Supplement A

Table 1 Operationalization of the variables included in the analysis

Variables	Measured in Lifelines
Educational attainment	Participants' educational attainment was categorized into nine levels: 1 = no education (did not finish primary school), 2 = primary education (primary school, special needs primary school), 3 = lower or preparatory secondary vocational education (such as lts, leao, lhno, vmbo), 4 = junior general secondary education (such as mavo, (m)ulo, mbo-short, vmbo-t), 5 = secondary vocational education or work-based learning pathway (such as mbo-long, mts, meao, bol, bbl, inas), 6 = senior general secondary education, pre-university secondary education (such as havo, vwo, atheneum, gymnasium, hbs, mms), 7 = higher vocational education (such as hbo, hts, heao, 'kandidaats' university education (e.g. bachelor), 8 = university education, 9 = other. Categories 1-4 = low, categories 5-6 = middle and categories 7-8 = high. Participants who selected answer 9 ('other', n = ~4,300) were categorized based on the specifications provided in degree_highest_adu_q_1_a (EDUCOTHER). These specifications were manually reviewed for educational terms, and participants were then assigned to the low, middle, or high educational attainment group, or no group. Further details can be found at wiki-lifelines/educationalattainment.
Equivalized household income	Income was measured by the question 'What is the net income per month?'. Participants could choose from the options 'Less than € 750', '€ 750 - € 1000', '€ 1000 - € 1500', '€ 1500 - € 2000', '€ 2000- € 2500', '€ 2500- € 3000', '€ 3000 - € 3500', 'more than € 3500', 'I do not know this', 'I prefer not to answer that'. The midpoint of these answers was used to measure equivalized income. For 'Less than € 750', € 750 was used as the midpoint. For 'more than € 3500', € 3500 was used as the midpoint.
	Participants were asked to their household size by the question 'How many people live from this income'. They could choose from an answer ranging from 1 to more than 6 persons. The square root of the household size was used to calculate equivalized income (OECD, 2018). For the answer 'more than 6', 7 was used as the household size.
Living arrangement	Participants' partner presence was measured by the question 'Do you have a partner now?'. They could choose from the options 'Yes I am married', 'Yes, I have a live-in partner of registered partnership', Yes I am in a relationship but we are living apart / I am going out with someone', No I am single / I have not partner', 'Other:'. The self-completed answer for the option 'Other:' could not be retrieved, so belong to missing values. The first two options indicate participants are living together with someone, so these will be assigned to the 'cohabiting' category. The other two options indicate those who are not living with someone, so will be assigned to the category 'not cohabiting'.

Table **2 Continued**

Variables	Measured in Lifelines
Coronary heart disease (CHD) risk factors	CHD risk factors is based on the presence of heart failure, or the experience of a heart attack or stroke (Livingston et al., 2017) (National Health Service, 2024) Participants were asked 'Have you ever had a heart attack?' (yes / no), "Do you have heart failure (decreased pumping of the heart)?" (yes / I don't know / no) and 'Do you ever had a stroke?' (yes / no). If participants have answered 'yes' on one of these questions, they are at risk for CHD. Those who answered 'I don't know' on the question whether they have heart failure, were assigned to the 'no' category.
Physical inactivity	Participants were asked two questions 'On average of how many days a week, in total, do you spend at least half an hour cycling, chores, gardening, sports or other strenuous activities?', for both summer and winter time. The answer to both questions could range between 0 – 7 days. By taking the average of both answers, a new dichotomous variable was created to indicate whether respondents meet the criteria of being active for at least half an hour on 5 days per week (Ministerie van Volksgezondheid, Welzijn en Sport, 2021). Those with an average of ≥5 meet the criteria (0) and those <5 do not meet the criteria (1).
Depressive symptoms	The PROMIS-29 profile assesses various aspects of mental and physical health (Dutch Flemish PROMIS National Center, n.d.). The Emotional Distress-Depression short form 4a measures depressive symptoms, with scores translated into T-scores (Health Measures, 2016; Health Measures 2021) Participants responded to four statements regarding their emotional experiences in the past 7 days. Each statement required a response on a scale of five options: 'never', 'rarely', 'sometimes', 'often', or 'always'. The statements included are 'I felt worthless', 'I felt helpless', I felt depressed', 'I felt hopeless. According to Health Measures, the answers to these statements are assigned by a number, where never = 1, rarely = 2, sometimes = 3, often = 4 and always = 5 (Health Measures, 2016). The sum of the scores could then be transformed to a T-score, according to the PROMIS depression scoring manual (Health Measures, 2021). Based on the cut-off points Dutch population a new dichotomous variable is created, defining those with T-scores <55 with no depressive symptoms (0) and those ≥55 with depressive symptoms (1) (Dutch-Flemish PROMIS National Center, 2023).
Social participation	The Ability to Participate in Social Roles and Activities short form 4a measures social participation, which is part of the PROMIS-29 profile (Dutch Flemish PROMIS National Center, n.d.). Participants responded to four statements regarding their social participation. Each statement required a response on a scale of five options: 'never', 'rarely', 'sometimes', 'usually', or 'always'. The statements included are 'I have trouble doing all of my regular leisure activities with others', ', I have trouble doing all of the family activities that I want to do', 'I have trouble doing all of my usual work (include work at home)', ' I have trouble doing all of the activities with friends that I want to do'. According to Health Measures (Health Measures, 2018a) the answers to these statements are assigned by a number, where never = 5, rarely = 4, sometimes = 3, usually = 2 and never = 1. The sum of the scores could then be transformed to a T-score, according to the PROMIS ability to participate in social roles and activities scoring manual (Health measures, 2018b). Based on the cut-off values of the Dutch population a new dichotomous variable is created, defining those with T-scores > 46 are well able to participate socially (0) and those with T-scores ≤ 46 are considered less able to participate socially (1) (Dutch-Flemish PROMIS National Center, 2023).

Table **3 Continued**

Loneliness	Participants respond to six statements regarding their experience of loneliness. Each statement required a response on a scale of five options 'yes!', 'yes', 'more or less', 'no', 'no!'. The statements included are 1 = 'I experience an emptiness around me', 2= 'I miss people around me', 3 = I often feel abandoned', 4 = 'I have enough people to fall back on in case of adversity', 5 = 'I have many people that I can fully trust', 6 = 'there are enough people I feel closely connected to'. On items 1-3 "more or less", "'yes", "yes!" can be counted and represents the emotional loneliness score. On the items 4-6 count the negative answers "no!", "no", "more or less" can be counted and represent the social loneliness score. The missing values for both emotional and social loneliness must also be counted. The emotional and social loneliness scores can be added up, so a respondent can score a total of six points in case of extreme loneliness. The total loneliness score is valid only if the sum of the missing emotional loneliness score and the missing social loneliness score equals 0 or 1. By adding the emotional and social loneliness score a new dichotomous variable can be created that indicates those with a score 0-1 as not lonely (0) and those with a score 2-6 as lonely (1) (Van Tilburg, 2023).
Church attendance	Participants were asked 'How often have attended a religious gathering in the past 12 months?'. They could choose from seven different answers, 'multiple times a week', '1 time per week', '1 time per 2 weeks', '1 time per month', 'less than 1 time per month', '1 time', 'not a single time'. The first four answers indicate those attending religious meetings once a month or more (1). The last three answers indicate those attending religious meetings less than once a month (0).

Table 4 Summary of missing data for variables included in the analysis

Variable	Missing (N)	Missing (%)
Voluntary work	<10	0.8
Educational attainment	22	1.7
Paid work	<10	0.8
Living arrangement	38	2.8
CHD risk presence	32	2.5
Hypertension presence	<10	0.8
High cholesterol presence	<10	0.8
Depressive symptoms	<10	0.8
Social network size	<10	0.8
Informal caregiving	<10	0.8
Taking care of grandchildren	<10	0.8
Social participation	<10	0.8

Tabel 3 Univariable linear regression for IDN decline, DET decline , OCL decline and ONB decline

Variables	IDN decline B (95% C.I.)[1]	p-value	DET decline B (95% C.I.)	p-value	OCL decline B (95% C.I.)	p-value	ONB decline B (95% C.I.)	p-value
Voluntary workers								
• *Never volunteers*	*Ref.*		*Ref.*		*Ref.*		*Ref.*	
• *Past volunteers*	-3.98 [-25.8, 18.9]	0.72	-11.95 [-67.5, 43.6]	0.67	0.011 [-0.007, 0.028]	0.23	-11.18 [-46.1, 23.7]	0.53
• *Current volunteers*	4.34 [-12.9, 21.6]	0.62	1.53 [-42.4, 45.5]	0.95	0.012 [-0.002, 0.026]	0.09	-4.66 [-32.3, 22.9]	0.74
Covariates								
Age	0.90 [-0.6, 2.4]	0.23	0.41 [-3.3, 4.1]	0.83	**-0.001 [-0.003, 0.00]**	**0.02**	1.96 [-0.4, 4.3]	0.10
Age groups	6.15 [-10.0, 22.3]	0.46	4.05 [-37.1, 45.2]	0.85	-0.010 [-0.022, 0.003]	0.15	24.93 [-0.9, 50.7]	0.06
Female	-1.13 [-14.8, 12.5]	0.87	-17.78 [-52.4, 16.8]	0.31	0.009 [-0.002, 0.020]	0.12	8.24 [-13.5, 30.0]	0.46
Educational attainment								
• *Low*	*Ref.*		*Ref.*		*Ref.*		*Ref.*	
• *Middle*	-1.10 [-18.2, 16.0]	0.90	33.81 [-9.6, 77.2]	0.13	-0.007 [-0.021, 0.006]	0.31	-14.88 [-42.2, 12.5]	0.29
• *High*	3.76 [-12.8, 20.4]	0.66	25.81 [-16.3, 67.9]	0.23	**0.014 [0.001, 0.027]**	**0.04**	-2.67 [-29.2, 23.9]	0.84
Paid work	-7.04 [-20.9, 6.8]	0.32	17.81 [-17.5, 53.1]	0.32	0.010 [-0.001, 0.021]	0.07	-18.65 [-40.8, 3.5]	0.10
Cohabiting	-6.24 [-27.5, 15.1]	0.57	**-60.40 [-114.6, -6.2]**	**0.03**	-0.002 [-0.019, 0.016]	0.86	-6.46 [-40.7, 27.8]	0.71
Equivalized household income	0.00 [-0.01, 0.02]	0.87	-0.01 [-0.04, 0.03]	0.62	0.000 [0.000, 0.000]	0.15	0.01 [-0.01, 0.03]	0.40
• Missing data income	-5.34 [-26.7, 16.0]	0.62	-15.69 [69.9, 38.5]	0.57	0.001 [-0.016, 0.018]	0.88	-15.70 [-49.7, 18.3]	0.37

1. Unstandardized beta and confidence interval
2. OCL decline is the only decline score measured in hitrate instead of speed measure

Table 3 continued

Variables	IDN decline		DET decline		OCL decline		ONB decline	
	B (95% C.I.)	p-value	B (95% C.I.)	p-value	B (95% C.I.)	p-value	B (95% C.I.)	p-value
Self-reported health								
• *Excellent*	*Ref.*		*Ref.*		*Ref.*		*Ref.*	
• *Very good*	-0.27 [-20.0, 19.4]	0.98	47.23 [-2.9, 97.4]	0.07	0.004 [-0.012, 0.020]	0.63	11.86 [-19.7, 43.4]	0.46
• *Good*	2.98 [-16.4, 22.4]	0.76	25.67 [-23.7, 75.0]	0.31	-0.002 [-0.017, 0.014]	0.83	13.96 [-17.0, 45.0]	0.38
• *Mediocre / poor*	-26.18 [-60.0, 8.23]	0.14	45.74 [-41.8, 133.3]	0.31	-0.020 [-0.047, 0.008]	0.16	16.98 [-38.0, 72.0]	0.55
CHD risk presence	-18.51 [-55.4, 18.4]	0.33	-78.59 [-173.4, 16.2]	0.10	0.027 [-0.003, 0.056]	0.08	-40.11 [-98.8, 18.6]	0.18
High cholesterol	**16.12 [0.5, 31.3]**	**0.04**	4.31 [-35.6, 44.2]	0.83	0.004 [-0.009, 0.016]	0.54	11.59 [-13.3, 36.5]	0.36
Hypertension	0.27 [-13.9, 14.4]	0.97	**61.58 [25.6, 97.5]**	**<0.001**	0.010 [-0.002, 0.021]	0.10	6.32 [-16.3, 28.9]	0.58
Hearing problems	5.80 [-9.6, 21.2]	0.46	10.58 [-28.5, 49.6]	0.60	-0.006 [-0.018, 0.006]	0.35	2.19 [-22.3, 26.7]	0.86
Physical inactivity	2.68 [-11.8, 17.2]	0.72	3.33 [-33.6, 40.2]	0.86	0.009 [-0.002, 0.021]	0.11	-8.01 [-31.2, 15.2]	0.50
Obesity	5.83 [-13.2, 25.1]	0.55	8.19 [-40.8, 57.2]	0.74	-0.006 [-0.022, 0.009]	0.41	16.10 [-14.6, 46.8]	0.30
Depressive symptoms	-8.48 [-29.5, 12.6]	0.43	35.35 [-18.2, 88.9]	0.20	-0.008 [-0.025, 0.009]	0.34	0.29 [-33.4, 34.0]	0.99
Small social network size	2.72 [-10.8, 16.3]	0.69	-7.89 [-42.4, 26.6]	0.65	**-0.013 [-0.024, -0.003]**	**0.02**	8.16 [-13.5, 29.9]	0.46
Loneliness	-1.62 [-18.4, 15.2]	0.85	16.78 [-26.0, 59.6]	0.44	-0.001 [-0.015, 0.012]	0.86	-5.70 [-32.6, 21.2]	0.68
Low social participation	3.35 [-23.1, 29.8]	0.80	-14.88 [-82.2, 52.5]	0.67	-0.014 [-0.035, 0.007]	0.20	-4.44 [-46.7, 37.9]	0.84
Taking care of grandchildren	-2.86 [-17.0, 11.3]	0.69	4.42 [-31.5, 40.4]	0.81	0.003 [-0.008, 0.015]	0.56	-8.39 [-31.0, 14.2]	0.47
Informal caregiving	-4.30 [-18.9, 10.3]	0.56	-13.04 [-50.2, 24.1]	0.49	-0.006 [-0.018, 0.006]	0.30	-6.71 [-30.0, 16.5]	0.57
Church attendance	-1.38 [-17.0, 14.3]	0.86	-18.47 [58.2, 21.3]	0.36	-0.010 [-0.023, 0.002]	0.11	-8.39 [-33.4, 16.6]	0.51
Baseline score	**-718.03 [-782.9, -653.1]**	**<0.001**	**-966.78 [-1040.5, -893.1]**	**<0.001**	**0.766 [0.748, 0.783]**	**0.00**	**-870.27 [-973.9, -766.6]**	**<0.001**

Table 4 Multivariable linear regression OCL decline

Variables	OCL decline B (95% C.I.)	p-value
Intercept	-0.950 [-0.997, -0.903]	<0.001
Voluntary workers		
• *Never*	*Ref.*	
• *Past volunteers*	0.000 [-0.007, 0.007]	0.95
• *Current volunteers*	0.001 [-0.005, 0.007]	0.80
Covariates		
Age	**0.001 [0.000, 0.001]**	**0.01**
Female	-0.002 [-0.007, 0.003]	0.45
Educational attainment		
• *Low*	*Ref.*	
• *Middle*	-0.003 [-0.008, 0.003]	0.33
• *High*	**-0.011 [-0.017, 0.005]**	**<0.001**
Paid work	0.004 [-0.001, 0.010]	0.12
Cohabiting	0.003 [-0.004, 0.009]	0.47
Equivalized household income	-0.000 [0.000, 0.000]	0.14
Missing data income	-0.003 [-0.010, 0.005]	0.46
Self-reported health		
• *Excellent*	*Ref.*	
• *Very good*	-0.005 [-0.011, 0.002]	0.15
• *Good*	-0.004 [-0.010, 0.003]	0.24
• *Mediocre / poor*	-0.007 [-0.020, 0.005]	0.27
CHD risk presence	0.010 [-0.002, 0.021]	0.11
High cholesterol	0.000 [-0.005, 0.005]	0.92
Hypertension	**0.006 [0.001, 0.010]**	**0.01**
Hearing problems	-0.001 [-0.006, 0.004]	0.64
Physical inactivity	0.001 [-0.004, 0.006]	0.64
Obesity	0.000 [-0.006, 0.007]	0.88
Depressive symptoms	0.003 [-0.004, 0.011]	0.37
Small social network size	0.002 [-0.003, 0.006]	0.46
Loneliness	0.002 [-0.004, 0.008]	0.56
Low social participation	0.004 [-0.006, 0.014]	0.42
Taking care of grandchildren	-0.001 [-0.005, 0.004]	0.78
Informal caregiving	-0.001 [-0.005, 0.004]	0.76
Church attendance	-0.002 [-0.007, 0.003]	0.50
Baseline score	**0.781 [0.762, 0.799]**	**0.000**
R^2	0.860	

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