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Control beliefs level and change as predictors of subjective memory complaints

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Objective: Low control beliefs (CB) are related to objective cognitive functions, but the link between CB and subjective memory complaints (SMC) is unclear. The aim of this study was to investigate the associations between CB (level and change) and SMC over a 10-year span.
Methods: The study utilized a large national sample of participants ($N = 3272$, $M = 56.52$, SD = 11.84) from the Midlife in the US Study (MIDUS) to examine if both level (mean of Time 1 and Time 2) and change (Time 2 minus Time 1) of CB (personal mastery and perceived constraints) longitudinally predict SMC.
Result: Both the level of personal mastery and perceived constraints predicted SMC. Long-term changes in perceived constraints, but not in personal mastery, also predicted SMC. No age difference was found for the effects of CB (age × CB) on SMC.
Conclusion: The findings support the notion that the risk of SMC is related to low CB, and full consideration of CB level and change is needed for intervention development to combat memory loss.

Keywords: control beliefs; memory complaints; cognition; MIDUS; memory loss

Introduction

Control beliefs (CB) refer to the perception that one can influence what happens in life and to what degree personal actions can lead to preferred outcomes (Agrigoroaei & Lachman, 2011). Literature has ample evidence suggesting that those believing one has higher level of control over situations or life events reported better physical health (Krause & Shaw, 2003; Lachman, 1986; Lachman, 2006), better memory and cognitive functioning (Caplan & Schooler, 2003; Colcombe & Kramer, 2003; Hertzog, McGuire, & Lineweaver, 1998; Lachman & Agrigoroaei, 2012; Seeman, McAvay, Merrill, Albert, & Rodin, 1996; Valentijn et al., 2006; Windsor & Anstey, 2008), happier and healthier (Lachman, Neupert, & Agrigoroaei, 2011), better emotional well-being (Kunzmann, Little, & Smith, 2002; Lachman, Röcke, Rosnick, & Ryff, 2008; Rodin, 1986), and enhanced recovery after falls via bolstered perceived control (Ruthig, Chipperfield, Newall, Perry, & Hall, 2007). One study conducted in a nursing home revealed that those residents given more control over their environment (e.g., taking care of a plant, choosing activities), result in positive long-term effects on well-being, activity, and health (Langer & Rodin, 1996). The concept of CB is similar to self-efficacy theory (Pearlin & Pioli, 2003), where a higher level of self-efficacy (or CB) enhances human accomplishment and personal well-being, and reduces stress and lowers vulnerability to depression (Bandura, 1994).

Subjective memory complaints (SMC)

Previous studies also established that SMC in the elderly may hold value as a predictor of mild cognitive impairment (Caselli et al., 2014; Luck et al., 2010) or dementia (Abdulrab & Heun, 2008; Amieva et al., 2008; Frisoni, Fox, Jack, Scheltens & Thompson, 2010; Geerlings, Jonker, Bouter, Ader & Schmand, 1999; Jessen et al., 2010; Jonker, Dik, Van Kamp, & Deeg, 2000; Lee, 2014; van Harten et al., 2013; Wang et al., 2004). For example, Geerlings et al. (1999) suggested that memory complaints are a relatively strong predictor of Alzheimer's disease in the elderly even when cognitive impairment is not yet apparent. Jessen et al. (2010) proposed that SMCs are a possible pre-mild cognitive impairment condition in the clinical manifestation of Alzheimer disease. SMC has also been suggested as an indicator of slower general information processing speed and delayed recall (Mol, van Boxtel, Willems, & Jolles, 2006). Studies have found better objective memory performance predicted lower risk of SMC for the elderly (65−74 yrs) (Fritsch, McClendon, Wallendal, Hyde, & Larsen, 2014). Accordingly, SMC may provide important clinical information about early neurodegenerative processes and should be carefully monitored (Haley et al., 2009). van Harten et al. (2013) claimed that cerebrospinal fluid evidence (of preclinical AD patients with SMC) might predict cognitive decline over time. In addition, one recent study found greater decline of objectively

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measured memory over 10 years was associated with current everyday memory problems (Hahn & Lachman, 2014).

Given that SMC is a good predictor of memory loss, reporting numerous or particularly severe memory problems are associated with worse memory performance over time. Conversely, reporting more control over life events (high-level CB) is associated with better memory and cognitive functioning, further enhancing personal accomplishment and well-being, which in turn, promotes and strengthens their CB. Accordingly, the assumption of an inverse relationship between SMC and CB in the study is logical and understandable. However, no previous study has included the variables of longitudinal CB level (the average of Time 1 and Time 2 CB scores) and change (the differences of Time 1 and Time 2 scores) to capture a comprehensive account of its influence on SMC.

Present study

This study focuses on the predictive effect of both CB level and change on SMC assessed over a decade after initial CB measurements. The researcher assumes that CB plays a vital role in determining the pre-clinical memory problem (SMC).

Hypotheses

The researcher expected those who had stronger sense of control would state fewer memory complaints (SMC) a decade later. Moreover, the researcher expected that if CB changes negatively (decreases from Time 1 to Time 2), this would predict more memory complaints (higher SMC score), whereas CB change positively would be associated with lower SMC. Lastly, the researcher tested whether control level and change (mastery and constraints) would serve as a moderator of age differences in SMC. We expected the effects of age difference in SMC would be significantly reduced with varied CB level (mastery level × age, constraints level × age) and amount of change (mastery-change × age, and constraints-change × age).

Methods

Study sample

Data were drawn from the Midlife in the US Study (MIDUS) surveys. Subjects constituted a nationally representative sample of non-institutionalized, English-speaking adults within the coterminous United States in 1994−1996 (MIDUS 1) (Ryff et al., 2012). A longitudinal follow-up, 10 years later was conducted in 2004−2006 (Wave II). Approximately, 4963 (75% response rated, adjusted for mortality) were successfully contacted to participate in another ~30 min phone interview, followed by the completion of self-administered questionnaires returned by mail. Respondents which completed all measures used in Wave II ($N = 3272$) ranged in age from 34 to 84 years ($M = 56.52$, SD = 11.84).

Compared with dropped out, those who participated at the second wave showed positive health-related characteristics on most variables (Table 1). The included sample was lower on SMC (fewer complaints) ($t(3963) = 3.142$, $p = .002$, effect size (ES) = −.132), younger ($t(4951) = -3.782$, $p < .001$, ES = − .112), more educated ($t(4954) = -9.324$, $p < .001$, ES = .281), better financial situation ($t(926) = -2.250$, $p < .05$, ES = .089), more physical activity ($t(3654) = -2.801$, $p = .005$, ES = .142), more cognitive activity ($t(3956) = -6.128$, $p < .001$, ES = .166), better personal mastery ($t(3825) = -1.957$, $p = .05$, EF = .033), and lower level of self-perceived constraints ($t(3740) = 4.886$, $p < .001$, EF = −.248). However, they did not differ in terms of sex distribution: women (χ^2 (1) = .004, $p = .947$), change of mastery (t (3825) = −1.266, $p = .206$, ES = −.057), and change of constraints ($t(3740) = .127$, $p = .899$,

Table 1. Comparison between the included and excluded samples for analysis.

Variable	Included sample ($N = 3272$)	Excluded sample ($N = 1691$)	P value	ES[d]
Memory complaints, Z score (SD)	−.06(2.36)	.26(2.48)	.002	−.132
Age, mean (SD) in years	56.48 (11.84)	57.90 (13.63)	.000	−.112
Women, %	53.30	53.40	.947	–
Education, level (SD)	7.43(2.50)	6.73(2.49)	.000	.128
Financial[a], mean (SD)	6.51(2.10)	6.31(2.38)	.024	.089
Physical activity, mean (SD)	3.13(1.29)	2.94(1.39)	.005	.142
Cognitive activity, mean (SD)	3.01(.82)	2.87(.86)	.000	.166
Mastery, mean (SD)	5.80(.86)	5.72(.94)	.050	.033
Constrains, mean (SD)	2.54(1.02)	2.79(1.16)	.000	−.248
Mastery-change[b], Mean (SD)	−.57(3.97)	−.33(4.48)	.206	−.057
Constraints-change[c], Mean (SD)	−.29(8.53)	−.23(10.28)	.899	−.006

Notes: The outcome and all the predictors were measured at Time 2, except for mastery and constraints (both are the mean of Time 1 and Time 2), and for mastery-change and constraints-change (both are the measure value from Time 1 subtracted by Time 2).
[a]The financial situation ranges from 0 (worst) to 10 (best).
[b]Mastery-change refers to the mastery scores from MIDUS 1 subtracted from MIDUS 2 (Time 2 − Time 1) for the measure of personal mastery.
[c]Constraints-change refers to the constraints scores from MIDUS 1 subtracted from MIDUS 2 (Time 2 − Time 1) for the measure of perceived constraints.
[d]ES refers to effect size (Cohen's d).

ES = −.006). A more complete discussion of selective attrition among the MIDUS longitudinal sample is available (Radler & Ryff, 2010).

Measures

All measures were collected via phone interview followed by extensive self-administered questionnaires.

Dependent variable

Subjective memory complaints

This is a three-item dependent variable, which inquires of participants about their current memory function:

(1) How would you rate yourself today compared to five years ago on memory?

(2) Compared to other people your age, how would you rate your memory?

(3) I don't remember things as well as I used to.

Participants rated their SMC on a five-point scale ranging from 1 (improved a lot) to 5 (gotten a lot worse) for the question in item (1) and from 1 (excellent) to 5 (poor) for the question in item (2). For item (3), they rated their SMC on a seven-point scale ranging from 1 (agree strongly) to 7 (disagree strongly). The third item was reverse recoded first, and the composite Z score of the three items was computed. A higher score indicates memory worsening (more memory complaints). Cronbach's alpha reliability of the three items is 0.72. An exploratory principal component factor analysis with varimax rotation yielded one factor with eigenvalues greater than 1 and accounts for 63.87% of total cumulative variance.

Independent variables

Control beliefs (CB) level

Two aspects of general self-perceived control from MIDUS study, personal mastery, and perceived constraint, were assessed with a 12-item composite (Cronbach's α Time 1 = .85, Time 2 = .87) (Agrigoroaei & Lachman, 2011) at Time 1 and Time 2. There were four items measuring personal mastery (e.g., When I really want to do something, i usually find a way to succeed at it.) and eight items measuring perceived constraints (e.g., There is little I can do to change the important things.). This measure of CB level (personal mastery and perceived constraints) over outcomes in life was computed by averaging scores on the two corresponding subscales from MIDUS at both Wave I (Time 1) and Wave II (Time 2). For example, level of personal mastery = 1/2 (personal mastery at Time 1 + personal mastery at Time 2). The means of CB (mastery and constraints) for MIDUS 1 and MIDUS 2 scores were used to predict SMC instead of the MIDUS 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 (Glymour, Weave, Berkman, Kawachi, & Robins, 2005; Turiano et al., 2012). Use of the mean score of the Time 1 and Time 2 measurements as CB level avoids this issue, but this method underestimates the true effect of change (Cain, Kronmal, & Kosinski, 1992; Turiano et al., 2012).

Change of personal mastery and perceived constraints were operationally defined in this study by the corresponding scores from MIDUS 1 subtracted from MIDUS 2 for both measures. For example, change of constraints = constraints at Time 2 − constraints at Time 1. This yielded a difference score (change score) for both measures for each individual. Persons with positive change scores were those for whom an MIDUS 2 level score was higher than their MIDUS 1 score. The change, mean scores, and standard deviations for both personal mastery and perceived constraints scores are displayed in Table 2.

For this study, the reliability Cronbach's α for mastery (Time 1 = .69, Time 2 = .74) and constraints (Time 1 = .85, Time 2 = .85) are acceptable. The scores for both measures range from 1 (strongly agree) to 7 (strongly disagree) and were reverse scored for these items. A higher value reflects higher personal mastery and perceived constraints. Both measures have been used by researchers (e.g., Hahn & Lachman, 2014; Kitayama, Karasawa, Curhan, Ryff, & Markus, 2010; Lachman & Weaver, 1998).

Paired *t*-tests using a Bonferroni adjustment documented if both the mastery and constraints mean scores were significantly different from MIDUS 1 to MIDUS 2 (Table 2). They indicated that both mastery and constraints mean scores decreased over the 10-year interval, and both the mean differences were statistically significant, showing mean-level mastery and constraints change.

Covariates

Demographic variables

The researcher examined age (M = 56.52, SD = 11.84), sex (1 = male, 2 = female), education level (1 = no school, 12 = Ph.D. or professional degree) and financial situation (0 = worst possible financial situation, 10 = best possible financial situation).

Physical activity

Twelve questions assessing frequency of vigorous and moderate intensity physical activity in both summer and winter seasons were used. These questions were scored with 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). The scores were averaged with the maximum value representing the highest frequency of physical activity across all intensity levels and domains.

Table 2. Mean mastery and constraints scores for MIDUS 1 and MIDUS 2 with paired *t*-tests.

Control beliefs	MIDUS 1 Mean	MIDUS 2 Mean	Mean change	t (df)
Mastery	5.84	5.76	−.08	4.78(3271)***
Constraints	2.55	2.52	−.03	1.97(3271)*

Note: *$p < .05$, ***$p < .001$.

Cognitive activity

This measure was created by averaging the self-reported frequencies on a six-point scale (1 = never, 2 = once a month, 3 = several times a month, 4 = once a week, 5 = several times a week, 6 = daily) of engaging in six cognitive activities: reading books/magazines/news; playing word games such as crossword, puzzles, or scrabble; attending educational lectures or courses; writing such as letters, stories, or journal entries; and using a computer (to send email or search the internet). Higher values represent a higher frequency of cognitive activity.

Statistical analysis

Hierarchical multiple regression analysis was performed by entering the covariates (Model 1), and the other block of predictors (level of mastery and constraints, change of mastery and constraints) (Model 2) to test our first and second hypothesis for the relationship of these predictors with SMC. Furthermore, interaction effects between CB and age (mastery × age, constraints × age, mastery-change × age, and constraints-change × age) were computed (Model 3) to explore if the association between CB (mastery and constraints) and dependent variables (SMC) varied by age.

Results

Inter-correlation for all variables in the study is shown in Table 3. The independent variable of personal mastery and perceived constraints strongly related to the dependent variable of SMC. In the hierarchical multiple regression model-1, covariates of better financial situation, higher education, and higher frequency of physical and cognitive activities were negatively associated with SMC (see Table 4), advanced age stated more SMC, women reported more SMC than men, and education level was not related to SMC (R square = 0.05, F (6, 3265) = 30.07, $p < 0.001$).

Model-2 evaluated whether the CB (mastery and constraints) measures predicted SMC over and above the covariates. Except for mastery-change, both the level of mastery and constraints, and constraints-change were significantly related to SMC even after controlling for the covariates (adjusted R square = 0.12, F (4, 3261) = 65.08, $p < 0.001$). These results suggest that higher level of personal mastery, lower level of perceived constraints, and smaller constraints difference (Time 2 − Time 1) predicted less memory loss at Time 2. The mastery change from Time 1 to Time 2 is not a significant predictor of SMC ($p = .085$).

Lastly, model-3 analysis revealed that none of the interaction effects between CB factors (level and change for mastery and constraints) and age were significant predictors of SMC (Table 4). This result suggests that the association between CB and SMC do not vary by age.

Discussion

The current study analyzes two-wave cohort data separated by a decade from randomly selected nationally (US) representative, community dwelling, middle-age or older-adult samples. This study builds on previous investigations documenting how low perceived control is considered a risk factor for poor cognitive function (Hertzog et al., 1998; Lachman & Agrigoroaei, 2012; Seeman et al., 1996; Valentijn et al., 2006), and extends those findings to explore the relationship between self-perceived control and SMC (as a predictor of dementia). Specifically, this study focuses on how the level and change of CB (personal mastery and perceived constraints) over time is related to SMC. The study findings revealed for mastery and constraints, higher levels of mastery predicted better SMC outcomes, whereas higher levels of constraints reflected poorer outcomes. Furthermore, constraints-change over time, but not mastery-change, significantly predicted SMC.

Both perceived constraints and the personal mastery are longitudinally related to SMC. These results agreed with previous studies (Lachman & Agrigoroaei, 2012; Seeman et al., 1996), which claim CB is linked to memory task performance. Interventions that target adaptive behaviors and beliefs, such as maintaining high CB may

Table 3. Bivariate correlations among study variables.

	SMC	Age	Sex	Education	Finance	PA	CA	Mastery	Constraints	Mastery-change
SMC										
Age	.06*									
Sex	−.05**	−.04*								
Education	−.11**	−.11**	−.10**							
Finance	−.13	.15**	−.08**	.17**						
PhA[a]	−.10	−.30**	−.14**	.10**	.01					
CoA[b]	−.16	−.05**	.13**	.35**	.10**	.10**				
Mastery[c]	−.24**	−.04*	−.04*	.04*	.20**	.11**	.11**			
Constraints[d]	.29**	.04*	.07**	−.19**	−.32**	−.14**	−.19**	−.55**		
Mastery-change[e]	−.07**	.00	−.011	.01	.08**	.03	.02	.03	−.03	
Constraints-change[f]	.08**	−.04*	.03	.02	−.09**	−.01	.01	−.02	−.06**	−.33**

Notes: [a]PhA = physical activity, [b]CoA = cognitive activity, [c]Mastery = mean of MIDUS 1 and MIDUS 2 mastery level, [d]Constraints = mean of MIDUS 1 and MIDUS 2 constraints level,
[e]Mastery-change = mastery level difference over time (T2 − T1), [f]Constraints level difference over time (T2 − T1), *$p < .05$, **$p < .01$.

Table 4. Hierarchical multiple regression with subjective memory complaints as the dependent variable (midlife in the United States study).

	Model 1		Model 2		Model 3	
	B (β)	SE	*B* (β)	SE	*B* (β)	SE
Age	.01(.04)***	.00	.01(.04)*	.00	.01(.04)*	.00
Sex	.24(.05)**	.08	.17(.04)*	.08	..17(.04)*	.08
Education	−.03(−.03)	.02	−.02(−.02)	.02	−.02(−.02)	.02
Finance	−.13(−.13)***	.02	−.02(−.02)	.02	−.02(−.02)	.02
PA	−.11(−.06)**	.03	−.06(−.03)	.03	−.06(−.03)	.03
CA	−.40(−.14)***	.05	−.30(−.11)***	.05	−.30(−.11)***	.05
Mastery			−.04(−.11)***	.01	−.04(−.11)***	.01
Constraints			.03(.20)***	.00	.03(.20)***	.00
Mastery-change			−.02(−.03)	.01	−.02(−.03)	.01
Constraints-change			.02(.08)***	.01	.02(.08)***	.01
Mastery × age					.00(−.02)	.00
Constraints × age					.00(−.02)	.00
Mastery-change × age					.00(−.01)	.00
Constraints-change × age					.00(.01)	.00

Notes: Model 1: $R2 = .05$, $F(6, 3265) = 30.07$; Model 2: adjusted $R2 = .12$, $F(4, 3261) = 65.08$; Model 3: adjusted $R2 = .12$, $F(4, 3257) = .547$. The outcome and all the predictors were measured at Time 2, except for mastery and constraints were mean scores of Time 1 and Time 2, mastery-change and constraints-change were the difference of Time 1 and Time 2 (T2 − T1). Age, mastery, constraints, mastery-change, and constraints-change score were centered to the mean. $^{*}p <= .05$; $^{**}p <= .01$; $^{***}p <= .001$.

help older adults adapt to age-related decline of working memory (Hahn & Lachman, 2014). The findings of current studies extended previous studies (e.g., Lachman & Agrigoroaei, 2012**)** by linking CB to SMC. In this study, for those who believed they can influence what happens in their life, lead to fewer memory complaints. Based on Bandura's theory, the sense of control is a fundamental core set of self-regulation that affects the interpretation of situations and provides motivation to attempt new tasks (Bandura, 1997). Accordingly, the possible mechanisms linking CB and SMC might be that individuals with higher CB are more likely to engage in cognitive activities, which lead to better memory performances (Jopp & Hertzog, 2007; Lachman & Agrigoroaei, 2012; Lachman, Agrigoroaei, Murphy, & Tun, 2010), and consequently, lead to fewer memory complaints.

Most importantly, this study provides evidence that long-term changes in perceived constraints predicted SMC. This finding points the attention of research to the relationship between SMC and change of perceived constraints. It has been suggested individual variability in CB may exist over time (Eizenman, Nesselroade, Featherman, & Rowe, 1997; Lachman, 2006). Accordingly, the significant results of perceived-constraints change in this study may be a useful modifiable factor for developing intervention strategies to prevent cognitive impairment conditions (Jessen et al., 2010), specifically memory loss. In addition, these results underscore the importance of cross-time dynamics in perceived constraints as independent influences on memory health.

However, the change in mastery over time (from Time 1 to Time 2) was not significantly related to SMC, though there was an observable trend ($p = .085$, not shown in Table 4). It may be that mastery is already high at Time 1 (5.83 out of 7), minor reduction (−.08) at Time 2 is tolerable for memory health. However, the reduction in constraints (−.03) seems to have larger impact on SMC. That is, even with less constraints reduction compared to mastery, constraints significantly predicted later SMC. It seems reasonable that CB would encounter more challenges resulting from increasing loss and decreasing gains through the aging process (Baltes, Lindenberger, & Staudinger, 2006). Lachman, Rosnick, and Röcke (2009) noted that many of the changes that accompany aging are not controllable. This study served as an exploratory study, because no previous study included long-term changes of CB (mastery and constraints) to analyze its effects on SMC in one model.

The study did not find the relation of CB (level and change of mastery and constraints) to SMC varied by age ($p > .05$). Previous findings suggest that with age, the sense of control declines (Lachman & Firth, 2004; Lachman & Weaver, 1998; Mirowsky & Ross, 2007). The reasons for non-significant results might be (1), this study separated CB into mastery and constraints for statistical analysis, that decrease age impact on CB−SMC relationship; and (2), the relationship between CB and SMC was indeed not varied on the age range (34–84 years) in participants of this study.

As noted by Lachman et al. (2011), 'attention to the sense of control can enrich the work by researchers, policy makers, clinicians, and other scientists and practitioners interested in promoting good health and well-being in adulthood and later life' (p. 176). Overall, the study findings are consistent with self-efficacy control theories, which stress the vital role of individual's perceived ability in carrying out specific goals or tasks (Bandura, 1997) are helpful in maintaining or optimizing cognitive health in adulthood and old age (Hertzog, Kramer, Wilson, & Lindenberger, 2008; Rowe & Kahn, 1998; Windsor &

Anstey, 2008). However, since both personal mastery and perceived constraints decrease through the aging process (Table 2), strategies to maintain and even increase mastery and reduce constraints may be a challenge for future gerontologists.

Considering the inherent complexities connecting CB to health, the fact remains that CB is a modifiable variable. In future studies, it will be important to identify the characteristics of those with decreasing self-perceived ability, in order to provide resources. It is also interesting to further explore how CB (level and changes) is related to other aspects of health (e.g., heart problems, or diabetes), mortality, or other aspects of cognitive function (e.g., attention, or working memory).

This study also has some limitations. The results concern a group from 34 to 85 years old, which may be too heterogeneous. The interaction effects (CB × age) in the study show non-significant results, which may not represent the whole picture of aging effects. In future studies, it will be useful to include a smaller range of age, or include the very old (age 85–94) group, given this group has the fastest growth among the elderly population between 2000 and 2010 (Werner, 2011). A long-term randomized controlled trial research design will also be needed for examining the cause–effect relationship for the established associations.

Conclusion

This study provided longitudinal evidence that further supports CB is associated with a key cognitive aging outcome, SMC. Long-term changes in perceived constraints deserve more attention in the field of memory health. CB is modifiable; it appears that one solution to lessen memory loss is to develop strategies for promoting personal mastery and reducing constraints in later life.

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