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Research Article

Longitudinal Associations Between Personal Growth and Cognitive Functioning in Adulthood

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Abstract

Objectives: While personal growth has been found to be associated with multiple aspects of health in adulthood, its associations with cognitive functioning have not been fully understood. The present study aimed to assess both directions of such longitudinal associations.

Method: Using data from the second wave (Time 1 [T1]) and third wave (Time 2 [T2]) of the Midlife in the United States (MIDUS) study (N = 4,206; mean age = 56.0 [standard deviation (SD) = 12.3]), a longitudinal measurement model containing latent variables of episodic memory and executive function was first constructed. Built on the measurement model, a cross-lagged panel model was analyzed to assess relationships between personal growth and the two areas of cognitive functioning, in which T1 personal growth predicted residualized changes in episodic memory and executive function, and T1 episodic memory and executive function predicted change in personal growth, controlling for covariates.

Results: T1 personal growth significantly predicted smaller decreases in episodic memory, whereas it did not predict change in executive function. T1 episodic memory, but not T1 executive function, significantly predicted smaller decreases in personal growth.

Discussion: The present findings were unique, particularly implying potential longitudinal reciprocity between personal growth and episodic memory. These findings and implications can inform future research aimed at exploring approaches to promoting personal growth and cognitive functioning among aging adults.

Keywords: Cognitive aging, Eudaimonic well-being, MIDUS

Multiple aspects of cognitive performance have been suggested to decline on average during adulthood though their changes may be gradual among a nonclinical adult population and may differ among individuals (Hughes et al., 2018; Salthouse, 2009). As such individual differences in cognitive performance may be accounted for by possibly modifiable factors, research (e.g., Antoniou & Wright, 2017; Robinson & Lachman, 2018; Segel-Karpas & Lachman, 2018; Wilson et al., 2015) has addressed those psychosocial and behavioral factors that may be protective against cognitive decline during adulthood. As such a potential factor, the present study addressed personal growth as it has been found to be associated with different aspects of health and well-being during adulthood (see Ryff, 2014 for review) but its relations with cognitive functioning have been understudied. This study aimed to fill in the gap in the literature by analyzing the data of a national sample from the Midlife in the United States (MIDUS) study.

Personal Growth

Personal growth is a key component of Ryff's (1989, 2014) conceptualization of psychological well-being,

which addresses aspects of well-being beyond simply feeling "happy" and corresponds to *eudaimonia* depicted by Aristotle as achieving human potential. While Ryff addressed six core components of psychological well-being or being "self-actualized, individuated, fully functioning or optimally developed" (Ryff, 2014, p. 11; for its six dimensions, see Ryff, 1989, 2014), she suggested that personal growth as well as purpose in life are the most existential dimensions of well-being. Personal growth refers to a personal sense of realizing one's potential while subjectively experiencing continued improvement in self, development, and growth and is also characterized by openness to new experiences (Ryff, 1989, 2014). In contrast to those with a high sense of continued growth, individuals who report low personal growth are likely to feel personal stagnation without being engaged with their lives, exploring new experiences, nor seeing much improvement in self. The construct of personal growth is related to optimal development suggested by previous theories (Ryff, 1989, 2014), such as Maslow's (1968) emphasizing self-actualization (i.e., fulfilling one's full potential) and Erikson's (1959) proposing stages of psychosocial development. Among Erikson's stages, ego integrity versus despair may be most relevant to personal growth as it is likely to involve growth-oriented themes or struggles to integrate oneself into a whole (Bauer & Park, 2010; Marcia, 2010; Staudinger, 2001). While ego integrity is considered a predominant developmental task in late adulthood, concerns, and strivings related to ego integrity are present at earlier age periods (Marcia, 2010; Staudinger, 2001). Personal growth may share some features with purpose in life, or a sense of direction having meaningful goals and aims in life (Ryff, 1989, 2014), while Ryff suggested that these two dimensions were distinct constructs. For example, both personal growth and purpose in life may be related to intrinsic values or goals, which address needs for growth associated with meaningful activity engagement as well as intimacy and societal contribution (Sheldon & Kasser, 1995, 2001). These two existential dimensions have been found to be lower in older ages cross-sectionally (Ryff, 1989; Ryff & Singer, 2008) and tend to decline with age longitudinally (Springer et al., 2011), possibly or partly due to such societal factors as limited opportunities for self-realization and purposeful engagement in our current society (Riley et al., 1994; Ryff, 2014). However, it should be noted that Bauer and Park (2010) pointed out that the results of Ryff and Singer (2008) also indicated a high level of personal growth (relative to levels of the other dimensions of psychological well-being) among older adults and stated that "personal growth is a keystone of older adults' well-being" (p. 73). As intrinsic values and goals addressing growth-related needs are suggested to contribute to well-being (Sheldon & Kasser, 1995, 2001), personal growth and purpose in life have been found to be associated with multiple aspects of health (see Ryff, 2014 for review).

Relations Between Personal Growth and Cognitive Functioning

Previous research has investigated purpose in life more thoroughly, when compared with personal growth, in relation to cognitive functioning or related outcomes. For example, Boyle et al. (2010, 2012) showed associations of purpose in life with reduced risks of Alzheimer's disease and reduced effects of pathological changes related to the disease on cognitive functioning in later life. In addition, using the MIDUS sample, Lewis et al. (2017) found that purpose in life cross-sectionally predicted episodic memory and executive function controlling for covariates. However, including an additional wave of MIDUS data, Dewitte et al. (2020) found that purpose in life predicted only change in subjective evaluation of memory ability, not change in the objective measure of episodic memory, while executive function was not examined in their study. In contrast, a longitudinal study by Wilson et al. (2013) for older adults found that purpose in life predicted better subsequent episodic memory and executive function (i.e., working memory and perceptual speed), controlling for covariates. They also addressed potential reciprocity and found that executive function, but not episodic memory, positively predicted subsequent purpose in life. Related to personal growth, an additional analysis by Wilson et al. (2013) showed that the association of the prior rate of cognitive decline with subsequent personal growth did not differ from, or might be comparable to, the significant association of cognitive decline with lower levels of subsequent purpose in life. However, in this analysis, including personal growth, they did not distinguish between different aspects of cognition (i.e., episodic memory and executive function) or assess the other directionality (i.e., from personal growth to cognitive decline). In another study (Maher et al., 2017), while direct relationships between personal growth and cognitive functioning were not addressed, personal growth (as well as purpose in life) did not differ between "SuperAgers" (i.e., those aged 80 or older whose episodic memory was exceptional or at least comparable to people a few decades younger) and cognitively average adults of the matched ages. On the other hand, Eren-Koçak and Kiliç (2014) found that higher executive function predicted posttraumatic growth, or positive personal change after experiencing an earthquake, though the authors noted as a limitation of the study that posttraumatic growth and cognitive functioning were measured years after the earthquake. As research on associations of personal growth with cognitive functioning has been limited in contrast to research on purpose in life, the present study focused on addressing such associations of personal growth.

Despite the limited research, it can be speculated that personal growth may be linked to cognitive functioning. Related to Erikson's stage of ego integrity versus despair (Erikson, 1959), life review, involving autobiographical memory (i.e., specific memories of the personal past, which can be used in developing a story of one's life; Bluck &

Habermas, 2001), may help aging individuals experience psychological maturation and growth (Staudinger, 2001) that may result in enhancing their subjective sense of personal growth. While autobiographical memory is different from episodic memory, or the ability to recall events that occurred minutes or hours ago (Conway, 2001), these two types of memories may be closely related. According to the dual memory system proposed by Conway et al. (2004) involving the episodic memory system, some transient episodic memories are integrated into the "long-term self" that contains self-relevant knowledge to develop autobiographical memories (for more details of the dual memory system, see Conway et al., 2004; Singer et al., 2013). In addition, executive function (characterized by cognitive abilities, such as inhibitive and strategic processes and working memory) may also be involved in autobiographical memory, particularly in accessing specific personal memories used for the development of autobiographical memory (Piolino et al., 2010; Roberts et al., 2018). Considering these possible relationships, it is speculated that cognitive abilities, including episodic memory and executive function, may help generate autobiographical memories, possibly promoting personal growth. On the other hand, those with a high sense of personal growth may be inclined to continue using those cognitive abilities related to autobiographical memory, and the active cognitive engagement may help them maintain their cognitive abilities.

As discussed earlier, personal growth and purpose in life may be overlapping constructs, and meaning-making, or getting meaning or purpose in life, is a key aspect of growth-oriented life review or narratives (Bauer & Park, 2010; Staudinger, 2001). However, considering the distinct emphasis of personal growth on seeking continuous improvement to achieve one's full potential (Ryff, 1989, 2014) rather than simply making meaning, it is speculated that its relations to cognitive functioning may be unique compared with those of purpose in life specifically for episodic memory and executive function as identified in the earlier mentioned previous studies.

Purpose of the Present Study

The present study aimed to contribute to the literature by investigating longitudinal associations of personal growth with episodic memory and executive function during adulthood, which previous research had not fully addressed. Specifically, this study examined cross-lagged relationships between personal growth and these two cognitive abilities for the adult sample from the MIDUS study. The present study made two hypotheses based on the earlier-mentioned speculations on possible bidirectional relationships between personal growth and cognitive functioning. While taking general tendencies of declines with age in personal growth (Springer et al., 2011) and cognitive abilities (Salthouse, 2009) into consideration, it was hypothesized that higher baseline personal growth would predict *smaller* decreases in episodic memory and executive function (Hypothesis 1); and higher baseline levels of episodic memory and executive function would predict *smaller* decreases in personal growth (Hypothesis 2). Although it was speculated that patterns of associations of personal growth might differ for episodic memory and executive function, such possible differences were examined in an exploratory manner due to the lack of previous research.

Method

Sample and Data

The present study analyzed data from the second and third waves of the MIDUS study, which has been a series of national surveys on various demographic, psychosocial, behavioral, health, well-being, and other factors for American adults (University of Wisconsin—Madison Institute on Aging, 2021). MIDUS has conducted three waves of longitudinal surveys in 1995–1996 (N = 7,108, aged 20–75), in 2004–2006 (N = 4,963, aged 28–84), and in 2013–2014 (N = 3,294, aged 39–93). Because MIDUS started adopting cognitive measures of interest in their second wave, the present study used data from the second wave (Time 1 [T1]) and third wave (Time 2 [T2]) and included only those who participated in the cognitive measurement ("Cognitive Project"; Ryff & Lachman, 2017, 2019) at T1 or at both T1 and T2. The average age of the respondents (N = 4,206) included in the present study was 56.0 (standard deviation [SD] = 12.3) at T1, and 54% were women.

Measures

For the present study, measures were selected from MIDUS measures (Ryff et al., 2017, 2019). Cronbach's alphas for the scales are provided later referring to the documentation of MIDUS (Ryff et al., 2017, 2019).

Personal growth (at T1 and T2)

MIDUS respondents were asked how much they agreed with items/statements related to personal growth (as well as other dimensions of psychological well-being, including purpose in life as mentioned later; Ryff, 1989). Seven items were included for personal growth, such as "I am not interested in activities that will expand my horizons" and "I have the sense that I have developed a lot as a person over time" (to be reverse-coded). The respondents used a 7-point Likert-type scale ranging from 1 (*strongly agree*) to 7 (*strongly disagree*; see Author Note 1). After some of the items were reverse-coded so that higher scores would indicate higher personal growth, the items were summed as its overall score, which could range from 7 to 49. Cronbach's alphas were 0.75 at both T1 and T2.

Cognitive measures (at T1 and T2)

For a subset of their participants at the second (T1) and third (T2) waves, MIDUS administered the Brief Test of Adult Cognition by Telephone (BTACT; Lachman et al.,

2014). The BTACT was comprised of subtests that addressed different areas of cognition. Using scores from these subtests, a two-factor solution with latent constructs of episodic memory and executive function was proposed and supported by Lachman et al. (2014), and the present study adopted this two-factor solution. The latent variable of episodic memory was constructed with scores from two subtests/items of (1) immediate and (2) delayed word list recall, while that of executive function was constructed with scores from five subtests/items of (1) digits backward, (2) category fluency, (3) number series, (4) backward counting, and (5) the Stop and Go Switch Task (aimed at measuring task-switching and inhibitory control) as seen in Figure 1 (see Author Note 2). For details on these subtests and related statistics, see Lachman et al. (2014) and Ryff and Lachman (2017, 2019).

Covariates (at T1)

In addition to demographic measures (i.e., age, sex, and education), self-rated physical health, positive affect, negative affect, and purpose in life were included as covariates due to their potential associations with cognitive functioning. Specifically, physical health is closely related to age-related cognitive decline (Deary et al., 2009), and positive and/or negative affect has been found to be associated with cognitive outcomes (Hittner et al., 2020; Zainal & Newman, 2021). As Dewitte et al. (2020) included these as covariates when examining cross-lagged associations between purpose in life and cognitive outcomes, the present study also selected these covariates. Purpose in life was also included to examine the effects of personal growth independent of this other dimension of eudaimonic well-being as well as to contrast the results of the present study focusing on personal growth with previous findings for purpose in life.

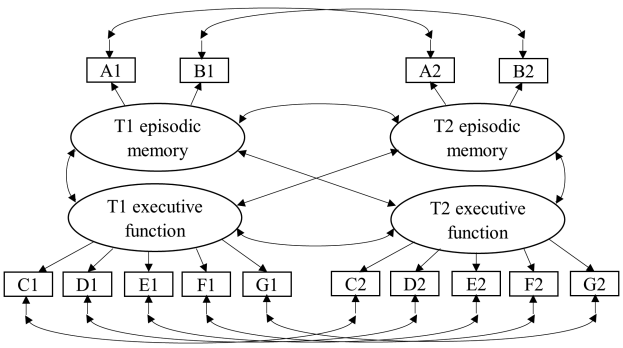

Figure 1. Longitudinal measurement model for episodic memory and executive function. The letter for each indicator refers to the following: A = immediate word list recall, B = delayed word list recall, C = digits backward, D = category fluency, E = number series, F = backward counting, and G = Stop and Go Switch Task (SGST). The number for each indicator refers to the time point of measurement. For example, F2 refers to backward counting ("F") at T2 ("2"). For visual clarity, variances are omitted, while residual variances (omitted) of each pair of the same measures/indicators at T1 and T2 were correlated as shown with double-headed arrows in the figure. All latent variables were also correlated as shown with double-headed arrows. T1 = second wave (Time 1); T2 = third wave (Time 2).

Demographic measures.—Age (in years), sex (male = 0, female = 1), and education (in years) at T1 were included as demographic covariates. As MIDUS used a categorical variable for education, it was recoded into a continuous variable in years ranging from 4 to 20 (e.g., "no school/some grade school" = 4 years; "some high school" = 10 years, "GED" or "graduated from high school" = 12 years, "graduated from a 4- or 5-year college, or bachelor's degree" = 16 years, and "Ph.D, ED.D, MD, DDS, LLB, LLD, JD, or other professional degree" = 20 years).

Self-rated health.—MIDUS respondents were asked to rate their physical health by using a 5-point Likert-type scale ranging from 1 (*excellent*) to 5 (*poor*). The scores were reverse-coded so that higher scores would indicate better health.

Positive and negative affect.—MIDUS respondents were asked how much of the time they had feelings related to positive and negative affect for the past 30 days (Mroczek & Kolarz, 1998). For positive affect, six items were included, such as "cheerful," "extremely happy," and "satisfied." For negative affect, six items were included, such as "so sad nothing could cheer you up," "restless or fidgety," and "that everything was an effort." The respondents used a 5-point Likert-type scale ranging from 1 (*all of the time*) to 5 (*none of the time*). For each of the measures, their six items were reverse-coded, so that higher scores would indicate higher positive or negative affect, and then averaged as its overall score, which could range from 1 to 5. Cronbach's alphas were 0.90 at T1 and 0.91 at T2 for positive affect and 0.85 at both T1 and T2 for negative affect.

Purpose in life.—In the way described earlier for the personal growth measure, MIDUS respondents rated seven items related to purpose in life using a 7-point Likert-type scale ranging from 1 (*strongly agree*) to 7 (*strongly disagree*; Ryff, 1989). Some examples of these items are: "I live life one day at a time and don't really think about the future"; "I enjoy making plans for the future and working to make them a reality" (to be reverse-coded). The summed score of the seven items (some of which were reverse-coded) was used as the overall score of purpose in life, which could range from 7 to 49. Cronbach's alphas were 0.70 at T1 and 0.72 at T2.

Analytic Strategy

In order to assess longitudinal associations of personal growth with episodic memory and executive function, the present study conducted longitudinal structural equation modeling (SEM) analyses referring to Little (2013). A longitudinal measurement model or two-wave confirmatory factor analysis (CFA) model including latent variables of

episodic memory and executive function was constructed first, and then an SEM model including these latent variables and (observed) variables of personal growth as well as covariates was analyzed. For all the models, maximum likelihood was used with Mplus (Muthén & Muthén, 2017) so that all available data would be used to reduce biases in producing estimates considering the attrition of the respondents from T1 to T2.

Longitudinal measurement model

A longitudinal measurement model or CFA model was constructed, including two waves of cognitive measures as shown in Figure 1. The latent variables of episodic memory and executive function at each wave were constructed with two and five subtests or indicators, respectively, as mentioned earlier. The means and variances of T1 latent variables were set at 0 and 1, respectively. The settings for T2 latent variables were changed in the factorial invariance tests as described later, and their means and variances were estimated in the finalized measurement model with constraints of invariance, so that they could be compared with the statistics at T1 (to assess their change over time). With these settings for the latent variables, loadings and intercepts were not fixed at any specific value for any of their indicators. All T1 and T2 latent variables were correlated with each other. In addition, the residual variances of each pair of the same measures/indicators at T1 and T2 were correlated with each other as they could share some information unique to each of the individual measures (Little, 2013).

Following the suggestions of Little (2013), a set of factorial invariance tests across time (i.e., the latent constructs remaining constant over two waves) were conducted for the two waves of latent variables as a preliminary analysis before conducting the subsequent, main SEM analysis. Based on the results of the factorial invariance tests reported in detail in the online Supplementary Material (see the section titled "Factorial Invariance Tests for the Longitudinal Measurement Model"), the measurement model was finalized with partial strong (intercept) invariance in addition to complete weak (loading) invariance. Model fit indices were used to determine whether the model had an acceptable model fit (root mean square error of approximation [RMSEA] <0.08, comparative fit index [CFI] >0.90, and standardized root mean squared residual [SRMR] <0.08; Kline, 2015; Little, 2013).

SEM model: Cross-lagged panel model

While keeping the constraints added to the finalized measurement model of partial strong invariance, an SEM model, more specifically, a cross-lagged panel model (Little, 2013; Orth et al., 2021), was constructed, in which the observed variable of T1 personal growth predicted residualized changes in the latent variables of episodic memory and executive function and T1 episodic memory and executive function predicted residualized changes in personal growth (see Author Note 3) as shown in Figure 2. For all regression paths, T1 covariates (i.e., age, sex, education, self-rated health, positive affect, negative affect, and purpose in life) in addition to the baseline (T1) level of each of the outcomes were controlled for. In the model, the latent and observed variables of T1 predictors and covariates (i.e., exogenous variables) were allowed to correlate with each other, and the error terms of the three outcome variables (i.e., T2 latent and observed endogenous variables) were also allowed to correlate with each other. The same criteria for model fit indices as those for the measurement model were used (i.e., RMSEA <0.08, CFI >0.90, and SRMR <0.08 as an acceptable model fit; Kline, 2015; Little, 2013).

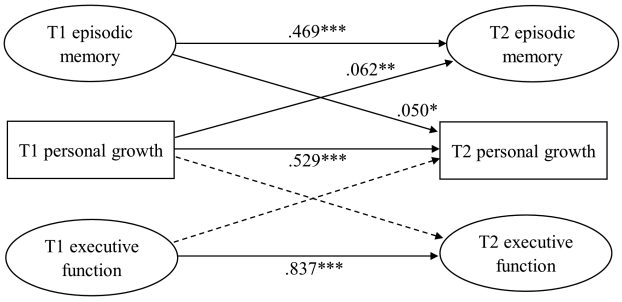

Figure 2. Cross-lagged panel model for personal growth and cognitive outcomes. For visual clarity, the following items are omitted: indicators of the latent variables of episodic memory and executive function (see Figure 1); observed variables of covariates, including T1 age, sex, education, self-rated health, positive affect, negative affect, and purpose in life, which were controlled for in all regression paths in the figure (see Table 3); covariances among all exogenous variables, including T1 personal growth, episodic memory, executive function, and omitted covariates, which were allowed to correlate with each other; variances or error terms of all variables; covariances among the error terms of all outcome variables, including T2 personal growth, episodic memory, and executive function, which were allowed to correlate with each other. As the baseline (T1) level of each outcome measure as well as other predictors and covariates were controlled for, the effects of predictors were on residualized change in the outcome variable. The solid lines indicate significant regression paths, and values next to the lines show the standardized coefficient of their effect (***$p < .001$; **$p < .01$; *$p < .05$). The dashed lines indicate nonsignificant regression paths (whose coefficients are not shown earlier). T1 = second wave (Time 1); T2 = third wave (Time 2).

Moreover, additional exploratory analyses were conducted using cross-lagged panel models by excluding purpose in life or personal growth (which was replaced with two waves of purpose in life to assess effects on residualized change in purpose in life). These analyses aimed to further contrast possible differences between the associations of personal growth with cognitive functioning and those of purpose in life.

Results

Descriptive Statistics and Longitudinal Measurement/CFA Model

Descriptive statistics for the observed variables are summarized in Table 1, while a correlation matrix of the observed

variables is provided in the online Supplementary Material (see Supplementary Table S1). The finalized measurement/CFA model had an acceptable model fit (RMSEA = 0.042, CFI = 0.975, SRMR = 0.040) though the model chi-square was significant (χ^2 = 605.775, *df* = 73, $p < .001$). Table 2 shows selected statistics for the finalized measurement model, which indicates that both episodic memory and executive function differed between T1 and T2 (i.e., decreased over time) significantly ($p < .001$).

Table 1. Descriptive Statistics for Respondents Selected for the Present Study

	MIDUS2 (T1) (*N* = 4,206)	MIDUS3 (T2) (*N* = 2,995)
Variable	*M* (*SD*)/%	*M* (*SD*)
Age	56.0 (12.3)	—
Sex (% female)	54%	—
Education (in years)	14.3 (2.7)	—
Self-rated health	3.5 (1.0)	—
Positive affect	3.4 (0.7)	—
Negative affect	1.5 (0.6)	—
Purpose in life	38.5 (6.9)	—
Personal growth	38.5 (6.9)	38.3 (6.8)
Immediate word list recall	6.7 (2.3)	6.7 (2.4)
Delayed word list recall	4.4 (2.6)	4.4 (2.7)
Digits backward	5.0 (1.5)	5.0 (1.5)
Category fluency	18.8 (6.2)	18.8 (6.1)
Number series	2.3 (1.5)	2.3 (1.6)
Backward counting	37.3 (11.4)	36.3 (11.4)
Stop and Go Switch Task	1.1 (0.3)	1.4 (0.4)

Notes: The online Supplementary Material provides more detailed descriptive statistics, including comparisons between those who participated in both the T1 and T2 surveys and those who participated in only the T1 survey, as well as differences in the measures at T1 and T2 for those who participated in both surveys. MIDUS = Midlife in the United States; *SD* = standard deviation; T1 = second wave (Time 1); T2 = third wave (Time 2).

SEM/Cross-lagged Panel Model

The results for the cross-lagged panel model are summarized in Table 3 and Figure 2. The model had an acceptable model fit (RMSEA = 0.038, CFI = 0.963, SRMR = 0.033) though the model chi-square was significant (χ^2 = 1,142.66, *df* = 165, $p < .001$).

Predicting residualized change in episodic memory

T1 personal growth ($\beta = 0.062$, $p < .01$) predicted smaller decreases (see Author Note 4) in episodic memory. The results for the effects of the covariates indicate that older people ($\beta = -0.277$, $p < .001$), men ($\beta = 0.140$, $p < .001$), and those with lower education ($\beta = 0.058$, $p < .001$) had greater decreases in episodic memory. The other covariates, including purpose in life, did not predict change in episodic memory.

Predicting residualized change in executive function

T1 personal growth did not predict change in executive function, whereas older people ($\beta = -0.169$, $p < .001$) and those with higher negative affect ($\beta = -0.053$, $p < .01$) had greater decreases in executive function. The other covariates, including purpose in life, did not predict change in executive function.

Predicting residualized change in personal growth

T1 episodic memory ($\beta = 0.050$, $p < .05$), but not T1 executive function, predicted smaller decreases in personal growth. The results for the effects of the covariates indicate that older people ($\beta = -0.062$, $p < .01$), men ($\beta = 0.036$, $p < .05$), as well as those with lower education ($\beta = 0.089$,

Table 2. Selected Statistics for the Longitudinal Measurement Model of Partial Strong Invariance for Episodic Memory and Executive Function

Parameter	Estimate	Parameter	Estimate
Standardized loadings (S.E.) on T1 episodic memory:		Standardized loadings (S.E.) on T2 episodic memory:	
Immediate word list recall	0.945 (0.010)	Immediate word list recall	0.955 (0.010)
Delayed word list recall	0.835 (0.009)	Delayed word list recall	0.849 (0.010)
Standardized loadings (S.E.) on T1 executive function:		Standardized loadings (S.E.) on T2 executive function:	
Digits backward	0.451 (0.013)	Digits backward	0.496 (0.014)
Category fluency	0.574 (0.012)	Category fluency	0.615 (0.012)
Number series	0.652 (0.011)	Number series	0.687 (0.012)
Backward counting	0.741 (0.010)	Backward counting	0.778 (0.010)
Stop and Go Switch Task (multiplied by –1)	0.536 (0.013)	Stop and Go Switch Task (multiplied by -1)	0.431 (0.012)
Means (standard deviations) of the latent variables (unstandardized for comparison between T1 and T2):			
T1 episodic memory	0.000 (1.000)	T2 episodic memory	–0.108 (1.072)
T1 executive function	0.000 (1.000)	T2 executive function	–0.242 (1.081)

Notes: All loadings on T1 and T2 episodic memory and executive function were significant ($p < .001$). While the unstandardized loadings of each pair of the same measures were constrained to be equal between T1 and T2, their standardized loadings (reported earlier) could differ between waves. The means of each of the latent variables differed between T1 and T2 significantly ($p < .001$). T1 = second wave (Time 1); T2 = third wave (Time 2).

Table 3. Cross-lagged Panel Model: Effects of Predictors and Covariates on Residualized Changes in Cognitive Outcomes and Personal Growth (i.e., T2 Outcomes Controlling for Their Baseline Level)

Predictor/covariate	Standardized coefficient β(S.E.)
T2 episodic memory predicted by:	
T1 episodic memory (baseline level)	0.469 (0.018)***
T1 personal growth	0.062 (0.023)**
T1 age	−0.277 (0.018)***
Sex (female)	0.140 (0.016)***
T1 education	0.058 (0.017)***
T1 self-rated health	0.032 (0.018)
T1 positive affect	0.004 (0.022)
T1 negative affect	−0.036 (0.023)
T1 purpose in life	−0.007 (0.023)
T2 executive function predicted by:	
T1 executive function (baseline level)	0.837 (0.016)***
T1 personal growth	0.005 (0.016)
T1 age	−0.169 (0.014)***
Sex (female)	0.009 (0.011)
T1 education	0.007 (0.013)
T1 self-rated health	0.020 (0.013)
T1 positive affect	−0.018 (0.015)
T1 negative affect	−0.053 (0.016)**
T1 purpose in life	−0.002 (0.016)
T2 personal growth predicted by:	
T1 personal growth (baseline level)	0.529 (0.019)***
T1 episodic memory	0.050 (0.020)*
T1 executive function	0.021 (0.029)
T1 age	−0.062 (0.019)**
Sex (female)	0.036 (0.016)*
T1 education	0.089 (0.017)***
T1 self-rated health	0.035 (0.017)*
T1 positive affect	0.002 (0.019)
T1 negative affect	−0.056 (0.020)**
T1 purpose in life	0.114 (0.021)***

Notes: T1 and T2 episodic memory and executive function were latent variables (see Figure 1), and all the other variables were observed variables. T1 = second wave (Time 1); T2 = third wave (Time 2).
***$p < .001$; **$p < .01$; *$p < .05$.

$p < .001$), poorer self-rated health (β = 0.035, $p < .05$), higher negative affect (β = −0.056, $p < .01$), or lower purpose in life (β = 0.114, $p < .001$) had greater decreases in personal growth.

Additional Cross-lagged Panel Models

In the main analysis as reported earlier (also see Table 3), purpose in life did not independently predict residualized change in episodic memory or executive function. The results of additional analyses for further exploration to contrast the associations of personal growth and purpose in life are briefly summarized here, while their detailed results will be available upon request.

In an additional analysis with a cross-lagged panel model excluding purpose in life, while keeping all the other variables, main findings for both directions of associations of personal growth with episodic memory and executive function (i.e., whether these associations were significant or not, whether the associations were positive or negative) did not differ from those reported in this study (Table 3 and Figure 2). In another additional analysis relacing personal growth with (two waves of) purpose in life, T1 purpose in life did not predict changes in the two cognitive measures (without controlling for personal growth) either, and neither T1 episodic memory nor executive function predicted change in purpose in life (i.e., T2 purpose in life, controlling for its T1 level as well as covariates). Thus, no significant associations were found between purpose in life and the two cognitive measures.

Discussion

The present study addressed possibly bidirectional relationships of personal growth with episodic memory and executive function for aging adults by analyzing a cross-lagged panel model. While personal growth is a core dimension of eudaimonic well-being related to optimal development suggested by Maslow (1968) and Erikson (1959), it has been understudied compared with purpose in life as another dimension of well-being. As discussed later, the present findings actually indicate that personal growth, rather than purpose in life, may be more relevant to cognitive functioning, particularly episodic memory, among aging adults, so this study makes a unique contribution to improving knowledge in the understudied area of research.

Hypotheses 1 and 2 were partially supported: while no relationships between personal growth and executive function were found in the present study, personal growth and episodic memory predicted smaller decreases in each other as hypothesized. These findings can be contrasted with the results of purpose in life not predicting change in episodic memory, which corresponds to the findings of Dewitte et al. (2020), or executive function. Considering the present findings showing both directions of longitudinal relationships between personal growth and episodic memory, it is speculated that their relationships may be reciprocal, which should be longitudinally addressed in further research having an additional wave of data. A possible explanation on the relationships between personal growth and episodic memory may be related to their links to autobiographical memory as discussed earlier. Autobiographical memories can be used when aging adults develop coherent narratives and life stories that promote their life review and potentially enhance their sense of growth and development (Bauer & Park, 2010; Bluck, 2003; Webster, 2003). As a possible explanation, maintaining a high sense of personal growth may both facilitate and require autobiographical memory, which uses information from the episodic memory system (Conway et al., 2004; Singer et al., 2013).

High personal growth, possibly with elaborate autobiographical memories, may help aging adults maintain their episodic memory by continuing to use the memory system. On the other hand, good episodic memory may allow them to continue generating autobiographical memories as sources of life stories that can help them maintain their personal growth. As the present study did not examine autobiographical memory, these speculations need to be tested in future research.

Another question that the present findings could not answer and needs to be addressed in future research is *why* only personal growth, not purpose in life, might be longitudinally related to episodic memory. In a life review, aging adults are inclined to engage in meaning-making with autobiographical memories and life narratives (Bauer & Park, 2010; Erikson, 1959; Staudinger, 2001), and this engagement is seemingly related to both personal growth and purpose in life. However, as the present study found that personal growth predicted and was predicted by episodic memory independent of purpose in life, this suggests that some unique aspects of personal growth, beyond meaning-making, are related to episodic memory (possibly linked to autobiographical memory). As aging adults with high personal growth maintain a sense of continuous improvement while being open to new experiences and seeking opportunities to achieve their potential (Ryff, 2014), they may be likely to engage in life review actively using episodic memory and autobiographical memory, aiming to enhance their sense of growth through their experiences. Such active use of memory may be beneficial for their cognitive functioning. On the other hand, it may be easier for those who have good episodic memory and autobiographical memory to get a sense of growing when having new experiences by generating more memories that can be used to elaborate their life narratives (see Author Note 5). Thus, one potential direction of future research is to identify unique aspects of personal growth relating to episodic memory as well as address the mechanisms of the potential reciprocal relationships between personal growth and episodic memory (possibly through autobiographical memory).

Related to this direction of research, another direction is to develop intervention studies to determine whether personal growth and episodic memory can be enhanced by increasing each other. This area of research is particularly important as both cognitive functioning (Hughes et al., 2018; Salthouse, 2009) and personal growth (Ryff, 1989; Springer et al., 2011) tend to decline with age. Especially if they are reciprocally related as discussed earlier, effective interventions would be needed to prevent their possible downward spiral (in which decreased personal growth might lead to decreasing episodic memory, which might in turn result in further decreasing personal growth). Some training for aging adults aimed at improving memory and other cognitive abilities (e.g., Carlson et al., 2008) may be useful to enhance their personal growth, whereas some interventions increase personal growth (e.g., narrative programs; Banyard et al., 2019) may be helpful to improve episodic memory and related cognitive abilities (e.g., autobiographical memory). These future studies are expected to contribute to identifying effective ways to promote personal growth and cognitive functioning.

There were some limitations to be noted for the present study. First, while two waves of data made it possible to examine the relationships of the variables longitudinally, it was not possible to completely address the potential reciprocity as mentioned earlier, which would require at least three waves of data. A follow-up study addressing the longitudinal reciprocity should be conducted in the future when MIDUS has an additional wave. As another limitation, while MIDUS conducted a brief hearing check and measured self-reported hearing for the BTACT (via phone) and their results indicated that the performance in the cognitive test was unaffected, Lachman et al. (2014) suggested having more sensitive audiometric assessments to more thoroughly evaluate how hearing could affect the performance at the BTACT. In addition, while episodic memory was measured by immediate and delayed word list recall in MIDUS, this type of traditional memory test could assess only a part of episodic memory without addressing contexts where and when participants remembered past events or evaluating their conscious awareness of those events (Tulving, 2002). As these missing features of episodic memory, as well as related memory systems not examined in the present study (e.g., autobiographical memory), may be relevant to memories of events and contexts facilitating personal growth, using more comprehensive memory measures would have been preferable. Finally, while MIDUS has been a large-scale national survey, more than 90% of the respondents reported their race as White. Thus, findings obtained using this sample might not be representative for the general population in the United States, so replication studies should be conducted for diverse populations to determine whether the findings of the present study are generalizable.

In conclusion, despite its limitations, the findings of the present study were unique, particularly indicating that personal growth and episodic memory predicted smaller decreases in each other, implying their potential longitudinal reciprocity. These findings and implications can inform future research, including intervention studies, aimed at exploring approaches to promoting personal growth and episodic memory among aging adults while improving the understanding of their relationships.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

Author Notes

1. For this measure of personal growth as well as the measures of positive affect, negative affect, and purpose in life as described later, MIDUS used a Likert-type scale

for individual items of each measure indicating that higher scores would indicate *lower* levels of the construct. However, when computing the overall scale scores of each measure, MIDUS reverse-coded scores of individual items (except ones of negatively-worded items) so that higher overall scores would indicate *higher* levels of the construct. As the present study used the overall scores of these measures, their higher scores indicated higher levels of each construct (e.g., higher personal growth).

2. For these individual cognitive measures or observed variables, except for Stop and Go Switch Task (SGST), higher scores would indicate better test performance. The possible range of scores for each measure was: from 0 to 15 for immediate word list recall; from 0 to 15 for delayed word list recall; 0 (if no correct answer was provided) or from 2 to 8 for digits backward; from 0 to 5 for number series. For the tests of category fluency and backward counting, there were no upper limits (i.e., providing as many answers as possible within a certain time limit), while the actual highest scores were 42 at T1 and 40 at T2 for category fluency and 100 at T1 and 90 at T2 for backward counting. The scores of SGST were composite latency scores for reaction time in the test.
3. In this cross-lagged panel model, the baseline level of each outcome (i.e., episodic memory, executive function, or personal growth) at T1 was controlled for in predicting the outcome at T2. Thus, the predictor(s) would predict the T2 outcome residualized for its T1 level, which could be interpreted as change (relative to others) that was not explained by the initial level of the outcome (Orth et al., 2021).
4. The effect on residualized change concerns relative, rather than absolute, change (compared with individuals with lower personal growth, in terms of this specific effect on episodic memory). Because all the outcomes declined overall from T1 to T2 (see Table 2 for episodic memory and executive function and Supplementary Table S2 of the Supplementary Material for personal growth), the phrase "smaller decreases" is used here as well as when describing positive effects on the other outcomes (if the effects were significant).
5. These speculations were made referring to a helpful comment from an anonymous reviewer for this journal article that led the author of the present study to address connection between openness to new experience and personal growth (or a sense of growing from experience). It should be noted, however, that the whole content of the speculations may differ from what the reviewer might speculate, as the author added some more speculations considering the connection of personal growth with openness to new experience.

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Conflict of Interest

None declared.

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The present study used data sets of the Midlife in the United States study that are publicly available at the website of the Institute for Social Research at the University of Michigan: https://www.icpsr.umich.edu/web/ICPSR/series/203. The detailed analytic methods will be available upon request by contacting the author. The present study was not preregistered.

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