



2 **Working beyond SPA and the trajectories of cognitive and mental**
3 **health of UK pensioners: Do gender, choice, and occupational status**
4 **matter?**

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8 **Abstract**

9 We assessed the association between work status beyond state pension age (SPA) and the long-term trajectories of cognitive
10 and mental health for men and women separately, and the extent to which this relationship is conditioned by their occu-
11 pational status and whether the choice to retire or continue working is voluntary or involuntary. Data are pensioners (aged
12 between SPA and SPA + 9) from the English Longitudinal Study of Ageing waves 4 (2008/09) through 9 (2018/19). The
13 analytic sample includes 959 men and 1217 women when considering cognitive outcomes and 1131 men and 1434 women
14 when evaluating depression. Findings based on growth curve models reveal that, compared to women who retired at SPA and
15 without any particular reason, their peers who retired due to frailing health reported a more precipitous decline in memory
16 over time (coefficient = -0.10). However, analysis stratified by occupation shows that this association between ill-health
17 retirement and long-term memory decline was concentrated among older women of the highest occupational status. We also
18 found that men who retired or worked past SPA voluntarily reported a better baseline verbal fluency and were less likely to
19 report depression over time (coefficient for work = 0.80; coefficient for retired = 0.87). Women who worked past SPA volun-
20 tarily were less likely to report depression at baseline (OR = 0.53). Policies that extend work life should offer older people
21 more personal control over decision surrounding retirement.

22 **Keywords** Cognition · Depression · ELSA · Involuntary retirement · Voluntary retirement

23 **Introduction**

24 Given the shrinking size of working age compared to post-
25 working age persons, most governments across Europe have
26 implemented policies to disincentivize early exits from the
27 labour force and instead, raised the state pension age (SPA)
28 for retirement (Komp 2018). Through prolonged employ-
29 ment, such reforms are expected to mend the flailing pen-
sion systems. However, if older adults are unable to work

30 until the raised SPA or if prolonged work impairs health,
31 the fiscal burden might simply shift from post-retirement
32 pensions to other parts of social insurance, including health
33 care. Understanding the association between working past
34 SPA and cognitive and mental health, as such, remains criti-
35 cal to policies on work and retirement.
36

37 Drawing on the English Longitudinal Study of Ageing
38 (ELSA), a nationally representative sample of people aged
39 50 years and over in England, we aim to contribute to this
40 end in four ways: First, while most extant research is lim-
41 ited to understanding either the overall effect of retirement
42 on health (i.e. health status change pre-and post-retirement)
43 or the health repercussions of early retirement (e.g. Ata-
44 lay and Barrett 2014; Nishimura et al. 2018), we assess the
45 association between working beyond SPA and cognitive and
46 mental health. Second, we explore the extent to which the
47 health consequences of working past SPA are conditioned
48 by whether the decision to do so is voluntary or involun-
49 tary. Third, given existing gender disparities in experiences
50 related to work, health, and life in general (Calasanti and

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51 Slevin 2001), we assess the above associations for men and
 52 women separately. Lastly, given that the health effects of
 53 both, employment and early retirement are linked to work
 54 type and conditions (Calvo et al. 2013), we examine the
 55 extent to which the associations between working past SPA
 56 and cognitive and mental health are moderated by occupa-
 57 tional status.

58 **Paid work and cognitive and mental health**

59 Through employment, most people acquire new skills,
 60 adapt to changing workplace demands, meet new people
 61 and engage in social interactions, all requiring the use of
 62 several high-ordered cognitive processes that help maintain
 63 cognitive reserve (Stern 2012) and protect against cognitive
 64 decline (Bjelajac et al. 2019). Retirement may reduce eve-
 65 ryday opportunities to engage in cognitively complex activi-
 66 ties increasing the risk of cognitive decline (Bianchini and
 67 Borella 2016; Bonsang et al. 2012). Retirement, also, may
 68 result in mental distress given that, according to role theory,
 69 paid work offers social and psychological resources both of
 70 which protect against stressful circumstances, alleviate dis-
 71 tress, and improve mental health (Thoits 2011; Wang et al.
 72 2011). Unless prepared for alternate social roles and activi-
 73 ties in post-retirement years, those who exit the workforce
 74 may lack the structure, social interactions, and predictability
 75 that accompany most paid work. Alternatively, according to
 76 the psychosocial-environmental hypothesis, retirement could
 77 support both, cognitive and mental health to the degree that
 78 it removes work stress and work-family conflicts, (Andel
 79 et al. 2016; Axelrad et al. 2017) and frees up time to focus on
 80 health (van der Heide et al. 2013) and other mentally revital-
 81 izing activities, such as volunteering, which may facilitate
 82 a more stable transition to retirement (Henning et al. 2016).

83 **Retirement timing and health**

84 The association between retirement and health may be
 85 conditioned by whether retirement is deemed early, on
 86 time, or delayed based on one's age at the time of this
 87 transition (Börsch-Supan and Jürges 2009). Chronological
 88 age, which is used to allocate social ranking, establishes
 89 expectations, which in turn prescribe a "social timetable"
 90 for all major life course transitions, including retirement
 91 (Neugarten et al. 1965). Based on the *cultural-institutional*
 92 hypothesis (Dannefer et al. 2011), transitions that occur
 93 "on time" match the existing cultural scripts and as such,
 94 yield better health outcomes compared to ones that tran-
 95 spire "off-time". When a transition is "off" time or defies
 96 the so-called social clock, individuals are likely deprived
 97 of the otherwise expected or "anticipatory socialization"
 98 related to that transition. For instance, while retiring
 99 early liberates an individual from work-related tedium

and working past retirement age ensures sustained finan-
 cial benefits, both, the early and delayed retirement may
 deprive older adults of the "shared" experiences related
 to this transition—unless their peers also happen to retire
 simultaneously. While empirical findings on how timing
 conditions the health impact of retirement remain con-
 flicted (Calvo et al. 2013), some studies have found more
 positive mental and physical health outcomes for those
 whose retirement matches the culturally expected timing
 associated with this transition (van Solinge and Henkens
 2007).

Gender and occupational class

Given their varying employment histories, opportunities,
 and experiences, health ramifications of working past SPA
 may vary by gender. Women and men have different work-
 force attachments. Most men consider work to have a cen-
 tral role in their lives whereas women are equally invested
 in non-paid work roles (Quick and Moen 1998; McMunn
 2015). Prolonged paid work, especially working past SPA,
 may more negatively affect older women if it is combined
 with other non-paid work roles (such as caregiving); retire-
 ment, as such, may provide greater protection against
 cognitive decline and improve mental health for women.
 Alternatively, the gendered division of labour affects not
 just employment experiences but also retirement (Calasanti
 and Slevin 2001). That is, while men often reap full-time
 leisure as a prize for a lifespan of employment (Barnes and
 Parry 2004), women often end up doing the same or added
 amount of housework after retirement (Quick and Moen
 1998). Continued employment, consequently, could provide
 older women with sustained social-psychological resources,
 which could positively affect both, their cognitive and men-
 tal health (Easterlin 2003).

Working past SPA may also render differential cognitive
 and mental health effects for older workers based on their
 occupational status. In particular, blue-collar jobs that are
 characterized by high job strain, constant supervision, and
 lack of creativity and autonomy render workers more vulner-
 able to mental and cognitive distress (Karasek 1979; Rav-
 esteijn et al. 2018). Individuals retiring early from physically
 strenuous jobs report better health and cognition whereas,
 for their peers in less physically demanding jobs, early retire-
 ment translates into reduced health (Mazzonna and Peracchi
 2017). Prolonged work also may result in differential health
 outcomes for workers in higher versus lower occupational
 statuses because while the former may revel in their work,
 the latter often are forced to extend working for financial rea-
 sons. Additionally, jobs that require creativity and complex-
 ity—typically, ones in higher occupational bracket—may
 help older adults retain function due to greater "cognitive

reserves” (Stern 2012). Jobs that lack complex and creative tasks, unfortunately, preclude the opportunity to invest in and build the human capital necessary to protect against cognitive decline typically associated with ageing.

Choice in decision to work or retire

Regardless of the type and status of employment, personal choice in whether to retire or continue working reflects personal control over one’s immediate environment. Control theories (Zarit et al. 2003) suggest that important life transitions, such as retirement, over which there is no control (e.g. involuntary retirement or forced prolonged work) may compromise health (Szinovacz and Davey 2005). Expectedly then, previous studies do find individuals who retire involuntarily report more adverse mental health effects relative to their counterparts who retire voluntarily (Gallo et al. 2006; van Solinge and Henkens 2007). Most extant studies, however, are limited to research on either the overall effect of retirement on health or the health repercussions of early retirement.

Data

Data are from the English Longitudinal Study of Ageing (ELSA). ELSA is a cohort study on the health, economics, and welfare of the ageing population in England, which aims to represent people aged 50 and over living in private households in England. The initial samples were drawn in 2002. A follow-up survey, which was conducted every two years to form a wave, has been repeated 9 times thus far. Ethical approval for all the ELSA waves was secured from the National Research and Ethics Committee.

Sample

We utilized ELSA waves 4 (2008/09) through 9 (2018/19) for this study. Wave 4 is the first wave including questions about the reasons why participants still work beyond SPA and wave 9 is the most recent one available (Barnes et al. 2020). Because we aim to assess the health impact of work status of pensioners, participants who did not reach SPA at wave 4 were excluded. The SPA was 65 for male and 60 for female participants at wave 4 (2008/09). In other words, males younger than 65 and females younger than 60 at wave 4 were not included in our study (Bozio et al. 2010). The upper age limit of the participants was also restricted, 74 years for men and 69 years for women; this decision reflected the negligible proportion of individuals remaining in the workforce beyond these ages (Di Gessa et al. 2018). People who ‘never worked’ or did not report the reason to retire/work and respondents without any valid

response on outcome variables between waves 4 and 9 were excluded. Also excluded were participants with missing data on the conceptually relevant covariates. Finally, persons who reported having dementia at baseline were excluded when assessing cognitive function as the outcome. The final analytic sample includes 959 men and 1217 women when considering cognitive outcomes and 1131 men and 1434 women when evaluating depression. Figure S1 in online Supplementary Information displays the process of sample selection.

Measures

Outcome variables

The outcome variables are cognitive function and psychological distress over 10 years of follow-up in ELSA. Cognitive function is assessed using verbal episodic memory and verbal fluency. To assess verbal episodic memory, participants listened to a list of 10 common words and were asked to recall as many as possible, both immediately and after a short delay. The score scale of memory is from 0 to 20 which combines the score of immediate and delayed recall with a higher score indicating better memory (Murre et al. 2013). To test verbal fluency, which also is reflective of executive functioning, participants were asked to name as many animals as possible within a minute, with a score range of 0–55 with higher scores indicative of better performance (Shao et al. 2014). Depressive symptoms, used to assess psychological distress, were measured by the abbreviated 8-item version of the Centre for Epidemiological Studies Depression Scale (CES-D; Radloff 1977). Participants with a score greater than 4 are considered as having high depressive symptoms (Ní Mhaoláin et al. 2012). Memory and depression were repeatedly measured at each wave between waves 4 through 9, and verbal fluency was repeatedly measured at waves 4, 5, 7, 8, and 9.

Independent variable

The main independent variable was work status combined with the motivation driving the decision to either work or retire. It was measured at wave 4. While participants could offer multiple motivations, they were also asked the main motivation for work/retirement, which we used in this study. The distribution of specific reasons that motivated the decision to either continue working or retire is available in online Supplementary Information Table S1. We grouped these reasons into four types: reached retirement age, own ill health, voluntary, and involuntary reasons. Then, we grouped participants into 6 categories by combining motivation and work status: in work after SPA and voluntary reason for work (labelled as ‘work and voluntary’); in work after SPA and involuntary reason for work (labelled as ‘work

244 and involuntary’); retired and voluntary reason for retiring
 245 (labelled as ‘retired and voluntary’); retired and involuntary
 246 reason for retiring (labelled as ‘retired and involuntary’);
 247 retired and own ill-health reason (labelled as ‘retired and
 248 ill health’); retired and the reason is reached retirement age
 249 (labelled as ‘retired and SPA’) (Di Gessa et al. 2018).

250 Covariates

251 We included whether work status remains the same in the
 252 follow-up (no; yes) and marital status (‘married/cohabit’,
 253 ‘single’, ‘divorced/separated’ and ‘widowed’) as time-var-
 254 ying variables. Other covariates were measured at baseline
 255 (wave 4). Age was centred by SPA for men and women,
 256 separately. Ethnicity included white or non-white. Child-
 257 hood social class was measured by father’s occupation at
 258 age 14, including ‘Manager/Professional’, ‘Non-manual’
 259 ‘Manual’ and ‘Other’. The highest educational qualification
 260 was categorized as degree (International Standard Classifi-
 261 cation of Education-ISCED level 6), higher education below
 262 degree (ISCED level 4 and 5), A level (ISCED level 3), O
 263 level (ISCED level 2), lower than O level/foreign/other, and
 264 no qualification. Occupational class (before retirement) was
 265 measured by the National Statistics Socio-economic Clas-
 266 sification three-class version (managerial/professional, inter-
 267 mediate, and routine/manual). Household wealth (quintiles)
 268 and number of children were also included. Health covari-
 269 ates comprised the presence of limiting long-standing illness
 270 (no; yes, not limiting; yes, limiting), and any limitations with
 271 the activities of daily living (no; yes) measured by ADL
 272 and IADL. Baseline depression and objectively measured
 273 grip strength were adjusted when assessing cognitive health.
 274 These covariates were chosen due to their well-documented
 275 relationship with work status and cognition and depression
 276 in the literature (e.g. Rice et al. 2011; Sternäng et al. 2016;
 277 Jorm 2000; Xue et al. 2018).

278 To minimize the practice effects of the cognitive tests,
 279 the ELSA questionnaire used four different and validated
 280 10-word lists to access delayed recall in each wave. Addi-
 281 tionally, we included the square root of the number of previ-
 282 ous visits (e.g. 0, 1, 1.4, 1.7...) in the regression models to
 283 account for re-test effects (Vivot et al. 2016; Romero Starke
 284 et al. 2019).

285 Statistical method

286 We employed growth curve models (also known as multi-
 287 level models). The growth curve model included respond-
 288 ents if they have at least one wave of response on the health
 289 outcome between wave 4 and 9. Linear growth curve mod-
 290 els were applied for continuous outcomes (memory and
 291 fluency), and logistic growth curve models were used for
 292 the binary depression variable. People who retired and the

reason was ‘reached retirement age’ (‘retired and SPA’) 293
 were used as the reference group. 294

295 A ‘time’ variable was generated in the study to represent 295
 the follow-up time. This time variable ranges from 0 (wave 296
 4) to 5 (wave 9), and every unit increase in this time vari- 297
 able indicates a 2-year increase in the follow-up time. The 298
 coefficient of this time variable shows the slope of individual 299
 trajectories of cognition or depression over time. A quad- 300
 ratic term of time was included in the model to represent 301
 the nonlinear trajectories of outcomes. Interaction between 302
 the independent variable and time was included in the model 303
 to assess the long-term impact of work status/motivation. 304
 Analyses were conducted for episodic memory, verbal flu- 305
 ency, and depression, respectively. An interaction between 306
 baseline age and time was also included for cognition to 307
 reflect the complex relationship between age and cognition 308
 (no significant interaction for depression, and thus was not 309
 included). 310

311 Considering the close linkage between occupational 311
 class and work status/motivation, we also assessed whether 312
 the occupational class is an effect modifier by including an 313
 interaction between work status/motivation and occupational 314
 class in the models. 315

316 Sensitivity analysis by excluding early retirement before 316
 SPA was conducted. 317

318 Results

319 Table 1 shows the descriptive characteristics of older male 319
 and female participants in our study. In our sample, women 320
 were on average 5.4 years younger than men. Women were 321
 more likely to work after SPA than men, either involuntar- 322
 ily (12.4% vs. 5.2%) or voluntarily (23.4% vs. 14.6%). For 323
 both men and women, ‘retired and voluntary’ was the most 324
 common reason for retirement, followed by ‘retired and ill 325
 health’. Compared to men, women were 9% less likely to live 326
 with a partner, have a degree qualification (16% vs. 20%), 327
 be in a management and professional occupational class, 328
 but women were more likely to come from a managerial/ 329
 professional and non-manual childhood social class (40% 330
 vs. 33%). Women had fewer children than men. The distribu- 331
 tion of race was comparable between men and women, with 332
 98% being white. Women, on average, had 1.7 higher score 333
 of memory and 1 higher score of verbal fluency than men; 334
 women also, however, were more likely to report depression 335
 and had lower grip strength. 336

337 Table 2 shows the associations between work status 337
 after SPA and memory for men and women, separately. 338
 Women in different groups of work status, either in work 339
 or retired, for voluntary reasons or not, all had similar 340
 memory at baseline (i.e. similar intercepts). However, 341
 during the 10-year follow-up between waves 4 and 9, 342

Table 1 Characteristics of men and women in this study^a

	Women (n = 1217) %	Men (n = 959) %
<i>Work status and motivation</i>		
Retired and SPA	13.06	18.35
Retired and ill health	17.09	20.44
Retired and involuntary	12.08	15.75
Retired and voluntary	21.94	25.65
Work and involuntary	12.41	5.21
Work and voluntary	23.42	14.60
<i>Ethnicity</i>		
White	98.11	97.60
Non-white	1.89	2.40
<i>Marital status</i>		
Single	4.27	5.32
Married/cohabit	67.13	76.54
Divorced/separated	14.79	8.45
Widowed	13.80	9.70
<i>Education</i>		
Degree	16.19	20.23
Higher education below degree	13.48	17.41
A Level	7.81	6.47
O Level	22.43	17.31
Lower than O Level/foreign/other	12.33	11.68
No qualification	27.77	26.90
<i>Occupational class</i>		
Managerial/professional	28.51	37.43
Intermediate	28.92	22.42
Routine/manual/other	42.56	40.15
<i>Father's occupation</i>		
Manager/Professional	20.13	15.33
Non-manual	19.88	17.41
Manual	37.39	40.77
Other	22.60	26.49
<i>Household income</i>		
Lowest quintile	13.80	15.33
2	18.32	15.75
3	20.79	20.33
4	21.04	22.73
Highest quintile	26.05	25.86
<i>Number of children</i>		
0	12.08	11.26
1	14.13	11.57
2	36.48	38.58
3	22.43	22.21
4 or more	14.87	16.37
<i>Limitations</i>		
Yes	22.35	25.55
No	77.65	74.45
<i>Depression</i>		
No	83.98	91.03

Table 1 (continued)

	Women (n = 1217) %	Men (n = 959) %
Yes	16.02	8.97
<i>Long-standing illness</i>		
None	46.43	41.71
Yes and limiting	30.40	32.85
Yes and not limiting	23.17	25.44
Mean age, yr (SD)	64.11 (2.97)	69.49 (2.86)
Mean grip strength, kg (SD)	23.14 (6.15)	36.36 (8.66)
Mean memory (SD)	11.31 (3.27)	9.66 (3.13)
Mean verb fluency (SD)	21.55 (6.60)	20.60 (6.63)

^an is based on the sample used for memory analysis

women who retired for own ill health showed a faster rate (slope) of memory decline over time than women in the 'retired and SPA' group (trajectories are shown in Fig. 1). The coefficient of the interaction between 'retired and ill health' and time variable was -0.10 (95%CI: -0.17 , -0.02), suggesting that, every year, for women who retired for own ill health their memory scores declined by 0.10 more than for their peers in the 'retired and SPA' group. While statistically significant, this effect might be marginal considering that the average memory score of women is 11. Women in other work status groups show similar rates of memory decline in the follow-up as women in the 'retired and SPA' group (i.e. no interaction between independent variable and time). Men in different work statuses after SPA did not show differences in their memory either in the baseline or in the follow-up (trajectories are shown in online Supplementary Information Figure S2).

In term of effect modifications, there was an interaction between work status and occupational class for women's memory trajectories ($p < 0.05$). Analysis stratified by occupation shows that the association between ill-health retirement and long-term memory decline was concentrated among older women of the managerial/professional (highest) occupational status (Table 3). Coefficient of the interaction between 'retired & ill health' and time is -0.18 (95%CI: -0.33 , -0.03).

While work status after SPA was not associated with long-term trajectory of verbal fluency either for men or women, men who retired or continued working for voluntary reasons reported a better baseline verbal fluency. Results and predicted trajectories of verbal fluency with men and women's work status are shown in Table S2 and Figure S3-S4 in online Supplementary Information. No effect modifier role of occupational class was found for verbal fluency (results are not shown in tables).

Table 4 shows the association between work status beyond SPA and the long-term trajectory of depression by gender. Women who continued to work voluntarily were

Table 2 Association between work status beyond SPA and the trajectory of memory by gender

	Women (n = 1217)		Men (n = 959)	
	Coef	95% CI	Coef	95% CI
<i>Work status and motivation</i>				
Retired and SPA	Ref.		Ref.	
Retired and ill health	0.40	-0.18, 0.98	-0.08	-0.63, 0.46
Retired and involuntary	-0.002	-0.60, 0.59	-0.50	-1.06, 0.05
Retired and voluntary	0.17	-0.35, 0.69	0.29	-2.05, 0.79
Work and involuntary	0.12	-0.48, 0.73	0.54	-0.25, 1.34
Work and voluntary	0.09	-0.45, 0.63	0.16	-0.42, 0.74
<i>Work status and motivation × Time</i>				
Retired and SPA	Ref.		Ref.	
Retired and ill health	-0.10**	-0.17, -0.02	-0.06	-0.14, 0.03
Retired and involuntary	0.02	-0.06, 0.10	0.03	-0.05, 0.12
Retired and voluntary	0.03	-0.04, 0.09	0.01	-0.06, 0.08
Work and involuntary	0.03	-0.08, 0.08	0.03	-0.09, 0.15
Work and voluntary	0.01	-0.06, 0.09	0.03	-0.06, 0.12
<i>Baseline age</i>	-0.13***	-0.18, -0.07	-0.07*	-0.13, -0.01
<i>Marital status</i>				
Single	Ref.		Ref.	
Married/cohabit	-0.31	-1.03, 0.41	1.12**	0.34, 1.90
Divorced/separated	-0.30	-1.05, 0.44	1.16**	0.31, 2.01
Widowed	-0.23	-0.97, 0.50	1.27**	0.43, 2.10
<i>Father's occupation</i>				
Manager/professional	Ref.		Ref.	
Non-manual	0.25	-0.18, 0.68	-0.36	-0.88, 0.16
Manual	-0.15	-0.54, 0.25	-0.15	-0.61, 0.32
Other	-0.15	-0.58, 0.28	0.11	-0.40, 0.62
<i>Education</i>				
Degree or higher	Ref.		Ref.	
Higher education below degree	-0.79***	-1.29, -0.29	-1.10***	-1.59, -0.60
A Level	-0.32	-0.93, 0.28	-1.55***	-2.22, -0.87
O Level	-0.46 [†]	-0.95, 0.03	-1.01***	-1.53, -0.50
Lower than O/foreign/other	-1.02***	-1.58, -0.47	-1.31***	-1.92, -0.71
No qualification	-1.81***	-2.31, -1.30	-2.05***	-2.58, -1.52
<i>Occupational class</i>				
Managerial/profession	Ref.		Ref.	
Intermediate	-0.08	-0.46, 0.31	-0.23	-0.65, 0.19
Routine/manual/other	-0.41*	-0.80, -0.02	-0.68**	-1.08, -0.28
<i>Ethnicity</i>				
White	Ref.		Ref.	
Non-white	-0.92 [†]	-1.93, 0.09	-1.71 [†]	-2.67, -0.75
<i>Illness</i>				
None	Ref.		Ref.	
Yes and limiting	-0.13	-0.51, 0.25	-0.26	-0.64, 0.13
Yes and not limiting	-0.07	-0.42, 0.27	0.04	-0.33, 0.40
<i>Baseline depression</i>				
Without depression	Ref.		Ref.	
With depression	-0.44*	-0.83, -0.05	-0.50 [†]	-1.04, 0.04
<i>Change work status</i>				
No	Ref.		Ref.	
Yes	-0.05	-0.33, 0.23	-0.43*	-0.82, -0.04

Table 2 (continued)

	Women (n=1217)		Men (n=959)	
	Coef	95% CI	Coef	95% CI
<i>Household income</i>				
Lowest quintile	Ref.		Ref.	
2	0.36	-0.13, 0.85	-0.11	-0.64, 0.42
3	0.51*	0.01, 1.01	-0.02	-0.55, 0.50
4	0.90**	0.39, 1.41	-0.05	-0.58, 0.49
Highest quintile	1.00***	0.48, 1.52	0.14	-0.43, 0.70
<i>Number of children</i>				
0	Ref.		Ref.	
1	0.21	-0.36, 0.77	-0.56	-1.25, 0.13
2	0.25	-0.25, 0.74	-0.25	-0.85, 0.36
3	0.12	-0.41, 0.64	-0.25	-0.88, 0.38
4 or more	0.05	-0.52, 0.62	-0.22	-0.89, 0.45
<i>Limitations</i>				
Yes	Ref.		Ref.	
No	0.43*	0.05, 0.81	0.23	-0.15, 0.62
Grip strength	0.05***	0.03, 0.07	0.03**	0.01, 0.05
Practice effect	1.17***	0.79, 1.54	0.95**	0.58, 1.31
Time	0.05	-0.03, 0.14	-0.05	-0.15, 0.06
Time × Time	-0.01***	-0.02, -0.01	-0.01**	-0.02, -0.003
Baseline age × Time	-0.01**	-0.02, -0.003	-0.01	-0.02, 0.002
<i>Random effect</i>				
Variance of time	0.02	0.02, 0.03	0.03	0.02, 0.05
Variance of constant	4.09	3.67, 4.57	3.44	3.00, 3.93

[†] $p < 0.1$ * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Fig. 1 Work status beyond SPA and the trajectory of memory for women

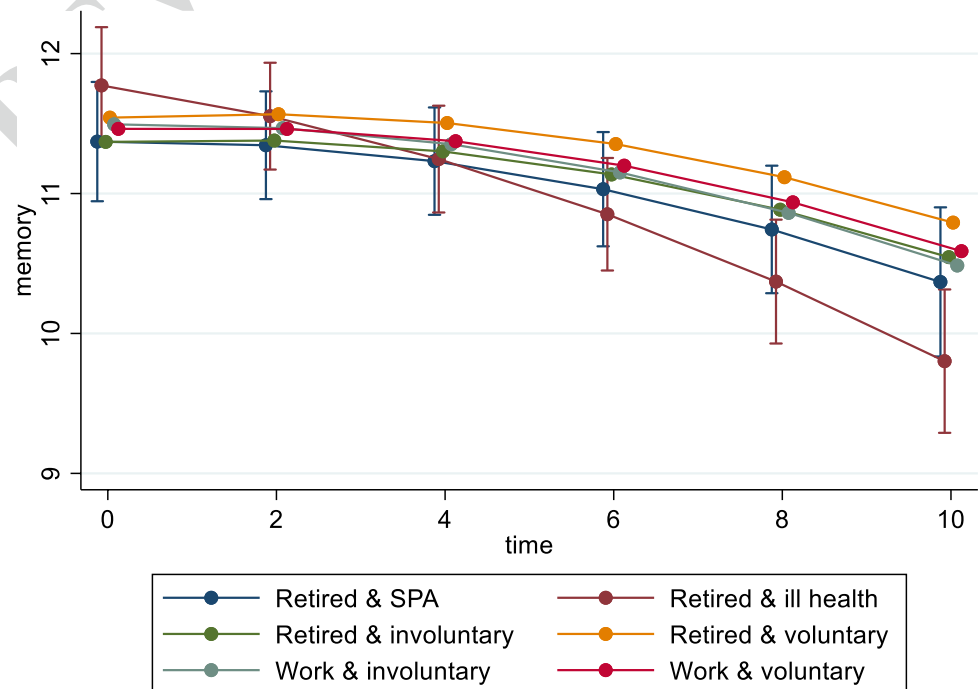


Table 3 Association between work status beyond SPA and the trajectory of memory among women in the managerial/professional (highest) occupational class (n = 347)

	Coef	95% CI
<i>Work status and motivation</i>		
Retired and SPA	Ref.	
Retired and ill health	−0.10	−1.27, 1.07
<i>Work status and motivation × Time</i>		
Retired and SPA	Ref.	
Retired and ill health	−0.18*	−0.33, −0.03

* $p < 0.05$

381 43% (OR: 0.53; 95%CI: 0.29, 0.97) less likely to report
 382 depression than their peers in the ‘retired and SPA’ group at
 383 baseline, and this difference endured over time (trajectories
 384 are shown in online Supplementary Information Figure S5).
 385 However, women who retired for voluntary reasons were
 386 more likely to report depression in the follow-up, although
 387 this effect was only marginally significant ($0.05 < p < 0.1$).

388 Compared to men in the group of ‘retired and SPA’, men
 389 who retired for involuntary reasons or own ill health were
 390 about 2 times more likely to report depression at baseline
 391 (borderline significance), and this difference endured over
 392 time. Men who work for voluntary reasons showed a lower
 393 rate (slope) of developing depression than their peers in
 394 the ‘retired and SPA’ group in the follow-up (coefficient
 395 for work and voluntary \times time = 0.80, 95%CI: 0.65, 0.99).
 396 Trajectories are shown in Fig. 2. This suggests a beneficial
 397 association between working voluntarily past SPA and men-
 398 tal health in the long-term for men. Similar long-term pat-
 399 tern was observed for men who retired voluntarily, although
 400 the association appears to be weaker (coefficient = 0.87) and
 401 only marginally significant ($0.05 < p < 0.1$).

402 Results from the sensitivity analysis (Table S3–S5 in
 403 online Supplementary Information) are consistent with our
 404 main results, and additionally, the sensitivity analysis shows
 405 that women who retired due to ill health reported a more
 406 precipitous decline in verbal fluency over time.

407 Discussion

408 We examined the association between work status beyond
 409 SPA and the long-term trajectories of cognitive and men-
 410 tal health for men and women separately, and the extent to
 411 which this relationship is conditioned by occupational status
 412 and whether the choice to retire or continue working is vol-
 413 untary or involuntary. We found that women who retired due
 414 to ill health reported a more precipitous decline in memory
 415 over time, however, this association concentrated among
 416 older women of the highest occupational status. Our study

also revealed that compared to men who retired at SPA,
 those who retired or worked past SPA voluntarily reported
 a better baseline verbal fluency and were less likely to report
 depression over time. Women who worked beyond SPA vol-
 untarily were less likely to report depression at baseline.

Work, retirement, and cognitive health

Compared to women who retired at SPA and without any
 particular reason, their peers who retired due to frailing
 health reported a more precipitous decline in memory
 over time. Over time, exiting the workforce may reduce
 structured opportunities to engage in cognitively complex
 activities increasing the risk of cognitive decline (Bianchini
 and Borella 2016; Bonsang et al. 2012; Xue et al. 2018).
 Ill health also may limit mobility, prevent leisure pursuits
 and social activities, and instead force consolidating of daily
 activities around health problems (Charmaz 1991). Put sim-
 ply, ill health that propelled retirement may compromise
 social and health mechanisms needed to ensure cognitive
 performance in later life.

However, the memory decline associated with ill-health
 retirement is concentrated among those in the highest occu-
 pational status. On one hand, our finding is consistent with
 a recent study by Xue and colleagues (2018) who find that
 higher occupational status is protective against cognitive
 decline while individuals continue to work, but the “protec-
 tive effect” ceases upon retirement. Relative to lower-status
 jobs, those of higher occupational status, which involve
 more intellectually complex, challenging, and creative tasks
 protect individuals against cognitive decline (Schooler et al.
 1999). As such, according to the “use it or lose it” hypoth-
 esis, exiting from a higher-status job may mean the loss of
 cognitive resources necessary for healthy cognition. More-
 over, given that professionals are more likely to reap intrinsic
 benefits from their work (Sass 2016), ill-health retirement
 also may represent a loss of psychological resources (e.g.
 sense of worth), negatively influencing memory over time.

On the other hand, based on the cognitive reserves
 hypothesis (Stern 2012), persons in highly complex and
 creative jobs are expected to enjoy a “protracted” protective
 effect of having worked in jobs that require higher-ordered
 cognitive processes (e.g. problem-solving; strategic think-
 ing). Consequently, those in the highest occupational grade
 are expected to avail established (i.e. pre-retirement) cog-
 nitive mechanisms or/and acquire new ones to manage mem-
 ory fluctuations (Steffener and Stern 2012). We encourage
 future scholarship to assess exact factors (e.g. perceptions
 of occupational prestige and stigma associated with retiring
 from a higher-status job) that amplify cognitive decline in
 this particular group of women.

Women of all other work statuses—be it still working
 or retired either voluntarily or involuntarily—reported

Table 4 Association between work status beyond SPA and the trajectory of depression by gender

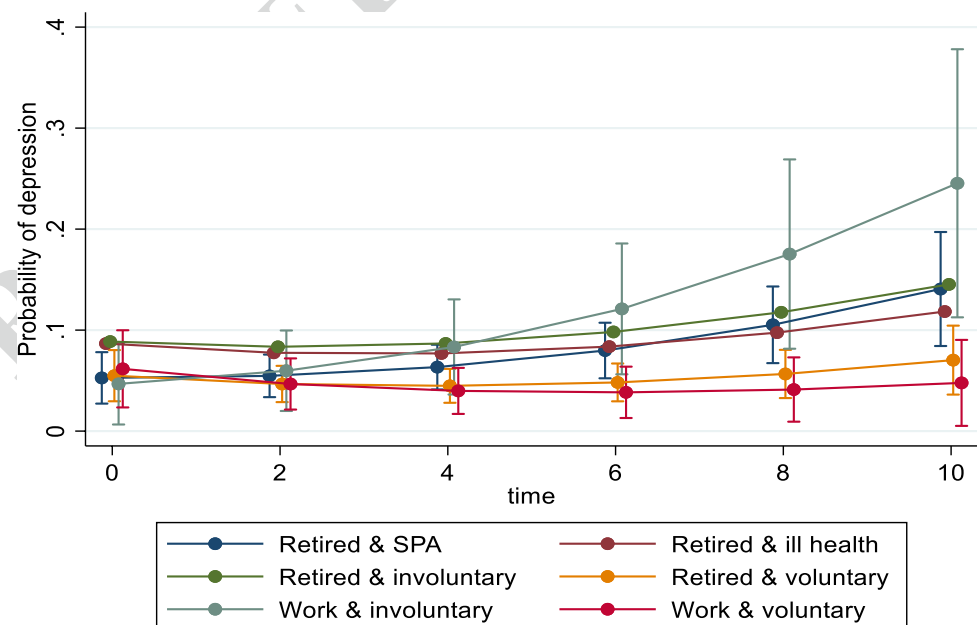
	Women (n = 1434)		Men (n = 1131)	
	OR	95% CI	OR	95% CI
<i>Work status and motivation</i>				
Retired and SPA	Ref.		Ref.	
Retired and ill health	1.49	0.88, 2.55	2.05 [†]	0.93, 4.52
Retired and involuntary	0.88	0.47, 1.62	2.12 [†]	0.91, 4.94
Retired and voluntary	0.62	0.35, 1.12	1.06	0.43, 2.59
Work and involuntary	1.04	0.56, 1.94	0.85	0.23, 3.17
Work and voluntary	0.53 [*]	0.29, 0.97	1.25	0.42, 3.70
<i>Work status and motivation × Time</i>				
Retired and SPA	Ref.		Ref.	
Retired and ill health	1.10 [†]	0.99, 1.22	0.90	0.78, 1.03
Retired and involuntary	1.09	0.97, 1.23	0.93	0.81, 1.08
Retired and voluntary	1.11 [†]	0.99, 1.24	0.87 [†]	0.75, 1.01
Work and involuntary	1.01	0.89, 1.15	1.16	0.93, 1.43
Work and voluntary	1.02	0.90, 1.15	0.80 [*]	0.65, 0.99
Baseline age	0.96	0.92, 1.01	0.98	0.91, 1.05
<i>Marital status</i>				
Single	Ref.		Ref.	
Married/cohabit	0.80	0.39, 1.63	-0.36 [*]	0.14, 0.92
Divorced/separated	1.09	0.52, 2.26	0.70	0.25, 1.93
Widowed	1.50	0.72, 3.12	1.43	0.54, 3.79
<i>Father's occupation</i>				
Manager/professional	Ref.		Ref.	
Non-manual	0.94	0.61, 1.46	1.10	0.54, 2.26
Manual	1.10	0.74, 1.63	0.81	0.42, 1.57
Other	0.89	0.58, 1.36	0.91	0.45, 1.83
<i>Education</i>				
Degree or higher	Ref.		Ref.	
Higher education below degree	0.84 [†]	0.50, 1.42	1.13	0.54, 2.36
A Level	0.59	0.31, 1.10	2.14 [†]	0.89, 5.19
O Level	1.01	0.62, 1.64	1.43	0.68, 2.98
Lower than O Level/foreign/other	0.77	0.44, 1.34	0.98	0.42, 2.28
No qualification	0.91	0.55, 1.50	1.03	0.49, 2.16
<i>Occupational class</i>				
Managerial/profession	Ref.		Ref.	
Intermediate	1.52 [*]	1.03, 2.27	1.21	0.69, 2.15
Routine/manual/other	1.55 [*]	1.05, 2.28	1.14	0.67, 1.95
<i>Ethnicity</i>				
White	Ref.		Ref.	
Non-white	1.10 [†]	0.99, 1.22	3.65 ^{**}	1.41, 9.47
<i>Illness</i>				
None	Ref.		Ref.	
Yes and limiting	2.32 ^{***}	1.64, 3.28	2.49 ^{**}	1.48, 4.20
Yes and not limiting	1.14	0.79, 1.65	1.27	0.73, 2.22
<i>Baseline depression</i>				
Without depression	Ref.		Ref.	
With depression	-0.50	-1.04, 0.04	-0.44 [*]	-0.83, -0.05
<i>Change work status</i>				
No	Ref.		Ref.	
Yes	1.13	0.70, 1.82	0.80	0.32, 1.95

Table 4 (continued)

	Women (n = 1434)		Men (n = 1131)	
	OR	95% CI	OR	95% CI
<i>Household income</i>				
Lowest quintile	Ref		Ref	
2	0.86	0.57, 1.30	0.60	0.32, 1.12
3	0.76	0.49, 1.17	0.60	0.32, 1.12
4	0.52**	0.33, 0.83	0.53 [†]	0.27, 1.03
Highest quintile	0.50	0.31, 0.82	0.39*	0.19, 0.81
<i>Number of children</i>				
0	Ref		Ref	
1	0.71	0.42, 1.23	1.13	0.47, 2.73
2	0.80	0.50, 1.29	0.80	0.36, 1.76
3	0.94	0.57, 1.56	0.86	0.37, 2.00
4 or more	0.91	0.54, 1.56	0.85	0.35, 2.04
<i>Limitations</i>				
Yes	Ref		Ref	
No	0.45***	0.33, 0.62	0.33***	0.21, 0.53
<i>Time</i>	0.73	0.65, 0.84***	0.98	0.83, 1.17
<i>Time × Time</i>	1.02***	1.01, 1.03	1.01	1.00, 1.02
<i>Random effect</i>				
<i>Variance of time</i>	0.05	0.03, 0.08	0.04	0.01, 0.10
<i>Variance of constant</i>	1.32	0.85, 2.05	2.49	1.54, 4.03

[†] $p < 0.1$, * $p < 0.05$, ** $p < 0.01$ *** $p < 0.001$

Fig. 2 Work status beyond SPA and the trajectory of depression for men



468 comparable memory function both, at baseline and over time
 469 relative to their counterparts who retired at SPA without
 470 citing any particular reason. The lack of statistically mean-
 471 ingful differences between women of the other diverse work
 472 groups is consistent with conclusions from a recent review
 473 on the long-term repercussions of retirement on cognition.

Based on 29 longitudinal studies, Alvarez-Bueno and col-
 leagues (2020) concluded that retirement does not nega-
 tively impact overall cognition among older adults and only
 slightly adversely affects their memory functioning. In our
 study, the lack of statistically significant differences between
 women of diverse work statuses may reflect the fact that the

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women in our sample are much older while most existing studies include relatively younger (i.e. young-old) group of women as they are focused on assessing the cognitive health impact of early retirement as opposed to testing the cognitive health effects of working past SPA. For similar reasons, we speculate, our study also fails to find statistically meaningful differences in the memory function of older men of diverse work statuses, either at baseline or over time. We found that men who retired or worked past SPA voluntarily reported a better baseline verbal fluency, and this difference endured over time. Verbal fluency indicates crystallized cognitive abilities, and the baseline differences may reflect a selection into self-controlled work transitions rather than an effect of retiring or working past SPA.

494 **Work, retirement, and psychological health**

495 Relative to their peers who retired at SPA, older men who
496 continued working past SPA voluntarily were less likely to
497 report depression over time, and this effect holds regardless
498 of the occupational status. Employment is a source of not
499 just economic resources, like income and health insurance,
500 but social resources (e.g. social support) and psychological
501 assets, namely sense of mastery and self-esteem (e.g. Wick-
502 rama et al. 1997). Such economic, social, and psychological
503 resources, in turn, protect against stress and maintains men-
504 tal health (Thoits 2011). Research shows that older adults
505 who remain active and engaged in personally and socially
506 fulfilling activities, such as paid work, report less distress
507 and better mental health (Hao 2008; Wethington et al. 2000).
508 Our finding that working past SPA is positively consequen-
509 tial for mental health of older men is of significance for
510 both, individuals and rapidly ageing societies. The implica-
511 tion is for us to create and maintain work environments that
512 are conducive for the mental health of older workers who
513 wish to continue working past SPA. Interestingly, a similar
514 beneficial mental health association was observed for men
515 who retired for voluntary reasons, although the association
516 appears to be weaker and only marginally significant.

517 Women who work past SPA voluntarily are also less
518 likely to report depression at baseline, and this difference
519 endured over time. Important to note, however, is that
520 women who retired voluntarily report an increased (albeit,
521 marginally significant) risk of developing depression over
522 time, a finding which contradicts what we find for men in
523 our sample. One possible explanation is that the advantages
524 attached to retirement may cancel out by the disadvantages
525 typically associated with this transition. For instance, while
526 retirement liberates women from work-family conflict, it also
527 triggers negative attitudes about retirement given that the
528 current cohort of older women still have the same (or in
529 fact, added) household obligations after retirement as they
530 did before retiring (Calasanti 1996; Quick and Moen 1998).

The overall findings here are indicative of three general
inferences. First, health in later life hinges less on whether
a person is retired on time or working past SPA and more
on the choice surrounding the decision to retire or continue
working. This is particularly the case for older men, and this
could reflect gendered socialization and gender variations in
meanings attached to formal social roles. Second, the com-
plexity surrounding retirement demands that we continue
to assess the impact of this transition on health within the
context of individual characteristics, gender being one of
them. And, finally, the health effect of retirement or extended
work life is far from static; in fact, our findings suggest that
it is more likely to shift over time. It is the unfolding of
cognitive and mental functioning over time that is likely to
portray a picture that is closer to the realities surrounding
work, retirement, and health.

547 **Limitations and future directions**

548 Our findings, we caution, need to be inferred within the con-
549 text of important limitations. First, the ambiguous associa-
550 tion between retirement and health, at least, partially can be
551 attributed to the insufficient account of health selection bias,
552 that is, that poor health may be a cause, not a consequence,
553 of workforce exit (Bound et al. 1999). As such, when assess-
554 ing cognitive decline, we excluded those respondents who
555 reported having dementia at baseline and treated as a separ-
556 ate category those individuals who reported retiring due to
557 ill health. However, reverse causality still is possible and dis-
558 cussed in a number of studies (e.g. Behncke 2012; Bonsang
559 et al. 2012; Coe and Lindeboom 2008) that employ advanced
560 research designs to tackle the endogeneity problem related
561 to the link between health and retirement. Nonetheless, most
562 extant work including ours lacks any perfect solution to this
563 issue and partly because most observed effects related to
564 work, health, and retirement are tied both to established
565 social-structural contexts or/and variations within specific
566 sub-groups of workers/retirees. Moreover, the association
567 between retirement and health remains susceptible to a
568 multitude of unobservable factors, such as personality and
569 genetic pre-dispositions or/and family-level processes (Calvo
570 et al. 2013).

571 Second, although we have adjusted for occupational class
572 and tested interactions between work and occupational sta-
573 tuses, specific work conditions before retirement, namely
574 job strain, opportunities for meaningful social interaction,
575 and creativity, were not adjusted in the models, as these vari-
576 ables were only measured among those who were currently
577 employed at the time of the interview. Future scholarship
578 should consider the questions of what changes emerge in
579 occupations over time? Which occupations translate into
580 phased retirement or bridge jobs? How may the job traits

581 within different occupations affect work behaviour and
 582 expectations, retirement timing in the future cohorts of older
 583 workers, and ultimately their cognitive and mental health
 584 over time. Identifying characteristics of occupations associ-
 585 ated with pre-SPA could point out specific areas in need of
 586 policy reform.

587 Additionally valuable would be to discern how couples
 588 and families, in addition to individuals, respond to pen-
 589 sion reforms. Retirement as a transition has increasingly
 590 become a couples' transition as opposed to being limited
 591 to an individual decision (Hospido 2015). This may be
 592 particularly true for women. Women, on an average, have
 593 fewer financial resources and women of older cohorts,
 594 especially, are relatively less attached to labour force than
 595 men; consequently, their decision to retire may be even
 596 more influenced by their partners' decisions surrounding
 597 work and retirement (van der Horst et al. 2017). Inter-
 598 estingly, the latest research (Bertogg et al. 2021) based
 599 on data from the European Union Statistics reveals that
 600 women's likelihood of retiring is increased even if they
 601 are the main earner in the household, which suggests that
 602 women are more likely to compensate for their non-tra-
 603 ditional income by retiring earlier. Given these findings
 604 and the continued increase in women's labour force par-
 605 ticipation (Gehring and Klasen 2017), retirement likely
 606 will remain a matter of joint determination and as such,
 607 pension policies related to work and retirement are most
 608 likely to succeed if we can discern not just how individu-
 609 als, but couples and families respond to them.

610 Third, growth curve models can be estimated in the
 611 presence of partially missing data (including individuals
 612 with data from only one measurement occasion) if the
 613 missing data mechanism can be assumed to be missing
 614 completely at random or missing at random (Rauden-
 615 bush and Bryk 2002). We think the missing at random
 616 assumption is reasonable in our case, as the observed data
 617 captured key confounding influence, e.g. long-standing
 618 illness and other socio-economic factors which related
 619 to both attrition and the outcome of interest. That said,
 620 nonignorable missingness still is possible, and given
 621 that some respondents dropped out of the sample due to
 622 death or poor health, the generalizability of the findings
 623 remains limited.

624 Fourth, we grouped several reasons of work/retire-
 625 ment into four broad categories (reached retirement
 626 age, own ill health, voluntary, and involuntary reasons).
 627 Future research should investigate the heterogeneity
 628 within groups and assess which reason and circumstance
 629 related to retirement is particularly consequential for
 630 older adults' health. This strand of future work may also
 631 consider, in addition to work status, the health repercus-
 632 sions of work histories. And, lastly, given that the wel-
 633 fare reform policies vary across countries, future studies

634 should explore the relationships we are assessing in our
 635 study within a cross-cultural context to evaluate whether
 636 the associations between later life work transitions and
 637 health extend across nations and as such, across varying
 638 socio-institutional contexts.

639 Conclusion

640 Continuing to assess the cognitive and mental health impact
 641 of working beyond SPA is important given that policy
 642 reform to extend working lives, to a large extent, is predi-
 643 cated on the assumption that today's older adults, unlike
 644 their predecessors, are in much better health. If working
 645 beyond the current SPA improves cognitive and mental
 646 health, this finding would bolster policy efforts to further
 647 prolong work lives and perhaps, stimulate concrete ways
 648 to engage and facilitate older workers into more productive
 649 careers. Conversely, if working after SPA is reflective of a
 650 decline in cognitive and mental well-being, delaying retire-
 651 ment would be problematic both, for the individual and over-
 652 all economy given the rising health care costs accrued from
 653 declining health. Moreover, understanding the relevance of
 654 personal choice and motivation in conditioning the health
 655 consequences of retirement or prolonged employment can
 656 inform family members, practitioners, and policymakers as
 657 they pinpoint opportunities for improving retirement-related
 658 decisions and guide the choices of a future generation of
 659 older workers and retirees.

660 **Supplementary Information** The online version contains supplemen-
 661 tary material available at <https://doi.org/10.1007/s10433-021-00644-4>.

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