

Active ageing and quality of life – cross-sectional and reciprocal longitudinal associations

Taina Rantanen

taina.rantanen@jyu.fi

University of Jyväskylä

Erja Portegijs

UMCG, University of Groningen

Markku Kauppinen

University of Jyväskylä

Katja Kokko

University of Jyväskylä

Timo Hinrichs

University of Jyväskylä

Johanna Eronen

University of Eastern Finland

Katja Lindeman

University of Jyväskylä

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Abstract

Background

Active ageing (AA) at individual level refers to striving for good quality of life (QOL) through activities as per one's goals, abilities and opportunities.

Aims

First, to assess the associations of QOL and the components of AA: goals, abilities and opportunities to act, and activity. Second, to study the reciprocal associations of AA and QOL.

Methods

961 community-dwelling people aged 75, 80 or 85 years participated in the AGNES study and 663 responded four years later. AA was quantified using the University of Jyväskylä AA Scale (UJACAS, 17 activities self-rated for will, opportunity, ability, and activity; range 0–272). QOL was assessed with the 13-item Older People's Quality of Life Questionnaire (OPQOL-brief, range 13–65). Theory-driven path model and longitudinal cross-lagged model were constructed and their fit with observed data tested.

Results

Will, opportunity and ability to act and the level of activity were associated with each other and with QOL. Longitudinally AA and QOL scores declined (UJACAS Mean, M, 200, SE 1.4 vs. M 186, SE 1.3; QOL M 55, SE 0.2 vs. M 53, SE 0.2; $p < 0.001$ for both). In the longitudinal cross-lagged model, AA and QOL were associated at baseline and follow-up and showed moderate to strong stability over time. A significant cross-lagged path emerged from baseline AA to the follow-up QOL ($\beta = 0.25$, 95% CI 0.19–0.32).

Discussion and Conclusions

When growing old individuals may promote their QOL through their approach to life by balancing their activity as per their goals, opportunities and abilities.

Introduction

When growing old, quality of life (QOL) reflects multifaceted perceptions of satisfaction with elements of life, such as health, social relationships, living environment, or opportunities for valued activities [1, 2]. Good QOL is a focal public policy and health care goal and something that people are intrinsically motivated to seek through their own actions by pursuing activities arising from the basic human motivations of social connectedness, autonomy and competence [3, 4].

Activity theory originating in the 1950's [5] suggested that ageing will be more favorable for older adults who remain engaged and active rather than for those who disengage from activities. Substantial literature supports the idea that taking part in different activities enhances QOL among older people [4],

however, many of the previous studies do not control for reverse causality or address only a few specific activities, such as physical or social activities, and describe the content and degree of activity based on pre-determined external criteria (e.g. time use, frequency, energy expenditure). That may bias the results by overlooking the more unassuming activities. Older people may characterize their activeness in a rather commonplace way, such as getting out of the house, being busy, or walking for transport [6]. All in all, it is unclear whether activity promotes better QOL or whether better QOL propels more activity when growing old.

WHO defined AA policy as “the process of optimizing opportunities for health, participation, and security in order to enhance QOL as people age” and emphasized that preferences and abilities of older people should be considered in the policies. [2]. However, pertaining to research of individuals this policy concept has not been fully operationalizable, which has curbed research progress. To fill in this deficiency, we adjusted the WHO policy goal definition of AA to the context of individuals as follows: AA is the striving for elements of wellbeing through activity pertaining to individual goals, abilities and opportunities. We suggested that the process of balancing the will to act, ability to act and opportunities to act and the extent of activity is fed by the interaction of intrinsic capacities (all physical and cognitive abilities one has) and the social and physical environment [7].

We then developed the University of Jyväskylä AA Scale (UJACAS) that can be used to quantify AA through self-assessment. The UJACAS includes 17 essential activities. The agency in each activity is captured by self-rating the magnitude of one’s will to act, opportunity to act, ability to act, and activity. The ratings form the subscales of UJACAS and their sum the total score which describes a latent construct of AA [8]. The novelty of UJACAS is that it captures diverse forms of activity in old age expressed by the purpose of each activity rather than using fixed objective standards. This allows for task modifications - adaptive responses to reduce task strain enabling continued activity. For example, “enjoying the outdoors” may now refer to a stroll in a park even though earlier in life it denoted hiking in the woods. Higher AA scores assessed with UJACAS have been found to coincide with better self-rated health and greater autonomy, life-space mobility, and higher quality of life [8, 9, 10].

The first aim was to analyze using cross-sectional data whether all components of AA (will, ability, opportunity, activity) are related to QOL when they are factored in simultaneously. Second, we assessed the longitudinal reciprocal associations of AA and QOL over time to clarify which propels the other. The expected results will expand earlier knowledge by clarifying the directed associations of AA components and QOL, and by elucidating the temporal relationship of AA and QOL potentially laying grounds for identifying future AA intervention approaches.

Methods

Study design and setting

This study is part of the 'AA - resilience and external support as modifiers of the disablement outcome' (AGNES). Briefly, the AGNES study involves a probability sample of community-dwelling older people living in the city of Jyväskylä in Central Finland. Baseline data were collected between 2017 and 2018 in at-home interviews using computer assisted personal interviewing, and the initial baseline sample consisted of 1,021 participants who were 75, 80, or 85 years old. Comprehensive details of the baseline study protocol and recruitment procedures have been previously published elsewhere [7, 11]. Due to missing data in some variables, the final sample size for the cross-sectional baseline analyses was 967. Follow-up data were collected between 2021 and 2022. Of the 1,021 baseline participants who had not withdrawn consent, 904 survived and were contacted by telephone and a letter in 2021–2022. Of them, 172 were not interested, 27 were not reached, and 26 were excluded. A total of 679 participants were recruited, but fifteen participants withdrew their consent, and one participant was excluded during the home interview due to communication difficulties. Finally, the home interview was conducted with 663 participants, representing 73.3% of the target sample and 64.9% of the original sample. Because of some missing data, the final sample for longitudinal analysis consisted of 640 people. Study attrition did not differ based on sex or self-rated economic situation. Those who discontinued had lower UJACAS total score and QOL score at baseline than those who responded also at follow-up (UJACAS 182, SE 1.78 vs. 200, SE 1.15, $p < 0.001$; QOL 52.8 SE 0.33 vs. 55.2, SE 0.22, $p < 0.001$).

Active Ageing

The UJACAS consists of 17 items: practicing memory, using a computer, advancing matters in one's own life, exercising, enjoying the outdoors, taking care of one's appearance, crafting or DIY, making the home cozy and pleasant, helping others, maintaining friendships, getting to know new people, balancing personal finances, making one's days interesting, practicing artistic hobbies, participating in events, advancing societal/communal matters, and doing things according to one's world view [8]. Participants evaluate on a 5-point Likert scale how much they have wanted to do each activity, their ability and opportunity to perform the activity, and their amount or frequency of doing the activity during the four weeks immediately prior to the interview. Response Likert scale options range from 0 (not at all/very low) to 4 (very much/very high) with verbalization of rating depending on the wording of the question. Subscores (range 0–68) for the will to act, ability to act, opportunities to act, and doing the activities, and the summed composite score (range 0–272) were calculated with higher scores reflecting a higher level of AA. We have previously shown that the scale has good psychometric properties, test–retest reliability, and that it assesses a unidimensional latent construct of AA [8]. To correct for at most two missing values in a subscale, we used the following formula:

$17 \times (\text{sum score/items responded to}).$

Quality of life

We assessed QOL with the short version of the Older People's Quality of Life Questionnaire (OPQOL-brief). The scale includes 13 items. They cover a person's satisfaction with life overall, future prospects, health, social relationships, activity, leisure, home, safety, and financial situation. Response options range from 1 (strongly disagree) to 5 (strongly agree) and the sum score from 13 to 65, with higher scores indicating higher QOL [12].

Other variables

Age and sex data were collected from the sampling information provided by the Digital and Population Data Services Agency in Finland during the recruitment process. Marital status was self-reported and categorized as married or cohabiting vs. other. Perceived financial situation and self-rated health were measured using a five-point scale, ranging from very good to very poor [7]. For analytical purposes, self-rated financial situation was recoded into two categories: good (very good, good) vs. poor (average, poor, very poor). Walking difficulty was self-assessed for a distance of 2 km with five response options ranging from not at all to very much/unable. Maximal walking speed was tested in the laboratory over 10 meters and timed with photocells [7]. Lower extremity function was measured using the Short Physical Performance Battery (SPPB; [13]), which comprises tests for standing balance, chair stands, and walking speed; scores range from 0 to 12, with higher scores indicating better physical performance. Depressive symptoms were assessed using the Center for Epidemiologic Studies-Depression scale (CES-D; [14]), where higher scores correspond to more severe depressive symptoms.

Statistical methods

Descriptive baseline statistics are shown for men and women separately to advise about the need to adjust for sex in the multivariate analyses (means, M, and standard errors, SE, for continuous variables, and percentages for categorical variables) and Pearson correlation tests were calculated using IBM SPSS Statistics for Windows, version 28.0.

Structural Equation modelling (SEM) was conducted using baseline data to examine cross-sectionally whether the components of AA (will, ability and opportunity to act, and activity) correlate with QOL when associations are assessed simultaneously considering their mutual dependences and accounting for environmental factors, intrinsic capacity, and age. In the model, maximal walking speed represents intrinsic capacity because it forms the central node in the network of intrinsic capacities of older people [15]. Self-rated financial situation, a proxy for financial assets, was included as an indicator of environmental factors. The model was structured based on the previously published theoretical model proposing that ageing, intrinsic capacity and environmental factors provide a frame for AA, which, in turn, promotes QOL [7]. Based on this framework, directional associations among the variables were specified and the fit of the model to the observed data was evaluated. The estimated path coefficients should be interpreted conditional on the other paths included in the model. All four AA components were allowed to correlate with each other. Age, walking speed and perceived financial situation were included in the

model as independent variables. Sex was not included in the model because baseline AA and QOL score did not differ. Maximum likelihood estimation with standard errors (MLR) was used to obtain parameter estimates assuming missing values to be missing at random. In the final model, only statistically significant associations were retained.

The total UJACAS score, previously shown to express a unilateral latent construct of AA [8], was used in the longitudinal analyses of the temporal associations of AA and QOL. Cross-lagged panel analysis was constructed to examine their reciprocal associations from baseline (2017–2018) to the four-year follow-up (2021–2022). The analysis included 640 participants who had complete baseline data on UJACAS and QOL and who also participated in the follow-up assessment. Parameters were estimated using MLR, and missing data were handled using full information maximum likelihood (FIML). Altogether, follow-up QOL were estimated for three participants, and follow-up UJACAS for seven participants.

An initial cross-lagged panel model including reciprocal cross-lagged paths between AA and QOL was specified. Nested models were compared using scaled chi-square difference tests appropriate for the MLR estimator [16] model selection was additionally informed by AIC and BIC values. The final model was adjusted for baseline sociodemographic characteristics, including age, sex and marital status, because within time correlations of QOL and AA at baseline and autoregressive correlations of QOL over time differed between sexes. Results are reported as standardized regression coefficients with corresponding 95% confidence intervals (95% CI).

Model fit was assessed using the following criteria: statistically non-significant ($p > 0.05$) chi-squared test (χ^2); root mean square error of approximation (RMSEA) values between 0.05 and 0.08; standardized root mean square residual (SRMR) values ≤ 0.08 ; the comparative fit index (CFI) values > 0.95 [17, 18]. The significance level was set at $p < 0.05$ for all analyses. The Mplus version 8.2 was used for SEM and cross-lagged modelling.

Results

At baseline, 60% of the participants were women and the age ranged from 74.7 to 85.3 years. Table 1 shows the baseline characteristics of the participants according to sex. QOL and AA scores did not differ between men and women (Table 1). Good or very good or health was reported by 49% of men and 44% of women. For reporting no difficulty walking 2 km, the proportions were 70% and 59%, respectively. Men were more often than women married or co-habiting and reported good or very good financial situation.

Table 1
Baseline characteristics of participants stratified based on sex

	Men (N = 435)		Women (N = 582)		T-test
	M	SE	M	SE	t-test P
QOL ¹ , score	54.6	0.3	54.2	0.3	0.137
UJACAS ² , total score	192.8	1.5	193.70	1.4	0.325
Will ³ , subscore	42.5	0.5	44.4	0.4	0.002
Ability ⁴ , subscore	59.6	0.4	58.4	0.4	0.038
Opportunity ⁵ , subscore	50.9	0.5	50.3	0.5	0.358
Activity ⁶ , subscore	39.7	0.4	40.6	0.4	0.130
Age, years	78.8	0.2	78.8	0.2	0.462
CES-D ⁷ , score	8.0	0.3	9.1	0.3	0.010
SPPB ⁸ , score	10.0	0.1	9.9	0.1	0.037
Maximal walking speed, m·s ⁻¹	1.9	0.2	1.6	0.1	< 0.001
	%		%		Chi square p
Married, co-habits	80		43		< 0.001
Self-rated financial situation					0.005
Very good	12		8		
Good	54		48		
Satisfactory	33		42		
Poor, very poor	1		2		
No difficulty walking 2 km	70		59		0.003
Self-rated health					0.310
Very good, good	49		44		
Average	47		51		
Poor, very poor	4		5		

¹Quality of life, ²University of Jyväskylä Active Aging Scale, ³Will to act, ⁴Ability to act, ⁵opportunity to act, ⁶Activity, ⁷Center for Epidemiologic Studies Depression scale, ⁸Short Physical Performance Battery

Figure 1 shows the cross-sectional SEM including components of AA and QOL and their associations with age, financial situation and walking speed. Poor financial situation was associated with worse and higher walking speed with better QOL. Will to act, ability to act, opportunity to act and extent of activity were associated with each other and showed direct associations with QOL when all four were modelled simultaneously. The strongest pathways to QOL were observed from the opportunity to act (0.26, SE 0.04), ability to act (0.21, SE 0.04) and will to act (0.18 SE 0.04) components of AA while the association from activity to QOL was less evident (0.08 SE 0.05). Between AA components, higher ability was associated with more opportunities and higher will to act. Its association with the extent of activity was weaker, though statistically significant. Will to act was strongly linked to activity but also to more opportunities to act. (χ^2), RMSEA (< 0.06), CFI (1.00), AGFI (0.99) and RMR (0.016) were good, and the model fitted the data well indicated with $\Delta 2$ p-value 0.22.

The average duration of the follow-up was 3.9 years (SD 0.03). Over the follow-up, there was a marked decline in mean AA and QOL scores (UJACAS Mean, M, 200, SE 1.4 vs. M 186, SE 1.3; QOL M 55, SE 0.2 vs. M 53, SE 0.2; $p < 0.001$ for both). The decline did not differ between sexes.

Cross-lagged models using baseline and follow-up AA total scores and QOL scores data were constructed to shed light on their temporal relationship. The initial cross-lagged panel model, which included bidirectional cross-lagged paths between AA and QOL was saturated. To obtain a more parsimonious model, the non-significant path from QOL at baseline to AA at follow-up was removed. The simplified model did not fit significantly worse than the full model, $\chi^2(1) = 2.98$, $p = .084$, and was therefore retained as the final model. Consistent with this decision, the simplified model showed a slightly lower BIC (19,046.81 vs. 19,049.79), although AIC values were nearly identical (18,988.81 vs. 18,987.33). In addition, a model excluding all cross-lagged paths between AA and QOL fit the data significantly worse than the full model, ($\Delta\chi^2(2) = 40.17$, $p < .001$), supporting the retained model with one cross-lagged path.

In the final model, the within time associations of the total AA score and QOL were statistically significant at both baseline and follow-up ($\beta = 0.65$, 95% CI 0.60–0.71; $\beta = 0.51$, 95% CI 0.44, 0.51, respectively). Both constructs also showed moderate to strong stability over time (AA: $\beta = 0.70$, 95% CI 0.66–0.75; QOL: $\beta = 0.45$, 95% CI 0.38–0.52). A significant cross-lagged path emerged from baseline AA to the follow-up QOL ($\beta = 0.25$, 95% CI 0.19–0.32) whereas baseline QOL did not predict follow-up AA (Fig. 2).

Discussion

The main result of this study is that the more active approach to life one has when growing old the more likely one is to maintain good QOL over time. Cross-sectionally and in line with the theoretical model,

ability, opportunity and will to act showed positive links to higher activity cross-sectionally [7, 19]. The association from activity to QOL was modest, while the links to QOL from other AA components were stronger. This suggests that having more abilities, opportunities and will to be active may propel good QOL when the extent of activity is taken into account.

Our findings about the temporal relationship of AA and QOL are novel and they provide new perspectives about the process of AA and QOL. We have previously reported that AA and QOL correlate positively and observed parallel changes in them from 2017–2018 to amid the COVID-19 pandemic first wave in the spring 2020 [10]. The current study extends the earlier findings by showing directed associations between the components of AA and QOL and by providing information about the temporal relationship between AA and QOL over four years. The current findings are relevant for policies and interventions aimed at promoting AA, and at the same time lay grounds for future studies of AA.

Activity theory which started to develop in the 1950's, when Robert J. Havighurst and Ruth Albrecht [5] suggested that taking part in personally fulfilling activities promotes QOL in older adults. AA has been widely promoted as a policy goal but has also spurred critique centering around the lack of attention to personal preferences and inequalities. For example, the AA Index (AAI) used by the European Union and other countries predominantly concentrates on productive activities and does not consider what activities are personally important for older adults [20]. AAI is an aggregate index and does not create individual scores, which prohibits analyses of predictors and consequences of AA of participants. Additionally, it is conceptually incoherent, because it includes predictors of AA (e.g. access to health services, life expectancy) and consequences of AA (e.g. mental well-being) in the index in addition to the activities. UJACAS includes only activities selected through a multiphase iterative process including statistical testing, qualitative interviews among older people, and reviews by an interdisciplinary expert group. Its items do not overlap statistically and are considered essential by older people themselves, which supports their ability to quantify the magnitude of AA of participants in a meaningful way [8]. We created and validated UJACAS in Finland in the Northern/Western European context. It has subsequently been validated in other countries and translated into other languages [21, 22, 23, 24]. UJACAS was recently assessed as the most comprehensive AA scale of the over 20 identified scales [25]. UJACAS describes activities based on their purpose which prevents sidelining those with functional decline who do the activities in modified ways suitable for their capabilities. We reported recently that lower extremity performance explained 17.6% of the variation in the total UJACAS score [26] showing that physical performance correlates with AA but does not dictate it.

The current results provide strong evidence that motivational aspects for activity are central in AA. Even though not widely studied, it has been established that older people have diverse personal goals which they may modify by adopting new goals and disengaging from old goals when personal circumstances change; they also act based on their goals [27]. The three widely accepted theories of goal modification in old age assume that goal adjustment results from loss of resources. The model of selective optimization with compensation (SOC) proposes that optimizing the efforts and compensating for deficiencies when striving toward the most important, remaining goals will propel successful ageing [8].

The dual-process model of developmental regulation suggests that finding new ways to strive to the goals or modifying the goals, i.e. using tenacious or flexible coping strategies underlie goal modification in old age [29] – an idea shared by the motivational theory of life-span development presenting elective and loss-based goal modification [30.] Our current cross-sectional finding of higher ability to act yielding more will to act and more will to act yielding to more opportunities and more activity, can equally well be interpreted as resulting from improvements as from losses. Unfortunately, we cannot with current data address how commonly motivational aspects related to different activities are modified based on improvements in personal circumstances in old age. Future research should consider the possibility of increased or new personal resources, e.g. more available time, improved literacies, solved health problems, moving house or new social contacts, and whether they are accompanied by upgraded or new goals when growing old.

The observed positive link from will to act to opportunities to act and from opportunities to act to extent of activity resonates with the idea of tenacious goal pursuit. The current results suggest that in addition to abilities, personal efforts to change the circumstances for activities underlie activity in old age. According to an earlier study, tenacity may compensate for difficulties in functioning. Older people with deficits in physical functioning who scored high in tenacious goal pursuit had close to mean level of leisure activity participation, whereas scoring low in tenacity was associated with very little activity [31]. Another study showed that using both tenacious and flexible coping strategies was favorable for out-of-home mobility thus supporting participation in society [2]. This supports that tenacity in goal pursuit may contribute to AA. However, future studies should address this in more detail.

As shown here, opportunities to do different meaningful activities may stem from personal motivation but environmental and social factors are also essential. In the current analysis poor financial situation was linked to fewer opportunities to act. We suggest that a discrepancy between will and opportunities to act may result in unmet activity needs. Unmet activity needs may stem from environmental hindrances especially if personal resources are limited. We have previously introduced a concept specifically describing unmet needs related to physical activity. It emerges when somebody willing to be physically active perceives insufficient opportunity for it. We reported that low socio-economic status together with lack of social support and accompanied with mobility limitation increased the risk of unmet physical activity need over seven-fold compared to when these risk factors were absent [33]. In communities, availability of a range of pursuits for people of all ages and accessibility of technologies, venues, social events and communication channels fosters equal opportunities for valued activities potentially promoting good QOL.

The current results support that implementing interventions and policies to promote AA could lead to improved quality of life, but only limited information is available on the optimal approach of such interventions. Our experiences on this topic may prove useful for those intending to launch such interventions. In 2017–2019 we conducted a year-long randomized controlled trial about individualized counselling aiming to foster autonomous motivation for self-selected activities. We also provided ideas and information about available activities. We did not arrange new activities ourselves [34]. We

encouraged self-selected activities outside the home and activities involving social interaction, anticipating that such activities would have the largest ‘spill-over’ effect on other activities and QOL. We expected that the counselling will increase will to act and that the information about available activities would improve opportunity and ability to act, respectively, subsequently elevating the UJACAS activity subscore and the total score. The results showed that will to act did not change, but activity increased modestly. The ability or the opportunity to act did not change. We observed a statistically significant but modest effect on the total UJACAS score and no effect on the QOL [35]. It is possible that interventions supporting autonomous motivation of individuals for self-selected activities without changing their context may have only a minor influence on AA.

A year after completing the intervention study, in spring 2020, social distancing was recommended for people aged 70 and older in Finland to prevent the spread of the SARS-CoV-2 virus causing COVID-19. We realized that a “natural experiment” of policies reducing environmental support for AA was under way. Participation in activities outside the home and involving other people were suspended: restaurants were closed, physical activity and cultural classes discontinued, venues were shut, and events and gatherings banned. In 2020 compared to two years before, UJACAS score declined on average by 24 points accompanied by a decline in QOL [10]. The most steeply deteriorated component of AA was the perceived opportunity to act. It was followed by the will to act and the frequency of doing the activity while the perceived ability to do the activity declined the least. These results showed that the collapse of environmental support for out-of-home activities and social contacts was reflected in AA scores. Conversely, policies ensuring opportunities for meaningful activities may be an efficacious way to foster AA.

The strengths of this study include a novel and comprehensive approach to quantifying AA and its components at the individual level, longitudinal population-based data, analyses that give an idea of temporal order by controlling for autocorrelations, and a policy-relevant outcome. The results may be generalizable to a community-living section of the older population without severe disabilities, which may lead to under-estimating the associations between AA and QOL. Had the study attrition been smaller, the associations might have been stronger. However, the follow-up sample comprised 73.3% of the target sample, which is acceptable considering that the age range at the follow-up was from 79 to 89 years. The AA components underlying QoL were studied only cross-sectionally, which provides hypothesis for future studies. It is possible that the exceptional conditions during the COVID-19 pandemic taking place in the course of the follow-up may limit the generalizability to other time periods. However, this influence is universal, so the potential bias does not concern solely our study. Our earlier analyses on trajectories of life-space mobility, an indicator of outdoor mobility related with AA, show marked though not full recovery after the pandemic [36].

Conclusion

We conclude that when growing old, people can promote their QoL through their own actions by balancing the ability, will and opportunity to act with their activity, a process that is framed by

environmental in individual factors.

Declarations

Competing interests:

The authors have no competing interests.

Statement of human and animal rights

The Ethics Committee of the Wellbeing Services County of Central Finland provided a positive ethical statement for the AGNES baseline study on 23rd of August in 2017 and for the follow-up study on 7th of September in 2021. The AGNES study follows the principles of the Declaration of Helsinki.

Informed consent:

All participants signed an informed consent form before the start of the study. The study protocol followed the principles stipulated in the Declaration of Helsinki.

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Author Contribution

TR led the study, acquired funding, analysed data and wrote the manuscript. MK analyzed data, KK collected data and drafted the manuscript, TH collected data and drafted the manuscript, JE collected data and edited manuscript, KL collected data and analysed data and wrote part of statistical methods. All authors reviewed the manuscript and contributed to conceptualization.

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Data Availability

The authors confirm that some access restrictions apply to the data. Researchers interested in using the data must obtain approval from the director of the AGNES study, Professor Taina Rantanen (taina.rantanen@jyu.fi), and are required to follow the protocol on the protection of privacy and comply with the relevant Finnish laws.

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Figures

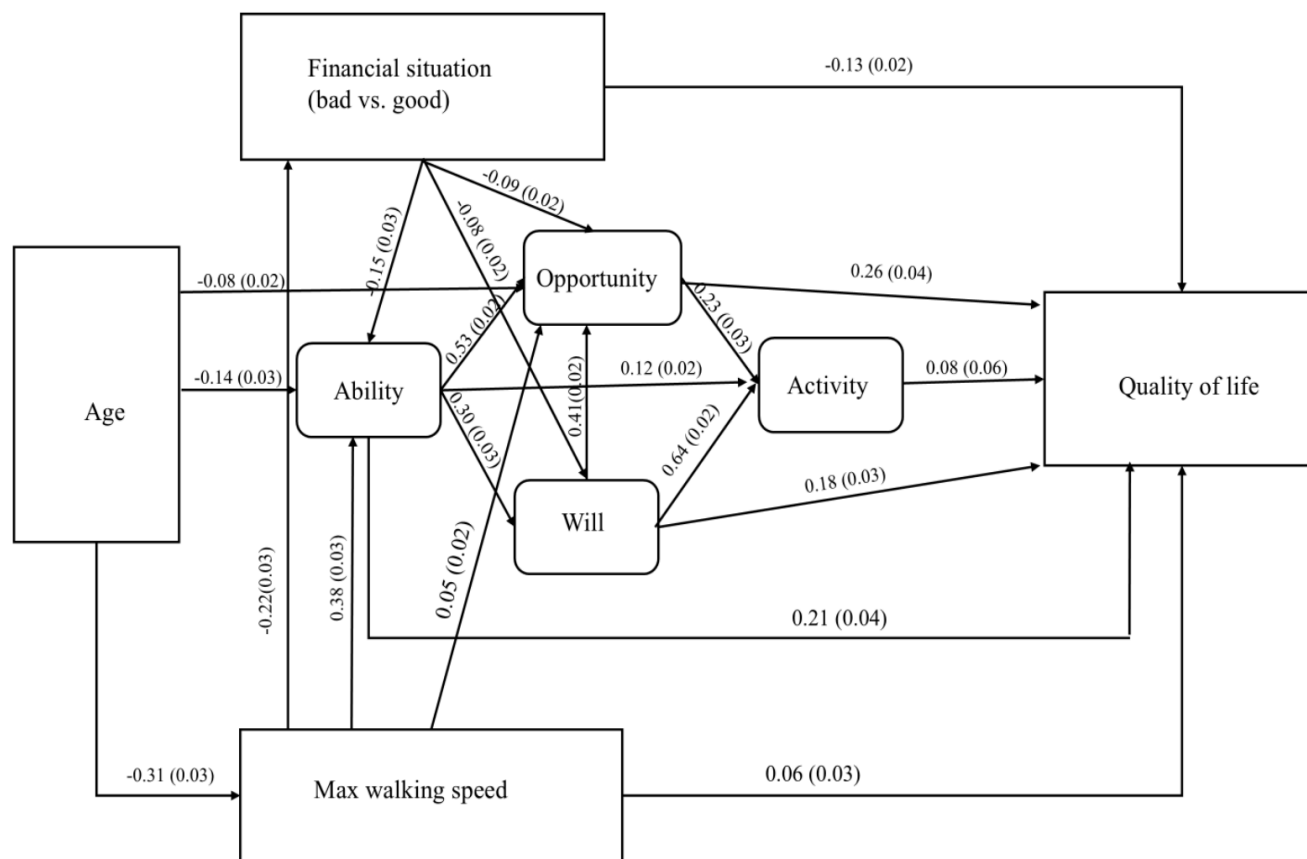


Figure 1

The path model of the cross-sectional association between AA components and QOL. The path coefficients and their (standard errors) are shown (N=967). AA components are indicated by Will, will to act; Ability, Ability to act; Opportunity, opportunity to act; Activity, magnitude of activity). Solid lines indicate statistically significant associations and arrows the assumed direction of the association. All variables included in the model are shown.

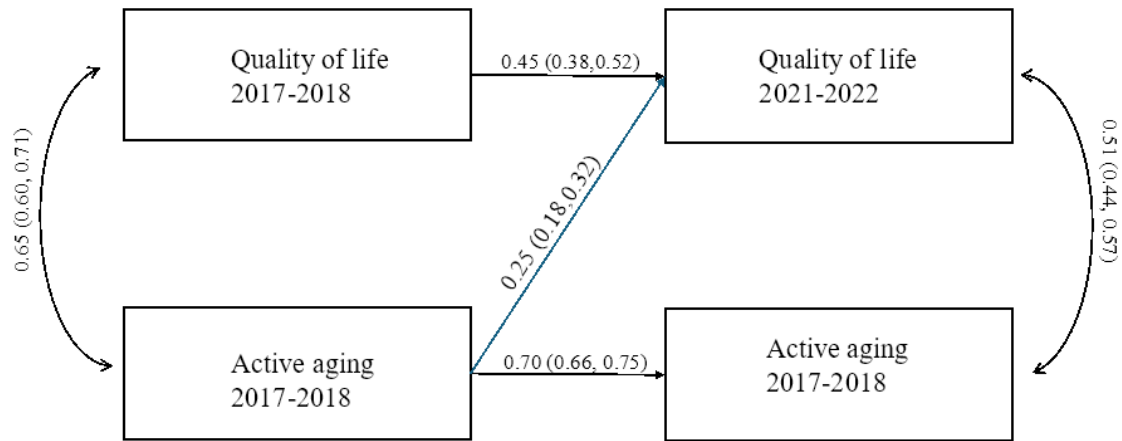


Figure 2

Standardized regression coefficients and 95% CIs for the longitudinal model examining associations between quality of life (OPQOL) and AA total score (UJACAS) (n = 640). Covariates (sex, age, and marital status) are included in the model but not shown for clarity. Solid arrows indicate statistically significant paths (p < 0.05)