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Life satisfaction across adulthood: different determinants at different ages?

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Abstract

It is likely that with aging and changing life circumstances, individuals' values shift in systematic ways, and that these shifts may be accompanied by shifts in the determinants of their subjective judgments of well being. To examine this possibility, the relations among the Satisfaction With Life Scale (SWLS) and a number of personality, affect, demographic, and cognitive variables were examined in a sample of 818 participants between the ages of 18 and 94. The results indicated that although many variables had significant zero-order correlations with the SWLS, only a few variables had unique utility in predicting life satisfaction. Invariance analyses indicated that while the qualitative nature of life satisfaction remains constant across adult age, the influence of fluid intelligence on judgments of life satisfaction declines with age. In contrast, negative affect is negatively associated with life satisfaction consistently across the adult age span.

Keywords

Satisfaction With Life Scale; subjective well-being; aging; invariance; structural equation modeling

Introduction

Subjective well-being (SWB) is often conceptualized as having cognitive-judgmental components, characterized by life satisfaction, and emotional components, characterized by the presence of positive affect and the absence of negative affect (Diener, Suh, Lucas, & Smith, 1999). There is strong evidence to suggest that these cognitive and emotional components are related both to a host of individual difference variables and to each other (e.g., Diener & Suh, 1998). This project is specifically concerned with the properties and determinants of the cognitive-judgmental aspects of SWB, as measured by the Satisfaction With Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985), and whether these properties and determinants differ with age.

Predictors of SWB

Research indicates that demographic variables combined (e.g., education, income, gender, and martial status) may only account for approximately 8–15% of the variance in determining

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between-person differences in subjective well-being (e.g., Diener et al., 1999), whereas results from twin studies indicate that upwards of 50% of the variance in SWB may be accounted for by genetics. Such findings might be best understood in the context of top-down theories (e.g., Headey & Wearing, 1989), which explain that life events cause SWB to temporarily deviate from an equilibrium state that is unique to each individual and related to more stable personality characteristics and other psychological traits.

Positive and negative affect are often used as measures of the emotional component of SWB (e.g., Diener et al., 1999). Consistent with the temperament theory of well-being (Lykken, 1999), significant correlations have been reported between positive and negative affect and life satisfaction using the Positive Affect Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988) (e.g., Steverink & Lindenberg, 2006).

Depression and anxiety are central facets of negative affect (e.g., Tellegen, 1985), and, therefore, their relations to life satisfaction are expected to be similar to that of negative affect. Indeed, Arrindell, Meeuwesen, and Huyse (1991) found that anxiety was significantly related to life satisfaction ($r = -0.54$). Likewise, depression is consistently reported to be negatively related to life satisfaction in both clinical (Hyer et al., 1987) and non-clinical samples (e.g., Arrindell et al., 1991; Schimmack, Oishi, Furr, & Funder, 2004).

Previous research has consistently found perceived health to be associated with life satisfaction (e.g., George & Landerman, 1984). Okun, Stock, Haring, and Witter (1984) reported a correlation of 0.32 between health and SWB in a meta-analysis. In a more recent study, Arrindell, Heesink, and Feij (1999) reported correlations of 0.29 and 0.26 (for females and males, respectively) between self-rated health and levels of life satisfaction in a large sample of young adults from the Netherlands.

Increased age is frequently associated with an increase in health problems, the loss of loved ones, and a lack of financial independence. Despite these difficulties, few researchers find a strong relationship between age and SWB and typically report that there are very little age differences in SWB (e.g., Herzog & Rodgers, 1981; Horley & Lavery, 1995; Kunzmann, Little, & Smith, 2000; Mroczek & Kolarz, 1998). In fact, some researchers find that increased age is associated with a decrease in negative affect (e.g., Charles, Reynolds, & Gatz, 2001). The phrase ‘paradox of well-being’ has been used to describe this unexpected positive relationship.

Value-as-a-moderator model

In the SWB literature, Oishi, Diener, Suh, and Lucas (1999) have proposed a value-as-a-moderator model, in which individual, cultural, and situational variations in predictors of life satisfaction can be systematically predicted by salient values. Consistent with this model, Oishi et al. (1999) reported that, for example, ratings of SWB were more influenced by grade satisfaction for the student participants who valued achievement more than for those who did not.

The value-as-a-moderator model of SWB allows for systematic generation of hypotheses regarding age differences in cognitive abilities as predictors of life satisfaction and, as such, we use this model as framework for our hypotheses throughout the paper. However, it should be noted that we do not actually measure values in this study and instead are using various individual difference characteristics as surrogates for values. The results from this project are therefore relevant to the value-as-a-moderator model, but are not necessarily definitive until a correspondence is established between an individual's level of characteristics and his or her values.

There is evidence to suggest that increasing age is associated with a shift in values. According to Carstensen's socio-emotional selectivity theory (Carstensen, 1991, 1995), goals are influenced by the perception of available time. That is, perceived limitations on the amount of time left in life changes the way one prioritizes goals. Namely, those individuals who perceive less available time value goals with greater emotional meaning rather then goals with long-term pay-offs. These age-associated differences in motivation include focusing more on the emotional aspects of situations, using coping strategies that are emotion-based over those that are problem-based, and a preference for social contacts that are emotionally gratifying over ones that are novel. Further, there is evidence that not only are we more motivated to improve our well-being as we age (by prioritizing our goals) but we may also be more skilled at controlling our emotions (Lawton, Kleban, Rajagopal, & Dean, 1992).

In an interview study of 171 middle-aged (30–64) and older (65+) adults, Ryff (1989) reported that although both age groups answered that family was most important in life, the middle-aged group was significantly more likely to report that their job was more important whereas older adults were more likely to report that health was more important. When asked, ‘What would you change (about your life)?’ middle-aged adults were significantly more likely to say that they would engage in ‘active self-improvement’ and would have ‘more accomplishments’ whereas the older adults were significantly more likely to report that they would change nothing. Based on the value-as-a-moderator model, there is reason to believe that shifts in values would result in differential patterns of predictors of life satisfaction. For example, because older adults reportedly value health more than middle-aged adults (Ryff, 1989), we would predict that health would be a significant predictor for older adults, but not for younger adults.

Intelligence and well-being

Intelligence is one of the strongest predictors of success in life (e.g., educational attainment, occupational achievement; income, even physical well-being; e.g., Gottfredson, 2002; Gottfredson & Deary, 2004). In a recent study, Isaacowitz and Smith (2003) found that above and beyond demographic and contextual variables, general intelligence was a unique predictor of SWB. Interestingly, higher levels of intelligence predicted increased positive affect and increased negative affect in the sample of adults age 70 to 105. To explain these findings, Issacowitz and Smith called upon Rowe and Khan's (1997, 1998) model of successful aging which specifies that high levels of cognitive functioning are an important and critical component to aging successfully. Issacowitz and Smith elaborate on this theory and suggest that greater levels of cognitive functioning allow one to stay more engaged with life which in turn may bring greater enjoyment, but also a greater risk of loss and disappointment. However, the Isaacowitz and Smith study did not differentiate between fluid and crystallized intelligence.

Intelligence is often partitioned into two broad ability categories: fluid intelligence, which is associated with effortful cognitive processing, and crystallized intelligence, which is associated with knowledge that is acquired from a culture or environment. Just as physiological capacities are known to decline with aging, fluid intelligence (e.g., spatial ability, reasoning) tends to decline across the adult lifespan. Alternatively, crystallized intelligence (e.g., vocabulary, knowledge) tends to increase across adulthood (e.g., Salthouse, 2004) as the increased experience associated with age results in an accumulation of knowledge. These different trajectories may imply different predictions in regards to SWB.

We predict that fluid intelligence may be more highly valued, and therefore a better predictor of life satisfaction, during younger adulthood than older adulthood. Specifically, there are fewer older adults in the workforce, and older adults tend to report that their jobs are less important than do middle aged adults (Ryff, 1989). Because fluid intelligence is a good determinant of job performance (e.g., Hunter & Schmidt, 1996), we therefore expect that it is more valued at younger ages, when jobs are also more highly valued.

Alternatively, while fluid intelligence may be less important in some ways at older ages, we predict that crystallized intelligence may gain in importance with adult age. Knowledge and wisdom are often associated with increased age and experience (e.g., Clayton & Birren, 1980; Sternberg, 1985). It has even been postulated that age-related increases in knowledge may be used to compensate for age-related decreases in processing capacities (e.g., Baltes & Baltes, 1990). We therefore expect that due to its growth and potentially increasing role in cognition with advancing adult age, crystallized intelligence will be a stronger determinant of life satisfaction with adult age.

The present study

To fully investigate the predictive value of personality, demographic, health, and intelligence across different age groups, several steps were taken. First, we examined measurement invariance of the SWLS across three age groups spanning the age range from 18–94 to ensure that the SWLS measured the construct of interest (i.e., life satisfaction) to the same extent across the groups. Establishment of measurement invariance will allow for differences in construct means and interrelations across the groups to be interpreted unambiguously (Horn & McArdle, 1992; for examples see Oishi, 2006 and Vautier, Mullet, & Jmel, 2004). There are different levels of measurement invariance. To establish *configural invariance*, the structure of the variables and the latent construct should be the same across the different groups (Horn, McArdle, & Mason, 1983). *Metric invariance* is a more stringent test of invariance and is established when the magnitudes of unstandardized coefficients (i.e., the loadings) from the construct to the observed variables are the same across the groups (Horn & McArdle, 1992). We tested whether the SWLS exhibited both types of measurement invariance. Second, we examined zero-order correlations and unique associations between personality, affect, demographic, health, intelligence, and the SWLS. Numerous studies have examined the correlations between these variables and life satisfaction (see Diener et al., 1999, for review), but few have examined all of these variables together (Isaacowitz & Smith, 2003; Mroczek & Kolarz, 1998). In this study, the relative predictive utility of personality traits, affect, and intelligence are examined simultaneously. Third, in order to reduce the number of predictor variables into a parsimonious number of meaningful dimensions of individual differences, the variables were subjected to an exploratory factor analysis (EFA). Using structural equation modeling, the relations between the latent predictors and the life satisfaction construct were examined to determine whether they were invariant across age group.

In summary, the main goals of this project are two-fold. The first purpose is to identify personality, demographic, and cognitive variables that have relationships with the SWLS. The second goal of this project is to examine age differences in predictors of life satisfaction with a theoretical focus on perceived health and intelligence. Prior to the pursuit of this goal, we will also determine whether the measurement properties of the SWLS vary as a function of age group.

Method

Participants

Participants consisted of 818 individuals between the ages of 18 and 94 who were recruited from Charlottesville, VA, via newspaper advertisements, flyers, and referrals from other participants. Participants came to the laboratory three times for approximately two hours each occasion as part of two larger studies, and completed a number of questionnaires between the first and third session. Sixteen participants were excluded from the analyses because they scored 23 or below (out of 30) on the Mini-Mental Status Exam (MMSE; Folstein, Folstein, & McHugh, 1975), a global assessment tool often used to screen for dementia. An additional four participants did not report their age or withdrew from the study. Table 1 reports the descriptive statistics of the sample divided into three age groups. Inspection of the table indicates that age was associated with increased years of education, and decreased self-ratings of health. Health was measured on a five point scale (1 = Excellent, 5 = Poor) and the average rating for all of the groups was close to 2.0, which is equivalent to a health rating of 'good.'

Materials

Life satisfaction was assessed with the SWLS (Diener et al., 1985), which is comprised of five items rated on a 7-point Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). The five items are: 'In most ways my life is close to my ideal' (Ideal), 'The conditions of my life are excellent' (Condition), 'I am satisfied with my life' (Satisfied), 'So far I have gotten the important things I want in life' (Important), and 'If I could live my life over, I would change almost nothing' (Change). Descriptive statistics and reliability coefficients for all scales are presented in Table 1.

Neuroticism was assessed with the 10-item version of the International Personality Item Pool scale (IPIP; Goldberg, 1999). We measured depression using The Center for Epidemiological Studies-Depression scale (CESD; Radloff, 1977), and trait anxiety using the Trait anxiety subscale of the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). In addition, general positive affect and negative affect was assessed using the Positive and Negative Affect Scale (PANAS; Watson et al., 1988).

Self-reported health was assessed with the following eight questions: How would you rate your health at the current time from (1) excellent to (5) poor; How much are your daily activities limited in any way by your health or health-related problems from (1) not at all to (5) a great deal; How many different prescription medications do you take each week? The following five questions were yes/no questions: Have you ever had surgery for cardiovascular (heart or artery) disease?; Have you ever had general anesthesia during a surgical operation?; Are you currently taking medication or under dietary restrictions for high blood pressure, or have you been treated for this condition in the past?; Have you ever had a head injury with loss of consciousness for greater than five minutes?; Have you ever had medical treatment for a neurological problem? In addition to the questionnaires, fluid ability and crystallized ability were also measured.

Fluid ability

Fluid ability was measured with a Matrix Reasoning task (Raven, 1962), the Shipley Abstraction task (Shipley, 1940), and the Letter Sets task (Ekstrom, French, Harman, & Dermen, 1976). In the Matrix Reasoning task, participants were instructed to select the best alternative to complete a missing cell in a pattern. The Shipley Abstraction task required participants to fill in numbers or letters to complete a series. In the Letter Sets task, participants are required to select which set of letters does not belong among a number of other letter sets. Estimates of reliability for these variables in similar samples were reported by Salthouse (2005) and Salthouse, Atkinson, and Berish (2003). They were all above 0.7.

Crystallized ability

Crystallized ability was measured with the WAIS-III Vocabulary subtest (Wechsler, 1997) which requires participants to define words out loud, the Woodcock-Johnson picture vocabulary test (Woodcock & Johnson, 1990) which requires participants to identify pictures, and a test of synonym vocabulary (Salthouse, 1993) and antonym vocabulary (Salthouse, 1993). In the synonym and antonym vocabulary tests, participants select which word from a set of alternatives is the best synonym (or antonym). Estimates of reliability for these variables in similar samples were reported by Salthouse (2005) and Salthouse et al. (2003), and were all above 0.8.

Model fit

As recommended by Hu and Bentler (1998), several fit statistics were used to examine the fit of the models. The Chi-square statistic is one of the most commonly used fit indices and is a reflection of how close the hypothesized covariance matrix matches the observed covariance matrix. The root-mean-square error of approximation (RMSEA), Bentler's comparative fit statistic (CFI), and the Tucker-Lewis Index (TLI) were also selected. RMSEA values closer to zero indicate a better fit to the data, a value of$\leq$ 0.08 is considered acceptable (Browne & Cudeck, 1993), and a model with an RMSEA value of$\leq$ 0.06 is considered to have a good fit (Hu & Bentler, 1999). For the CFI and TLI indices, values closer to one indicate a better fit to the data, with values greater than 0.95 indicative of a good fit (Hu & Bentler, 1999; for a detailed discussion of fit indices see Hu & Bentler, 1998).

Results

The results are divided into three sections. The first section reports the results of the measurement equivalence analyses. Analyses regarding the potential predictors and correlates of the Satisfaction With Life Scale are presented in the second section. The third section presents the results from the EFA and the structural equation modeling analyses designed to examine the age invariance of the predictors of the SWLS.

Age invariance of the SWLS

The sample was divided into three groups comprised of a young adult group (18–39 years of age, N = 200), a middle-aged adult group (40–59 years of age, N = 310) and an older adult group (60–94 years of age, N = 288). One of the simplest ways to investigate whether each loading was significantly different across the two groups was to initially constrain all the loadings to be the same across groups, under the assumption of metric invariance, and to use the metric invariance model as a baseline model. As can be seen in Table 2, the metric invariance (baseline) model provided an acceptable fit to the data (RMSEA = 0.06, CFI = 0.97).

To determine whether the unstandardized coefficient for each variable was significantly different across the two age groups, the loading of each variable was allowed to vary across the groups, one at a time. If allowing a loading to vary across groups does not significantly improve the fit of the data (as measured by change in chi-square per change in degree of freedom) then one can conclude that the magnitude of the loading does not differ significantly across the groups. Of most interest in Table 2 is the last column which reports whether the fit of each model is significantly better than the baseline metric model in which all the loadings are constrained. Inspection of the last column indicates that none of the models fits significantly better than the metric model. In fact, even when all five loadings are free to vary across the groups in the configural model, the fit is not significantly better, suggesting that the relations between the five variables and the life satisfaction construct is equivalent across the three age groups. Configural invariance was measured by constraining the structure of the model to be the same across the three groups so that the five variables of the SWLS loaded on to a one-factor life satisfaction construct for both the young and older group, but none of the loadings were constrained to be the same.[1] Table 3 lists the standardized factor loadings for the SWLS model, and it can be seen that each of the loadings are significantly greater than zero.

[1]This was achieved by fixing the variance of the latent life satisfaction variable to 1.0 in each of the groups, in order to define the metric of the latent variable.

Predictors and correlates of life satisfaction

Table 4 presents zero-order correlations between life satisfaction and its predictors, as well as the standardized regression coefficients of each predictor in a simultaneous regression in which life satisfaction was the dependent variable. Depression, anxiety, and neuroticism were significantly negatively related to life satisfaction, and positive affect as measured by the PANAS-P was significantly positively related to life satisfaction both independently and uniquely when examined in the context of the other variables in the simultaneous regression. Although age, health, education, PANAS-N, picture vocabulary, and synonym vocabulary were related to life satisfaction independently, none of these relations were found to be uniquely related when examined in the context of other variables.

EFA and age invariance of the latent variable predictors

In order to examine the predictors of SWB in the context of latent variables, an exploratory factor analysis (EFA) was performed to reduce the number of predictors and to identify the latent constructs that underlie the measured variables. There is a substantial amount of research indicating that many personality and affect variables are correlated, and most cognitive abilities (in this study we examined indicators of crystallized and fluid abilities) are at least moderately correlated with one another. Consequently, maximum likelihood factoring with promax rotation, which permits the factors to be correlated with one another, was used to conduct the EFA.

To identify an appropriate structure that can be potentially replicated, it is important that the variables included in the factor analysis are reliable. As reported in Table 1, all the variables are highly reliable, with Cronbach's alphas each greater than 0.80. It is also important that the communalities (amount of variance explained by the common factors) of the variables are high since substantial distortions may occur if variables with low communalities are included in the analysis (MacCallum, Widaman, Zhang, & Hong, 1999). Accordingly, 20 variables (excluding the age, education, and sex variables because it is unlikely they would load meaningfully on to a construct) were entered into the initial EFA. Of those 20 variables, four had communalities less then 0.3; the health demographic variables of heart surgery (.14), anesthesia (.08), loss of consciousness (.08), and neurological treatment (.14) were subsequently removed from the analysis.

To determine the number of factors to retain the chi-square fit statistic, supplemented by interpretability and theoretical value of the subsequent solution, was evaluated. The final analyses with 16 input variables resulted in four factors (loadings are presented in Table 5): a crystallized ability (Gc) factor comprised of the WAIS-III vocabulary subtest, the Woodcock-Johnson picture vocabulary subtest and tests of synonym and antonym vocabulary; a Negative Affect factor consisting of the PANAS-N, PANAS-P, neuroticism, trait anxiety, and CESD questionnaire variables; a fluid ability factor (Gf) comprised of the Shipley Abstraction, Matrix Reasoning, and Letter Sets variables; and a Health factor comprised of 4 variables (health, health limits, number of medications, and blood pressure medication) from the demographic questionnaire. Each variable was assigned to the factor in which it loaded highest.

Do the predictors of life satisfaction vary across age?

The final goal of this project was to examine whether the predictors of life satisfaction remained the same across age. Specifically, are the relations among the constructs approximately equivalent across the young and older age groups? As discussed earlier, we expect the predictive utility of health to increase with age. We also expect the predictive utility of intelligence to differ by age group, but in different directions for different forms of intelligence. To examine such predictions, we examined two multi-group models according to Figure 1, with the first operationalizing intelligence in terms of acquired knowledge (Gc) and the second operationalizing intelligence in term of cognitive processing (Gf).

For both sets of analyses, the configural model served as the baseline model. Configural invariance was examined by constraining the structure of the model to be the same across the two age groups. The Gc model, as can be seen in Table 6, exhibited configural invariance because the model fit the data well (χ^2 = 817.79, *df* = 387, RMSEA = .037). Two additional types of invariance were examined in this model. In the metric invariance analyses, the lower-order factor loadings (i.e., the loadings from each of the latent constructs to the manifest variables) were constrained to be equal across the two groups. Structural invariance refers to the tests concerning the relations among the latent constructs (Byrne, Shavelson, & Muthén, 1989), and in the structural invariance analyses the high-order regression coefficients (from the three higher-order constructs to the life satisfaction construct) were constrained to be the same across age, in addition to the lower-order factor loadings. Inspection of Table 6 indicates the Gc model has both metric invariance and structural invariance since the models do not fit significantly worse than the configural model (as determined by change in chi-square per change in degree of freedom). The standardized structural relations across the entire sample to the life satisfaction construct were −0.69 from the negative affect construct, −0.05 from the health construct, and .02 from the Gc construct. Negative affect was the only significant predictor of life satisfaction at the $p < 0.01$ level.

These same analyses were conducted with the Gf model. As with the Gc model, the baseline configural model fit the data well (see Table 8; χ^2 = 668.65, *df* = 339, RMSEA = 0.035) and the metric invariance model did not fit significantly worse than the configural model. The finding of metric invariance indicates that the unstandardized lower-order factor loadings are approximately equivalent in magnitude across the three groups. However, inspection of the last row in Table 7 shows that the structural invariance model fits significantly worse than the configural model, indicating that the magnitude of the higher-order (construct to construct) loadings may be changing across the groups. Consistent with our prediction, fluid ability was a significant predictor of life satisfaction in the younger and middle-aged groups, but not in the older group. The standardized structural relations from the Gf construct to the life satisfaction construct was 0.29 ($p < 0.01$) for the younger group, 0.13 ($p = 0.01$) for the middle-aged group, and −0.10 (n.s.), for the older group. *t*-tests using the unstandardized coefficients and standard errors indicated that the difference in the magnitude of the loadings was not significant between the younger and middle-aged group, ($t(1, 508) = 1.78$, n.s.), but the difference was significant between the younger and older groups ($t(1, 486) = 4.83$, $p < .01$), and the middle-aged and older group ($t(1, 596) = 4.22$, $p < .01$). As expected, negative affect was a significant predictor of life satisfaction across the three groups. We had also predicted that Gc and health would be more strongly associated with life satisfaction in the older group but these findings were not substantiated.

Discussion

There were two goals of this project. The first goal of the project was to examine the magnitude of the relations to life satisfaction and, specifically, to investigate which variables had unique relations to the SWLS. The second goal of the project was to determine whether these relations varied as a function of age. This latter goal was motivated by the value-as-a-moderator model (Oishi et al., 1999), which predicts that as individuals age, their changing values result in changing determinants of their subjective well being.

Before pursuing the above goals, it was necessary to examine whether the construct of life satisfaction had the same meaning across the adult lifespan. We therefore examined whether the scale was invariant across the three age groups. Results from latent variable analyses support the assumption that life satisfaction variables, as measured by the SWLS, represent the same construct, to the same degree across the age groups spanning the adulthood. The one-factor life satisfaction model demonstrated both configural and metric invariance, providing evidence that comparisons made across groups are appropriate.

To investigate the predictors of life satisfaction, multiple variables spanning personality, affect, ability, and health were considered both independently and simultaneously as predictors of life satisfaction. Consistent with top-down theories of SWB, and as would be expected from prior research, positive affect, trait anxiety, depression, and neuroticism were found to have unique utility in predicting life satisfaction. Although PANAS-N was significantly correlated with SWLS score ($r = -0.33$), it did not make a unique contribution in predicting life satisfaction after considering the influences of the other predictors. As expected from research which suggests that demographic variables account for a small portion of the variance associated with life satisfaction, the demographic variables of age, sex, and education were not unique predictors of life satisfaction.

The final set of analyses was performed to determine whether the predictors of life satisfaction were invariant across the three age groups. Twenty of the variables were subjected to an EFA to determine the structure of correlations among the variables. Sixteen of the variables loaded on to four latent factors including a crystallized intelligence factor, a Negative Affect factor, a fluid intelligence factor, and a Health factor.

Two three-factor models were subsequently examined, one with intelligence defined in terms of cognitive processing, and the other with intelligence defined in terms of acquired knowledge. In both models, the negative affect construct was a significant predictor of life satisfaction. This finding is consistent with the results from the simultaneous regression in which nearly all the variables comprising the Negative Affect construct had unique relations to life satisfaction (i.e., PANAS-P, Neuroticism, Depression, and Trait anxiety) and although PANAS-N did not have a unique utility in predicting life satisfaction in the simultaneous regression, it had a significant zero-order correlation with life satisfaction. Further, these results are consistent with numerous other studies reporting that positive and negative affect (e.g., Diener et al., 1999), as well as depression and anxiety, are related to life satisfaction (e.g., Arrindell et al., 1991; Blais, Vallerand, Pelletier, & Briére, 1989; Hyer et al., 1987; Pilcher, 1998) and act as top-down influences.

Health was not a significant predictor of life satisfaction in the simultaneous regression or in either of the structural equation models. This was somewhat unexpected since we had hypothesized, based on the value-as-a-moderator model (Oishi et al., 1999), that there would be a robust relationship between health and life satisfaction and that this relation would increase as a function of age. However, Isaacowitz and Smith (2003) reported that in a hierarchical regression predicting SWB (using positive affect and negative affect variables as measures of SWB) the effect of health was eliminated by the inclusion of personality variables. This would suggest that health is not a unique predictor of SWB and as mentioned, none of the health variables were uniquely related to life satisfaction in our simultaneous regression. In addition, the self-reported health rating by participants in this project was quite high ($M = 2.1$, $SD = 0.81$), with 72% of the participants reporting that they were in ‘excellent’ or ‘good’ health. This implies that there may not be enough variability in health ratings to detect a relationship with the SWLS.

The invariance analyses of the predictors across the age groups indicated that the Gc model exhibited both configural and metric invariance, which suggests that the structure of the model and the relations of the observed variables to the latent variables were the same across groups. This is an important finding because it suggests that the constructs of interest are representing the same construct across the different age groups and meaningful quantitative comparisons may be made. This model also demonstrated structural invariance. That is, the relations of the predictor constructs to the life satisfaction construct were the same across the age groups. We had hypothesized that as a measure of intelligence, the Gc construct would be significantly related to life satisfaction in the older group, but not the younger groups since increased knowledge is often associated with older age (e.g., Clayton & Birren, 1980; Sternberg, 1985). However, our results indicate that Gc was not a significant predictor for any of the groups. Nevertheless, two measures of crystallized intelligence, picture vocabulary and synonym vocabulary, were significantly correlated with life satisfaction independently. The positive correlation suggests that increased life satisfaction is related to an increase in knowledge. However, when considered in the context of the other variables, these measures were no longer significantly related to life satisfaction.

Invariance analyses of the Gf model also indicated both configural and metric invariance. However, the Gf model lacked structural invariance suggesting that the relations of the predictor variables to the life satisfaction factor were different across the age groups. The specific loadings across the three groups, from the predictor constructs to the life satisfaction construct, were examined to determine which predictor(s) had differential relations across age. As would be expected, the negative affect and health construct demonstrated the same pattern in the Gf model as in the Gc model. Namely, negative affect was a significant predictor of life satisfaction across the three groups and health was not a significant predictor of life satisfaction in any of the age groups. Consistent with our predictions in the context of the value-as-a-moderator model (Oishi et al., 1999), fluid ability was a significant predictor of life satisfaction in younger adults and middle-aged adults, but was not a significant predictor for the older adults. We attribute this result to differences in lifestyle between younger and older adults. Older adults are less likely to be in the workforce whereas younger adults are still in the workforce and attempting to attain career goals. For that reason, it is likely that Gf has a greater importance, and therefore greater value, for younger adults who are in the process of striving for success.

Although our results may be compelling because of the large sample (N = 798) that ranges across the adult lifespan, the sample is comprised of high-functioning adults who are in good health and who are highly educated (M = 15.67 years of education, SD = 2.88). An important next step is to replicate these findings in a more diverse sample. Further, although we used the value-as-a-moderator model as a framework for generating our hypotheses, we did not directly assess participants' rating of values for the predictors of interest (health, negative affect, Gc, and Gf). Therefore the findings in this study only indirectly support the value-as-a-moderator model and our conclusions regarding the model are suggestive, but not conclusive, and in need of further investigation.

Conclusion

Collectively, these findings suggest Negative Affect, as represented by Neuroticism, Trait Anxiety, Depression, PANAS-N, and PANAS-P variables, has a robust negative relationship with life satisfaction across the lifespan. This is consistent with top-down theories of SWB which emphasize the propensity to view life experiences as being either positively or negatively driven by personality characteristics that remain fairly stable across the adult lifespan. Further, the construct of fluid ability is positively related to life satisfaction in a group of younger and middle-aged adults but not in a group of older adults, suggesting that cognitive functioning plays a larger role in life satisfaction earlier in adulthood. Health and crystallized intelligence were not significant predictors of life satisfaction for any age group. In sum, the present research demonstrates that the degree to which health and affect are associated with life satisfaction is invariant across age, whereas the degree to which fluid intelligence, another important individual difference variable, is associated with life satisfaction varies across age. The search for age-specific as well as age-invariant predictors of life satisfaction is an important research agenda for the aging society.

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References

Arrindell WA, Heesink J, Feij JA. The satisfaction with life scale (SWLS): Appraisal with 1700 healthy young adults in The Netherlands. Personality and Individual Differences 1999;26:815–826.

Arrindell WA, Meeuwesen L, Huyse FJ. The Satisfaction With Life Scale (SWLS): Psychometric properties in a non-psychiatric medical outpatients sample. Personality and Individual Differences 1991;12:117–123.

Baltes, PB.; Baltes, MM. Psychological perspectives on successful aging: The model of selective optimization with compensation. In: Baltes, PB.; Baltes, MM., editors. Successful aging: Perspectives from the behavioral sciences. New York: Cambridge University Press; 1990. p. 1-34.

Blais MR, Vallerand RJ, Pelletier G, Briére NM. L'Échelle de satisfaction de vie: Validation canadienne-française du ‘Satisfaction With Life Scale’ [French-Canadian validation of the Satisfaction With Life Scale]. Canadian Journal of Behavioural Science 1989;21:210–233.

Browne, MW.; Cudeck, R. Alternative ways of assessing model fit. In: Bollen, KA.; Long, JS., editors. Testing structural equation models. Newbury Park, CA: Sage; 1993. p. 445-455.

Byrne BM, Shavelson RJ, Muthén B. Testing for the equivalence of factor covariance and mean structures: The issue of partial measurement invariance. Psychological Bulletin 1989;105:456–466.

Carstensen LL. Selectivity theory: Social activity in life-span context. Annual Review of Gerontology and Geriatrics 1991;11:195–217.

Carstensen LL. Evidence for a life-span theory of socioemotional selectivity. Current Directions in Psychological Science 1995;4:151–156.

Charles ST, Reynolds CA, Gatz M. Age-related differences and changes in positive and negative affect over 23 years. Journal of Personality and Social Psychology 2001;80:136–151. [PubMed: 11195886]

Clayton, VP.; Birren, JE. The development of wisdom across the lifespan: A reexamination of an ancient topic. In: Baltes, PB.; Brim, OG., Jr, editors. Life-span development and behavior. Vol. 3. New York: Academic Press; 1980. p. 103-135.

Diener E, Emmons RA, Larsen RJ, Griffin S. The satisfaction with life scale. Journal of Personality Assessment 1985;49:71–75. [PubMed: 16367493]

Diener, E.; Suh, EM. Subjective well-being and age: An international analysis. In: Schaie, KW.; Lawton, MP., editors. Annual review of gerontology and geriatrics: Focus on emotion and adult development. New York: Springer; 1998. p. 304-324.

Diener E, Suh EM, Lucas RE, Smith HE. Subjective well-being: Three decades of progress. Psychological Bulletin 1999;125:276–302.

Ekstrom, RB.; French, JW.; Harman, HH.; Dermen, D. Manual for kit of factor-referenced cognitive tests. Princeton, NJ: Educational Testing Services; 1976.

Folstein MF, Folstein SE, McHugh PR. Mini-mental state: A practical method for grading the cognitive state of patients for the clinician. Journal of Psychiatric Research 1975;12:189–198. [PubMed: 1202204]

George LK, Landerman R. Health and subjective well-being: A replicated secondary data analysis. International Journal of Aging and Human Development 1984;19:133–156. [PubMed: 6519818]

Goldberg, LR. A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In: Mervielde, I.; Deary, I.; De Fruyt, F.; Ostendorf, F., editors. Personality Psychology in Europe. Vol. 7. Tilburg University Press; The Netherlands: 1999. p. 7-28.

Gottfredson, LS. Highly general and highly practical. In: Sternberg, RJ.; Grigorenko, EL., editors. The general factor of intelligence: How general is it?. Mahwah, NJ: Erlbaum; 2002. p. 331-380.

Gottfredson LS, Deary IJ. Intelligence predicts health and longevity, but why? Current Directions in Psychological Science 2004;13:1–4.

Headey B, Wearing A. Personality, life events, and subjective well-being: Toward a dynamic equilibrium model. Journal of Personality and Social Psychology 1989;57:731–739.

Herzog AR, Rodgers WL. The structure of subjective well-being in different age groups. Journal of Gerontology 1981;36:472–479. [PubMed: 7252081]

Horley J, Lavery JJ. Subjective well-being and age. Social Indicators Research 1995;34:275–282.

Horn JL, McArdle JJ. A practical and theoretical guide to measurement invariance in aging research. Experimental Aging Research 1992;18:117–144. [PubMed: 1459160]

Horn JL, McArdle JJ, Mason R. When is invariance not invariant: A practical scientist's look at the ethereal concept of factor invariance. The Southern Psychologist 1983;1:179–188.

Hu LT, Bentler PM. Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. Psychological Methods 1998;3:424–453.

Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal 1999;6:1–55.

Hunter JE, Schmidt FL. Intelligence and job performance: Economic and social implications. Psychology, Public Policy, and Law 1996;2:447–472.

Hyer L, Gouveia I, Harrison WR, Warsaw J, Coutsouridis D. Depression, anxiety, paranoid reactions, hypochrondriasis, and cognitive decline in later-life inpatients. Journal of Gerontology 1987;42:92–94. [PubMed: 3794207]

Isaacowitz DM, Smith J. Positive and negative affect in very old age. The Journals of Gerontology: Psychological Sciences 2003;58B:143–152.

Kunzmann U, Little TD, Smith J. Is age-related stability of subjective well-being a paradox? Cross-sectional and longitudinal evidence from the Berlin Aging Study. Psychology and Aging 2000;15:511–526. [PubMed: 11014714]

Lawton MP, Kleban MH, Rajagopal D, Dean J. Dimensions of affective experience in three age groups. Psychology and Aging 1992;7:171–184. [PubMed: 1610505]

Lykken, D. Happiness: What studies on twins show us about nature, nurture, and the happiness set point. New York: Golden Books; 1999.

MacCallum RC, Widaman KF, Zhang S, Hong S. Sample size in factor analysis. Psychological Methods 1999;4:84–89.

Mroczek DK, Kolarz CM. The effect of age on positive and negative affect: A developmental perspective on happiness. Journal of Personality and Social Psychology 1998;75:1333–1349. [PubMed: 9866191]

Oishi S. The concept of life satisfaction across cultures: An IRT analysis. Journal of Research in Personality 2006;41:411–423.

Oishi S, Diener E, Suh E, Lucas RE. Value as a moderator in subjective well-being. Journal of Personality 1999;67:157–184.

Okun MA, Stock WA, Haring MJ, Witter RA. Health and subjective well-being: a meta-analysis. International Journal of Aging and Human Development 1984;19:111–132. [PubMed: 6519817]

Pilcher JJ. Affective and daily event predictors of life satisfaction in college students. Social Indicators Research 1998;43:291–306.

Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. Applied Psychological Measurement 1977;1:385–401.

Raven, J. Advanced Progressive Matrices Set II. London: Lewis; 1962.

Rowe JW, Kahn RL. Successful aging. The Gerontologist 1997;37:433–440. [PubMed: 9279031]

Rowe, JW.; Kahn, RL. Successful aging: The MacArthur Foundation Study. New York: Pantheon Book; 1998.

Ryff CD. Happiness is everything, or is it? Explorations on the meaning of psychological well-being. Journal of Personality and Social Psychology 1989;57:1069–1081.

Salthouse TA. Speed and knowledge as determinants of adult age differences in verbal tasks. Journal of Gerontology: Psychological Science 1993;48:29–36.

Salthouse TA. What and when of cognitive aging. Current Directions in Psychological Science 2004;13:140–144.

Salthouse TA. Relations between cognitive abilities and measures of executive functioning. Neuropsychology 2005;19:532–545. [PubMed: 16060828]

Salthouse TA, Atkinson TM, Berish DE. Executive functioning as a potential mediator of age-related cognitive decline in normal adults. Journal of Experimental Psychology: General 2003;132:566–594. [PubMed: 14640849]

Schimmack U, Oishi S, Furr RM, Funder DC. Personality and life satisfaction: A facet-level analysis. Personality and Social Psychology Bulletin 2004;30:1062–1075. [PubMed: 15257789]

Shipley WC. A self-administering scale for measuring intellectual impairment and deterioration. Journal of Psychology 1940;9:371–377.

Spielberger, CD.; Gorsuch, RL.; Lushene, R.; Vagg, PR.; Jacobs, GA. Manual for the State-Trait Anxiety Inventory Form Y. Palo Alto, CA: Consulting Psychologists Press; 1983.

Sternberg RJ. Implicit theories of intelligence, creativity and wisdom. Journal of Personality and Social Psychology 1985;49:607–627.

Steverink N, Lindenberg S. Which social needs are important for subjective well-being? What happens to them with aging? Psychology and Aging 2006;21:281–290. [PubMed: 16768575]

Tellegen, A. Structures of mood and personality and their relevance to assessing anxiety, with an emphasis on self-report. In: Tuma, AH.; Maser, J., editors. Anxiety and the anxiety disorders. Hillsdale, NJ: Erlbaum; 1985.

Vautier S, Mullet E, Jmel S. Assessing the structural robustness of self-rated satisfaction with life: a SEM analysis. Social Indicators Research 2004;68:235–249.

Watson D, Clark LA, Tellegen A. Development and validation of brief measures of Positive and Negative Affect: The PANAS scales. Journal of Personality and Social Psychology 1988;54:1063–1070. [PubMed: 3397865]

Wechsler, D. Wechsler Adult Intelligence Scale. Vol. 3rd. San Antonio: Psychological Corporation; 1997.

Woodcock, RW.; Johnson, MB. Woodcock-Johnson Psycho-Educational Battery-Revised. Allen, TX: DLM; 1990.

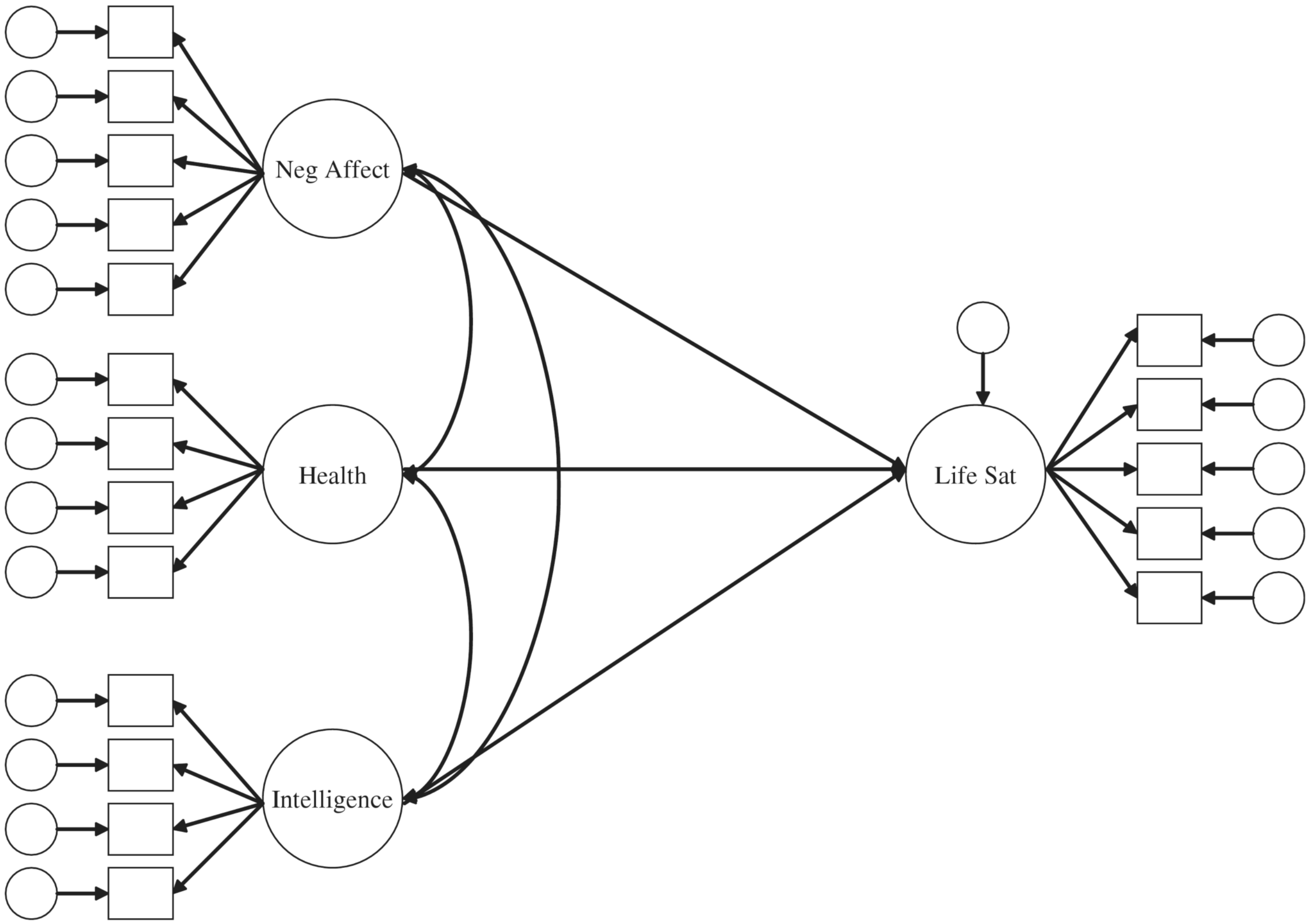

Figure 1.
Structural model with three factors predicting life satisfaction.

Table 1

Sample characteristics.

	Age				
	18–39	**40–59**	**60–94**	**Age *r***	**Reliability**
Number	200	310	288	NA	
Age	26.18 (6.37)	50.37 (5.48)	72.04 (7.66)	NA	
% female	58.0	72.6	60.4	−0.01	
Years of education	14.92 (2.22)	15.60 (2.83)	16.26 (3.21)	0.19*	
Self-rated health	1.86 (.76)	2.08 (.85)	2.14 (.79)	0.17*	
Health limits	1.18 (.55)	1.51 (.80)	1.74 (.86)	0.32*	
Questionnaires					
SWLS	23.46 (6.86)	22.37 (7.29)	26.04 (5.94)	0.12*	0.90
Neuroticism	28.80 (5.42)	27.43 (5.69)	25.81 (5.39)	−0.18*	0.88
Depression	14.30 (8.76)	11.47 (8.77)	8.70 (7.57)	−0.22*	0.90
Anxiety	40.25 (10.11)	36.39 (9.67)	31.90 (9.10)	−0.06	0.93
PANAS-P	27.79 (7.07)	29.45 (7.53)	31.91 (7.29)	0.19*	0.88
PANAS-N	14.27 (5.32)	13.45 (5.50)	12.10 (4.10)	−0.17*	0.88

* $p < 0.01$; the mean of each variable is reported and the standard deviation is reported in parenthesis. Age *r* is the correlation of each measure with age.

Table 2

Goodness of fit-indices for age invariance models of the life satisfaction construct.

	Goodness-of-fit indices								
Model	X^2	*df*	X^2/df	**CFI**	**RMSEA**	**90% CI**	ΔX^2	Δdf	$p < .01$
Metric invariance	94.16	25	3.77	0.97	0.06	.05–.07	Baseline model		
Ideal free	93.96	23	4.09	0.97	0.06	.05–.08	0.20	2	no
Condition free	89.99	23	3.91	0.97	0.06	.05–.07	4.17	2	no
Satisfaction free	90.73	23	3.94	0.97	0.06	.05–.07	3.43	2	no
Important free	93.14	23	4.05	0.97	0.06	.05–.08	1.02	2	no
Change free	91.35	23	3.97	0.97	0.06	.05–.08	2.81	2	no
Configural invariance	72.83	15	4.86	0.98	0.07	.05–.09	21.33	10	no

Note: CFI = Comparative Fit Index; RMSEA = root-mean-square error of approximation; CI = Confidence Intervals.

Table 3

Standardized factor loadings for the SWLS model across the entire sample.

Variable	Standardized coefficient
Ideal	0.86*
Condition	0.86*
Satisfied	0.89*
Important	0.78*
Change	0.64*

* $p < 0.01$.

Table 4

Predictors of life satisfaction.

Variable	Zero order correlation	Standardized regression coefficient
Age	0.12*	−0.04
Sex (M = 0)	−0.05	−0.07
Education	0.13*	0.05
Health	−.18*	0.01
Health limits	−0.06	0.00
Heart surgery	0.02	−0.04
Anesthesia	0.05	0.02
Blood pressure meds	0.03	0.00
Loss of consciousness	0.00	−0.01
Neurological treatment	−0.01	−0.04
Number of medications	0.04	0.04
Neuroticism	−0.28*	0.11*
Depression	−0.59*	−0.32*
Anxiety	−0.60*	−0.42*
PANAS-P	0.26*	0.09*
PANAS-N	−0.34*	0.03
Vocabulary	0.09	0.03
Picture vocabulary	0.11*	−0.06
Synonym vocabulary	0.08*	0.03
Antonym vocabulary	0.11	−0.05
Shipley Abstraction	0.06	0.04
Matrix Reasoning	0.00	0.01
Letter Sets	0.06	0.05

* $p < 0.01$.

Table 5

Pattern matrix from the EFA.

Item	F1 (Gc)	F2 (Negative affect)	F3 (Gf)	F4 (Health)
Vocabulary	**0.80**	0.02	0.10	−0.02
Picture vocabulary	**0.70**	−0.05	−0.01	0.08
Antonym	**0.84**	0.00	−0.04	−0.02
Synonym	**0.82**	0.01	−0.02	0.02
CESD	0.02	**0.86**	−0.06	0.00
Trait anxiety	0.02	**0.92**	0.00	−0.03
Neuroticism	−0.05	**0.60**	0.08	0.11
PANAS-P	−0.22	**−0.38**	−0.07	0.08
PANAS-N	−0.24	**0.50**	0.01	0.03
Shipley Abstraction	−0.02	0.00	**0.90**	0.05
Matrix Reasoning	−0.03	0.07	**0.74**	−0.12
Letter Sets	0.09	−0.03	**0.68**	0.00
Health	0.04	0.25	−0.05	**0.44**
Health limits	0.05	0.05	−0.11	0.46
Blood pressure medication	−0.03	−0.06	−0.04	**0.61**
Number of medications	0.01	−0.07	0.11	**0.78**
Eigenvalue	4.031	2.953	2.236	0.969
Percent variance explained	22.52	16.16	10.43	4.04
Cumulative percent variance explained	22.52	38.68	49.11	53.15

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Table 6

Goodness of fit indices for the Gc age invariance models.

	Goodness-of-fit indices							
Model	X^2	*df*	X^2/df	**CFI**	**RMSEA**	ΔX^2	Δdf	$p < .01$
Configural	817.79	387	2.11	0.93	0.037		Baseline	
Metric	850.62	415	2.05	0.93	0.036	38.83	28	no
Structural	863.60	421	2.05	0.93	0.036	45.80	34	no

Note: CFI = Comparative Fit Index; TLI = Tucker Lewis Index; RMSEA = root-mean-square error of approximation.

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Table 7

Goodness of fit indices for the Gf age invariance models.

	Goodness-of-fit indices							
Model	X^2	*df*	X^2/df	**CFI**	**RMSEA**	ΔX^2	Δ *df*	$p < .01$
Configural	668.65	339	1.97	0.94	0.035	Baseline		
Metric	704.75	365	1.93	0.94	0.034	36.10	26	no
Structural	727.67	371	1.96	0.94	0.035	59.02	32	yes

Note: CFI = Comparative Fit Index; TLI = Tucker Lewis Index; RMSEA = root-mean-square error of approximation.