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## Declarations

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### Conflict of Interest

The author has no conflicts of interest to declare that are relevant to the content of this article.

### Compliance with Ethical Standards

The author has followed the journal's guidelines of ethical responsibilities. Since the present study is based on secondary data analysis, ethical standards for data collection (e.g., informed consent) are not applicable.

### Informed Consent

Not applicable (due to secondary data analysis).

# Longitudinal and Age-Related Implications of Primary and Secondary Control for Hedonic and Eudaimonic Well-Being

While factors that may affect happiness have been widely studied (e.g., Diener et al., 2003; Oishi et al., 2011; Peterson et al., 2007; Ryff, 1989; Seligman, 2002; Waterman, 1993), their implications for happiness may vary between adults of different ages. Among such factors, the present study specifically addressed control strategies aimed at controlling or influencing one's external environment or internal world, including different types of primary and secondary control (Heckhausen & Schulz, 1995; Schulz & Heckhausen, 1999), as the use of primary and secondary control may or should be changed with age to achieve adaptive development (Heckhausen et al., 2010). Previous research (Deci & Ryan, 2008; Ryff & Singer, 2008) also distinguished between two major aspects of well-being: hedonic and eudaimonic well-being. The present study examined the longitudinal associations of primary and secondary control with hedonic and eudaimonic well-being and their age differences, which had not been fully understood. The findings of this study are expected to inform future research aimed at exploring effective approaches to promoting well-being, which should possibly be tailored to adults of different ages.

## Primary and Secondary Control

How one deals with their life circumstances has great implications for well-being through late adulthood (Haynes et al., 2009; Heckhausen et al., 2010). In their life-span theory of control, which has evolved into the Motivational Theory of Life-Span Development (MTLD; Heckhausen et al., 2010), Heckhausen and Schulz (1995) contrasted two types of approaches or control strategies: primary control and secondary control. Primary control is behavior aimed at directly changing the external environment to obtain desired outcomes, whereas secondary

control is aimed at changing one's internal processes such as cognitions and emotions while adapting to the environment (Heckhausen & Schulz, 1995; Schulz & Heckhausen, 1999). These two approaches may be intertwined. People strive to shape their external environment with primary control to achieve their desired goals and developmental potential, and secondary control can help maintain and enhance their future use of primary control by protecting their motivational resources or adjusting their goals when primary control fails (Heckhausen & Schulz, 1995; Schulz & Heckhausen, 1999). As the life-span theory of control and MTLD suggested, there may be age-related shifts in primary and secondary control (Heckhausen et al., 2010; Schulz & Heckhausen, 1999). Primary control tends to continue increasing until middle adulthood, after which it starts decreasing possibly due to age-related losses or declines (e.g., decreased physical abilities and health). In order to compensate for such losses in primary control with age, secondary control is expected to continually increase during middle and late adulthood. Due to these age-related shifts, the adaptivity of these different control strategies may vary among adults of different ages. For example, for older individuals, focusing largely on primary control may not be beneficial for their well-being because of reduced opportunities for goal attainment possibly influenced by age-related losses. In addition, depending on the aspect of happiness or well-being, primary and secondary control may have different implications. The following section distinguishes aspects of well-being before addressing associations of control strategies with these aspects of well-being.

**Hedonic and Eudaimonic Well-Being**

Research has suggested two conceptualizations of "happiness," including hedonic and eudaimonic well-being, as distinct constructs (Deci & Ryan, 2008; Huta & Waterman, 2014; Ryff & Singer, 2008). For hedonic well-being, research generally addresses subjective well-

being or one's evaluation for themselves in terms of the degree of their sense of well-being (i.e., feeling happy), which is characterized by high positive affect, low negative affect, and high life satisfaction (Deci & Ryan, 2008). In contrast, the conceptualization of eudaimonic well-being is considered to be rooted in the view of Aristotle on living well, which is more than feeling happy and satisfied and is concerned with fulfilling one's true potential (Deci & Ryan, 2008; Ryff & Singer, 2008). Specifically, in conceptualizing eudaimonic well-being covering "frequently endorsed aspects of what it means to be healthy, well, and fully functioning" (Ryff & Singer, 2008, p. 19), Ryff suggested six dimensions of psychological well-being including autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance (for the definitions of these specific dimensions, see Ryff, 1989; Ryff & Singer, 2008).[1] Some age-related tendencies have been found for hedonic/subjective well-being and eudaimonic/psychological well-being. For example, previous research suggested that older adults tended to report higher subjective well-being than younger adults possibly due to the "positivity effect" or focusing more on positive information (Carstensen et al., 2003; Carstensen & DeLiema, 2018). In contrast, Springer et al. (2011) showed that some aspects of psychological well-being including personal growth and purpose in life declined with age, which may be due to limited opportunities for meaningful societal roles for older adults (Ryff, 2017).

**Associations of Primary and Secondary Control with Hedonic and Eudaimonic Well-Being**

Primary and secondary control have been found to be linked to multiple areas of subjective or psychological well-being and health (see Heckhausen et al., 2010 for review), though possible differences in the associations of control strategies, particularly their longitudinal associations, for eudaimonic and hedonic well-being have not been well understood. It is speculated that primary control or striving to achieve their important goals may help adults

enhance their sense of achievement improving emotional conditions and evaluation of their lives (i.e., hedonic well-being) and sense of fulfilling their potential (i.e., eudaimonic well-being). However, relying solely on primary control may not be an optimal or feasible strategy when external environments are little controllable; instead, it may be more adaptive to control internal (e.g., cognitive, emotional) processes by using secondary control (Wrosch et al., 2006). Secondary control may involve distinct approaches including self-protection by seeing the positive aspect of challenging situations (i.e., positive reappraisals) and goal disengagement or adjustment by lowering aspirations (Wrosch & Heckhausen, 1999), which may have different implications for well-being. When facing negative life events, positive reappraisals may protect individuals from exacerbating negative emotions and lowering hedonic well-being and help them maintain their eudaimonic well-being, for example, seeing an opportunity for growth and finding some meanings or purposes in those negative experiences while accepting themselves as they are. In contrast, lowering aspirations or goal disengagement may be maladaptive and lower well-being as it can be associated with experiences of failure and reduce opportunities for goal attainment, though lowering aspirations or goal disengagement may sometimes be beneficial especially when the individual's goal is unrealistic or futile possibly due to their limitations (e.g., health conditions) (Wrosch et al., 2000).

Related to age-related shifts in the use of different control strategies as discussed earlier, there may be age differences in how the control strategies are associated with hedonic and eudaimonic well-being. For example, a cross-sectional study of Wrosch et al. (2000) found that primary control or persistence in goal striving was more strongly related to higher subjective well-being in their younger group (aged 25-39) than older group (aged 60-76). They also reported that among their middle-aged (aged 40-59) and older groups, positive reappraisals as a

strategy of secondary control was more strongly related to higher subjective well-being than the relationships of persistence in goal striving, whereas another strategy of secondary control, lowering aspirations, predicted lower subjective well-being independent of age. These age differences may be due to age-related shifts in life priorities. As adults become older, they tend to experience fewer gains (e.g., fewer opportunities to expand their knowledge and skills) and more losses (e.g., greater physical decline), which may change their goals and life priorities (Ebner et al., 2006). While acknowledging the limited time in their lives, aging adults may focus more on engaging in meaningful activities and deepening their social relationships rather than striving for gaining new information and skills and expanding their social networks (Carstensen, 1992; Carstensen et al., 2003). While primary control or persistence in goal striving may remain important for older adults to work on selected (i.e., fewer) goals meaningful to them, it may become more important to savor their lives by using positive (re)appraisals or seeing their experiences including negative ones in a positive and meaningful manner. Lowering aspirations may also become more adaptive for older adults, who are more likely to need to adjust their goals due to age-related decline, to focus on other, more attainable goals (Heckhausen et al., 2010), though this tendency was not observed in Wrosch et al. (2000) addressing subjective well-being. These age-related shifts may be more relevant to some dimensions of eudaimonic or psychological well-being including personal growth, purpose in life, and positive relations with others, as aging adults may enhance their eudaimonic well-being through meaningful or intrinsically motivating activities and relationships (Bauer & Park, 2010; Carstensen et al., 2003). Previous research has been limited in lacking longitudinal investigations that comprehensively address age variations in the associations of different control strategies with the two aspects of well-being.

**Purpose of the Present Study**

The present study aimed to fill in the gap in the literature by examining the longitudinal associations of different strategies of primary and secondary control with hedonic/subjective and eudaimonic/psychological well-being during adulthood and their age differences. Building on the implications of or speculations from the previous findings, the following two sets of hypotheses (common to the outcomes of hedonic/subjective and eudaimonic/psychological well-being) were made.

The first set of hypotheses were for associations of primary and secondary control with well-being among adults overall:

H1.a.: Primary control (i.e., persistence in goal striving) would predict increases in well-being.

H1.b.: Secondary control as positive reappraisals would predict increases in well-being.

H1.c.: Secondary control as lowering aspirations would predict decreases in well-being.

The second set of hypotheses were for age differences in these associations addressed by the first set of hypotheses:

H2.a.: The associations of primary control with well-being would be more negative (or less positive) for older rather than younger adults.

H2.b.: The associations of secondary control as positive reappraisals with well-being would be more positive for older rather than younger adults.

H2.c.: The associations of secondary control as lowering aspirations with well-being would be more positive (or less negative) for older rather than younger adults.

These hypotheses were made considering the implications of primary and secondary control and their age-related shifts as discussed earlier referring to the MTLD building on the

life-span theory of control (Heckhausen et al., 2010; Schulz & Heckhausen, 1999). While lowering aspirations was expected to have negative implications for well-being among adults overall, it might be beneficial for older individuals, for whom goal adjustment might have become more important due to their age-related decline and losses in order to focus on their selected and meaningful goals.

For the outcomes of hedonic and eudaimonic well-being, some different patterns of results were expected. For example, the age differences suggested in the second set of hypotheses, particularly in the associations of the two types of secondary control, might be prominent especially for eudaimonic well-being as older individuals were more likely to prioritize meaningful activities and relationships, which could be closely related to (some aspects of) eudaimonic well-being and might be facilitated by positive reappraisals and/or lowering aspirations (or goal adjustment to focus on more realistic meaningful goals). However, due to the scarcity of previous research contrasting the potential benefits of primary and secondary control for hedonic and eudaimonic well-being and their age differences, the present study examined those possible differences in an exploratory manner while additionally addressing individual dimensions of hedonic and eudaimonic well-being.

## Methods

### Sample and Data

The data analyzed in the present study were from the second and third waves of the Midlife in the United States (MIDUS; University of Wisconsin - Madison Institute on Aging, 2020). The first wave of MIDUS was conducted in 1995-1996 as an American national survey for 7,108 participants aged 20 to 75 (Brim et al., 2020) aiming to examine demographic, behavioral, psychological, and social factors and their role for health and well-being in

adulthood. Since MIDUS added scales for psychological well-being with higher internal consistency from the second wave, the present study used only data from the second wave of their survey conducted in 2004-2006 (N = 4,963, aged 28 to 84; "Time 1 [T1]" in the present study) and the third wave conducted in 2013-2014 (N = 3,294; "Time 2 [T2]"). The average age of participants was 55.4 (SD = 12.4) at T1, and 53% of them were women.

## Measures

For demographic characteristics and other measures of MIDUS (Ryff et al., 2017, 2019) adopted in the present study, descriptive statistics are summarized in Table 1.

### *Demographic Characteristics*

T1 age (in years), sex, and education were included. The sex variable was recoded to male = 0 or female = 1. The education variable was recoded into a dichotomous variable: college graduation (from a four- or five-year university or with a bachelor's degree) or higher education = 1, or lower education = 0.

### *(Poor) Physical and Functional Health: Chronic Health Conditions and Functional Limitations*

Considering the potential negative impacts of poor physical and functional health on psychological states or well-being (Ryff, 2014), physical and functional health variables were included as additional covariates. For physical health, the measure for the number of chronic health conditions was adopted. This measure indicated the total number of chronic conditions, such as high blood pressure, diabetes, and stroke, MIDUS respondents reported experiencing for the past 12 months. For functional health, the measure for functional limitations based on the Medical Outcomes Study 36-item short-form health survey (SF-36) (Ware Jr. & Sherbourne, 1992) was adopted. For this measure, MIDUS respondents reported the degree (ranging from 1

[*a lot*] to 4 [*not at all*]) of their health limiting their seven daily activities such as lifting or carrying groceries, climbing flights of stairs, and moderate and vigorous activities (e.g., running). After reverse-coding the scores (i.e., higher scores indicating greater functional limitations), the seven items were averaged as the scale of functional limitations.

***Primary Control and Secondary Control***

As predictors in the present study, the measures for one measure of primary control (persistence in goal striving) and two measures of secondary control including positive reappraisals and lowering aspirations (Wrosch et al., 2000) were used. The measure of primary control consisted of five items (e.g., "When things don't go according to my plans, my motto is, 'Where there's a will, there's a way'"), while the measures of secondary control consisted of four items for positive reappraisals (e.g., "I find I usually learn something meaningful from a difficult situation") and five items for lowering aspirations (e.g., "When I can't get what I want, I assume my goals must be unrealistic"). MIDUS respondents reported how well each of the items/statements described them by using a 4-point Likert-type scale ranging from 1 (*a lot*) to 4 (*not at all*). After reverse-coded (i.e., higher scores indicating higher levels of each type of primary or secondary control), the four or five items were averaged for each measure. The Cronbach's alpha of primary control at T1 was .78, and the alphas of secondary control were .78 for positive reappraisals, and .61 for lowering aspirations.

***Eudaimonic Well-Being: Psychological Well-Being***

In order to construct latent variables of psychological well-being, corresponding to eudaimonic well-being, at the two time points, Ryff's measures addressing six dimensions of psychological well-being including autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance (Ryff, 1989) were used. Each of the

measures consisted of seven items, such as “I am not afraid to voice my opinions, even when they are in opposition to the opinions of most people” (autonomy), “In general, I feel I am in charge of the situation in which I live” (environmental mastery), “I have the sense that I have developed a lot as a person over time” (personal growth), “I know that I can trust my friends, and they know they can trust me” (positive relations with others), “I have a sense of direction and purpose in life” (purpose in life), and “When I look at the story of my life, I am pleased with how things have turned out” (self-acceptance). For each of the items, MIDUS respondents reported how strongly they agreed or disagreed with the statement by using a 7-point Likert-type scale ranging from 1 (*agree strongly*) to 7 (*disagree strongly*). For each of the six measures or dimensions of psychological well-being, the scores were reverse-coded except for negatively-worded items (i.e., higher scores indicating higher levels of each construct) and then summed as its overall score. The Cronbach’s alphas of these measures at T1 and T2 were .71 and .69 for autonomy, .78 and .80 for environmental mastery, .75 and .75 for personal growth, .78 and .78 for positive relations with others, .70 and .72 for purpose in life, and .84 and .84 for self-acceptance.

### *Hedonic Well-Being: Subjective Well-Being*

In order to construct latent variables of subjective well-being, corresponding to hedonic well-being, at the two time points, three measures of subjective well-being including positive affect, negative affect, and life satisfaction were used. MIDUS adopted a shortened version of the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988). The respondents reported how much of the time during the past 30 days they felt “enthusiastic”, “attentive”, “proud”, and “active” (four items) for positive affect and felt “afraid”, “jittery”, “irritable”, “ashamed”, and “upset” (five items) for negative affect, using a 5-point Likert-type scale ranging

from 1 (*all of the time*) to 5 (*none of the time*). After reversed-coded (i.e., higher scores indicating higher levels of positive or negative affect), the four and five items were averaged for positive affect and negative affect, respectively. For life satisfaction, MIDUS respondents rated their satisfaction with six areas of their lives (i.e., life overall, work, financial situation, health, relationship with spouse/partner, and relationship with children), using a scale ranging from 0 (*the worst possible*) to 10 (*the best possible*) (Prenda & Lachman, 2001). The two items for relationship with spouse/partner and relationship with children were first averaged, and then the averaged score of the two items and scores of the remaining items were averaged as the overall score of life satisfaction. The Cronbach's alphas of these measures at T1 and T2 were .86 and .86 for positive affect, .80 and .81 for negative affect, and .71 and .71 for life satisfaction.

## Analytic Strategy

In order to longitudinally address two aspects of well-being, the present study adopted a longitudinal structural equation modeling (SEM) approach following the guidelines of Little (2013). A longitudinal measurement model using confirmatory factor analysis (CFA) for the latent variables labeled "subjective well-being (SWB)" and "psychological well-being (PWB)", corresponding to hedonic and eudaimonic well-being respectively, was first constructed and assessed, which was followed by SEM analysis aiming to test the hypotheses on longitudinal associations of primary and secondary control with SWB and PWB and their age differences. All the models were analyzed using maximum likelihood with Mplus (Muthén & Muthén, 1998-2017) allowing all available data to be used (i.e., full information maximum likelihood), which was expected to help produce less biased estimates despite the attrition of the sample.

### *Longitudinal Measurement Model*

As a measurement model to be used as a basis for the subsequent analyses, a two-wave

CFA model was constructed as shown in Figure 1. The latent variables of SWB and PWB at each wave had three SWB measures/indicators (for which the reverse-coded scores of negative affect were used so that higher scores would indicate less negative affect or better emotional state) and six PWB measures/indicators, respectively.[2] To increase the interpretability of results, the mean of the latent variables at T2 (i.e., outcomes of the present study) (and that of those at T1 in the configural and weak invariance models as described later, which was then freely estimated in the strong invariance model) was set at 0 and their variance (and that of T1 latent variables in the configural invariance model, which was then freely estimated in the weak and strong invariance models) was at 1, and no loadings nor intercepts were fixed for the first nor other indicators of all the latent variables. All the latent variables of the two time points were allowed to correlate with each other. In addition, as indicators of the same measures (e.g., positive affect) at different time points could share unique information, the residual variances of each pair of the indicators (e.g., T1 positive affect and T2 positive affect) were allowed to correlate with each other (Little, 2013). In order to test the assumption that the latent constructs of SWB and PWB remained the same over time, factorial invariance across time was evaluated. Specifically, configural (pattern) invariance, weak (loading) invariance, and strong (intercept) invariance were assessed as suggested by Little (2013). In testing configural invariance, the CFA model with the same pattern of loadings between two time points, as seen in Figure 1, while adding no constraints to any of the parameter estimates was assessed. When evaluating the model fit of this and subsequent CFA or SEM models, the following criteria were used indicating an acceptable model fit: RMSEA < .08, CFI > .90, and SRMR < .08 (Kline, 2015; Little, 2013). The CFA model of configural invariance had an acceptable model fit (RMSEA = .055, CFI = .962, SRMR = .036) while the chi-square statistic of model fit was significant, $\chi^2$ = 1,654.593, df = 120, p

< .001. In testing weak and strong invariance, CFI values for model fit before and after including additional constraints were compared, and a change in CFI of .01 or less was used as a criterion to indicate invariance (Cheung & Rensvold, 2002). For the test of weak invariance, constraints were added to the loadings for each of the latent constructs (i.e., SWB or PWB) so that the unstandardized loadings would be equal between each pair of the indicators of two time points (e.g., T1 positive affect and T2 positive affect). The CFI value from the CFA model of configural invariance (.962) to that of weak invariance (.962) changed little (< .001), which indicated weak (loading) invariance. Then, for the test of strong invariance, constraints were added to the intercepts for each of the latent constructs so that the unstandardized intercepts would be equal between each pair of the indicators of two time points. The CFI value from the CFA model of weak invariance (.962) to that of strong invariance (.960) changed by .002 (< .01), which indicated strong (intercept) invariance. As Little (2013) did not recommend further enforcing strict invariance on error variances and residuals for construct comparisons across time, the CFA model of strong invariance was considered to be the finalized measurement model. The CFA model of strong invariance had an acceptable model fit (RMSEA = .054, CFI = .960, SRMR = .041), while the chi-square statistic was significant ($\chi^2$ = 1,784.634, df = 134, p < .001).

***SEM Models***

In order to examine associations of each strategy of primary or secondary control with changes in SWB and PWB, an SEM model was constructed as shown in Figure 2, which was based on the finalized measurement model of strong invariance. In this SEM model, it was assessed whether T1 primary control (PC) and secondary control (positive reappraisals [SC-PR] and lowering aspirations [SC-LA]) predicted T2 latent variables of SWB and PWB controlling for their T1 or baseline latent variables (i.e., predicting residualized changes in these latent

constructs) as well as T1 covariates (i.e., age, sex, education, chronic health conditions, and functional limitations). In this model, T1 predictors and covariates except the dichotomous variables of sex and education were centered at their mean, all the exogenous variables (i.e., observed and latent variables at T1) were correlated with each other, and the error terms of endogenous or outcome (latent) variables (i.e., T2 SWB and PWB) were also allowed to correlate with each other. After evaluating this model, another SEM model additionally including the interactions of T1 age and PC, of T1 age and SC-PR, and of T1 age and SC-LA predicting the latent variables of T2 SWB and PWB (controlling for their T1 or baseline levels) was analyzed. This additional model with the interactions was aimed at assessing whether the effects of PC, SC-PR, and SC-LA on residualized changes in SWB and PWB differed by age. For the significant interactions found, post-hoc analyses were conducted to further examine the age differences as discussed later in detail.

***Additional, Exploratory Analyses***

In addition to the main analyses as described above, exploratory analyses were conducted to investigate more nuanced tendencies in associations of different strategies of primary or secondary control with specific dimensions of SWB and PWB. Specifically, path analysis was conducted to examine whether T1 PC, SC-PR, and SC-LA predicted residualized changes in the nine individual SWB or PWB measures (i.e., predicting the well-being measures at T2 controlling for the baseline/T1 levels of all the nine measures) by including the nine outcomes in one path analysis model while controlling for T1 age, sex, education, functional limitations, and chronic health conditions. Similar to the main analyses, the interactions between age and the three measures of primary or secondary control were then added to examine age differences in the associations.

## Results

For the finalized longitudinal measurement model (of strong invariance), factor loadings are summarized in Table 2. While the means of the latent variables of T1 SWB (0.002) and T2 SWB (0.000) did not differ, there was a significant difference ($p < .001$) in the means of the latent variables of T1 PWB (0.054) and T2 PWB (0.000) (i.e., PWB declined over time). Below, the results for the SEM models additionally including the predictors and covariates of observed variables for the outcomes of the latent variables of SWB and PWB are reported, which is followed by the results of the additional exploratory analyses for individual well-being outcomes.

### SEM Models for Changes in SWB and PWB

#### *Main Effects*

The first SEM model (as shown in Figure 2, without adding the interactions of age with primary or secondary control) had an acceptable model fit (RMSEA = .053, CFI = .925, SRMR = .046, while the chi-square statistic was significant ($\chi^2 = 3{,}713.122$, df = 246, $p < .001$). Table 3 shows standardized regression coefficients. Controlling for the covariates, T1 SWB ($\beta = .184$, $p < .05$) and PWB ($\beta = .166$, $p < .05$) predicted residualized change in each other; whereas, T1 PC ($\beta = .051$, $p < .01$) and SC-LA ($\beta = -.047$, $p < .01$), but not T1 SC-PR, predicted change in PWB, while none of T1 PC, SC-PR, and SC-LA predicted change in SWB. Thus, with regard to the first set of hypotheses, the results supported H1.a. (for PC) and H1.c. (for SC-LA) for PWB but not SWB, while they did not support H1.b. (for SC-PR) for either SWB or PWB. Among the covariates, only sex ($\beta = .034$, $p < .05$; men reporting more decreases in SWB), more T1 chronic health conditions ($\beta = -.089$, $p < .01$), and functional limitations ($\beta = -.117$, $p < .001$) predicted

decreases in SWB, but not change in PWB, while only older T1 age ($\beta = -.057$, $p < .05$) and lower education ($\beta = .056$, $p < .001$) predicted decreases in PWB, but not change in SWB.

***Interaction Effects of Age with Primary or Secondary Control***

In the second SEM model including the interactions of age with PC, SC-PR, and SC-LA (with model fit statistics of RMSEA = .049, CFI = .924, and SRMR = .042), all the interactions of age were significant for SWB and PWB. Specifically, residualized changes in SWB were predicted by the interactions of T1 age and PC ($\beta = -.049$, $p < .05$), of T1 age and SC-PR ($\beta = .052$, $p < .05$), and of SC-LA ($\beta = -.050$, $p < .05$). These results indicate that the associations of PC and SC-LA with changes in SWB were more negative (or less positive) for older rather than younger individuals, while the association of SC-PR was more positive (or less negative) for older individuals. In addition, changes in PWB were predicted by the interactions of T1 age and PC ($\beta = -.044$, $p < .05$), of T1 age and SC-PR ($\beta = .039$, $p < .05$), and of SC-LA ($\beta = -.036$, $p < .05$). These tendencies for PWB appeared similar to those for SWB: the associations of PC and SC-LA with changes in PWB were more negative (or less positive) for older rather than younger individuals, while the association of SC-PR was more positive (or less negative) for older individuals. Thus, with regard to the second set of hypotheses, only H2.a. (for PC) and H2.b. (for SC-PR) were supported for both SWB and PWB. While the interactions related to H2.c. (for SC-LA) were significant for both outcomes, the direction of their associations was opposite to what was hypothesized.

In order to illustrate these interaction effects, post-hoc SEM models were constructed and analyzed by replacing the age variable and interaction terms with the one recentered at either one standard deviation below or above the mean age (i.e., age 43.0 or age 67.9, respectively) and its interaction terms with T1 primary and secondary control. In these post-hoc models including

interaction terms, the effects of the predictors (i.e., PC, SC-PR, and SC-LA) would indicate their effects at the condition of the selected value for recentering the moderator (i.e., age) (Aiken & West, 1991; McCabe et al., 2018), or the effects for hypothetical younger (43.0-year-old) and older (67.9-year-old) individuals, controlling for the main effects of age and other covariates as well as the interaction effects of age and the predictors. Age differences in these effects are illustrated in Figure 3, while more detailed results will be available upon request. The patterns of the significance levels of the differed between the younger and older individuals. With regard to SWB, for the younger (43.0-year-old) individuals, T1 PC marginally predicted increases in SWB ($\beta = .061$, $p = .050$) and T1 SC-PR significantly predicted decreases in SWB ($\beta = -.065$, $p < .05$), though T1 SC-LA did not predict change in SWB. In contrast, for the older (67.9-year-old) individuals, only T1 SC-LA predicted decreases in SWB ($\beta = -.056$, $p < .05$) while neither T1 PC nor T1 SC-PR did. With regard to PWB, for the younger (43.0-year-old) individuals, only T1 PC predicted increases in PWB ($\beta = .094$, $p < .001$) while neither T1 SC-PR nor T1 SC-LA did. For the older (67.9-year-old) individuals, T1 SC-PR ($\beta = .077$, $p < .01$) and T1 SC-LA ($\beta = -.080$, $p < .001$) predicted increases and decreases, respectively, in PWB, though T1 PC did not predict change in PWB.

**Path Analysis Models for Changes in Individual Well-Being Outcomes**

For the additional exploratory analyses for the nine individual well-being outcomes, only major findings are reported in this article. More detailed results will be available upon request.

***Main Effects***

The results for the main effects on the nine well-being outcomes in the path analysis model before adding the interactions of age are summarized in Table 4. T1 PC predicted increases in all six individual PWB outcomes as well as positive affect but did not for the other

SWB outcomes. T1 SC-PR predicted increases in only personal growth, positive relations, and self-acceptance and did not for the other PWB outcomes or any of the SWB outcomes. T1 SC-LA predicted decreases in only some of the SWB and PWB outcomes including positive affect, environmental mastery, personal growth, purpose in life, and self-acceptance.

### *Interaction Effects of Age with Primary or Secondary Control*

In the model with the interactions of age with T1 PC, SC-PR, and SC-LA, two or all of the three interactions were significant for positive affect, negative affect, environmental mastery, purpose in life, and self-acceptance, while none of the interactions were significant for the other outcomes. Age differences for the outcomes with the significant interactions are summarized in Table 5, in which using the same procedure as described above for the SEM model to illustrate the interactions, the effects are estimated for hypothetical younger (43.0-year-old) and older (67.9-year-old) individuals. For these interactions or age differences, similar tendencies to those of the main analyses (for the latent variables of SWB and PWB) were observed. Specifically, the associations of PC and SC-LA were more negative (or less positive) for older rather than younger adults, while those of SC-PR were more positive for older individuals for these specific dimensions of SWB or PWB (though the direction of the effects of negative affect was opposite as higher levels of negative affect would indicate lower well-being). As there were some variations among the specific SWB and PWB outcomes, they are interpreted in the next section.

## Discussion

The present study aimed to examine longitudinal associations of different strategies of primary and secondary control with hedonic and eudaimonic well-being. This study was unique in additionally addressing age differences in these associations, and its findings can inform

research that explores how adults of different ages can continue enhancing their happiness as discussed below.

The first set of hypotheses were only partially supported: while none of the predictors of primary control (persistence in goal striving) and secondary control (positive reappraisals and lowering aspirations) predicted changes in SWB, persistence in goal striving and lowering aspirations predicted increases and decreases, respectively, in PWB (which supported H1.a. and H1.c. only for PWB) but positive reappraisals did not predict those changes (which did not support H1.b.). However, these findings do not show a complete picture of these associations as some age differences were found.

For persistence in goal striving and positive reappraisals, the findings indicate the tendencies of age differences expected in H2.a. and H2.b. referring to the life-span theory of control and MTLD (Heckhausen et al., 2010; Schulz & Heckhausen, 1999). While there were some nuanced differences for the outcomes of SWB and PWB, among older individuals compared to younger individuals, the associations of persistence in goal striving and positive reappraisals were overall less positive (or more negative) and more positive (or less negative), respectively, for well-being. For the outcome of SWB, persistence in goal striving and positive reappraisals appears to have more positive and negative implications, respectively, for younger individuals while these were not associated with SWB for older (67.9-year-old) individuals. Referring to the results of the additional analyses for individual well-being outcomes, it is speculated that for older individuals, the associations (positive for younger adults) of persistence in goal striving with overall SWB might be offset by increasing negative affect and the associations (negative for younger adults) of positive reappraisals might be offset by increasing positive effect. Thus, for older adults, these control strategies may be neither adaptive nor

maladaptive for SWB as the result of such offsetting effects on their emotions; in contrast, for younger adults, persistence in goal striving as primary control may be a more adaptive approach as positive reappraisals appears to be detrimental for their SWB. Possibly, for younger adults, who tend to focus on striving to acquire gains or expand their abilities (Ebner et al., 2006), positive reappraisals may lead to passivity, without taking actions to overcome their challenges by improving their abilities, which may result in lowering their feelings of happiness and contentment. In contrast, the findings for the outcome of PWB differed a little particularly for positive reappraisals. While persistence in goal striving was associated with increased PWB for younger adults but not for older adults as seen in the findings for SWB, positive reappraisals had positive implications for older adults unlike younger adults. When looking into individual PWB outcomes, the positive implications of persistence in goal striving for younger individuals appear to be due to increasing environmental mastery, purpose in life, and self-acceptance. Considering that environmental mastery, or ability to manage one's environment (Ryff, 2014), is closely related to primary control, which focuses on controlling external environments to achieve desired goals or outcomes, their link should be reasonable for younger adults, who tend to have more opportunities for managing and controlling their environments (Heckhausen & Schulz, 1995). In addition, as younger adults tend to prioritize achieving gains (e.g., expanding their abilities, continuing to achieve new goals) (Ebner et al., 2006), striving for gains by using primary control may promote their sense of purpose and self-acceptance or positive attitude toward themselves. For older adults, using positive reappraisals, rather than focusing on primary control by being persistent in goal striving, appears to have resulted in increased environmental mastery and self-acceptance. Despite possible decline with age in their actual ability to manage external

environments, positively interpreting their experiences of working on limited but meaningful goals may give a sense of mastery and facilitate their self-acceptance.

The hypothesis on age differences for lowering aspirations (H2.c.) was not supported as this secondary control strategy actually predicted more decreases, not increases, in both SWB and PWB for older individuals, while the associations were not significant for younger (43-year-old) individuals. With regard to individual well-being outcomes, this tendency of age differences was observed for positive and negative affect, environmental mastery, and purpose in life. Although it was speculated that adjusting goals by lowering aspirations could be adaptive for older individuals, who might have age-related limitations (e.g., decline in physical ability) in working on challenging goals, this control strategy may actually lead them to admit that they have those limitations that require them to compromise their important goals. Such acknowledgement may then negatively affect their emotions by making them see the fact that they are unable to manage their environments and leading them to decide to give up the goals in which they have seen some meanings or purposes.

Overall, these findings show more negative associations of persistence in goal striving as primary control and lowering aspirations as secondary control for well-being among older individuals compared to younger adults, while positive reappraisals as another strategy of secondary control had more positive associations for their well-being. The implications of the findings should be taken into consideration when developing future studies as discussed next.

**Future Research and Practical Implications**

Future research should further investigate the varying associations of control strategies with hedonic and/or eudaimonic well-being to identify the mechanism of these associations for adults of different ages. In order to improve the understanding of such mechanisms, it may be

valuable to study different age groups separately to examine the mechanisms possibly unique to each age group as younger adults' priorities or values may differ from those of older individuals as discussed earlier. For example, one of the potential focuses of future research would be on how secondary control, particularly positive reappraisals, could have negative implications for hedonic well-being among younger adults unlike older individuals and what other factors or mediators may be involved in the negative association. For older individuals, it should be examined how positive reappraisals, but not lowering aspirations, could lead to increasing their eudaimonic well-being. Identifying these mechanisms is also expected to help develop effective interventions to promote well-being or happiness for adults of different ages by modifying their control strategies and their relevant factors (e.g., mediators). Considering the age differences found in the present study, such interventions may need to be tailored to adults of different ages: possibly, the interventions should be aimed at increasing primary control while reducing secondary control for younger adults and at promoting positive reappraisals as a secondary control strategy for older individuals. For instance, for younger adults, some skills related to primary control such as problem solving, planning, and instrumental action (Connor-Smith & Flachsbart, 2007; Skinner et al., 2003) may be beneficial by helping them overcome their challenges by improving their external environments and circumstances while expanding their skills. On the other hand, as cognitive restructuring (e.g., positive reappraisals) is one type of secondary control (Helzer & Jayawickreme, 2015), improving cognitive restructuring skills may help older individuals enhance their internal experiences (e.g., increasing positive interpretations of their external experiences). These kinds of interventions tailored to adults of different ages may be beneficial for their well-being.

**Limitations**

Despite its unique contribution to the literature, the present study had some limitations to be noted. First, while the present study adopted Ryff's conceptualization of psychological well-being to address the construct of eudaimonic well-being, there has not been a consensus on the definition or dimensions of eudaimonic well-being among researchers (Huta & Waterman, 2014). The latent construct of PWB constructed in the present study may not have completely addressed the nature of eudaimonic well-being suggested by other researchers, so the present findings should be replicated using different "versions" of eudaimonic well-being to have a more comprehensive understanding of eudaimonic well-being and its associations with other factors. In addition, while life satisfaction is considered to be one component of SWB, it is a cognitive evaluation of one's life and may not be considered to be a component of hedonic well-being or *feeling* happy (Deci & Ryan, 2008). The present study included life satisfaction as an indicator of SWB corresponding to hedonic well-being, but it may be more appropriate to separate life satisfaction as a cognitive component from positive and negative affect as emotional components (concerning feelings of happiness) particularly if a research focus is mainly on hedonic well-being or different dimensions of subjective well-being. With regard to measures used in the present study, the measure of lowering aspirations was included to be contrasted with another strategy of secondary control (i.e., positive reappraisals) but its Cronbach's alpha (i.e., internal consistency) was lower than the conventionally acceptable level (< .7; Nunnally, 1978). MIDUS included other measures of secondary control strategies (e.g., selective secondary control, aimed at enhancing motivational commitment toward a selected goal by devaluating non-selected goals or alternatives; Heckhausen et al., 2010), but their internal consistency was also low. Thus, the present study focused on positive reappraisals and lowering aspirations (i.e., goal adjustment)

without using the other measures with low reliability. Another limitation of the present study is that although MIDUS was a national survey of American adults, their sample was not necessarily representative for the general population since approximately 90% of the respondents reported their racial origin as white. Replication studies using more racially and ethnically diverse samples are needed to assess the generalizability of the present findings for the national population. Furthermore, while the longitudinal nature of the present study helped eliminate the possibility of some directionality of the associations (i.e., the direction must be from T1 to T2, not from T2 to T1), this study remained correlational so did not allow causal inferences. Manipulating or modifying primary or secondary control to assess their effects on well-being as discussed earlier for future research can be a potential approach to overcoming this limitation while it would require a considerable amount of time to examine their longitudinal effects.

**Conclusions**

The present study aimed to contribute to the literature by addressing longitudinal associations of different strategies of primary and secondary control with two aspects of happiness, including hedonic/subjective and eudaimonic/psychological well-being, and their age differences. The findings indicate overall tendencies of more negative (or less positive) associations of primary control and more positive (or less negative) and more negative associations of two strategies of secondary control including positive reappraisals and lowering aspirations, respectively, with SWB and PWB for older individuals compared to younger individuals. These findings have practical implications and suggest some potential directions of future research aimed at further examining the role of different strategies of primary and secondary control for happiness and exploring potential interventions to promote happiness, for example, by modifying primary and/or secondary control for adults of different ages.

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## Footnote

[1.] While researchers had suggested various definitions for eudaimonic well-being (Huta & Waterman, 2014), the present study adopted Ryff's conceptualization of psychological well-being (Ryff, 1989; Ryff & Singer, 2008) corresponding to eudaimonic well-being as it can be contrasted with the conceptualization of subjective well-being.

[2.] With preliminary exploratory factor analyses, it was determined that having two latent constructs of SWB and PWB, rather than different structures of well-being, should be reasonable, which is reported in detail in the supplemental material (see the section titled "Preliminary Exploratory Factor Analysis").

**Table 1**

*Descriptive Statistics for MIDUS Respondents*

| Item / Variable | Time 1 (T1) (N = 4,963) | Time 2 (T2) (N = 3,294) |
|---|---|---|
| | Mean (SD) / % | Mean (SD) |
| Age | 55.4 (12.4) | - |
| Sex (female %) | 53% | - |
| Education (college graduate %) | 37% | - |
| Chronic health conditions | 2.5 (2.6) | - |
| Functional limitations | 1.8 (0.9) | - |
| Primary control – persistence in goal striving | 3.2 (0.6) | - |
| Secondary control – positive reappraisals | 3.0 (0.6) | - |
| Secondary control – lowering aspirations | 2.2 (0.5) | - |
| Positive affect | 3.6 (0.8) | 3.5 (0.8) |
| Negative affect | 1.5 (0.5) | 1.5 (0.5) |
| Life satisfaction | 7.5 (1.3) | 7.6 (1.3) |
| Autonomy | 37.1 (7.0) | 37.3 (6.7) |
| Environmental mastery | 38.2 (7.4) | 38.4 (7.5) |
| Personal growth | 38.4 (6.9) | 38.3 (6.8) |
| Positive relations with others | 40.6 (7.0) | 40.6 (6.7) |
| Purpose in life | 38.4 (7.0) | 38.1 (7.0) |
| Self-acceptance | 38.1 (8.2) | 38.0 (8.1) |

*Note.* T1 and T2 refer to the second and third waves of the MIDUS survey conducted in 2004-06 and 2013-14, respectively. A correlation matrix of these variables is provided in the online supplemental material (Table S1).

**Table 2**

*Loadings on T1 and T2 Latent Variables of Subjective Well-Being (SWB) and Psychological Well-Being (PWB) in the CFA Model of Strong Invariance*

| Indicator | Standardized loading (standard error) | Indicator | Standardized loading (standard error) |
|---|---|---|---|
| Loadings on T1 SWB (M = 0.002, SD = 0.982): | | Loadings on T2 SWB (M = 0.000, SD = 1.000): | |
| Positive affect | .731 (.009) | Positive affect | .720 (.010) |
| Negative affect (reverse-coded) | .630 (.011) | Negative affect (reverse-coded) | .615 (.012) |
| Life satisfaction | .710 (.009) | Life satisfaction | .684 (.011) |
| Loadings on T1 PWB (M = 0.054, SD = 0.997): | | Loadings on T2 PWB (M = 0.000, SD = 1.000): | |
| Autonomy | .537 (.010) | Autonomy | .548 (.011) |
| Environmental mastery | .853 (.005) | Environmental mastery | .855 (.006) |
| Personal growth | .736 (.007) | Personal growth | .735 (.008) |
| Positive relations with others | .734 (.007) | Positive relations with others | .740 (.008) |
| Purpose in life | .782 (.006) | Purpose in life | .786 (.007) |
| Self-acceptance | .889 (.004) | Self-acceptance | .889 (.005) |

*Note.* All loadings on each of the latent variables (i.e., T1 and T2 SWB and PWB) were significant ($p < .001$). While constraints were added so that the unstandardized loadings (not reported in the above table) of each pair of the same measure at T1 and T2 would be equal, their standardized loadings could differ slightly between the two time points as shown above.

**Table 3**

*Main Effects of the SEM Model for Predicting Residualized Changes in Subjective and Psychological Well-Being*

| Predictor/covariate of T2 SWB | Standardized coefficient β (standard error) | Predictor/covariate of T2 PWB | Standardized coefficient β (standard error) |
|---|---|---|---|
| T1 SWB (baseline) | .519 (.095)*** | T1 PWB (baseline) | .532 (.062)*** |
| T1 PWB | .166 (.081)* | T1 SWB | .184 (.076)* |
| T1 primary control - persistence in goal striving | .012 (.022) | T1 primary control - persistence in goal striving | .051 (.018)** |
| T1 secondary control - positive reappraisals | -.013 (.022) | T1 secondary control - positive reappraisals | .035 (.018) |
| T1 secondary control - lowering aspirations | -.011 (.019) | T1 secondary control - lowering aspirations | -.047 (.016)** |
| T1 age | .056 (.032) | T1 age | -.057 (.025)* |
| Sex (female) | .034 (.017)* | Sex (female) | .028 (.014) |
| T1 education | .011 (.017) | T1 education | .056 (.014)*** |
| T1 chronic health conditions | -.089 (.027)** | T1 chronic health conditions | .001 (.021) |
| T1 functional limitations | -.117 (.029)*** | T1 functional limitations | -.007 (.023) |

*Note.* *** p<.001, ** p<.01, * p<.05. SWB and PWB refer to subjective well-being and psychological well-being, respectively. T1 and T2 SWB and PWB were latent variables (see Figure 1), and all the other variables were observed variables.

**Table 4**

*Main Effects of Primary and Secondary Control on Residualized Changes in Individual Well-Being Measures*

| Predictor | Outcome (residualized change) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Positive affect | Negative affect | Life satisfaction | Autonomy | Environmental mastery | Personal growth | Positive relations | Purpose in life | Self-acceptance |
| T1 primary control - persistence in goal striving | .047* | .021 | .025 | .070*** | .066** | .037* | .043* | .053** | .054** |
| T1 secondary control - positive reappraisals | .031 | -.030 | -.024 | .007 | .016 | .083*** | .049** | .030 | .041* |
| T1 secondary control - lowering aspirations | -.039* | .027 | -.002 | -.028 | -.057** | -.058*** | -.024 | -.062*** | -.035* |

*Note.* *** p<.001, ** p<.01, * p<.05. The above effects are standardized (β), controlling for T1 age, sex, education, functional limitations, and chronic health conditions as well as baseline levels (at T1) of all the nine well-being measures in predicting each T2 well-being outcome. More detailed results (e.g., standard errors, coefficients of the effects of covariates) will be available upon request.

**Table 5**

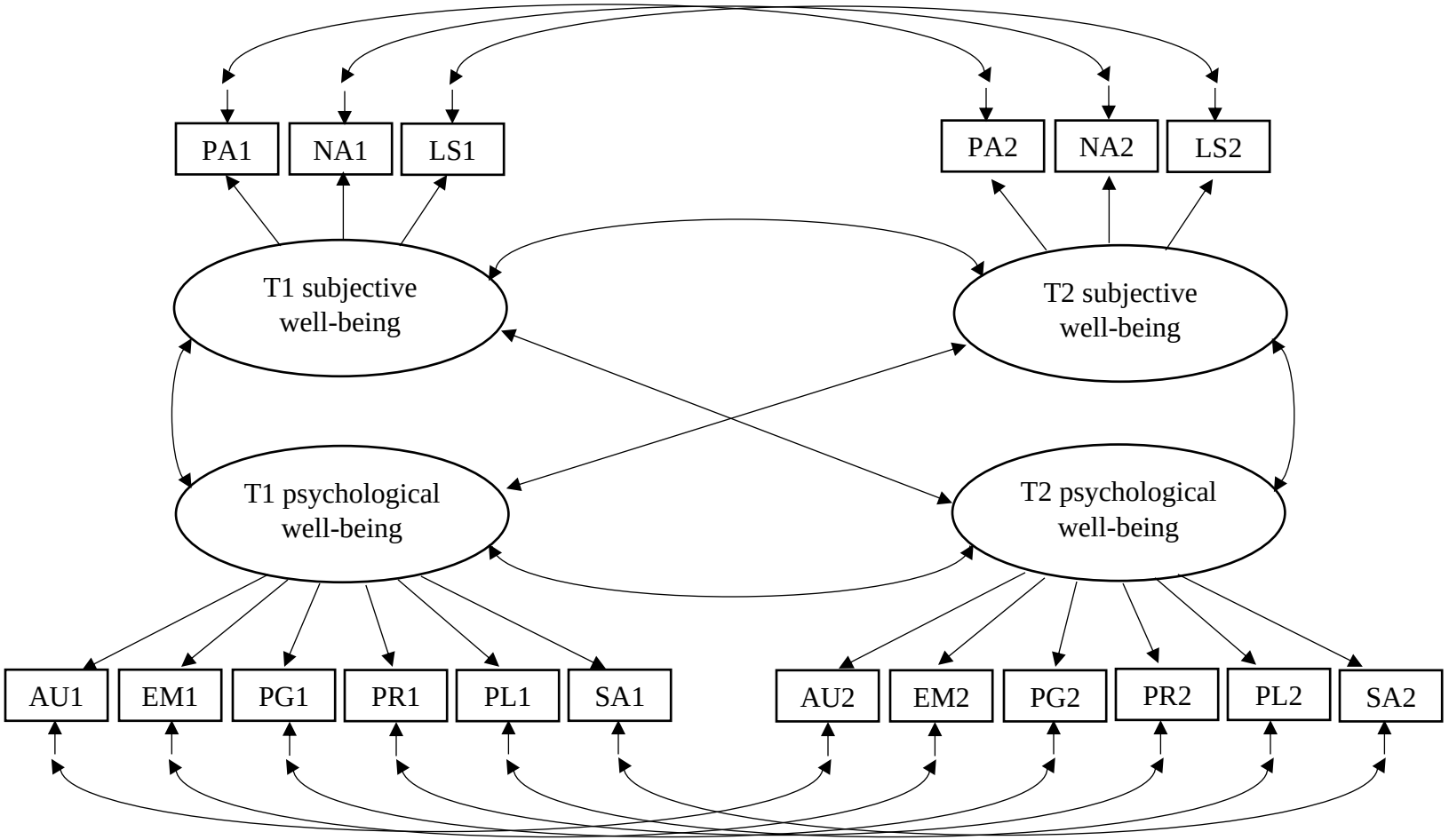
*Age Differences in the Effects of Primary and Secondary Control on Residualized Changes in Individual Well-Being Measures*

| Predictor | Outcome (residualized change) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Positive affect | | Negative affect | | Environmental mastery | | Purpose in life | | Self-acceptance | |
| | Younger | Older | Younger | Older | Younger | Older | Younger | Older | Younger | Older |
| T1 primary control - persistence in goal striving | No interaction | | -.049 | .091** | .108*** | .024 | .109*** | -.001 | .096*** | .009 |
| T1 secondary control - positive reappraisals | -.028 | .094** | No interaction | | -.032 | .066* | No interaction | | .001 | .086** |
| T1 secondary control - lowering aspirations | .001 | -.076** | -.030 | .076** | -.015 | -.094*** | -.018 | -.099*** | No interaction | |

*Note.* *** p<.001, ** p<.01, * p<.05. Coefficients are provided above only if the interaction of age and each predictor was significant (i.e., coefficients for life satisfaction, autonomy, personal growth, and positive relations with others are not shown above because none of the interactions were significant for these outcomes). The above standardized effects (β) are estimated for hypothetical younger (43.0-year-old) and older (67.9-year-old) individuals by recentering the age variable (i.e., moderator) at one standard deviation below and above the mean age, respectively, in the interaction models, where T1 age, sex, education, functional limitations, chronic health conditions, all the nine well-being measures (i.e., their baseline levels at T1), other predictors (i.e., primary or secondary control measures), and interactions between age and the three predictors were controlled for. In the models, the effects of the predictors show their effects at the condition of the selected value for recentering the moderator (Aiken & West, 1991; McCabe et al., 2018), which was age 43.0 or 67.9. More detailed results (e.g., standard errors, coefficients of the effects of covariates) will be available upon request.

**Figure 1**

*Longitudinal Measurement Model for Subjective and Psychological Well-Being*

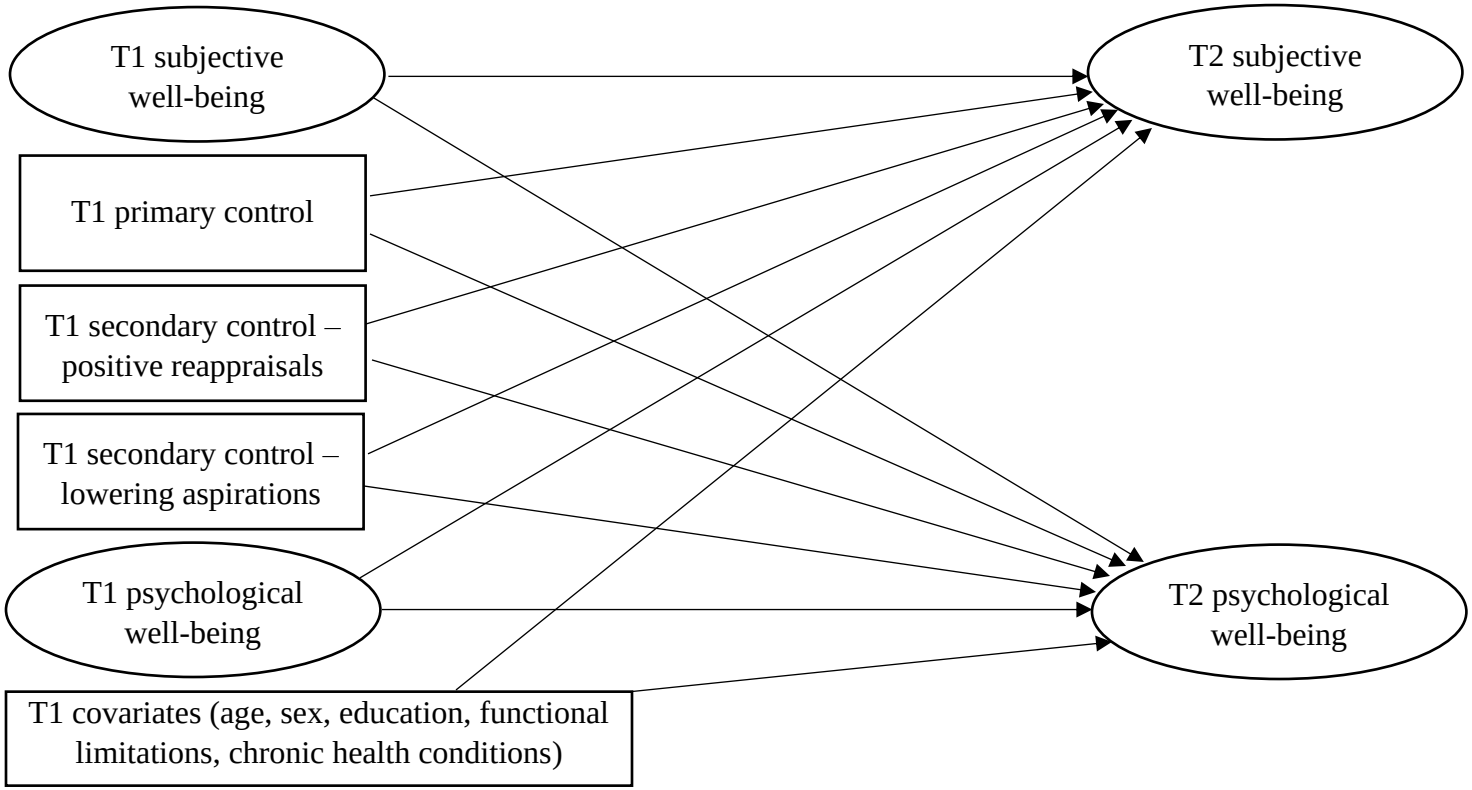



*Note.* The abbreviations for the indicators stand for: PA = positive affect; NA = negative affect; LS = life satisfaction; AU = autonomy; EM = environmental mastery; PG = personal growth; PR = positive relations with others; PL = purpose in life; SA = self-

acceptance. The number after each of the abbreviations refers to the time point of the measurement (e.g., PA2 = positive affect at T2). Double-headed arrows indicate covariances, while single-headed arrows indicate direct effects (i.e., factor loadings on each latent variable or effects of omitted residual variables). Variances are omitted in the above figure. The residual variables (omitted in the figure) of each pair of the same measures (i.e., observed variables) at the two time points were allowed to correlate with each other as shown above.

**Figure 2**

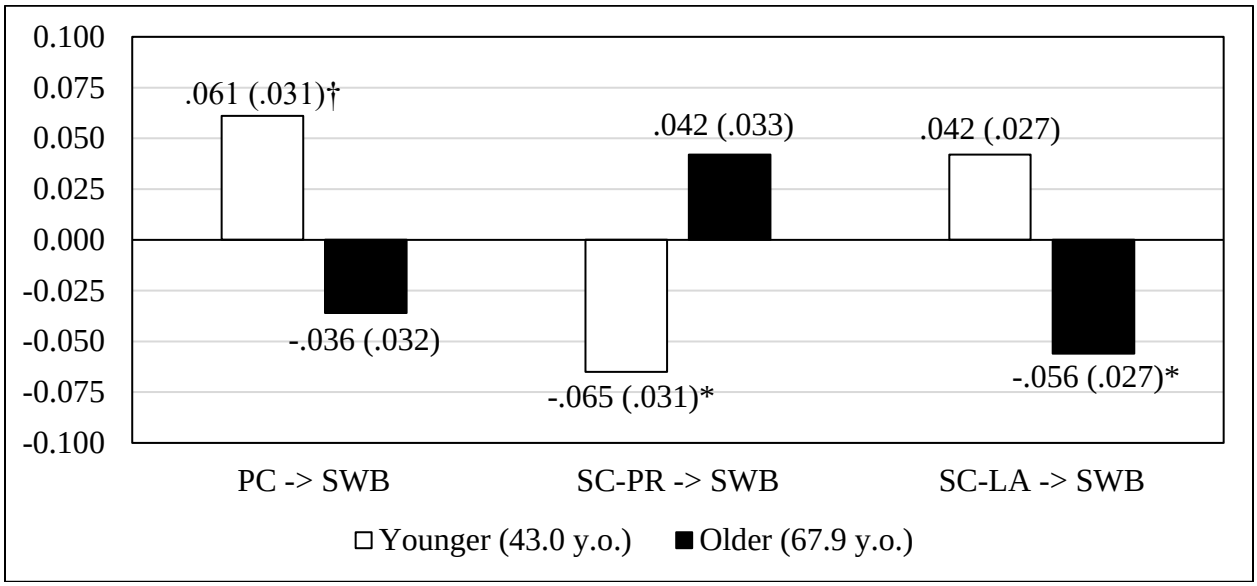
*Structural Equation Model for T1 Primary and Secondary Control Predicting Residualized Changes in Subjective and Psychological Well-Being*

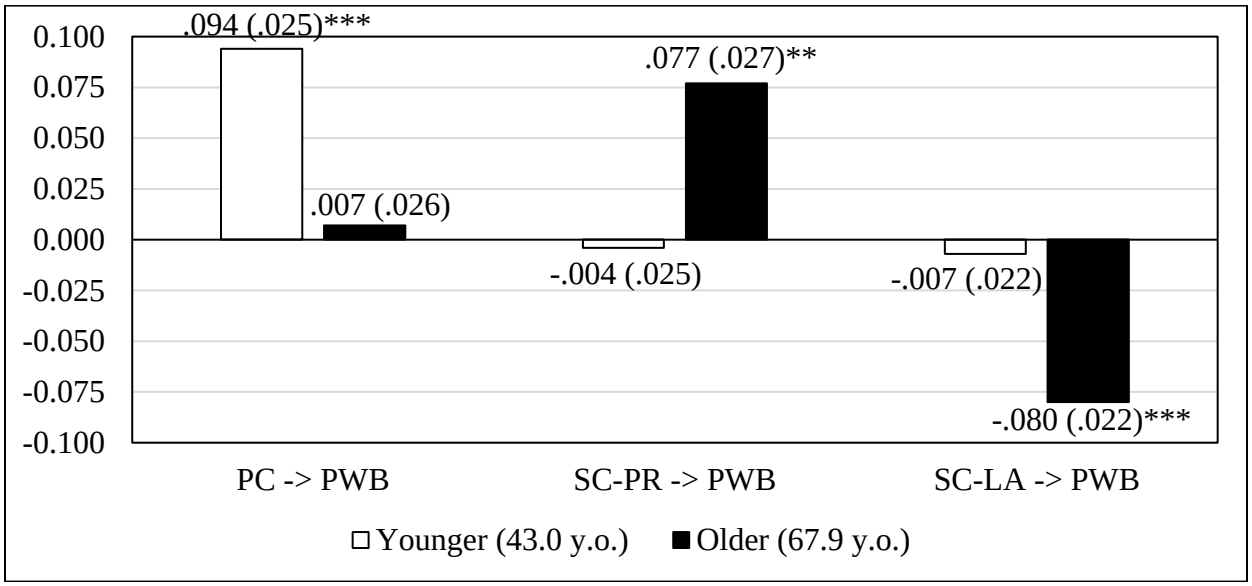



*Note.* The arrows in the above figure indicate regression paths in the SEM model, and this figure is simplified by omitting: the indicators of the latent variables of subjective well-being (SWB) and psychological well-being (PWB) (see Figure 1), covariance between each pair of all exogenous variables (i.e. predictors and covariates, which were allowed to correlate with each other), variance of each variable, and covariance between the error terms of T2 SWB and T2 PWB (which were allowed to correlate with each other). In the subsequent SEM model, the interaction term of T1 age and each measure of T1 primary or secondary control (which is not included in the above figure) was added for predicting T2 SWB and T2 PWB.

**Figure 3**

*Age Differences in Effects of Primary and Secondary Control on Residualized Changes in Subjective and Psychological Well-Being*




Note. The figures at the top and at the bottom show age differences in the effects of the predictors on residualized changes in subjective well-being (SWB) and psychological well-being (PWB), respectively. The other abbreviations refer to: PC = primary control (persistence in goal striving); SC-PR secondary control – positive reappraisals; SC-LA = secondary control – lowering aspirations. The labels indicate a combination of the predictor and outcome for each effect, for example, "PC -> SWB" refers to the effect of PC (at T1) on change in SWB. Values indicate standardized coefficients β (their standard errors in parentheses), and symbols are added

if the effects were significant (*** p<.001, * p<.05) or in the border of significance (†=.05). The above effects are estimated for hypothetical younger (43.0-year-old) and older (67.9-year-old) individuals by recentering the age variable (i.e., moderator) at one standard deviation below and above the mean age, respectively, in the interaction models, where T1 age, sex, education, functional limitations, chronic health conditions, well-being variables (i.e., their baseline levels at T1), other predictors (i.e., primary or secondary control measures), and interactions between age and the three predictors were controlled for. In the models, the effects of the predictors show their effects at the condition of the selected value for recentering the moderator (Aiken & West, 1991; McCabe et al., 2018), which was age 43.0 or 67.9. More detailed results will be available upon request.