Relationships between awareness of age-related change, subjective well-being, and psychological stress

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加齢に係る変化意識，主観的幸福感，心理的ストレスの関連

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要約

本研究は、加齢に伴う変化の認識（Awareness of Age-Related Change: AARC）、主観的幸福感（Subjective Well-Being: SWB）、および心理的ストレスの縦断的関係の検討を行った。AARC は、ライフスパン発達理論に基づき、心理的適応に重要な役割を果たすとされる。先行研究では AARC と幸福感の関連が報告されているが、多くは横断研究であり、時間的方向性を考慮した検討は不十分である。そこで本研究では、日本の 40 歳以上の成人 585 名を対象に、AARC 短縮版（AARC-10 SF）、人生満足度尺度（SWLS）、心理的ストレス尺度（K6）を用いて、2 時点（2022 年 7 月、2023 年 10 月）でオンライン調査を実施した。交差遅延効果モデルの分析の結果、AARC-gains と SWLS の間に双方向の関連が認められ、AARC-gains が高い人ほど後の主観的幸福感が高く、その逆も成立することが示された。一方、心理的ストレスは AARC-losses に対して一方向の関連が確認され、ストレスが高い人ほど後の AARC-losses が高いことが示された。これらの結果は、ライフスパン発達理論の枠組みと整合し、加齢に伴う適応過程の理解を深めるものである。介入においては、AARC-gains を促進し幸福感を高めることが高齢者のサクセスフル・エイジングに寄与する可能性がある。

Key words
subjective well-being, psychological stress, subjective aging, awareness of age-related change, life satisfaction

1. Introduction

Aging is a lifelong process that encompasses both opportunities for growth and challenges to adaptation. As global populations age, understanding how individuals perceive age-related changes has become increasingly important for promoting psychological well-being and successful aging (Westerhof, Nehrkorn-Bailey, Tseng, Brothers, Siebert, Wurm, Wahl, & Diehl, 2023).

These perceptions, often referred to as subjective aging, are multidimensional, including both positive and negative evaluations, each with distinct implications for mental health and overall functioning (Wahl, Diehl, Brothers, & Miche, 2013; Kaspar, Gabrian, Brothers, Wahl, & Diehl, 2019). Moreover, positive self-perceptions of aging have been shown to increase longevity (Levy, Slade, Kunkel, & Kasl, 2002).

To conceptualize these perceptions, Diehl and Wahl (2010) introduced the construct of awareness of age-related change (AARC), which reflects individuals' recognition of gains and losses associated with aging. AARC is grounded in lifespan developmental theory (Baltes, 1987), which posits that aging involves a dynamic interplay between growth and decline across multiple domains of functioning. According to this framework, individuals adapt throughout the life course by balancing gains and losses, shaping their overall experience of successful aging. This perspective underscores that aging is not solely characterized by losses but also includes perceived gains and opportunities for further development (Steverink, Westerhof, Bode, & Dittmann-Kohli, 2001; Baltes & Baltes, 1990).

The AARC construct has been operationalized through the AARC 10-item short form (AARC-10 SF; Kaspar et al., 2019), which assesses subjective aging experiences across five domains: health and physical functioning, cognitive functioning, interpersonal relations, social-cognitive and emotional functioning, and lifestyle and engagement. The scale captures both positive perceptions (gains) and negative perceptions (losses) of age-related changes. In Japan, Shiraishi, Horiuchi, & Brothers (2024) developed a culturally adapted version of the AARC-10 SF and confirmed its reliability and validity. Their findings

indicated that AARC-gains were positively correlated with life satisfaction and negatively correlated with depression and anxiety, whereas AARC-losses displayed the opposite pattern. These results align with international research demonstrating that AARC-gains predict higher psychological well-being and positive affect, while AARC-losses predict greater negative affect and lower well-being ((Brothers, Gabrian, Wahl, & Diehl, 2016; Sabatini, Silarova, Martyr, Collins, Ballard, Anstey, Kim, & Clare, 2020).

Research on well-being has traditionally followed two major approaches (Ryan & Deci, 2001). The hedonic approach focuses on subjective well-being (SWB), typically measured using instruments such as the Satisfaction with Life Scale (SWLS) and the Positive and Negative Affect Schedule (PANAS). In contrast, the eudaimonic approach emphasizes psychological well-being (PWB), as conceptualized by Ryff (1989), and is assessed using scales such as the Psychological Well-Being Scale (PWBS). Previous studies have consistently shown that AARC-gains are positively associated with SWLS, PANAS, and PWB, whereas AARC-losses are negatively associated with these indicators and positively associated with depression and anxiety (Brother et al., 2016; Watson, Clark, & Tellegen, 1988). A meta-analysis by Sabatini et al. (2020) further demonstrated that AARC-losses are negatively associated with life satisfaction and positively associated with depressive symptoms (CES-D).

Recent longitudinal studies have begun to clarify how AARC relates to psychological outcomes over time. For example, Wilton-Harding and Windsor (2022) showed that AARC was meaningfully associated with psychological well-being and goal adjustment in older adulthood, highlighting the role of subjective aging processes in adaptive functioning over time. Sabatini, Wahl, Diehl, Clare, Ballard, Brooker, Corbett, Hampshire, and Stephan (2023) reported bidirectional associations between AARC-losses and mental health indicators such as depressive and anxiety symptoms. These findings indicate that AARC not only correlates with well-being but also shifts meaningfully over time. However, previous longitudinal studies, including Sabatini et al. (2023), have primarily focused on physical, mental, and cognitive functioning, leaving it unclear how AARC is longitudinally associated with subjective well-being, particularly life satisfaction, and how psychological distress may shape these processes. Despite the growing number of longitudinal studies, most research on AARC and well-being is still cross-sectional, leaving the temporal direction of these associations insufficiently understood.

Previous studies have reported mixed findings: Dutt, Gabrian, & Wahl (2018) found that losses predicted depression, while Sabatini et al. (2023) observed bidirectional effects between losses and mental health indicators (see also Sabatini et al., 2020 for a systematic review and meta-analysis). These inconsistencies highlight the need for further longitudinal research that clarifies the directionality of these associations. Previous research, such as Sabatini et al. (2023), examined bidirectional associations between AARC and health indicators in Western contexts. However, their study did not include psychological distress as a predictor and focused primarily on older adults in Europe. The present study addresses these gaps by incorporating psychological distress (K6) into a cross-lagged model and by testing these associations in a Japanese sample aged 40 and older, thereby contributing evidence on cultural generalizability and intervention-relevant pathways. A longitudinal design is particularly valuable because it allows us to establish temporal precedence and clarify direction of relation, which are essential for designing effective interventions. Unlike direct intervention studies, longitudinal evidence identifies which constructs influence others over time, providing a theoretical basis for targeted strategies to enhance positive aging perceptions and reduce psychological distress.

The present study aims to address these gaps by examining longitudinal associations among AARC, life satisfaction, and psychological distress in a Japanese sample of adults aged 40 and older. Using a cross-lagged panel model (CLPM), we explore the temporal dynamics of positive and negative aging perceptions and their links to well-being and stress. Furthermore, by focusing on a Japanese context, this study contributes to understanding cultural variations in subjective aging processes and provides insights for interventions that promote resilience and well-being in later life.

2. Methods

2.1 Procedure and participants

After obtaining approval from the research ethics committee of Okayama University (Approval No.: sya_2022_03), we conducted an online survey using the Freeasy platform managed by I-Bridge Corporation. Participants were recruited through stratified sampling from a nationwide panel to ensure diversity in age and gender. The survey was administered at two time points: July 2022 (Time 1) and October 2023 (Time 2). The one-year interval was chosen based on prior longitudinal studies on subjective aging (e.g., Sabatini et al., 2023; Westerhof et al., 2023), which typically use 12-18 months to capture meaningful changes without excessive attrition.

The Time 1 data were previously reported in a peer reviewed publication. In the present study, we combine the published Time 1 data with newly collected Time 2 data to conduct longitudinal cross lagged analyses that were not part of the prior report. All participants provided informed consent online before completing the questionnaire.

A total of 585 adults aged 40 years and older (307 men, 278 women; mean age = 66.3 years, *SD* = 13.42) completed both waves and passed quality checks (e.g., attention items, exclusion of straight-lining responses). The follow-up rate was 65.1 %. Demographic data included age, sex, marital status, education, and household income.

The target sample size was informed by prior longitudinal studies on AARC and related constructs using CLPM (e.g., Kaspar et al., 2019; Sabatini et al., 2023), which typically analyze samples of 500 or more to ensure adequate power for detecting small-to-medium cross-lagged effects.

Incentives:
Participant compensation was managed by Freeasy according to platform policies (e.g., points or small monetary rewards). The research team did not provide direct cash incentives; all compensation was handled by the vendor.

2.2 Measures

2.2.1 Awareness of age-related change 10-item short form scale

The AARC-10 SF is the most widely used scale to measure AARC (Kaspar et al., 2019; Sabatini et al., 2023). The Japanese version of the AARC-10 SF (Shiraishi et al., 2024) assesses subjective aging experiences across five domains: (a) health and physical functioning, (b) cognitive functioning, (c) interpersonal relations, (d) social-cognitive and emotional functioning, and (e) lifestyle and engagement. The scale captures both positive (gains) and negative (losses) perceptions of age-related changes, with items rated on a five-point Likert scale ranging from 1 (not at all) to 5 (very much). Cronbach's α was .729 and .719 for AARC-gains, and .826 and .823 for AARC-losses, at Time 1 and Time 2, respectively.

2.2.2 Satisfaction with life scale

Life satisfaction was assessed using the Japanese version of SWLS, originally developed by Diener, Emmons, Larsen, & Griffin (1985) and translated by Sumino (1994). It consists of five items, each rated on a seven-point scale (1 = strongly disagree, 7 = strongly agree). The SWLS is a well-established measure of subjective well-being, demonstrating excellent internal consistency (Cronbach's α = .937 and .931, at Time 1 and Time 2).

2.2.3 Six-item Kessler psychological distress scale

To evaluate participants' non-specific psychological distress, we used the Japanese version of the six-item K6, originally developed by Kessler, Andrews, Colpe, Hiripi, Mroczek, Normand, Walters, & Zaslavsky (2002) and translated by Furukawa, Kawakami, Saitoh, Ono, Nakane, Nakamura, Tachimori, Iwata, Uda, Nakane, Watanabe, Naganuma, Hata, Kobayashi, Miyake, Takeshima, & Kikkawa (2008). The K6 consists of six items that assess psychological stress over the past 30 days, rated on a 5-point scale (1 = none of the time, 5 = all the time). The K6 is widely used for screening depressive and anxiety disorders and demonstrated excellent internal consistency (Cronbach's α =

Table 1: Demographic variables of the longitudinal sample

	M (*SD*)	%
Age at Time1	*M* = 66.30 (*SD* = 13.42)	
Sex (Male)		52.48 %
Married		73.16 %
Education		
1. Elementary and junior high schools		3.76 %
2. High school (old junior high school)		33.68 %
3. Junior college, technical college, vocational school		19.32 %
4. University		39.66 %
5. Graduate school		3.59 %
6. Others		0.00 %
Employment status		
1. Employed (full-time employee, self-employed, doctor, medical)		37.78 %
2. Unemployed (professional housewife, unemployed, other)		62.22 %
Children (1 = presence, 0 = absence)		67.35 %
Income		
1. < 2 million ¥		17.09 %
2. 2 million – < 4 million ¥		33.85 %
3. 4 million – < 6 million ¥		19.83 %
4. 6 million – < 8 million ¥		12.31 %
5. 8 million – < 10 million ¥		7.18 %
6. 10 million – < 12 million ¥		4.10 %
7. ≥ 12 million ¥		5.64 %

Table 2: Bivariate correlations between the primary variables at Time 1 and Time 2

		M	*SD*	α	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Time1 age	66.30	13.42		—													
2	Sex	0.52	0.50		.106 *	—												
3	Married	0.73	0.44		.361 **	.003	—											
4	Child	0.67	0.47		.476 **	–.035	.574 **	—										
5	Education	3.06	1.01		–.213 **	.232 **	–.046	–.109 **	—									
6	Income	2.94	1.64		–.215 **	–.046	.260 **	.134 **	.325 **	—								
7	Employmental status	0.38	0.49		–.475 **	.113 **	–.196 **	–.164 **	.246 **	.351 **	—							
8	Time1gain	2.85	0.72	.73	.250 **	.022	.099 *	.199 **	.029	.043	–.103 *	—						
9	Time1loss	2.25	0.82	.83	–.007	.031	–.014	–.034	–.018	–.093 *	–.016	.117 **	—					
10	Time1SWLS	3.64	1.41	.94	.371 **	.005	.333 **	.330 **	–.008	.147 **	–.154 **	.379 **	–.327 **	—				
11	Time1K6	1.69	0.82	.92	–.232 **	–.032	–.181 **	–.210 **	.025	–.080	.077	–.132 **	.549 **	–.531 **	—			
12	Time2gain	2.94	0.73	.72	.266 **	.018	.124 **	.248 **	.087 *	.061	–.041	.607 **	–.010	.354 **	–.142 **	—		
13	Time2loss	2.27	0.83	.82	–.018	.049	–.003	–.051	.015	–.040	.038	.030	.662 **	–.328 **	.557 **	.101 *	—	
14	Time2SWLS	3.64	1.39	.93	.358 **	.020	.309 **	.337 **	.021	.135 **	–.121 **	.387 **	–.261 **	.869 **	–.474 **	.416 **	–.292 **	—
15	Time2K6	1.66	0.83	.92	–.158 **	.023	–.141 **	–.185 **	–.042	–.097 *	.060	–.104 *	.476 **	–.483 **	.780 **	–.133 **	.569 **	–.483 **

Notes: AARC = Awareness of age-related change; SWLS = Satisfaction with Life Scale; K6 = 6-item Kessler Psychological Distress Scale. ** $p < .01$ * $p < .05$.

.915 at Time 1; α = .931 at Time 2).

2.2.4 Covariates

We controlled several sociodemographic factors, including the following: age at Time 1, education level (graduated from junior high school, high school, junior college, university or above, and other), income categories (< 2 million Yen, 2 million to < 4 million Yen, 4 million to < 6 million Yen, 6 million to < 8 million Yen, 8 million to < 10 million Yen, 10 million to < 12 million Yen, and ≥ 12 million Yen), sex (0 = male, 1 = female), employment status (0 = unemployed [homemaker, unemployed, other], 1 = employed [full-time employee, self-employed, doctor, healthcare worker]), marital status (0 = unmarried, 1 = married), and presence of children (1 = presence, 0 = absence). To ensure data quality, a response validity check was included at the end of the questionnaire. Categorical covariates (education, income, employment status, marital status, presence of children) were dummy-coded prior to inclusion in the SEM.

2.3 Statistical analysis

We applied a CLPM within a structural equation modeling (SEM) framework to the longitudinal data in AMOS version 28, controlling for age, sex, marital status, presence of children, educational background, and annual household income. We conducted exploratory multi-group analyses across three age categories (40-64, 65-74, 75+) to probe potential age moderation. Configural models were estimated and key cross-lagged paths were compared; the overall pattern (bidirectional links between AARC-gains and life satisfaction; unidirectional link from distress to AARC-losses) was consistent across groups, suggesting no meaningful age moderation within the present sample. To adjust for baseline characteristics, all covariates (age, sex, marital status, presence of children, educational background, and annual household income) were included as predictors of AARC-gains, AARC-losses, SWLS, and K6 at Time 2 and were allowed to covary with these variables at Time 1. Within-wave residual covariances among the Time 2 endogenous variables were freely estimated.

3. Results

Tables 1 and 2 summarize sample characteristics and correlations, as anticipated based on previous findings: gains relate positively to life satisfaction, while losses relate negatively to well-being indicators.

3.1 Paired *t*-tests

The results of the paired t-tests are presented in Table 3. Significant differences in AARC-gains were found between Times 1 and 2, meaning that individuals reported higher AARC-gains at Time 2 than at Time 1. This suggests a positive change in the awareness of age-related gains over time. No significant changes were observed in AARC-losses, life satisfaction (SWLS), or psychological distress (K6) between Times 1 and 2. These results indicate that no substantial changes occurred in the awareness of age-related losses, life satisfaction, and psychological stress over the observed period. The effect sizes (Cohen's *d*) for these comparisons were small, with AARC-gains exerting a small negative effect size (d = –0.124), and other variables displaying negligible effect sizes (AARC-losses: d = –0.029, SWLS: d = –0.003, K6: d = 0.040).

3.2 Cross-lagged panel model

As shown in Table 4 and Figure 1, the CLPM revealed several statistically significant associations among the variables. The model displayed an approximately acceptable fit: χ^2 (1) = 1.906, p = .167, TLI = .978, CFI = 1.000, RMSEA = .039; 90 % CI [0, .125], p = .436. The analysis demonstrated that AARC-gains at Time 1 significantly predicted AARC-gains at Time 2 (β = .540, p = .004). Furthermore, AARC-gains at Time 1 also significantly predicted life satisfaction at Time 2 (β = .056, p = .031), and life satisfaction at Time 1 significantly predicted AARC-gains at Time 2 (β = .104, p = .024). Similarly, AARC-losses at Time 1 significantly predicted AARC-losses at Time 2 (β = .487, p = .005), and psychological distress (K6) at Time 1 significantly predicted increased perceptions of AARC-losses at Time 2 (β = .281, p = .003). In terms of stability and influence across time, life satisfaction at Time 1 significantly predicted life satisfaction at Time 2 (β = .817, p = .002), and also negatively predicted psychological stress at Time 2 (β = –.115, p = .003). Additionally, psychological stress at Time 1 significantly predicted stress at Time 2 (β = .705, p = .002). An exploratory multi-group analysis across three age groups (40-64 years: *N*

Table 3: Descriptive statistics and paired *t*-test for AARC, SWLS, and K6

	Time 1		Time 2		Paired *t*-test		
	M	*SD*	*M*	*SD*	*t*	Cohen's *d*	*p*
AARC-gains	2.85	0.72	2.94	0.73	–3.38	–0.124	.00
AARC-losses	2.25	0.82	2.27	0.83	–0.86	–0.029	.39
SWLS	3.64	1.41	3.64	1.39	–0.15	–0.003	.88
K6	1.69	0.82	1.66	0.83	1.44	0.040	.15

Notes: AARC = Awareness of age-related change; SWLS = Satisfaction With Life Scale; K6 = 6-item Kessler Psychological Distress Scale. Significant effects are in bold.

Table 4: Results of the cross-lagged panel model

	T1		T2	95%Confidence intervals			*p*
				Estimate	Lower	Upper	
Autocorrelations	Time1 Gain	→	Time2 Gain	.540	.463	.611	.004
	Time1 Loss	→	Time2 Loss	.487	.403	.554	.005
	Time1 SWLS	→	Time2 SWLS	.817	.777	.859	.002
	Time1 K6	→	Time2 K6	.705	.628	.781	.002
Cross-lagged effects	Time1 Gain	→	Time2 SWLS	.056	.007	.099	.031
	Time1 Loss	→	Time2 K6	.047	–.023	.105	.262
	Time1 SWLS	→	Time2 Gain	.104	.014	.206	.024
	Time1 SWLS	→	Time2 K6	–.115	–.187	–.048	.003
	Time1 K6	→	Time2loss	.281	.196	.364	.003
	Time1 Gain	→	Time2loss	.016	–.058	.081	.715
	Time1 Gain	→	Time2 K6	.025	–.033	.080	.389
	Time1 Loss	→	Time2 Gain	–.063	–.150	.026	.194
	Time1 Loss	→	Time2 SWLS	.018	–.029	.069	.505
	Time1 SWLS	→	Time2loss	–.067	–.149	.011	.105
	Time1 K6	→	Time2 Gain	.052	–.036	.135	.214
	Time1 K6	→	Time2 SWLS	–.031	–.077	.022	.308

Note: Standardized path coefficients are reported. Significant effects are in bold. AARC = Awareness of age-related change; SWLS = Satisfaction with Life Scale; K6 = 6-item Kessler Psychological Distress Scale.

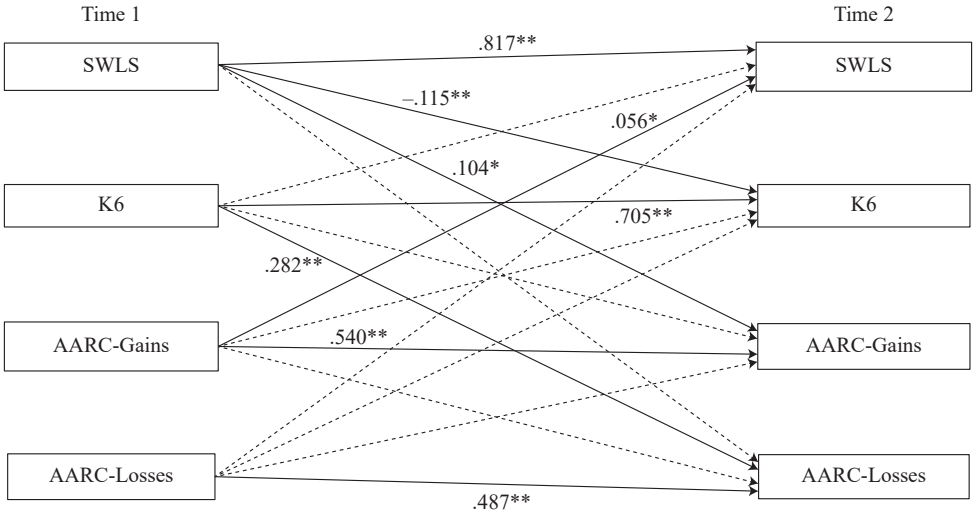

Figure 1: AARC, SWLS, and K6 cross-lagged panel model

Notes: Standardized regression coefficients are reported. Partial R^2 = *R*-squared/coefficient of determination. Error terms and error correlations, and control variables are omitted. Significant effects are provided in bold. AARC = Awareness of age-related change; SWLS = Satisfaction with Life Scale; K6 = 6-item Kessler Psychological Distress Scale. RMSEA = .039, TLI = .978, CFI = 1, χ^2 (15) = 1.906, p = .167. ** p < .01 * p < .05.

= 254; 65-74 years: N = 136; 75+ years: N = 195) indicated that the pattern of significant cross-lagged paths was consistent across groups—bidirectional links between AARC-gains and life satisfaction and a unidirectional link from psychological stress to AARC-losses—suggesting no meaningful age moderation.

4. Discussion

This study provides empirical evidence for a bidirectional relationship between AARC-gains and life satisfaction, as well as a unidirectional association between psychological stress and AARC-losses. These findings clarify how subjective aging processes relate to well-being and stress over time. The ultimate goal of interventions should be to enhance subjective well-being and reduce psychological distress. Instead of implying direct pathways from AARC-gains or AARC-losses to well-being, it is important to interpret these findings as temporal associations rather than causal effects. To avoid overinterpretation, it is es-

sential to acknowledge several methodological constraints of the traditional CLPM. The two-wave CLPM used in the present study cannot disentangle within-person fluctuations from stable between-person differences, meaning that the estimated cross-lagged paths should not be interpreted as causal effects. Instead, these paths reflect temporal associations after controlling for high autoregressive stability. Therefore, we refrain from making causal claims regarding the influence of AARC-gains or psychological distress and interpret the findings as directional patterns that may inform, but do not establish, potential mechanisms linking subjective aging and well-being.

Although mean-level changes were small, cross-lagged analyses reveal directional patterns that may provide insights for understanding temporal associations in subjective aging. This suggests that interventions targeting AARC-gains may still produce meaningful improvements even when overall mean changes are modest, because directional effects indicate potential leverage points for change. In other words, even when average scores remain relatively stable, deviations from a person's prior standing can prospectively predict subsequent outcomes after controlling for autoregressive paths. Our focus, therefore, is not on mean change per se but on temporal directionality among AARC-gains, life satisfaction, and psychological distress. Within this framework, the path from K6 at Time 1 to AARC-losses at Time 2 indicates that elevated distress predicts more negative aging perceptions.

In interpreting these findings, it is important to consider that effect sizes in gerontology tend to be smaller than the conventional benchmarks proposed by Cohen (1988; 1992) (i.e., r = .10, .30, and .50 for small, medium, and large effects, respectively). A recent meta-analytic investigation of effect size distributions in gerontological research reported empirically derived values of r = .12, .20, and .32 as small, medium, and large effects, respectively (Brydges, 2019). These values are substantially lower than the traditional guidelines. In the present study, the cross-lagged coefficients were modest in magnitude (AARC-gains T1 → SWLS T2: β = .056; SWLS T1 → AARC-gains T2: β = .104; psychological distress T1 → AARC-losses T2: β = .281), which fall within the typical effect size range observed in longitudinal gerontological research.

Therefore, the relatively small cross-lagged effects identified in this study should be interpreted within this field-specific context. Even modest associations may signal meaningful temporal dynamics in subjective aging, particularly when such effects accumulate over time or influence outcomes at the population level. Consequently, the present findings provide theoretically meaningful insights despite their small magnitude, and they align with the broader literature indicating that age-related psychological processes often exhibit subtle but consequential effects.

From a theoretical perspective, these findings align with lifespan developmental theory (Baltes, 1987), which emphasizes that aging entails a dynamic interplay of gains and losses across multiple domains. The observed bidirectional relationship between AARC-gains and life satisfaction reflects this adaptive process, highlighting how positive perceptions of age-related gains can support well-being throughout later life. The unidirectional effect of psychological stress on AARC-losses indicates that stress exacerbates negative aging perceptions, aligning with Dutt et al. (2018) but contrasting with Sabatini et al. (2023), who reported bidirectional effects. These discrepancies may reflect differences in measurement tools or cultural context, suggesting the need for further cross-cultural longitudinal research. Within the framework of lifespan developmental theory, these findings can also be interpreted through the lens of the Selection, Optimization, and Compensation (SOC) model. According to the SOC perspective, individuals adapt to age-related challenges by selecting meaningful goals, optimizing available resources, and compensating for losses when necessary. The observed bidirectional associations between AARC-gains and life satisfaction may reflect this adaptive process: individuals who perceive more age-related gains may be more likely to engage in goal selection and resource optimization that enhance their well-being, while higher life satisfaction may, in turn, facilitate a more positive interpretation of age-related changes. Thus, the reciprocal links identified in the present study are consistent with SOC-based mechanisms that highlight the dynamic interplay between aging perceptions and psychological adaptation.

The consistency of paths across age groups supports the robustness of our findings, although future research should examine invariance across broader demographic and cultural contexts. Rather than emphasizing specific techniques, future work should explore mechanisms underlying these relationships and develop culturally sensitive strategies to promote resilience and well-being.

5. Limitations and future research

This study has several limitations. First, the sample was restricted to adults aged 40 years and older, which limits the generalizability of the findings to younger age groups. AARC tends to become more salient in midlife and later adulthood; however, future research should examine these associations across a broader age range.

Second, the study relied exclusively on self-reported measures, which may be subject to social desirability bias. To strengthen the validity of the findings, future research should incorporate objective indicators of psychological stress and well-being.

Third, the study was conducted solely in Japan, and cultural factors may have influenced the results. In Japanese culture, aging is often viewed through the lens of interdependence and social roles, which may amplify the impact of AARC on well-being. Therefore, cross-cultural longitudinal studies are needed to determine the extent to which these findings can be general-

ized.

Fourth, because the data were collected via an online survey panel, the sample may overrepresent individuals who are comfortable with digital technologies and willing to participate in web-based questionnaires. Older adults with limited internet access or lower digital literacy may have been underrepresented. Therefore, our results should not be overgeneralized, and future research needs to take this potential sampling bias into account.

Fifth, because the present study included only two waves of data, we were unable to separate within-person and between-person components using a random-intercept cross-lagged panel model (RI-CLPM). In addition, we could not examine linear or nonlinear developmental trajectories using latent curve models, nor could we model within-person associations while accounting for individual trajectories through a latent curve model with structured residuals (LCM-SR). Therefore, future studies should incorporate at least three waves of data to allow for a more detailed investigation of longitudinal dynamics. These approaches would enable a more precise examination of the mechanisms through which AARC-gains, AARC-losses, and psychological distress influence one another across the lifespan.

Finally, differences in measurement tools—such as the use of K6 in this study versus CES-D in prior research—may affect comparability. Furthermore, because the K6 is designed to assess non-specific psychological distress rather than a specific stress response, interpretations involving psychological mechanisms should be made with this broader construct in mind.

6. Conclusion

This longitudinal study demonstrated a bidirectional relationship between AARC-gains and life satisfaction, indicating that positive perceptions of aging and well-being mutually reinforce each other. In contrast, psychological stress showed a unidirectional association on AARC-losses, suggesting that higher stress levels predict more negative aging perceptions.

These findings deepen our understanding of psychological adaptation processes in later life and provide insights into potential avenues for future research and practical applications. Specifically, the present findings suggest that patterns of associations among AARC-gains, life satisfaction, and psychological distress may provide useful insights for considering potential targets of future interventions and mitigate psychological distress. Future research should develop culturally sensitive interventions and examine these associations across broader age ranges and diverse cultural contexts.

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