A Joyful Heart is Good Medicine: Positive Affect Predicts Memory Complaints

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Objective: *Positive affect (PA) systematically improves cognitive performance on a wide range of cognitive tasks, but the link between PA and subjective memory complaints (SMCs) is unclear. The aim of this study was to investigate the associations between PA (level and change) and SMCs over a 10-year span.* **Methods:** *Current data included participants who completed all measures in the Midlife in the US Study (N = 2,214; age range: 50–84 years; mean: 62.81; standard deviation [SD]: 8.98). The level (mean of Time 1 and Time 2) and change (Time 2 minus Time 1) of PA was examined longitudinally to determine if PA predicts SMCs.* **Results:** *The long-term level and change of PA predicted SMCs. No age and education differences were found for the effects of PA (PA × age and PA × education) on SMCs. Additional comparison analysis found high PA (+1 SD) differs from low PA (−1 SD) on age, financial condition and depression,* and *physical activity.* **Conclusion:** *This study provides longitudinal evidence that further supports PA is associated with a key cognitive aging outcome, SMCs. Effective cognitive-health programs may need to pay more attention to PA intervention.* (Am J Geriatr Psychiatry 2016; 24:662–670)

Key Words: positive affect, subjective memory complaints, positive emotion, memory loss

INTRODUCTION

Emotion and cognition have historically been viewed as separate components. However, a growing body of work has proposed interdependence between the two.[1] Positive affect (PA) is defined as the feelings that reflect a level of pleasurable engagement with the environment,[2,3] such as happiness or joy. PA can be brief, longer lasting, or more steady trait-like feelings.[4]

Growing evidence reveals feelings of positive emotions benefit the individual beyond the intrinsic value of being happier.[5] Higher levels of PA have been suggested to relate to making more money,[6] better physical health,[5,7,8] enhanced self-control,[9] improved problem-solving,[10] enhanced working memory,[11] and a wide range of performance on cognitive tasks[10] that assess creativity,[12] categorization, word association, and verbal fluency.[13] In contrast, lack of PA was related to declines in the measures of global cognition, episodic memory, and perceptual speed.[14] Accordingly, the beneficial effect of PA is related to both physical and mental health. Furthermore, based on Carstensen's socioemotional selectivity theory,[15,16] as age increases,

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the role of emotion becomes increasingly important (yet better managed) in older people compared with younger people.

Subjective memory complaints (SMCs) are common among older adults.[17,18] A wealth of studies also revealed that SMCs in the elderly may hold value as a predictor of mild cognitive impairment[19,20] or dementia.[18,21–24] For example, Jessen et al.[23] proposed that SMCs are a possible pre–mild cognitive impairment state in the clinical symptoms of Alzheimer disease. SMC has also been suggested as an indicator of slower general information processing speed and delayed recall.[25] Accordingly, SMC may provide vital medical information about early neurodegenerative processes and should not be ignored.[26]

PA is a great source of human strength and augments an individual's personal and social resources.[12,27] One cross-sectional study suggested that people high on negative affect factors report more episodes of forgetfulness but absent objective cognitive impairments.[28] Watson and Tellegen[29] argued that positive and negative affects are two different dimensions. To date, the longitudinal relationship between PA and SMCs has not been examined. More importantly, as claimed by Seligman,[30] "positive emotion. . .may be one of our best weapons against mental disorder" (p. 5). Accordingly, the link between emotions and cognitive impairment seems to be apparent.

The present study used a nationally representative sample to examine the longitudinal association between both level and change of PA versus SMCs over a 10-year period. We hypothesized that both longitudinal level and change of PA would be associated with SMCs. In addition, we tested if the relationship between PA and SMCs varied by age or education.[31,32] We further explored the long-term differences of covariates (age, sex, education, finance condition, physical activity, and emotional disorder) in the study between higher (+1 standard deviation [SD]) and lower (–1 SD) PA. This provides information about the covariate distinctions between those with high PA and low PA over these years.

METHODS

Study Sample

Data were drawn from the Midlife in the US Study (MIDUS) surveys. The first phase (MIDUS I) began in 1994–1996 and included nationally representative samples of non-institutionalized, English-speaking adults within the coterminous United States.[33] A longitudinal follow-up, 10 years later, was conducted in 2004–2006 (MIDUS II). Approximately 4,963 original participants (75% response rated, adjusted for mortality) were successfully contacted to participate in another ~30-minute phone interview, followed by the completion of self-administered questionnaires returned by mail. The analytic sample included older adults who completed all measures in the current study for both waves (N = 2,214) ranging in age from 50 to 84 years (mean: 62.81; SD: 8.98). Characteristic comparisons of both included and excluded samples are presented in Table 1.

TABLE 1. Comparison between the included and excluded samples for analysis (t test)

Variable	Included Sample (N = 2,114)	Excluded Sample (N = 737)	p	Effect Size (Cohen's d)
Memory complaints, z score	−0.02 (2.35)	.18 (2.34)	0.235	−0.085
Mean age, yr	62.81 (8.98)	66.08 (9.86)	≤0.001	−0.346
Women, %	52.90	55.70	0.262	—
Education level	7.29 (2.56)	6.59 (2.54)	≤0.001	0.275
Mean financial[a]	6.67 (2.09)	6.66 (2.24)	0.777	0.005
Mean physical activity	2.97 (1.30)	2.81 (1.34)	0.170	0.121
No emotional disorder, %	82.00	80.79	0.573	—
Mean positive affect	3.44 (0.72)	3.54 (0.71)	0.004	−0.140
Mean positive affect_ change	0.06 (0.66)	0.01 (0.69)	0.215	0.074

Notes: Values in parentheses are SD. The outcome and all predictors were measured at Time 2, except for positive affect (the mean of Time 1 and Time 2) and positive affect_change (the measure value of Time 1 – Time 2). The t test results for the two groups were as follows: SMC (t(540.71) = 1.18), age (t(1,170) = 7.96), female (χ^2(1, N = 2,951) = 1.26, education (t(1263) = –6.32, financial (t(516.32) = –0.268, physical activity (t(145.77) = –1.324, no emotional disorder (χ^2(1, N = 2,181) = 0.301, positive affect (t(521.18) = 2.86, positive affect_change (t(510.74) = –1.242.

[a]The financial situation ranged from 0 (worst) to 10 (best).

Measurements

Dependent Variable

SMCs. Participants were asked three questions about their current memory function:

1. How would you rate yourself today compared with 5 years ago on memory?
2. Compared with other people your age, how would you rate your memory?
3. I don't remember things as well as I used to.

Responses to each item were coded as 1 (improved a lot) to 5 (gotten a lot worse) for Question 1 and from 1 (excellent) to 5 (poor) for Question 2. Participant responds to Question 3 were coded as 1 (disagree strongly) to 7 (agree strongly). The composite z score of all three questions was then computed, with a higher score indicating memory worsening. Cronbach's α reliability of the three items was .70. An exploratory principal component factor analysis with varimax rotation yielded one factor with eigenvalues greater than 1, which accounts for 62.73% of total cumulative variance.

Independent Variable

PA. Participants rated the six-item PA with the following question: "During the past 30 days, how much of the time did you feel: "cheerful," "in good spirits," "extremely happy," "calm and peaceful," "satisfied," and "full of life" (1, *none of the time*, to 5, *all of the time*)[34] at Time 1 and Time 2. Greater scores reflected higher PA. This scale has been widely used previously.[35]

This measure of positive feeling was computed by averaging scores on the corresponding subscale from MIDUS at both Wave I (Time 1) and Wave II (Time 2). For example, the level of PA = 1/2 (PA at Time 1 + PA at Time 2). The means of PA for Time 1 and Time 2 scores were used to predict SMCs instead of the Time 1 score by itself because adjustment for noisy baseline scores when analyzing change is known to produce spurious results in the presence of measurement error.[18,36,37] Use of the mean score of the Time 1 and Time 2 measurements as PA level avoids this issue, but this method underestimates the true effect of change.[37,38]

Change of PA over the 10 years was operationally defined in this study by the corresponding scores of Time 1 subtracted from Time 2 scores (i.e., change of PA = PA at Time 2 − PA at Time 1). This yielded a difference score (change score) of both measures for each individual. Individuals with positive change scores had Time 2 level scores higher than their Time 1 score. The PA mean and SDs for both Time 1 and Time 2 are shown in Table 2.

TABLE 2. Mean PA scores for MIDUS I and MIDUS II with paired t tests using a bonferroni adjustment (N = 2,214)

	Time 1	Time 2			
	Mean (SD)		|x| (SD)	95% CI	t (df)
PA	3.41 (0.72)	3.47 (0.69)	0.06 (0.66)	0.03–0.09	4.28 (2,213)[a]

Notes: |x|: absolute value of the mean change score; 95% CI: 95% confidence interval around the absolute mean change score.
[a]$p < 0.001$.

Internal consistency reliability in the present sample was excellent (Time 1 Cronbach's α = .91, Time 2 Cronbach's α = .90). Paired t tests using a Bonferroni adjustment documented if the PA mean scores were significantly different from MIDUS I to MIDUS II (Table 2). The tests indicated that PA mean scores increased over the 10-year interval and the mean differences were statistically significant, showing mean-level positive feelings change.

Covariates

Demographic Variables

This study examined age (mean: 62.81; SD: 8.98), sex (1 = male, 2 = female), education level (1 = no school, 12 = Ph.D. or professional degree), and financial situation (0 = worst possible financial situation to 10 = best possible financial situation).

Emotional Disorder: Anxiety/Depression

Participants responded to the following question: "In the past 12 months, have you experienced or been treated for any of the following: anxiety, depression, or some other emotional disorder?" (0 = no, 1 = yes).

Physical Activity

Participants responded to 12 questions regarding the frequency of moderate and vigorous level physical activity in both summer and winter seasons (1 = never to 6 = several times a week).

TABLE 3. Hierarchical multiple regression with SMCs as the dependent variable (MIDUS)

	Model 1			Model 2			Model 3		
	B (β)	SE	t	B (β)	SE	t	B (β)	SE	t
Age	0.01 (0.04)	0.01	1.81	0.02 (0.08)[a]	0.01	3.53	0.02 (0.08)[a]	0.01	3.55
Sex	−0.12 (−0.03)	0.10	−1.24	−0.04 (−0.01)	0.10	−0.46	−0.04 (−0.01)	0.10	−0.45
Education	−0.09 (−0.09)	0.02	−4.37	−0.10 (−0.11)[a]	0.02	−5.17	−0.10 (−0.11)[a]	0.02	−5.16
Finance	−0.08 (−0.07)[b]	0.02	−3.30	0.01 (0.01)	0.02	0.47	0.01 (0.01)	0.02	0.43
Physical activity	−0.17 (−0.10)[a]	0.04	−4.34	−0.13 (−0.07)[a]	0.04	−3.24	−0.12 (−0.07)[b]	0.04	−3.16
Emotional disorder	1.20 (0.19)[a]	0.13	9.22	0.54 (0.09)[a]	0.13	4.10	0.54 (0.09)[a]	0.13	4.09
Positive affect				−1.18 (−0.31)[a]	0.08	−14.03	−1.17 (−0.31)[a]	0.09	−13.75
Positive affect_change				−0.25 (−0.07)[a]	0.07	−3.59	−0.25 (−0.07)[a]	0.07	−3.58
PA × age							0.01 (0.02)	0.01	1.07
PA × education							0.01 (0.00)	0.03	0.17

Notes: Hierarchical multiple regression Model 1: $R^2 = 0.07$, $F(6, 2{,}207) = 28.89$, $p < 0.001$; Model 2: adjusted $R^2 = 0.15$, $F(2, 2{,}205) = 101.20$, $p < 0.001$; Model 3: adjusted $R^2 = 0.15$, $F(2, 2{,}203) = 0.58$, $p = 0.56$; t = t-test with df = 2,207, 2,205, and 2,203 for Models 1, 2, and 3, respectively. The outcome and all predictors were measured at Time 2, except for positive affect (mean scores of Time 1 and Time 2) and positive affect change (difference of Time 1 – Time 2). Age, education, positive affect, and positive affect_change scores were centered to the mean.

[a]$p \leq 0.001$.

[b]$p \leq 0.01$.

Statistical Analysis

The SMC outcomes from MIDUS II were regressed on the estimates of PA level and PA change, controlling for age, sex, education, financial situation, emotional disorders, and physical activity. Hierarchical multiple regression analysis was performed by entering the covariates (Model 1) and the other block of predictors (level and change of PA) (Model 2) to test our first and second hypotheses for the relationship of these predictors with SMCs. Furthermore, interaction effects between PA and age (PA × age) and between PA and education (PA × education) were computed (Model 3) to explore if the association between PA and the dependent variable (SMCs) varied by age and education. Finally, an independent t test was used to explore the potential differences in characteristics (sociodemographic, physical activity, emotional disorder) for higher (+1 SD) and lower (−1 SD) PAs over the 10 years demarked by the first and second wave questionnaires.

RESULTS

Hierarchical multiple regression revealed significant association between PA and SMCs. In Model 1, multiple regression analysis revealed that the covariates of higher education, better financial situation, higher frequency of physical activities, and emotional disorders were negatively associated with SMC (Table 3).

Model 2 evaluated whether the PA and PA change measures predicted SMCs over and above the covariates. Both the level of PA and PA change were significantly related to SMCs even after controlling for covariates (Table 3). These results suggest that higher levels of PA and larger PA differences (Time 2 – Time 1) predicted less memory loss at Time 2.

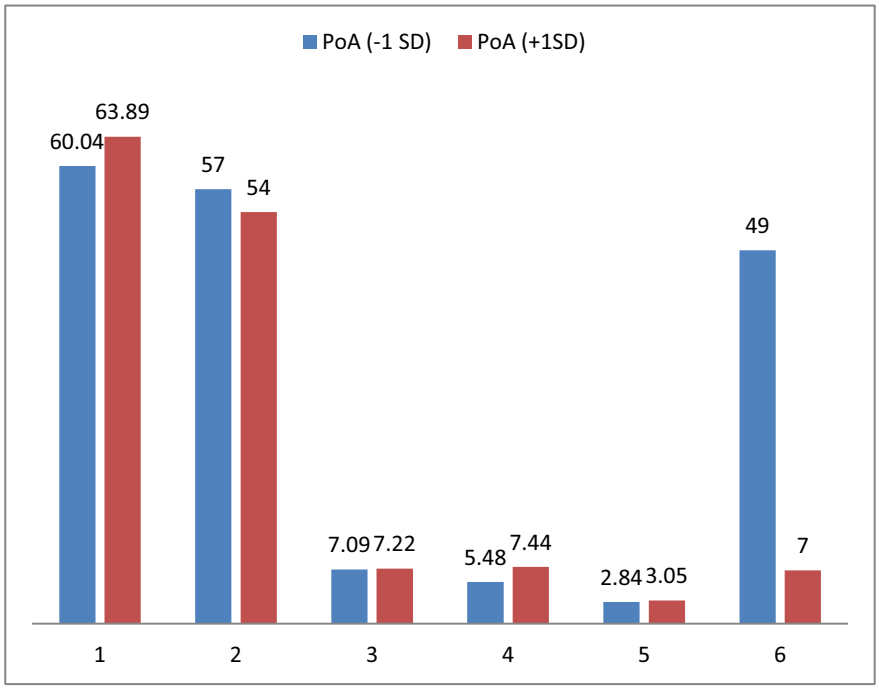
Model 3 showed nonsignificant interaction between PA and age (PA × age) and between PA and education (PA × education) for SMCs (Table 3). These patterns indicated that the relationship between PA and SMC did not vary by age or education.

Furthermore, an independent sample t test was performed to explore the differences between the participants with higher PA (mean + 1 SD) and lower PA (mean – 1 SD) over the decade covered by the study (Figure 1). The results revealed that those with 1 SD higher PA over the 10-year span were (Time 2) older, in better financial condition, participated in more physical activity, and had a lower incidence of emotional disorder. No differences were found for sex and education level.

DISCUSSION

This study focuses on the predictive effect of both PA level and change on SMCs assessed over a decade after initial PA measurements. Previous investigations

FIGURE 1. **Differential predicted values between lower (−1 SD) (N = 418) and higher (+1 SD) (N = 337) levels of positive affect over a decade on the following: 1, age in years (t(729.67) = −6.24, p < 0.001); 2, sex = female (%) (t(721.21) = 0.80, p > 0.05); 3, education level (t(705.73) = −0.68, p > 0.05); 4, finance condition level (t(649.00) = −6.24, p < 0.001); 5, physical activity frequency (t(752.01) = −2.24, p < 0.05); and 6, emotional disorder = yes (%) (t(473.91) = −14.02, p < 0.001).**



documented how higher PA is considered a protective factor for cognitive function.[11] This study builds on and extends those findings to explore the relationship between PA traits and SMCs (as a predictor of dementia). Overall, the results from the present research point to several conclusions. First, findings from the current research indicate that both PA levels and PA change were meaningfully associated with SMCs. Second, the relationship between PA and SMCs did not vary by age or education. Finally, long-term higher and lower PA were significantly and differently related to age, financial condition, physical activity, and emotional disorders. These findings are promising in that the memory losses in cognitive aging can be reduced, using a modifiable behavioral factor (being happy).

PA makes the greatest difference for memory complaints compared with all other variables in the study. This gives evidence of the possibility for some degree of personal control over memory loss in older adulthood by adopting an emotionally positive lifestyle. It has been suggested that cognitive function could be enhanced by positive affective states.[39,40] Within conceptual research frameworks, scholars have theorized that PA states give individuals access to a wider array of mental faculties that result in more efficient cognitive tasks.[40] For example, the proponents of Broaden-and-Build Theory of Positive Affect[41] argue that healthy individuals most often exist in a neutral or mildly positive affective state. They also theorize that when individuals access their cognitive store, such access is most efficiently facilitated during such states.[39] Given that SMCs may hold value as a predictor of mild cognitive impairment[19] or dementia,[21,24] the findings indicate PA may be a potential preventive strategy for those who are at risk for cognitive decline and dementia.

In addition, one of the most cited classic description of cognitive deficits in patients suggested that older people who have depression tend to have cognitive impairment that looks like dementia,[42,43] termed depressive

pseudo-dementia.[43] Literature has shown that individuals with depression tend to experience memory loss,[42,43] have deficits in the domains of episodic memory and learning,[44] or have multiple cognitive impairments[42] compared with normal subjects. Further, many depression measures include some reverse score of PA items (e.g., the Geriatric Depression Scale), and therefore the reverse relationship between PA and depression is consistent with this study's findings (as in Figure 1). The results confirm the notion that some SMCs fitting these parameters could be due to "pseudo-dementia."

Notably, positive and negative affect are presumed to be somewhat distinct[45] and indicate the influence of PA on psychobiologic processes are independent of negative affect.[5] Accordingly, although PA typically correlates negatively with negative affect, correlations between the two are modest in general.[45] That is, an individual scoring high in one indicator is not necessarily high (or low) in another indicator. For example, people who just lost their spouse might be experiencing negative mood, but if they believed their spouse has gone to heaven to be with God, they might also be content with the loss.

Studies regarding how PA was affected by the aging processes were mainly cross-sectional in nature.[46] This study provides evidence that long-term positive changes in PA predicted less SMCs. This finding points the attention of research to the relationship between memory losses and change of PA. This study confirms (in Table 2) individual PA increasing from Time 1 to Time 2 grants positive life-influencing changes. This echoes previous studies showing there are ways for people to become happier beyond genetics influences.[45,47] Accordingly, PA change may be a potential modifiable factor for developing intervention strategies to prevent cognitive impairment[23] and, specifically, memory loss. Furthermore, these findings highlight the vital cross-time dynamics in PA as independent influences on memory health.

Notably, PA can be enhanced through multiple ways. For example, a randomized controlled trial finding suggested that mindfulness training is an approach to increase positive emotions and greater appreciation of pleasant daily-life activities.[48] In addition, people who perform five acts of kindness on the same day during the week displayed higher well-being (vs. non-intervention control).[49] People who were randomly assigned to perform a variety of kind acts exhibited more happiness compared with those who did not vary their kind acts.[45,50] Importantly, Sheldon and Lyubomirsky[51] suggested that "even the best of intentions will fail to produce enhanced subjective well-being if the activity itself does not provide an opportunity for positive experiences and personal growth" (p. 141).

In addition, the implication of this study also suggests that timely recognition and treatment for emotional disorders in the elderly is important to the prevention of emotional disorders and also to prevent memory loss. Kang et al.[42] suggested that clinical diagnostic techniques, along with the normal age-related cognitive decline, multiple health problems, and the common use of several different medications, are often factors obscuring appropriate diagnosis of depression in the elderly. All these are potential reasons behind the lack of PA. No wonder there have been reports of high percentages of diagnostic error (false positive and false negative) in dementia.[42,52,53]

This study did not find the relation of PA to SMCs varied by either age or education. The nonsignificant interaction effects suggest that keeping PA in their daily life is equally important (for various ages and education) for these different groups to reduce memory loss. Hence, a potential memory intervention program could be developed for various ages (50 years and above in the study) and across the span of education levels of older adults.

The differential characteristics comparison between higher (+1 SD) and lower (–1 SD) PA in Figure 1 suggests that those with higher PA tend to be older, financially well off, more physically active, and less depressed. These findings are consistent with previous studies. For example, Carstensen's[16] emotional selective theory might explain how high–low PA appeared different according to age.[35] That is, older people become more selective in their social interactions to optimize emotional experiences.[16] Positive emotions influence daily functions and allow people to achieve career success (rather than vice versa)[12] and financial goals.[6,27] Notably, another study also found as countries become wealthier over time, their citizens' happiness did not increase.[54] Hence, money is a necessary, but not a sufficient, determinant of happiness.[45] The benefits of physical exercise have been well established.[55] Exercise stimulates the production of endorphins, which are neurochemicals that act as the body's natural painkillers and mood elevators.[56] Finally,

people in a PA state predicting less depression is easily understood.[57] For example, Wichers et al.[58] claimed PA broadened attentional focus so an individual may choose other positive elements from his or her current environment when under stressful situations: "Thus, the experience of PA may serve as an important protective factor against depression" (p. 19). Long-term exploration of this information among older adults is rare. This study provided the findings for a better understanding of the differences among these variables and is certainly useful for developing future cognitive improvement programs for older adults.

Research also shows that SMC is associated with working memory and attention.[59] The long-term facilitating effects of PA on SMCs in the current study imply that this affective state has the potential to improve cognitive ability. PA may also possibly improve a wide range of social (e.g., names of friends) activities that are linked to memory ability.

Future Study and Limitations

Future study may further explore how cognitive activity mediates the relationship between PA and SMCs. Additionally, a future study could divide the age groups into smaller gaps or include an older age group of ages 85–94, since this group is regarded as the fastest growing cluster among the elderly population.[60] This study also has some limitations. The results concern a group from 50 to 85 years old, which may be too heterogeneous. The interaction effects (PA × age, PA × education) in the study showed nonsignificant results and may not represent the whole lifespan of aging effects. The cause–effect relationship between PA and SMC could be further tested through long-term randomized controlled trial.

Conclusion

Philosophers such as Socrates and Plato have considered the associations between thinking and feeling in everyday human experience.[39] This study provided longitudinal evidence that further supports that PA is associated with a key cognitive aging outcome, SMCs. Long-term PA changes deserve more attention in the field of memory health. Longitudinal high–low PA seems to be related to different sociodemographics, levels of physical activity, and depression and warrants further study for the gerontology researcher. Positive emotion is attainable. It appears that one solution to lessen memory loss (and enhance cognitive health) is to develop strategies for becoming happier in later life.

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