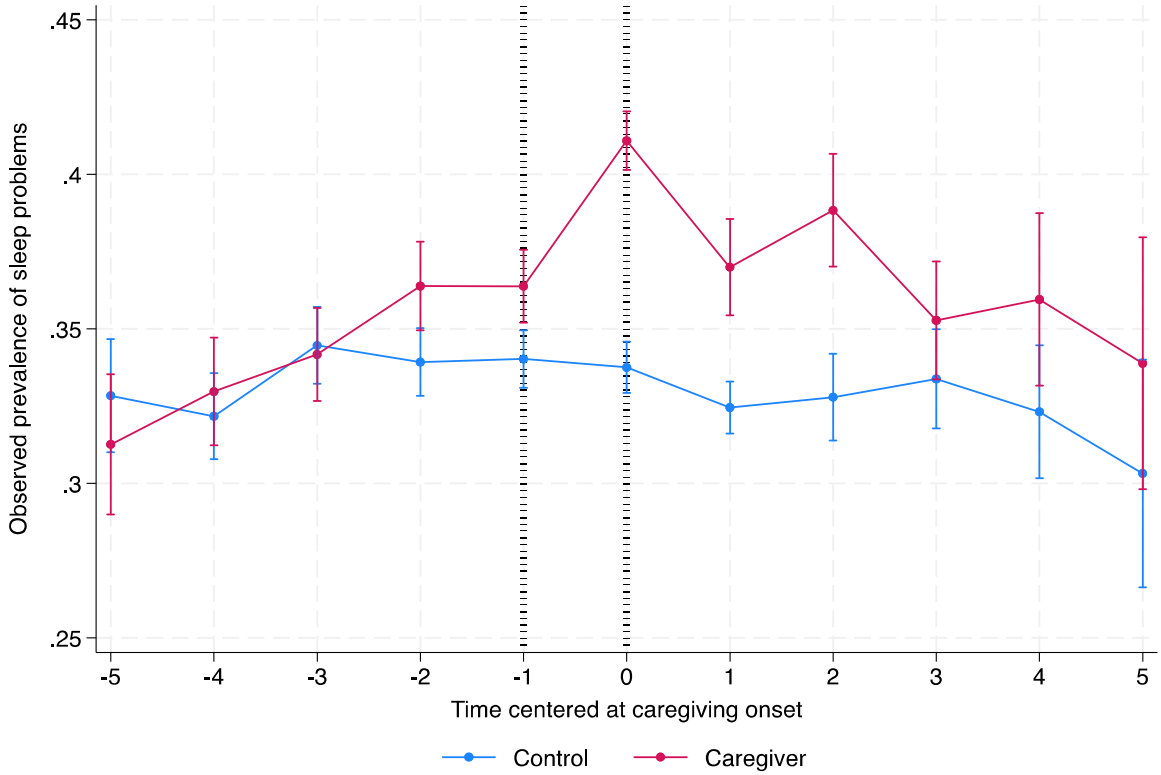

Figure S2. Observed sleep problems before and after the caregiving onset. Analysis stratified by caregiving status.

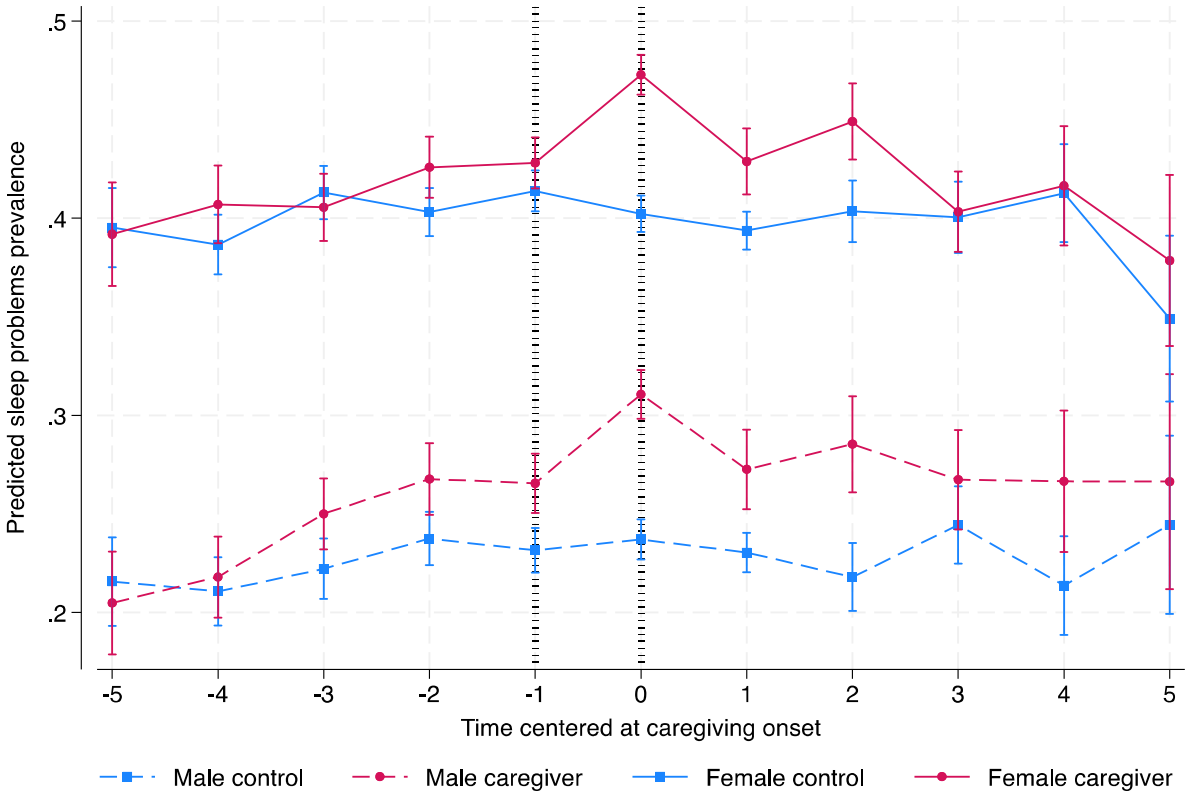

Figure S3. Predicted sleep problems prevalence before and after the caregiving onset. Analysis stratified by sex for caregivers and matched controls.