Article

Leisure-Time Physical Activity, Subjective Age, and Self-Rated Memory in Middle-Aged and Older Adults

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Abstract

Memory concerns are common in middle-aged and older adults. This study investigated the relation of leisure-time physical activity to self-rated memory and the possible mediating role of subjective age in this relationship in middle-aged and older adults. Cross-sectional analyses were conducted with a sample of 1,608 middle-aged and older adults from the second wave of the National Survey of Midlife Development in the United States (MIDUS2). In a path analysis conducted with Mplus, a higher level of leisure-time physical activity was associated with a more positive appraisal of memory compared to others of one's age; younger subjective age partially mediated this relationship. Neither gender nor age-group moderated the association. Age, race, education, marital status, health status, and negative affect were controlled for in the analyses. These findings suggest a possible role of physical activity in countering the effects of age stereotypes on perceived memory.

Keywords

leisure-time physical activity, subjective age, self-rated memory, aging, midlife

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Memory concerns are common in middle-aged and older adults (Lachman, 2004). Regular leisure-time physical activity may offer a protective advantage against this concern. Leisure-time physical activity is defined as engaging in moderate or vigorous physical activity during leisure or free time (Cotter & Lachman, 2010; Physical Activity Guidelines Advisory Committee, 2008). It has been well documented that leisure-time physical activity carries significant health benefits (Moore et al., 2012; Tessier et al., 2007). There has been increasing interest in the importance of physical activity in enhancing cognitive functioning (Bamidis et al., 2014). However, less research has been conducted on perceived memory than on cognitive performance (Rickenbach, Agrigoroaei, & Lachman, 2015), and there has been little research on physical activity and self-appraised memory. This study examined: (a) the association of leisure-time physical activity with more positive appraisals of one's memory in a large U. S. sample of middle-aged and older adults and (b) the role of feeling younger than one's age in partially mediating this relationship.

As individuals age, they commonly expect that they will perform less well on memory tasks (Levy, Zonderman, Slade, & Ferucci, 2012). Approximately one fifth of middle-aged adults and up to one third of older adults report memory complaints (Chen et al., 2014; Minett, Da Silva, Ortiz, & Bertolucci, 2008; Montejo, Montenegro, Fernández, & Maestú, 2011; Schofield et al., 1997). A key facet of this process involves self-rated memory. Self-rated memory has been variously measured as the appraisal of one's own memory compared with others (e.g., the National Survey of Midlife Development in the United States; Ryff et al., 2007) and as a scaled rating from poor to excellent (e.g., the Health and Retirement Study; Heerings & Conner, 1995; Juster & Suzman, 1995; see Rickenbach et al., 2015). Self-rated memory has also been included with other items to measure memory complaints (Lee, 2014b, 2016). Some evidence indicates that self-rated memory shows a modest relationship to memory performance (Rickenbach et al., 2015), though not all findings are consistent (Minett, Dean, Firbank, English, & O'Brien, 2005). Poor self-rated memory may also be a precursor to cognitive impairment and dementia (Jessen et al., 2010, 2014; Reid & MacLullich, 2006).

A substantial body of literature underscores the role of physical activity in quality of life (Acree et al., 2006; Bize, Johnson, & Plotnikoff, 2007; Gill et al., 2013; Ku, McKenna, & Fox, 2007). Most of the research in this area focuses on physical health. Compared to individuals who are physically inactive, those who engage in regular physical activity have lower rates of cardiovascular disease and Type 2 diabetes (Lee et al., 2012). Individuals who engage in regular moderate and vigorous physical activity report better self-rated physical health (Cotter & Lachman, 2010). In addition, adults who perform leisure-time physical activity three times a week report better self-rated health (Li, Lai, Tseng, Lin, & Chang, 2010). However, there is increasing interest in the possible role of physical activity in minimizing cognitive decline during aging (Agrigoraei & Lachman, 2011).

For example, evidence indicates that physical activity is associated with a reduction in age-related declines in general cognitive functioning (Bamidis et al., 2014; Bherer, Erickson, & Liu-Ambrose, 2013) and specifically in memory and executive function among older adults (Hindin & Zelinski, 2012). Despite growing interest in the role of physical activity in minimizing cognitive decline during aging, the role of physical activity in self-rated memory has been neglected (Rickenbach et al., 2015). However, two studies found that less leisure-time physical activity is associated with greater perceived memory complaints (Lee, 2014b; Lee, Hsiao, & Wang, 2013).

Younger "subjective age" (i.e., feeling younger than one's chronological age) is associated with more favorable cognitive outcomes in midlife and aging. In a longitudinal study that followed over 5,000 adults aged 50 and older, younger subjective age at baseline was related to better immediate and delayed recall at a 4-year follow-up (Stephan, Sutin, Caudroit, & Terracciano, 2016). In another longitudinal study that followed over 1,300 adults aged 50 to 75 years, younger subjective age at baseline prospectively predicted better episodic memory and executive function at a 10-year follow-up (Stephan, Caudroit, Jaconelli, & Terracciana, 2014). In terms of self-appraisals, there is cross-sectional evidence among older adults that younger subjective age is positively associated with perceived self-efficacy on memory tasks (Stephan, Caudroit, & Chalabaev, 2011).

Understanding the linkages among physical activity, subjective age, and self-rated memory is especially relevant to middle-aged and older adults. Although the benefits of participating in regular physical activity are well established (Middleton, Barnes, Lui, & Yaffe, 2010; Motl, McAuley, Snook, & Gliottoni, 2009), middle-aged and older women tend to engage in less regular physical activity compared to men (Centers for Diseases Control and Prevention, 2014). Women may also be particularly susceptible to age stereotypes because of differential emphasis on physical aging among women (Chrisler, Barney, & Palatino, 2016; McConatha, Rieser-Danner, & McConatha, 2004; Schafer & Shippee, 2009). In addition, gender role socialization may predispose women to lower confidence and efficacy on cognitive tasks, including memory (West, Welch, & Knabb, 2002). For both women and men, successful aging requires an ability to assimilate aging-related challenges to physical and cognitive functioning into positive beliefs about one's self (Sneed & Whitbourne, 2005). An ability to maintain a physically active lifestyle may contribute to this process. However, the mediational role of subjective age in the link between physical activity and self-rated memory has been unexplored across gender.

This Study

Extending previous research on physical activity and cognitive processes (Agrigoroaei & Lachman, 2011) and previous research on subjective age and

self-appraised aspects of memory (Stephan et al., 2011), the purpose of this study was to broaden understanding of cognitive pathways through which leisure-time physical activity may be beneficial for middle-aged and older adults. Specifically, we investigate: (a) the relation of leisure-time physical activity to self-rated memory in middle-aged and older adults and (b) the possible mediating role of subjective age in this relationship. Because evidence shows gender effects on attitudes concerning cognitive ability (Schafer & Shippee, 2009), the study further investigated whether gender is a possible moderator of these relationships. Moreover, applying evidence that increasing age is associated with both expectations of memory decrements (Levy et al., 2012) and declining physical activity in middle-aged and older adults (Centers for Diseases Control and Prevention, 2014; Troiano et al., 2008), the study also explored the possible moderating role of middle versus older age on the proposed relationships. We addressed these questions among middle-aged and older adults aged 40 to 75 years with data drawn from the second wave of the National Survey of Midlife Development in the United States (MIDUS2; Ryff et al., 2007). Analyses controlled for sociodemographic factors, negative affect, and health status.

Methods

Participants

This study was a secondary analysis of data from the second wave of the National Survey of Midlife Development in the United States (MIDUS2). Participants were 1,608 middle-aged and older adults in the MIDUS2 sample who were 40 to 75 years of age and provided sufficient data for the present analyses. MIDUS2 was conducted in 2004–2006 and was funded by the National Institute on Aging. The MIDUS2 study was based on a nationally representative English-speaking sample of adults. The data were obtained from a phone interview and self-administered questionnaires (Ryff et al., 2007). The data were accessed through a publicly available de-identified dataset and did not require institutional review board approvals.

Measures

Leisure-time physical activity. Leisure-time physical activity was measured by four items indexing moderate and vigorous activity. Participants were asked to indicate how often they engaged in both moderate (e.g., brisk walking, slow swimming, or low impact aerobics) and vigorous (e.g., running, vigorous swimming, or high intensity aerobics) physical activity during their leisure or free time in the summer and winter. The items were reverse-scored and coded as 1 = *never*, 2 = *less than once a month*, 3 = *once a month*, 4 = *several times a month*, 5 = *once*

a week, and 6 = *several times a week*. To obtain a continuous measure of leisure-time physical activity, scores were summed and averaged for the four items measuring moderate and vigorous activity in both summer and winter (see Holahan et al., 2011 and Lee, 2014a and, for a similar measure, Cotter & Lachman, 2010).

Subjective age. Participants were asked to report their felt age in the question, "Many people feel older or younger than they actually are. What age do you feel most of the time?" Subjective age was assessed by subtracting each participant's felt age from his or her chronological age and dividing the difference by his or her chronological age (Rubin & Bernstsen, 2006). Positive scores indicate a younger subjective age and negative scores indicate an older subjective age.

Self-rated memory. Following Rickenbach et al. (2015), self-rated memory was measured by an item asking participants to rate their memory compared with other people and their age on a 5-point scale. The item was reverse-scored and coded as 1 = *poor*, 2 = *fair*, 3 = *average*, 4 = *good*, and 5 = *excellent*.

Sociodemographic factors. Age of the participants was measured as a continuous variable. For the moderation analyses, gender was defined as men and women and age-group was defined as middle-aged (age 40 to 60 years) and older (age 61 to 75 years). Race was coded as Black and other racial background as one category, with White as the reference category. Education was coded into two levels: high school graduate or less and at least some college, with high school graduate or less as the reference category. Marital status was coded as married and unmarried, with unmarried as the reference category.

Negative affect. Participants were asked how much of the time they experienced six negative feelings during the past 30 days. Separate items indexed: so sad nothing could cheer you up, nervous, restless or fidgety, hopeless, everything was an effort, and worthless. The items were reverse-scored and coded as 1 = *none of the time*, 2 = *a little of the time*, 3 = *some of the time*, 4 = *most of the time*, and 5 = *all of the time*. A total score was computed by adding the six items; scores could range from 6 to 30, with lower scores indicating fewer negative feelings (Cronbach's $\alpha = .87$; Mroczek & Kolarz, 1998).

Health status. Health status was assessed by seven chronic conditions. Participants were asked, "In the past twelve months, have you experienced or been treated for any of the following: diabetes or high blood sugar; stroke; lupus or other autoimmune disorders; AIDS or HIV infection; multiple sclerosis, epilepsy or other neurological disorder." In addition, participants were asked if they had ever had heart trouble suspected or confirmed by a doctor or if they had ever had cancer . Each experienced condition was assigned a score

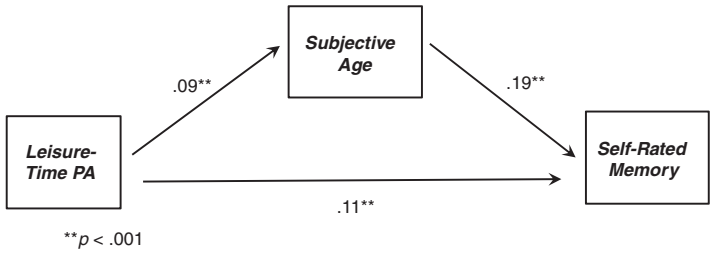

Figure 1. Integrative mediational model for the full sample, controlling for sociodemographic factors, negative affect, and health status. Standardized betas are included for each path (indirect effect = .02, $p < .01$).

of 1. A total score was computed by summing the experienced conditions, with a possible score range of 0 to 7 (Agrigoroaei & Lachman, 2011).

Data Analysis

Analyses were conducted using Mplus 7.4 (1998–2015). The model tested the path from leisure-time physical activity to self-rated memory, operating through subjective age. Specifically, the model examined the: (a) direct path from leisure-time physical activity to self-rated memory, (b) direct path from leisure-time physical activity to subjective age, (c) direct path from subjective age to self-rated memory, and (d) indirect effect from leisure-time physical activity to self-rated memory through subjective age (see Figure 1). To test the potential moderating roles of gender and age-group, the aforementioned model was reexamined in two separate two-group models. We controlled for traditional sociodemographic factors (age, race, education, and marital status) in the analyses. In addition, we controlled for negative affect and health status, both of which were significantly ($p < .01$) negatively correlated with self-rated memory ($r = -.34$ for negative affect and $r = -.17$ for health status).

Results

Sample Characteristics

The sample consisted of 844 women and 764 men. The average age of the sample was 56.57 years (standard deviation (SD) = 9.60). The sample comprised 1,475 Whites and 133 individuals reporting Black or other racial backgrounds. The majority of participants (1,115; 69.3%) were married and a majority (1,096; 68.2%) had at least some college education. Means and SDs for the study variables are shown for the total sample and separately for men and women in Table 1.

Table 1. Descriptive Data for the Total Sample and Separately for Men and Women.

		Men ($n = 764$)		Women ($n = 844$)	
	Total sample ($N = 1,608$)	Middle-aged ($n = 497$)	Older ($n = 267$)	Middle-aged ($n = 528$)	Older ($n = 316$)
Age in years, *M* (*SD*)	56.57 (9.60)	50.97 (5.84)	67.33 (4.23)	50.19 (6.04)	66.96 (4.05)
Race					
White (%)	91.7	93.0	93.6	89.6	91.8
Black and other (%)	8.3	7.0	6.4	10.4	8.2
Education					
Above high school (%)	68.2	73.4	68.9	67.4	60.4
Marital status					
Married (%)	69.3	75.3	83.5	65.0	55.4
Negative affect, *M* (*SD*)	9.01 (3.46)	8.99 (3.21)	7.99 (2.74)	9.73 (4.03)	8.69 (3.06)
Health status[a], *M* (*SD*)	.49 (.73)	.31 (.56)	.85 (.88)	.37 (.63)	.67 (.82)
Leisure-time PA, *M* (*SD*)	3.69 (1.66)	4.01 (1.57)	3.48 (1.67)	3.82 (1.64)	3.15 (1.66)
Subjective age[b,c], *M* (*SD*)	.18 (.19)	.18 (.18)	.17 (.15)	.16 (.21)	.20 (.15)
Self-rated memory[c], *M* (*SD*)	3.54 (.92)	3.59 (.88)	3.59 (.99)	3.45 (.96)	3.57 (.83)

[a]Sum of seven chronic conditions.
[b](Chronological age minus felt age)/chronological age.
[c]The subjective age and self-rated memory summary statistics are based on the non-missing samples of 1,554 and 1,596 observations, respectively.

Model Testing

Correlations among the study variables for the total sample are shown in Table 2. Results of the model test with the overall study sample are shown in Figure 1 with standardized betas for each path. The total effect of leisure-time physical activity on self-rated memory was significant ($\beta = .13$, $p < .001$). Leisure-time physical activity had a significant direct effect on self-rated memory ($\beta = .11$, $p < .001$), with individuals who participated in more leisure-time physical activity reporting better self-rated memory. In addition, leisure-time physical activity had a significant effect on subjective age ($\beta = .09$, $p < .001$) and subjective age had a significant effect on self-rated memory ($\beta = .19$, $p < .001$). Individuals who participated in more leisure-time physical activity felt younger and, in turn, feeling younger predicted better self-rated memory. The indirect effect of leisure-time physical

Table 2. Correlations Among Study Variables for the Total Sample ($N = 1{,}608$).

	1	2	3	4	5	6	7	8	9	10
1. Age	_									
2. Gender	−.01	_								
3. Race	−.05*	.05*	_							
4. Education	−.09**	−.08**	−.01	_						
5. Marital status	−.03	−.18**	−.11**	.000	_					
6. Negative affect	−.14**	.10**	.02	−.10**	−.08**	_				
7. Health status	.30**	−.01	.004	−.08**	−.01	.09**	_			
8. Leisure-time PA	−.19**	−.08**	−.10**	.21**	−.003	−.09**	−.14**	_		
9. Subjective age	.08**	.01	−.02	.09**	.02	−.25**	−.10**	.11**	_	
10. Self-rated memory	.04	−.05*	−.03	.18**	.02	−.34**	−.17**	.19**	.29**	_

*$p < .05$. **$p < .01$.

activity on self-rated memory through subjective age was statistically significant (effect = .02, $p < .01$).

Moderation Analyses

First, we examined the equivalence of the model across gender groups in a two-group analysis. The unconstrained model was a just-identified model. A constrained model in which each path was constrained to be equal across the two groups revealed good fit to the data, $\chi^2(3, 1608) = 1.41$, $p = .704$; CFI = 1.000; RMSEA = .970; SRMR = .004, indicating that the model did not differ significantly across men and women. Second, we conducted the moderation analysis across age-groups (i.e., middle-aged vs. older). The unconstrained model was a just-identified model. A constrained model revealed good fit to the data, $\chi^2(3, 1608) = 1.33$, $p = .721$; CFI = 1.000; RMSEA = .000; SRMR = .003, indicating that the model did not differ significantly across middle-aged and older adults.

Discussion

This study found in a large U.S. sample of middle-aged and older adults that more leisure-time physical activity was associated with a more positive appraisal of one's memory. Moreover, results showed that feeling younger than one's age partially mediated this relationship. Analyses controlled for sociodemographic factors, negative affect, and health status. A substantial literature demonstrates that physical activity is associated with healthy aging (Lee et al., 2012). The current findings contribute to an increasing interest in the role of physical activity in cognitive functioning during aging (Bamidis et al., 2014). Further, the findings highlight how, through a link to younger subjective age, physical

activity may help to counter negative stereotypes that have been shown to undermine cognitive functioning among older adults (Stephan et al., 2014, 2016).

Extending previous research on physical activity and cognitive processes (Agrigoroaei & Lachman, 2011), these findings demonstrated a relationship between leisure-time physical activity and middle-aged and older adults' appraisal that their memory was better compared to others of their age. Memory complaints are common among middle-aged and older adults (Chen et al., 2014; Lachman, 2004; Minett et al., 2008; Montejo et al., 2011; Schofield et al., 1997). Many studies have found positive relationships between physical activity and self-rated health (Li et al., 2010). Broadening research on physical activity (Bamidis et al., 2014; Bherer et al., 2013; Hindin & Zelinski, 2012) to include self-appraisals of cognitive functioning of older adults offers promise of a more positive aging experience.

In addition, building on previous research on subjective age and self-appraised aspects of memory (Stephan et al., 2011), the current findings showed that subjective age partially mediated the relationship between physical activity and self-rated memory. More leisure-time physical activity was positively associated with middle-aged and older adults feeling relatively younger than their chronological age. At the same time, the reverse association of subjective age to physical activity is also worthy of investigation. In fact, combining our results with previous research examining positive views of aging as a motivating factor in physical activity participation (Westerhof & Wurm, 2015; Wolff, Wurm, Ziegelmann, & Wurm, 2014) suggests a feedback loop whereby increased physical activity and younger subjective age reinforce one another in a reciprocal manner.

In turn, we found that the younger middle-aged and older adults felt, the more likely they were to rate their memory as better compared to others of their age. These findings reinforce previous cross-sectional evidence that younger subjective age is positively associated with perceived self-efficacy for memory tasks among older adults (Stephan et al., 2011). More broadly, these results are consistent with literature suggesting that negative stereotypes of aging may play a role in cognitive beliefs and performance among older adults (Hess, 2006; Hess, Auman, Colombe, & Rahhal, 2003; Levy, 1996; Levy et al., 2012; Schafer & Shippee, 2009).

Further, applying evidence that increasing age is associated with both expectations of memory decrements (Levy et al., 2012) and declining physical activity in middle-aged and older adults (Centers for Diseases Control and Prevention, 2014), we explored the possible moderating role of chronological age on the proposed relationships. Middle-age versus older status did not moderate the associations among leisure-time physical activity, subjective age, and self-rated memory. In addition, based on the fact that women engage in less physical activity than men (Centers for Disease Control and Prevention, 2014) and

that women may be more susceptible to age stereotypes (Chrisler et al., 2016; Schafer & Shippee, 2009), we also explored the possible moderating role of gender. We found that gender did not moderate the relations in the model. Thus, these findings are consistent with the view that advantageous relationships between leisure-time physical activity and both subjective age and self-rated memory are comparable for middle-aged and older men and women.

Some limitations should be kept in mind in interpreting these findings. Our results are correlational and do not provide evidence of causal relationships. There is a need for prospective research on leisure-time physical activity, subjective age, and self-rated memory. Rickenbach et al. (2015) provide a model of how this type of question might be approached across an extended interval using a series of 2-year lags across 10 years. In addition, all variables were self-reported and are subject to recall bias, common method variance, and social desirability. Previous research has indicated that although objective and subjective measures of physical activity provide similar results, the level of accelerometer-measured activity is lower than self-reported data (Troiano et al., 2008). Moreover, because the MIDUS sample was restricted to English-speaking adults and underrepresented racial and ethnic minorities, caution is needed in generalizing these findings to minority populations of middle-aged and older adults.

Physical activity is broadly associated with quality of life (Acree et al., 2006; Bize et al., 2007; Gill et al., 2013), especially with objective and perceived physical health (Cotter & Lachman, 2010; Lee et al., 2012; Li et al., 2010). These findings contribute to increasing interest in the broader role of physical activity in cognitive functioning among older adults (Bamidis et al., 2014; Bherer et al., 2013; Hindin & Zelinski, 2012). We found that middle-aged and older adults who report a higher frequency of leisure-time physical activity perceive themselves as younger and, in turn, are more likely to appraise their memory as better compared to others their age. Declines in physical activity accompany aging (Centers for Diseases Control and Prevention, 2014). At the same time, as people age they are subjected to pervasive negative age stereotypes that may undermine their cognitive functioning (Hess, 2006; Hess et al., 2003; Levy, 1996; Levy et al., 2012; Schafer & Shippee, 2009). These findings suggest a possible role of physical activity in countering the effects of age stereotypes on perceived memory.

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