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## Towards an active and happy retirement? Changes in leisure activity and depressive symptoms during the retirement transition

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### ABSTRACT

**Objectives:** Retirement is a major life transition in the second half of life, and it can be associated with changes in leisure activity engagement. Although theories of retirement adjustment have emphasized the need to find meaningful activities in retirement, little is known about the nature of changes in leisure activity during the retirement transition and their association with mental health.

**Methods:** Based on four annual waves of the 'Health, Aging and Retirement Transitions in Sweden' study, we investigated the longitudinal association of leisure activity engagement and depressive symptoms using bivariate dual change score models. We distinguished intellectual, social, and physical activity engagement.

**Results:** We found increases in all three domains of activity engagement after retirement. Although level and change of activity and depressive symptoms were negatively associated, the coupling parameters were not significant, thus the direction of effects remains unclear.

**Conclusion:** The results highlight the need to consider the role of lifestyle changes for retirement adjustment and mental health.

### ARTICLE HISTORY

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### KEYWORDS

Leisure activity; retirement adjustment; depressive symptoms

### Introduction

An active lifestyle is often seen as a key factor for successful aging (Rowe & Kahn, 1997). Particularly in older age, leisure activity engagement is a central part of an active lifestyle. In the present paper, we apply a broad and inclusive, so-called residual (Kuykendall, Boemerman, & Zhu, 2018; Roberts, 1999) or structural (Kuykendall, Tay, & Ng, 2015) definition of leisure activities as non-work related and non-obligatory activities that people engage in during their free time. Among older adults, leisure activity engagement is associated with higher well-being and better mental health (Lampinen, Heikkinen, Kauppinen, & Heikkinen, 2006; Silverstein & Parker, 2002), as well as with better physical and cognitive health (Bielak, Gerstorff, Anstey, & Luszcz, 2014; Chang, Wray, Lin, 2014; Köhncke et al., 2016; Lee, Chi, & Palinkas, 2019). The positive effects of leisure activity engagement seem to increase with age (Nimrod & Shrira, 2016), and are stronger in retirees than in workers (Kuykendall et al., 2015). Although leisure activity is associated with various health outcomes, we still know little about changes in leisure activity across significant life events such as the retirement transition, and how such changes in activity are related to mental health and adjustment.

### Changes in leisure activity after retirement

In older age, a shift from outdoor and active to indoor and passive leisure takes place (Nimrod & Janke, 2012).

Engagement in leisure activities in later life is usually a continuation of leisure activity engagement earlier in life (Agahi, Ahacic, & Parker, 2006; Nimrod & Janke, 2012), and tends to decrease in old age, when health declines set in (Janke, Davey, & Kleiber, 2006; Wetzel & Huxhold, 2016). However, there are considerable inter-individual differences in these changes (Janke et al., 2006; Strain, Grabusic, Searle, & Dunn, 2002).

Even though most people maintain a similar pattern of leisure activity engagement into later life, changes may happen in specific periods, such as the transition to retirement. After retirement, individuals usually have considerably more free time available than before, which can be used according to their own preferences. Continuity theory (Atchley, 1971) implies that people strive for continuity in most important aspects of their life. Leisure activity can help to maintain some aspects from their pre-retirement life by providing for example self-respect (Atchley, 1971), cognitive stimulation (Andel, Finkel, & Pedersen, 2016), and social contacts (Huxhold, Fiori, & Windsor, 2013). The retirement transition is thus a period in which older adults can potentially increase their engagement in leisure activities and an increased level might be important for late-life health, as people are less likely to start new activities later on (Nimrod & Janke, 2012).

Measures of leisure activity during the retirement transition have differed between previous studies. Unclear and changing definitions and measurement of leisure activity

engagement have been seen as a major problem in research on leisure activity and well-being in older adults (Adams, Leibbrandt, & Moon, 2011). In the present paper, we distinguish physical, social, and intellectual activities, which is common in the cognitive aging literature (see e.g. Fratiglioni, Paillard-Borg, & Winblad, 2004; Lam et al., 2015; Sposito, Neri, Yassuda, 2015; Wang, Xu, & Pei, 2012). These separate categories have been found to predict outcomes in different ways (Lam et al., 2015; Wang, Xu, & Pei, 2012) and also highlight potential pathways for benefits: Social activities may provide social support, in particular in times of distress (Iso-Ahola & Park, 1996), and feelings of relatedness and belonging (Kuykendall et al., 2018). Both social support and feelings of relatedness are important predictors of well-being in the retirement transition (Hansson, Buratti, Thorvaldsson, Johansson, & Berg, 2017; Henning, Bjälkebring, et al., 2019). Social leisure activity has been related to better well-being and mental health in older adults (Glass, Mendes de Leon, Bassuk, & Berkman, 2006; Hong, Hasche, & Bowland, 2009; Min, Ailshire, & Crimmins, 2016). Physical leisure activities may buffer stress as well (Harris, Cronkite, & Moos, 2006; Heaney, Carroll, & Phillips, 2014) and consequently promote mental health and well-being in older adults (Netz, Wu, Becker, & Tenenbaum, 2005; Penedo & Dahn, 2005). More specifically, a lower level of overall physical activity after retirement has been associated with increased depressive symptoms across the retirement transition (Dave, Rashad, & Spasojevic, 2008). Intellectual activities may mainly provide distraction and mental stimulation and are associated with better cognitive health in older adults (Lam et al., 2015), but have rarely been investigated as a correlate of well-being and mental health.

Most studies on changes in leisure activity after retirement have focused on physical leisure activity engagement (e.g. Berger, Der, Mutrie, & Hannah, 2005; Godfrey et al., 2006; Lahti, Laaksonen, Lahelma, & Rahkonen, 2011; Slingerland et al., 2007). Authors of a systematic review concluded that the total physical activity from leisure activities seems to increase during the transition to retirement (Barnett, van Sluijs, & Ogilvie, 2012), but only among people with higher socioeconomic status. With regard to leisure activity in general, previous studies showed mixed results, finding increases, decreases or stability in activity level (Earl, Gerrans, & Halim, 2015; Nimrod, 2007; Nimrod, Janke, & Kleiber, 2008; Rosenkoetter, Gams, & Engdahl, 2001; Scherger, Nazroo, & Higgs, 2011; Wetzel, Bowen, & Huxhold, 2019). Studies were often based on retrospective self-reports (Earl et al., 2015; Nimrod, 2007; Rosenkoetter et al., 2001) or compared only two time points (Nimrod et al., 2008; Scherger et al., 2011; Wetzel et al., 2019). Taken together, results on the development of leisure activity engagement across the retirement transition are equivocal.

### **Leisure activity and mental health in retirement**

A higher level of leisure activity is associated with better well-being and mental health, in particular among those retired (Kuykendall et al., 2015). The retirement transition may be a time period in which leisure activity is particularly beneficial. Van Solinge and Henkens (2008) argued that coping with the loss of the work role and establishing a

satisfying post-retirement lifestyle are the main tasks when entering retirement. Regarding the loss of the work role, leisure activity can offer alternative roles outside the work place to focus on, which should ease adjustment (Ryser & Wernli, 2017). Working has a number of important functions for the individual, such as providing identity, structure, social stimulation, collective purpose, and activity (Paul & Batinic, 2010), and when people retire, they need to find other activities to replace it. Leisure activity can help to replace work in this respect and facilitate continuity in retirement (Atchley, 1971). Likewise, the resource-based dynamic perspective on retirement adjustment postulates that change in retirement adjustment is a result of changes in social, emotional, financial, physical, cognitive, and motivational resources (Wang, Henkens, & van Solinge, 2011). Leisure activity in retirement may offer replacement for some of these resources (e.g. cognitive, physical, and social) previously provided at work.

Hence, it is possible that those more active in leisure activities before retirement may find it easier to withdraw from the work role, as alternative roles already exist. Further, increases in leisure activity may help preventing resource losses and achieve continuity. Therefore, both a higher level of pre-retirement engagement in leisure activities, as well as increases across the transition may have a positive impact on post-retirement mental health and adjustment.

Few studies have addressed the role of leisure activity in the retirement adjustment process. In a longitudinal multi-level model, Ryser and Wernli (2017) did not find that participation in clubs or group activities predicted affect in the retirement transition. Likewise, Van Solinge and Henkens (2005) did not find a significant association between number of pre-retirement hobbies and post-retirement perceived adjustment, but they did not look at changes in adjustment or activity. Retrospective studies show a positive association between increased activity engagement in retirement and post-retirement well-being (Earl et al., 2015; Nimrod, 2007). Nevertheless, the direction of causality remains unclear. Depressive symptoms often include inactivity and a lack of motivation, and go hand in hand with maladaptive health behaviors, which may limit activity as well (Lindwall, Larsman, & Hagger, 2011). Such reasoning is supported by research in a sample of widowed women, showing that the effect of depressive symptoms on leisure activity reduction was stronger than the effect of activity reduction on depressive symptoms (Janke, Nimrod, & Kleiber, 2008). Physical activity in particular seems to have a reciprocal relation with depression in older adults (e.g. Azevedo da Silva et al., 2012; Gudmundsson et al., 2015; Lindwall et al., 2011). Thus, longitudinal analyses are required to understand if leisure activity promotes well-being and mental health in retirement, or if those with better mental health are more likely and able to be active. For instance, before interventions to promote psychological health in retirement, based on increased leisure activity, can be planned, we need to understand if a potential association of mental health and leisure activity is driven by parallel changes, if lower mental health leads to inactivity, or if leisure activity can predict changes in mental health. However, we are not aware of studies investigating the bidirectional relationship between leisure activity and mental health across the transition to retirement.

## The present study

In the present study, we investigated the longitudinal association of leisure activity and depressive symptoms in the first three years of retirement in  $n = 1,033$  retirees. Analyses were based on the Swedish Health, Aging and Retirement Transitions in Sweden (HEARTS) study.

Given the potentially reciprocal association of activity and depression, we used a bivariate dual change score model (BDCSM; McArdle & Hamagami, 2001; McArdle, 2009). This model enables to test the direction of the relation between leisure activity and depressive symptoms. The model is explained more in detail in the method section. We expected bidirectional effects, therefore our hypotheses were:

H1: Higher leisure activity engagement predicts decreases in depressive symptoms.

H2: More depressive symptoms predict decreases in leisure activity engagement.

## Method

### Participants

Our analyses were based on four waves of data from the Swedish HEARTS study. HEARTS is a longitudinal study with annual measurements. Currently, four waves of data are available. The survey is conducted online, with a paper version available upon request. Of a nationally representative sample of people between 60–66 years of age at baseline ( $N = 14,990$ ), 5,913 individuals participated in the first assessment in 2015. In 2016, 4,651 people participated in wave 2, 4,320 in wave 3 in 2017, and 4,033 in wave 4 in 2018. For more information on the sample and the assessed information, see Lindwall et al. (2017).

In Sweden, state-based pensions can be taken out from age 61 on, and people cannot be dismissed from their employment for age reasons until age 67. The present analyses included people who were working at baseline and retired over the study period. People who considered themselves as workers at later waves were excluded. Furthermore, for people with indirect transitions (e.g. from unemployment) the retirement transition might have been when they left work, therefore we excluded participants who were unemployed, on sick leave, or received sickness benefits at any time point during the study. The final sample comprised 1,124 persons. Of these, 424 retired between waves 1 and 2, 367 between waves 2 and 3, and 333 between waves 3 and 4. Because of missing data on covariates, only 1,033 participants were included in the main analyses.

Table 1 shows baseline descriptive statistics of the study variables.

As we focused on the retirement transition as a longitudinal process, we re-centered the data around the retirement transition and included data from the wave before retirement until up to three waves afterwards. We included all retirees for whom we had data on the retirement status one wave before and one wave after retirement. Consequently, those who retired between the first two waves could contribute up to four waves, those who retired between wave 2 and 3 contributed up to three

Table 1. Descriptive statistics.

	<i>M (SD) / %</i>
Age at baseline	63.34 (1.64)
Age at retirement	64.26 (1.56)
Gender (% female)	56.81%
Tertiary education	53.48%
Average number of symptoms and diseases (pre-retirement)	3.55 (2.63)
Work satisfaction (pre-retirement, 1–7)*	5.75 (1.22)
Physical work demands (pre-retirement, 1–5)**	2.19 (1.39)
Working in retirement	29.42%
Control over timing of Retirement (1–5)***	4.62 (0.96)
Intellectual activity engagement (pre-retirement, 0–20)	14.14 (3.53)
Social activity engagement (pre-retirement, 0–40)	10.28 (3.42)
Physical activity engagement (pre-retirement, 0–40)	9.77 (3.86)
Depressive symptoms (pre-retirement, 0–3)	0.55 (0.36)

$n = 1,124$ . \* 7 = very satisfied \*\* 5 = completely correct \*\*\* 5 = 100% control. Note. The sample statistics include all individuals that were working at one wave and retired at the next. The  $n$  per cell varied from 1,083 – 1,124.

waves, and those who retired between wave 3 and 4 contributed two waves of data.

## Measures

### Activity

Leisure activity engagement was assessed with a list of 27 activities. Frequency of participation in each activity was provided on a scale from 1 (never or almost never) to 6 (everyday). We recoded this scale to 0–5. We excluded the following 4 items: (1) 'spending time at one's boat or summerhouse' was unclear as to what kind of activities were pursued there; (2) 'volunteering' was unspecific and volunteering and other prosocial behaviors are different from other leisure activities as they elicit both strong negative and positive emotions (Bjälkebring, Västfjäll, Dickert, & Slovic, 2016); (3) 'assisting relatives' was not considered a leisure activity; and (4) 'skiing/cycling' was not consistently assessed between waves.

As mentioned above, activities are often divided into pre-dominantly social, intellectual, and physical leisure activities (e.g. Lam et al., 2015), and they may contribute to mental health in different ways. We followed this differentiation in the present study. To better capture the qualitative differences between the activities, five independent raters with expertise on aging research and/or leisure activities, but without involvement in the present manuscript, rated each activity as representing one of four categories (i.e. intellectual, social, and cognitive, and 'no category applies'). The inter-rater reliability (Fleiss' Kappa, Fleiss, 1971) was high and significant ( $\kappa = .71$ ,  $p < .001$ ) reflecting substantial agreement among the raters (see Appendix A). Two activities were rated as 'no category' by more than one rater, namely 'hobbies such as crochet, sewing, carpentry, painting, collecting stamps etc.' (two raters rated as no category) and watching sport in the stadium (three raters rated as no category). One item was rated as social by two raters, intellectual by two raters, and not possible to categorize by the fifth (playing board games, card games, bingo, bridge etc.), so we excluded it as well. Fifteen items were categorized univocally. For the remaining five items, we chose the category for which the majority had voted. Instructions for raters and the results of the coding can be found in the Appendix A. Table 2 shows the activities defined as pre-dominantly physical, social, or intellectual.

Our main outcomes were sum scores for all three domains. Higher scores represent a higher level of activity frequency. Our resulting factors correlated positively, but only weakly, indicating that they represent different concepts. Correlations are presented in Table 3.

Authors of some previous studies have based their leisure activity scores on factor analysis (e.g. Gow, Pattie, & Deary, 2017); however, there are particular problems with applying the logic of factor analysis to the measures of leisure activity in the present study. Techniques such as confirmatory factor analysis (CFA) or exploratory factor analysis (EFA) assume one or several latent activity factors that underlie participation in different leisure activities, and they are based on close statistical associations between similar activities. Hence, it is assumed that engagement in one activity is related to engagement in other similar activities. However, because daily time for activities is restricted, engaging in one activity can also make it less likely to participate in another activity. This is in contrast to applying CFA or EFA to responses from a psychological self-report scale in which people's response to one item of a domain is expected to (and usually tends to) be related to their responses to other items in that domain. Furthermore, the present differentiation has a higher face validity and is often easier to interpret than results from CFA or EFA (Nimrod & Janke, 2012).

### Retirement status

Retirement status was assessed with a single item at all waves: 'Are you retired (i.e. have started to receive old age pension)?'. Response options included 1 'No', 2 'Yes - but continue working and do not perceive myself as a pensioner', 3 'Yes - continue working but perceive myself as a pensioner', or 4 'Yes, full-time retired'. In the present study, we defined those as retired who perceived themselves as retired (categories 3 and 4). Those who reported that they felt as retirees, but still worked, were coded as working in retirement, which was included as a covariate.

Table 2. Leisure activities.

Intellectual activities	Social activities	Physical activities
Reading books	Cultural activities	Gardening
Reading newspapers	Religious activities	Outdoor activities
Using the computer	Eating out	Walking
Crosswords	Visiting relatives	Dancing
	Being visited by relatives	Golf
	Visiting friends	Boule
	Being visited by friends	Ball games
	Study groups	Exercise

Table 3. Correlations of the three activity factors.

	1	2	3	4	5	6	7	8	9	10	11	12
1. I.A. (last assessment before retirement)	1											
2. S.A. (last assessment before retirement)	.21***	1										
3. P.A. (last assessment before retirement)	.21***	.26***	1									
4. I.A. (first assessment in retirement)	.81***	.16***	.17***	1								
5. S.A. (first assessment in retirement)	.23***	.68***	.21***	.25***	1							
6. P.A. (first assessment in retirement)	.17***	.21***	.72***	.18***	.22***	1						
7. I.A. (second assessment in retirement)	.76***	.09*	.15***	.81***	.20***	.13**	1					
8. S.A. (second assessment in retirement)	.16***	.62***	.16***	.17***	.70***	.18**	.24***	1				
9. P.A. (second assessment in retirement)	.14***	.18***	.67***	.12***	.18***	.74**	.18***	.21***	1			
10. I.A. (third assessment in retirement)	.72***	.19**	.23***	.79***	.20***	.23**	.81***	.23***	.25***	1		
11. S.A. (third assessment in retirement)	.20***	.58***	.20***	.18**	.65***	.26**	.26***	.71***	.23***	.26***	1	
12. P.A. (third assessment in retirement)	.10	.24***	.70***	.13*	.21***	.77**	.21***	.23***	.78***	.26***	.27***	1

$n = 322-1,033$ , depending on the time point. Note. I.A.=Intellectual Activity, S.A.= Social Activity, P.A. = Physical activity.

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

### Depressive symptoms

Depressive symptoms were assessed using the 8-item short form of the CES-D scale (Van de Velde, Levecque, & Bracke, 2009). Participants were asked how often they had experienced each of the symptoms during the last week, with the response options 0 'Rarely/never (less than 1 day)', 1 '1-2 days', 2 '3-4 days', and 3 'Most/all of the time (5-7 days)'. Cronbach's alpha was 0.80 for all time points. The 8-item CES-D showed strong measurement invariance (i.e. invariance of factor loadings and intercepts) across the four time points; however, because of the complexity of the bivariate dual change score models and consequent problems of model fit and convergence, we used manifest mean scores in the change score models.

### Covariates

We controlled for the effects of sociodemographic differences (age at retirement, gender and education), as well as the effects of basic financial resources, work in retirement, control over retirement, and disease load. Pre-retirement basic financial resources, a lack of control over retirement, as well as a worse health status may affect both post-retirement mental health (Henning et al., 2016) and the opportunity to engage in leisure activity, without a causal link between the two variables. Likewise, post-retirement work may also limit the hours to engage in leisure activity and at the same time be associated with better or worse mental health, depending on the underlying work motivation (Henning, Stenling, et al., 2019).

Information about age, gender, and education were taken from the first wave. We differentiated between highly educated individuals (at least some tertiary education) and others. Disease load was taken from the last survey before retirement. The measure was based on a list of 33 possible symptoms and diseases. To prevent an overlap with the depression scale, we excluded mental health symptoms and only included 27 physical symptoms/diseases. Financial resources were not assessed with the same item at all time points, hence, baseline financial resources were used as a proxy for general financial problems. Participants were asked if they could cover unpredicted costs of 15,000 SEK (~ €1,500) by means of their own household, with help from others, or not at all. Those who could afford it by their own means were coded as having basic financial resources (coded 1/0). Control over retirement was assessed with one item phrased 'Was it your decision to retire, or did you feel forced to do so (e.g. by health or organizational reasons etc.)?'. Response categories were 1

'It was my decision (100% my choice)', 2 'It was mostly my decision (~75% my choice)', 3 'It was partly my decision (~50% my choice)', 4 'It was my decision to a small extent (~25% my choice)', and 5 'It was not my decision, I was forced (0% my choice)'. We reversed the coding so higher scores indicated more control.

### Analysis

All analyses were performed using Mplus 7.4 (Muthén & Muthén, 2015). Missing data was handled using the full-information maximum likelihood estimator. Model fit was investigated with a combination of different fit indices – the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). A CFI greater than 0.90 and 0.95 typically reflects acceptable and excellent fit to the data, respectively. RMSEA and SRMR values less than 0.08 and 0.05 are usually seen as a reasonable and close fit to the data, respectively (Marsh, 2007; Marsh et al., 2010). The alpha level for all analyses was set to 5%.

We estimated three separate bivariate dual change score models (BDCSM; McArdle & Hamagami, 2001; McArdle, 2009) to assess associations between depressive symptoms and intellectual, social, and physical leisure activity engagement, respectively. The model is illustrated in Figure 1 and the setup was the same for all three analyses. The letter D refers to depressive symptoms, whereas the letter A refers to activity engagement. For both variables, the model includes an intercept, which relates to the baseline level ( $I_D/I_A$  in the figure), and a linear slope ( $S_D/S_A$ ), as well as a proportional change parameter to model complex nonlinear change ( $\beta_D/\beta_A$ ).

The advantage of the BDCSM, compared to other models such as latent growth curves, are the coupling parameters ( $\gamma_{DA}/\gamma_{AD}$ ), showing if the level of one variable at a specific time point [ $t$ ] predicts subsequent changes until the next measurement point [ $t + 1$ ] (and vice versa), over and above the general slope-slope association (Bainter & Howard, 2016; Schöllgen, Huxhold, & Schmiedek, 2012; Wetzel & Huxhold, 2016). This part of the model allows a better understanding of the directionality of effects and is the parameter of main interest.

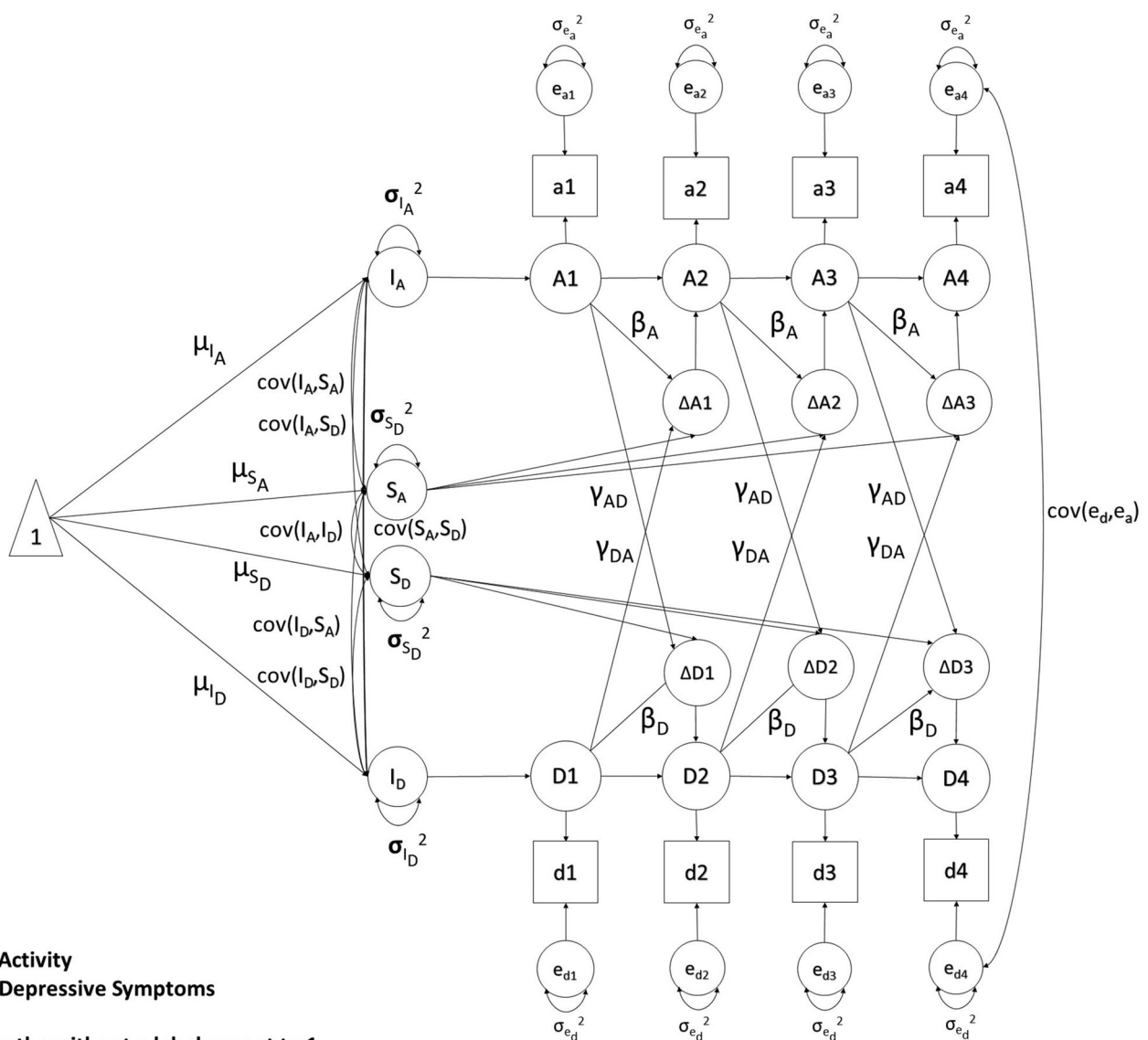


Figure 1. Bivariate dual change score model.

Further bivariate parameters include the covariance of the intercepts (i.e. associations between pre-retirement activity level and depressive symptoms,  $cov(I_D/I_A)$ ), slope-slope associations (associations between linear change in both variables,  $cov(S_D/S_A)$ ), and intercept-slope associations (i.e. associations between the pre-retirement level of one variable and linear change across time,  $cov(I_D/S_A)$  and  $cov(I_A/S_D)$ ). However, these parameters are more complex to interpret than in latent growth curves and thus are commonly interpreted with caution (Grimm, 2007). Residuals were correlated ( $cov(ed/ea)$ ). Error variances and coupling parameters were estimated equal across time points. The control variables were integrated as predictors of the intercept and slope factors of both variables in the BDCSM.

Following recommendations in the literature (McArdle & Grimm, 2010), we used model tests to compare nested models based on  $\chi^2$  values. The baseline model was a model with both couplings ( $\gamma_{DA}/\gamma_{AD}$ ) estimated, further models included either only the  $\gamma_{DA}$  or the  $\gamma_{AD}$  coupling parameters, to test directionality, or no couplings. If setting one or more parameters to 0 did not affect the model fit significantly, a more restricted model was chosen. This approach helps to understand which variable has a stronger effect on the other.

## Results

### Trajectories of leisure activity engagement across retirement

Figure 2 shows the trajectories of depressive symptoms. Figure 3 shows the trajectory of intellectual, social and physical leisure engagement, standardized for a better comparability. The graphs are derived from univariate change score models (see Table 4).

Whereas depressive symptoms seemed to decline slightly directly after the retirement event, followed by stability, engagement in the three activity domains seemed to show the opposite pattern, with initial increases and stability later on.

### Longitudinal associations of leisure activity engagement and depressive symptoms

We computed three bivariate dual change score models with covariates (age, gender, education, disease load, financial resources, post-retirement work, control over retirement) as predictors of the intercepts and slopes.

We compared models with both coupling parameters, only depressive symptoms predicting activity, only activity

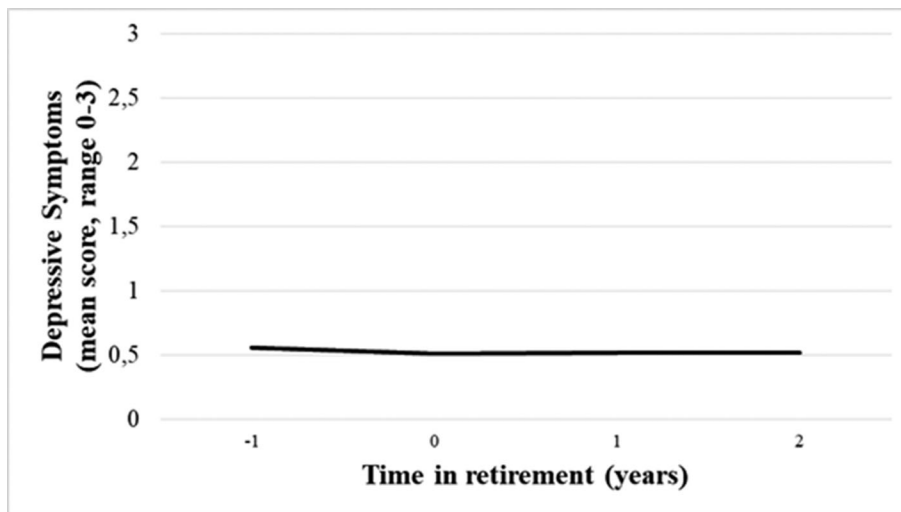


Figure 2. Change in depressive symptoms.

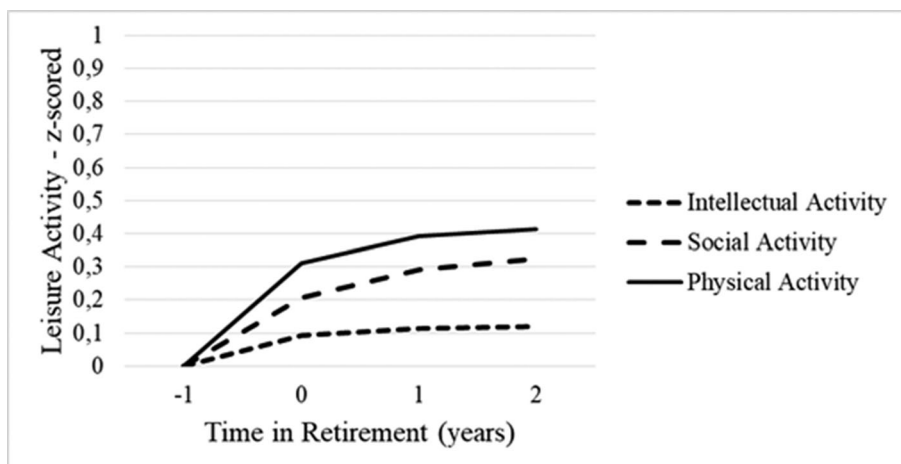


Figure 3. Changes in leisure activity engagement across retirement.



**Table 4.** Univariate dual change score models.

Parameter	Depressive Symptoms B (SE)	Intellectual Activity Engagement B (SE)	Social Activity Engagement B (SE)	Physical Activity Engagement B (SE)
Intercept	0.55 (0.01)***	14.12 (0.12)***	10.28 (0.10)***	9.76 (0.12)***
Linear slope	0.62 (0.10)***	11.13 (0.67)***	6.63 (1.13)***	8.22 (0.74)***
Proportional change	-1.20 (0.18)***	-0.77 (0.05)***	-0.59 (0.11)***	-0.74 (0.07)***
Variance intercept	0.09 (0.01)***	12.46 (0.53)***	8.18 (0.51)***	11.33 (0.65)***
Variance slope	0.10 (0.03)**	6.04 (0.77)***	3.50 (1.10)**	6.43 (1.21)***

Model Fit: Depressive Symptoms: CFI = 0.975, SRMR = 0.067, RMSEA = 0.056, 90% CI [0.037, 0.076]. Intellectual Activity: CFI = 0.997, SRMR = 0.067, RMSEA = 0.028, 90% CI [0.000, 0.051]. Social Activity: CFI = 0.997, SRMR = 0.027, RMSEA = 0.025, 90% CI [0.000, 0.049]. Physical Activity: CFI = 1.000, SRMR = 0.010, RMSEA = 0.000, 90% CI [0.000, 0.032]. \*\*\* $p < .001$ .

**Table 5.** Model fit of the three bivariate dual change score models.

	Intellectual activity		Social activity		Physical activity	
	$\chi^2$ (df)	$\Delta\chi^2$ (df)	$\chi^2$ (df)	$\Delta\chi^2$ (df)	$\chi^2$ (df)	$\Delta\chi^2$ (df)
Full coupling	101.27 (51)		72.65 (51)		81.22 (51)	
$\gamma_{DA}$ free	101.27 (52)	0.00 (1)	72.66 (52)	0.00 (1)	83.19 (52)	1.96 (1)
$\gamma_{AD}$ free	104.34 (52)	3.07 (1)	76.28 (52)	3.63 (1)	82.34 (52)	1.12 (1)
No couplings	104.59 (53)	3.32 (2)	76.45 (53)	3.80 (2)	84.39 (53)	3.16 (2)

**Table 6.** Bivariate dual change score models.

	Model 1: Intellectual activity		Model 2: Social activity		Model 3: Physical activity	
	Depressive symptoms B (SE)	Intellectual activity B (SE)	Depressive symptoms B (SE)	Social activity B (SE)	Depressive symptoms B (SE)	Physical activity B (SE)
Intercept baseline level	0.48 (0.48)	3.92 (4.53)	0.49 (0.48)	9.52 (4.54)*	0.50 (0.48)	13.42 (5.13)**
Intercept linear slope	0.63 (0.52)	1.09 (2.49)	0.62 (0.52)	2.11 (3.15)	0.59 (0.50)	8.03 (4.23)*
Proportional change	-1.32 (0.17)***	-0.49 (0.13)**	-1.32 (0.16)***	-0.61 (0.10)***	-1.28 (0.15)***	-0.82 (0.07)***
Univariate covariance intercept – slope	0.08 (0.01)***	3.81 (1.10)**	0.08 (0.01)***	4.28 (0.82)***	0.08 (0.01)***	7.69 (0.85)***
Residual variance level	0.07 (0.01)***	8.97 (0.49)***	0.08 (0.01)***	7.50 (0.51)***	0.08 (0.01)***	10.36 (0.64)***
Residual variance slope	0.10 (0.03)***	2.18 (1.01)*	0.10 (0.03)***	3.27 (0.98)**	0.10 (0.02)***	7.22 (1.24)***
<b>Bivariate associations</b>						
Covariance intercept activity – intercept depressive Symptoms		-0.06 (0.04)		-0.14 (0.04)***		0.00 (0.04)
Covariance intercept activity – slope depressive Symptoms		-0.08 (0.04)		-0.19 (0.05)***		-0.10 (0.04)*
Covariance intercept depressive symptoms – slope Activity		-0.02 (0.02)		-0.10 (0.03)**		-0.04 (0.03)
Covariance slope depressive symptoms – slope activity		-0.02 (0.02)		-0.10 (0.04)***		-0.06 (0.04)
Correlation of residuals		-0.02 (0.01)*		-0.03 (0.01)**		-0.06 (0.01)***
Depressive symptoms → change in activity		@0		@0		@0
Activity → change in depressive symptoms		@0		@0		@0

$N = 1,033$ . Note. Unstandardized parameters. Effects of covariates on intercepts and slopes are included in the model, but not displayed. Model fit: Intellectual activity: CFI = 0.985, SRMR = 0.031, RMSEA = 0.031, 90% CI [0.022, 0.039]. Social activity: CFI = 0.991, SRMR = 0.028, RMSEA = 0.021, 90% CI [0.009, 0.030]. Physical activity: CFI = 0.989, SRMR = 0.025, RMSEA = 0.024, 90% CI [0.014, 0.033]. \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ .

predicting depressive symptoms, and no coupling parameters. The fit for these models can be found in Table 5. For all three types of leisure activity, setting one or both coupling parameters to 0 did not decrease model fit significantly. Thus, the final models were those without estimated coupling parameters. Consequently, our results did not suggest that activity predicts depressive symptoms or vice versa, in contrast to our initial hypotheses.

However, the other bivariate parameters showed negative associations of activity and depression: More social activity at baseline was related to fewer depressive symptoms at baseline ( $cov(I_D/I_A)$ ,  $B = -0.14$ ,  $SE = 0.04$ ,  $p < .001$ ), and linear increases in social activity were related to linear decreases in depressive symptoms ( $cov(S_A/S_D)$ ,  $B = -0.10$ ,  $SE = 0.03$ ,  $p = .001$ ).

Higher pre-retirement social ( $B = -0.19$ ,  $SE = 0.05$ ,  $p < .001$ ) and physical ( $B = -0.10$ ,  $SE = 0.04$ ,  $p = .026$ ) activity engagement at baseline were associated with stronger linear decreases in depressive symptoms ( $cov(I_A/S_D)$ ). More depressive symptoms at baseline were related to decreases in social activity ( $cov(I_D/S_A)$ ,  $B = -0.10$ ,  $SE = 0.03$ ,  $p = .001$ ).

Residuals were negatively correlated for intellectual ( $cov(ed/ea)$ ,  $B = -0.02$ ,  $SE = 0.01$ ,  $p = .021$ ), social ( $B = -0.03$ ,  $SE = 0.01$ ,  $p = .006$ ) and physical activity ( $B = -0.06$ ,  $SE = 0.01$ ,  $p < .001$ ).

The final model parameters for the models can be found in Table 6. Covariate effects can be found in appendix B.

## Discussion

Leisure activity is believed to be a major source of well-being and mental health in retirement (Atchley, 1971; Kuykendall et al., 2015), but the growing literature on retirement adjustment has often neglected the role of leisure activity engagement in the adjustment process. In the present study, we investigated changes in intellectual, social, and physical leisure activity engagement across the retirement transition, as well as their associations with depressive symptoms.

In our sample, leisure activity engagement increased directly after retirement, but showed relative stability afterwards. This higher level of leisure activity was maintained

over the study period. This is encouraging with regard to the well-documented positive effects of leisure activity on health (e.g. Menec, 2003). The small short-term decrease of depressive symptoms after retirement is in line with earlier studies (e.g. Westerlund et al., 2010).

The main motivation behind the present paper concerned the longitudinal associations between leisure activity engagement and depressive symptoms. In line with earlier studies (e.g. Iso-Ahola & Park, 1996; Lindwall et al., 2011), mainly physical and social activity seems to be related to better mental health: People reporting more social activity engagement at baseline reported fewer depressive symptoms and increases in social activities were related to decreases in depressive symptoms. People who were more socially or physically active at baseline showed stronger decreases in depressive symptoms over time. However, higher depressive symptoms at baseline were also associated with linear decreases in social activity engagement. Leisure activity seems to have a negative relationship with mental health, and being active already before retirement may be associated with benefits for retirees.

Nevertheless, the most important parameters, the coupling parameters, did not show that higher social, physical or intellectual activity engagement predicted subsequent decreases in depressive symptoms in the retirement transition. These results are in line with earlier studies (Ryser & Wernli, 2017; Van Solinge & Henkens, 2005) and shed doubt on ideas of leisure activity as the main source of adjustment to a life without work. There may be other activities and roles that are more central for individual adjustment in retirement.

One explanation is that it may not be more activity, but satisfaction with one's leisure activity level (Kuykendall et al., 2015), that contributes to retirement adjustment. Retirees may have different optimal levels of leisure activity and may not always need increases to be satisfied. Higher leisure activity may sometimes even be detrimental to mental health in retirement, as a previous study found that planning too many social activities in retirement was associated with psychological distress in retirement (Yeung, 2013).

Moreover, it should be noted that we investigated change in depressive symptoms, not perceived retirement adjustment (Van Solinge & Henkens, 2005) or subjective well-being (Kuykendall et al., 2015; Ryser & Wernli, 2017). Participants of our study reported a very low level of depressive symptoms, showing a relatively good level of mental health, and there were only very small changes in depressive symptoms over time. Other well-being measures may be more likely to be affected by leisure activity.

Furthermore, in contrast to our expectations, depressive symptoms did not predict decreased activity levels either. Again, this may be mainly because of the low levels of depressive symptoms in our sample.

### Strengths and limitations

A strength of the present study is the inclusion of a wide range of activities, and the differentiation of different domains of activity. The large, relatively heterogeneous population-based sample allowed the investigation of inter-individual differences. Furthermore, advanced analyses allowed directional assumptions about the association of leisure activity engagement and depressive symptoms.

One limitation of the current study is the restriction to the years directly around the retirement transition. Neither potential anticipatory lifestyle changes, nor later long-term developments were included in our models. Furthermore, our sample is not completely representative. First, analyses were done in a Swedish sample, and Sweden has a strong welfare state and relatively low poverty in old age (Ebbinghaus & Neugschwender, 2011). Second, the HEARTS sample is comparably healthy and highly educated (Lindwall et al., 2017). It would be interesting to examine if the patterns of change described here replicate in other samples. Third, we deliberately restricted our analyses to direct retirement transitions and did not consider retirement from unemployment (Wetzel, Huxhold, & Tesch-Römer, 2016).

Finally, the effect of leisure activity engagement most likely depends on many inter-individual difference factors. For example, engaging in leisure activity might be more important for mental health if one felt a strong attachment to the former work place, as a form of compensation. Future studies should examine under which conditions leisure activity engagement can contribute to retirement adjustment.

### Conclusion

In the present study, we found that engagement in intellectual, social or physical leisure activities increased after retirement. Activity engagement was related to mental health, but the direction of effects was unclear. More research is needed to understand what kind of activities contribute to well-being or mental health, and which factors may moderate these associations.

### Disclosure statement

No potential conflict of interest was reported by the authors.

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### Data availability statement

Because of Swedish data protection laws, we are currently not allowed to share HEARTS data publicly. We are working on a solution for this problem.

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## Appendix A. Coding leisure activities

### Instructions

Please rate the following leisure activities as predominantly physical, social, or intellectual. If an activity may match more than one category, please choose the one that fits best. See below the descriptions.

Predominantly physical (p) – activities that mainly involve physical activity. The WHO describes physical activity as ‘any bodily movement produced by skeletal muscles that requires energy expenditure’. This may include sports or activities where you need to move around a lot.

Predominantly social (s) – activities that mainly involve social exchange and activity with others, such as doing things together with a friend or partner or doing things in a group.

Predominantly intellectual (i) – activities done mostly by oneself for mental stimulation.

Ratings		Rater				
Swedish text	English translation	1. Type	2. Type	3. Type	4. Type	5. Type
Trädgårdarbete (inklusive underhållsarbete och snöskottning)	Gardening (including maintenance work and snow shoveling)	P	P	P	P	P
Utomhusaktiviteter (t ex fiske, jakt, plocka bär/svamp)	Outdoor activities (e.g. fishing, hunting, search for mushrooms)	P	P	P	P	P
Kulturella aktiviteter (t ex gå på bio, teater, konserter, museum, utställningar)	Cultural activities (e.g. going to the movies, theatre, concerts, museum, exhibitions ...)	S	S	S	I	I
Deltar i religiösa aktiviteter	Participating in religious activities	S	S	S	X	S
Äta ute (på restaurant eller liknande)	Eating out (in a restaurant etc.)	S	S	S	S	S
Läsa böcker	Reading books	I	I	I	I	I
Läsa tidningar	Reading newspapers	I	I	I	I	I
Spela spel (t ex kortspel, bridge, bingo, brädspele)	Playing games (e.g. cards, bridge, bingo, boardgames)	S	X	I	S	I
Använda dator (t ex surfa på internet, skriva, spela spel)	Using the computer (e.g. surfing the internet, writing, playing games)	I	X	I	I	I
Löser korsord/sudoku eller liknande	Solving cross word puzzles/sudoku	I	I	I	I	I
Besöker släktingar	Visiting relatives	S	S	S	S	S
Har släktingar som kommer på besök	Having relatives visiting me	S	S	S	S	S
Hälsar på vänner/bekanta	Meeting friends/acquaintances	S	S	S	S	S
Har vänner/bekanta som kommer på besök	Having friends/acquaintances visiting me	S	S	S	S	S
Deltar i studiecirkel	Participating in evening classes/ study groups	S	I	S	S	I
Hobbyaktiviteter (t ex virka, sy, snickra, måla, samla frimärken mm)	Hobbies (e.g. crochet, sewing, carpentry, painting, collecting stamps etc.)	I	I	I	X	X
Promenader/stavgång	Going for a walk / nordic walking	P	P	P	P	P
Dansa	Dancing	P	P	P	P	P
Golf	Playing golf	P	P	P	P	P
Boule, bangolf eller liknande	Boule, minigolf etc.	S	X	P	P	P
Bollsport (t ex tennis, fotboll eller liknande)	Ball games (e.g. tennis, soccer)	P	P	P	P	P
Motion/träning (t ex jogging, gymnastik, styrketräning, Friskis & Svettis eller liknande)	Exercise (e.g. jogging, gymnastics, strength training)	P	P	P	P	P
Titta på idrott/vara åskådare på plats (dvs inte på TV)	Watching sport games (not on the TV)	S	X	S	X	X

Note. P = predominantly physical activity, S = predominantly social activity, I = predominantly intellectual activity, X = no category applies / miscellaneous.

## Appendix B. Effects of covariates

	Model Intellectual Activity		Model Social Activity		Model Physical Activity	
	Depressive symptoms	Intellectual activity	Depressive symptoms	Social activity	Depressive symptoms	Physical activity
Age → level	0.00 (0.01)	0.10 (0.07)	0.00 (0.01)	-0.01 (0.07)	0.00 (0.01)	-0.09 (0.08)
Gender → level	0.02 (0.02)	1.91 (0.21)***	0.02 (0.02)	0.98 (0.21)***	0.02 (0.02)	0.61 (0.24)*
Education → level	0.05 (0.02)*	0.62 (0.21)**	0.05 (0.02)*	0.58 (0.21)**	0.05 (0.02)	0.47 (0.24)
Disease load → level	0.03 (0.00)***	-0.06 (0.04)	0.03 (0.00)***	-0.12 (0.04)**	0.03 (0.00)***	-0.29 (0.05)***
Control → level	-0.03 (0.01)*	0.18 (0.11)	-0.03 (0.01)*	0.05 (0.11)	-0.03 (0.01)**	0.25 (0.12)*
Financial resources → level	-0.04 (0.05)	2.10 (0.44)***	-0.03 (0.05)	0.70 (0.45)	-0.04 (0.05)	1.52 (0.50)**
Post-retirement work → level	0.01 (0.03)	0.10 (0.24)	0.01 (0.03)	1.02 (0.24)***	0.01 (0.03)	0.16 (0.27)
Age → slope	0.01 (0.01)	0.06 (0.04)	0.01 (0.01)	0.05 (0.05)	0.01 (0.01)	-0.04 (0.06)
Gender → slope	0.03 (0.02)	1.11 (0.27)***	0.03 (0.03)	0.95 (0.19)***	0.03 (0.03)	0.14 (0.20)
Education → slope	0.04 (0.03)	0.42 (0.15)**	0.03 (0.03)	0.61 (0.16)***	0.04 (0.03)	0.55 (0.20)**
Disease Load → slope	0.04 (0.01)***	-0.01 (0.02)	0.04 (0.01)***	-0.05 (0.03)	0.05 (0.01)***	-0.18 (0.04)***
Control → slope	-0.07 (0.01)***	0.14 (0.07)**	-0.06 (0.01)***	0.11 (0.08)	-0.07 (0.02)***	0.45 (0.10)***
Financial resources → slope	-0.16 (0.05)**	0.80 (0.35)	-0.16 (0.05)**	0.39 (0.32)	-0.15 (0.06)**	1.69 (0.43)***
Post-retirement work → slope	-0.01 (0.03)	-0.20 (0.13)	-0.01 (0.03)	0.36 (0.18)*	0.00 (0.03)	-0.36 (0.22)