心理学报　2009, Vol. 41, No.11, 1091−1101
Acta Psychologica Sinica DOI: 10.3724/SP.J.1041.2009.01091

Long-term Stability and Variability in Memory Compensation among Older Adults: Evidence from the Victoria Longitudinal Study

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Abstract: Two memory status groups were derived from a parent sample of older adults participating in the Victoria Longitudinal Study (VLS) in Canada. A not impaired control (NIC) group and a mild memory deficit (MMD) group were compared at baseline and longitudinally (over five waves or 12 years) regarding their use of memory compensation techniques in everyday life. We used multi-level modeling (covarying age and education) to examine baseline level differences and long-term change patterns. Baseline results showed that the MMD participants reported greater recent increases in memory compensation strategy use in everyday life. Longitudinal results showed notable 12-year stability in memory compensation use, but group-related differences in the compensatory mechanism of effort. The covariate of education (potentially a marker of cognitive reserve) was associated with differential change in three memory compensation strategies over time.

Key words: memory compensation, mild memory deficit, multi-level modeling, Victoria Longitudinal Study

The Victoria Longitudinal Study (VLS) is a large-scale and long-term investigation of human aging. We begin this article by summarizing the VLS, with special attention to its (a) location, (b) mission, (c) key characteristics, and (d) main research directions. Subsequently, we present the background, methods, and new results of a study that illustrates the data emerging from this long-term longitudinal study.

Geographic Location. The VLS is located in the two western provinces of Canada, with the research headquarters in the province of Alberta (at the University of Alberta in Edmonton) and the main data collection station in the province of British Columbia (at the University of Victoria). The Director of the VLS (co-author Roger A. Dixon) has appointments that span the two locations. Other VLS co-investigators, collaborators, consultants, research assistants, and trainees are distributed across both Canadian locations, as well as in the United States, Australia, and Sweden.

Mission and Goals. A full and recent description of the VLS may be found in Dixon and de Frias (2004). Since it began in the late 1980s, the guiding mission of the VLS has been to follow successive large and well-characterized cohorts of middle-aged and older adults who are initially healthy (physically, cognitively, mentally) as they experience a variety of normal and neuropathological changes with aging. The descriptive goal has been to chart as many of these changes—and relationships among the changes — as possible over as long a period as available. The

Received date: 2009-04-23
The VLS and the research reported in this article are supported by a grant from the National Institutes of Health (National Institute on Aging; R37 AG008235) to Roger A. Dixon, who is also supported by the Canada Research Chairs program. We express appreciation to the VLS staff and participants. Correspondence concerning the article or the VLS should be addressed to Roger A. Dixon, Department of Psychology, P-217 Biological Sciences Building, University of Alberta, Edmonton, Alberta T6G 2E9, Canada. E-mail: rdixon@ualberta.ca

explanatory goal has been to identify protection factors, risk factors, precursors, sequelae, and time-varying covariates of long-term changes. Target processes include: (a) healthy cognitive changes with aging (e.g., successful aging), (b) normal cognitive decline with aging, (c) preclinical and neurodegenerative decline (e.g., mild cognitive impairment, dementia, Alzheimer's disease), and (d) variable and differential cases and trajectories.

Key Characteristics. The VLS follows a longitudinal sequential design, in that it has three main longitudinal samples, each beginning in a sequence of decades (1980s, 1990s, 2000s). For VLS Sample 1 we began collecting data on middle-aged and older adults (initially 55-85 years old) in the late 1980s, and since then have retested all available participants at three-year intervals. VLS Samples 2 and 3 began in the 1990s and 2000s, respectively, and followed the same longitudinal design. Therefore, presently, the VLS has collected multiple waves of data for each sample. Specifically, data are available for Sample 1 (7 waves or 18 years), Sample 2 (6 waves or 15 years), and Sample 3 (2 waves or 3 years). Each sample began with about 500-600 participants. Each wave of testing involves about 12 hours of contact with each participant. The protocol at each wave includes multiple measures of physical health, medications, physiological fitness, sensory status, lifestyle activities, memory performance (episodic, semantic, working), cognitive abilities (crystallized, fluid), neuropsychological and neurocognitive functioning, metacognitive beliefs or actions, affective aspects, and a variety of other domains.

Main Research Directions. The VLS embraces the principle that human aging is intrinsically multifaceted, multi-determined, and multidirectional. Therefore, it investigates aging with time-structured data sets and, when appropriate, multivariate change-oriented designs (Dixon, in press). Naturally, no single study has ever tapped the entire sequential VLS data set, but our studies have used many different subsets of data, including cross-sectional, short- and long-term longitudinal, small-case special population, and epidemiological designs. The predominant direction of research has been in both descriptive and explanatory studies of aging-related cognitive differences, variability, or trajectories.

We summarize eight illustrations. First, from the beginning of the VLS, our research examined cognitive change profiles, often linking individual differences in these profiles to theoretically relevant cognitive processes (e.g., cognitive resources; see Dixon, Wahlin, Maitland, Hultsch, Herzog, & Bäckman, 2004; Hultsch, Herzog, Dixon, & Small, 1998; Hertzog, Dixon, Hultsch, & MacDonald, 2003). Second, other research has explored cognitive aging phenomena as related to general health conditions (e.g., chronicity, health burden; see Wahlin, MacDonald, de Frias, Nilsson, & Dixon, 2006). Third, VLS research has examined the particular cognitive effects of specific health conditions or interventions, such as diabetes (Fischer, de Frias, Yeung, & Dixon, in press; Yeung, Fischer, & Dixon, 2009), medications (Tippe, de Frias, & Dixon, 2009), and mild stroke (Mansueti, de Frias, Bub, & Dixon, 2008). Fourth, VLS studies have linked cognitive change trajectories of older adults to biological vitality (i.e., biological age; see MacDonald, Dixon, Cohen, & Hazlitt, 2004) and even impending death (i.e., terminal decline; see MacDonald, Hultsch, & Dixon, 2008). Fifth, the fact that some aging adults inevitably transition into neurodegenerative conditions such as mild cognitive impairment or Alzheimer's disease has also been studied in recent years (Dixon, Garrett, Lentz, MacDonald, Strauss, & Hultsch, 2007), with a focus on establishing new and early markers of preclinical conditions. Sixth, neuropsychological characteristics of older adults have been explored (e.g., executive functions; de Frias, Dixon, & Strauss, 2006). Seventh, given the many changes that can occur with aging, some researchers have drawn attention to the fact there are also conditions that may protect, moderate, or remediate cognitive decline or promote cognitive health (Dixon, in press). These potential protection factors include the possibility that some older adults may engage in sufficient cognitive, social, or physical activities to minimize normal decline or protect against accelerated decline (e.g., Hultsch, Hertzog, Small, & Dixon, 1999; Small, Hughes, Hultsch, & Dixon, 2006; Stern, 2006). Finally, the eighth topic of recent research focuses on the clinical observation that some older adults may identify spontaneously, or learn through rehabilitation, or use performance-enhancing techniques that balance or compensate for everyday cognitive decline (Dixon & Bäckman, 1995; Dixon, Garrett, & Bäckman, 2008). Considering the latter, a series of VLS studies on the frequency, effectiveness, and conditions of memory compensation techniques have been conducted with considerable success (e.g., Dixon & de Frias, 2007). We turn now to this topic, as it is the target of the new research presented in this article.

Present Study

Substantial individual differences in typical trajectories of aging-related changes in memory have been reported by several longitudinal researchers (Hultsch et al., 1998; Tucker-Drob & Salthouse, 2008). In contrast, the range and magnitude of such individualized patterns of change are dramatically diminished as cohorts progress into and through neurodegenerative diseases such as AD. Between these two extreme patterns are clusters of aging individuals exhibiting profiles of change and variability that occasion some degree of diagnostic uncertainty. Are they normally aging adults but simply showing somewhat more pronounced, if not accelerated, cognitive decline? Or are they adults showing clinically significant cognitive deficits, or even transitioning into neurodegenerative disease, thereby meriting provisional classification as memory impaired, cognitively impaired, or even preclinical AD? Although much research has focused on the diagnostic criteria and methodological concerns for classifying and understanding these intermediate clusters of aging adults (e.g., Dixon et al., 2007; Winblad et al., 2004), we have recently taken a different tack. Specifically, we have adapted the notion that one aspect of cognitive health in aging may be evidenced by the extent to which older adults are able to adapt to the cognitive demands of their everyday life by using individual memory-enhancing techniques or by framing their environment to match or supplement their individual memory skills. These forms of adaptation to either changing memory demands or declining memory skills are referred to as *memory compensation*. In the VLS, we have conducted a series of studies examining which mechanisms of memory compensation are used by older adults, the correlates of these compensatory efforts, and the extent to which they may be linked to actual successful memory performance.

We first developed a self-report instrument, the Memory Compensation Questionnaire (MCQ; de Frias & Dixon, 2005; Dixon, de Frias, & Bäckman, 2001). The MCQ is characterized by five separable mechanisms of everyday memory compensation: (a) use of external memory aids, (b) use of internal memory assistive mnemonics, (c) allocation of increased effort to memory performance, (d) allocation of increased time to encode or retrieve to-be-remembered information, and (e) recruitment or use of human memory assistance. Two additional scales represent more general belief and commitment processes linked to memory compensation: (f) the extent to which individuals are committed to a high level of success in everyday memory tasks, and (g) the extent to which individuals believe that changes have occurred over the previous 5-10 years in each of the other compensation domains. The MCQ was first included in the VLS protocol in the early 1990s.

Our initial research with the MCQ revealed four important and thematic results. First, these techniques are indeed reported as used in specific memory-demanding circumstances of everyday life by several populations, including healthy older adults (Dixon et al., 2001), patients with mild AD (Dixon, Hopp, Cohen, de Frias, & Bäckman, 2003), adults with acquired brain dysfunction (Prigatano & Kime, 2003), and relatively healthy older adults with mild memory impairments (Dixon & de Frias, 2007). Second, the use of memory compensation techniques are linked to concurrent individual differences in personal status characteristics such as personality and health (de Frias, Dixon, & Bäckman, 2003). Third, substantial 6-year longitudinal variability in change is observed across the compensatory techniques, with dramatic differences in patterns for different techniques (Dixon & de Frias, 2004).

The fourth thematic result comes from the most recent study. Dixon and de Frias (2007) developed and documented criteria for two memory status groups of older adults: (a) a normal aging (not impaired cognitively, NIC) group and (b) a group with mild memory deficits (MMD). Using multi-level modeling we compared the groups on initial (VLS Sample 2, wave 1) use of the compensation techniques, 6-year changes (waves 1-3) in use of the techniques, and 6-year variability in use of the techniques. The first finding was that the MMD group reported more initial recruitment of other humans (e.g., caregivers, spouses) to help them compensate for everyday memory deficits than did the NIC group. Correspondingly, the MMD group also reported a selective increase in recent efforts to compensate for emerging memory decline. The second major finding was that for two memory compensation techniques (use of external memory aids in performing memory tasks, investment of extra effort in performing memory tasks), the 6-year change patterns differed significantly for the NIC and MMD groups. Whereas the MMD group declined slightly in their use of these compensation techniques, the NIC group increased their use of these techniques. Our interpretation was that the initially normal NIC group may have been experiencing increasing (over the six years of the study) memory challenges in everyday life. Perhaps they responded by gradually increasing their use of these compensatory techniques. Such results might signal cognitive resilience in older adults. However, it should be noted that clinically these two forms may differ in their efficiency and practicality in everyday life: Whereas the use of external memory aids is known to be widely effective, the investment of effort is more modestly effective and (eventually for older adults) likely to become resource-draining. We note one additional result: A corresponding finding was that, at least for these six years, the two groups showed substantial stability in use of the other compensation techniques.

In the present study, we further investigate this issue by testing a different VLS sample, defining two parallel memory status groups, and assembling a 5-wave (12-year) longitudinal data set. Specifically, we examine baseline cross-sectional differences in MCQ scale results, as well as 12-year changes and variability in memory compensation. The present study doubles the length of time (from 6 to 12 years) available in the previous study (Dixon & de Frias, 2007). In addition, the present study includes an indicator of education (years of schooling) as a covariate representing cognitive reserve (Stern, 2006).

Method

Participants

The participants were drawn from a parent sample of community-dwelling adults from the VLS Sample 1 (Wave 2 overall N = 333, including 200 women and 133 men; age, M = 71.72 years, SD = 5.82, range = 58-89; education, M = 14.13 years, SD = 2.99). Note that for Sample 1, the MCQ was first included at Wave 2, so the available five waves (waves 2 through 6, 12 years) of data were examined. Additional VLS sample characteristics have been reported previously (e.g., Dixon & de Frias, 2004; Hultsch et al., 1998). To classify Wave 2 participants into MMD and NIC groups, we used the previously established procedure (Dixon & de Frias, 2007) of developing a global composite measure of declarative memory using two indicators each of two principal systems (i.e., episodic and semantic memory). Using the distribution of composite memory scores in the parent sample, we classified that portion of the sample scoring above the parent sample mean as NIC (n = 167, including 101 women and 66 men; age, M = 70.86 years, SD = 5.33, range = 58-86; education, M = 15.11 years, SD = 2.87), whereas that portion scoring one standard deviation or more below the parent sample mean was classified as MMD (n = 54, including 36 women and 18 men; age, M = 74.31, SD = 7.02, range = 61-89 years; education, M = 12.65 years, SD = 2.76). The 34% (n = 112) of the parent sample scoring between the mean and one standard deviation below the mean were deleted from the present sample, a selection that creates conceptual and empirical distance between the two remaining groups. No differences were observed for health ratings (Wave 2: health relative to others of the same age: (NIC, M = .65, SD = .72; MMD, M = .75, SD = .66).

Measures

Because the key measures used in this study are published elsewhere, they are described briefly in this article.

Memory Compensation Questionnaire (MCQ). The MCQ requires participants to report the frequency (in 5-point Likert scales) with which they engage in everyday functional, adaptive, or strategic memory-related behaviors. Psychometric characteristics are well-established for five MCQ scales representing specific compensatory strategies and two MCQ scales representing general compensation-related processes (de Frias & Dixon, 2005). The five strategy scales are: (a) MCQ External (8 items) regarding the use external memory aids (e.g., calendars); (b) MCQ Internal (10 items) regarding the use of mnemonic strategies (e.g., rehearsal); (c) MCQ Time (5 items) regarding the extent to which respondent invests more time in performing a valued everyday memory task; (d) MCQ Effort (6 items) regarding the application of extra effort to perform everyday memory task; and (e) MCQ Recruitment (5 items) regarding the extent to which the respondent actively recruits or passively receives the memory-related assistance of other individuals (e.g., spouse). The two general scales are: (f) MCQ Success (5 items) regarding the extent to which a respondent is motivated or committed to a high level of success in performance on everyday memory tasks; and (g) MCQ Change (5 items) regarding the extent to which the participant believes changes have occurred over the past 5-10 years in each of the other six domains.

Memory. Four memory tasks were used as a composite memory assessment for purposes of classifying the participants into two groups, not impaired control (NIC) and mild memory deficits (MMD). The full procedures are described in the previous study (Dixon & de Frias, 2007), and the measures are described in multiple publications (e.g., Dixon et al., 2004; Hultsch et al., 1998). The two episodic memory tasks were: (a) VLS Word Recall, measured by a set of six equivalent categorized lists of common English nouns, with each participant studying and recalling two different lists rotating across each wave of measurement; and (b) VLS Story Recall, measured by a set of six narrative stories (24 sentences, 300 words, 160 propositions) describing an event in the life of an older protagonist), with each participant studying and recalling two different stories rotating across each wave of measurement. The two semantic memory tasks were: (c) Vocabulary, measured by a standard 54-item multiple-choice test (Ekstrom, French, Harman, & Dermen, 1976), and (d) Fact Recall, measured by two sets of 40 general information questions.

Research Questions. We first tested concurrent group mean-level differences in MCQ scale frequencies at baseline. Second, we examined overall longitudinal mean-level changes and individual differences (variability) in intraindividual changes. Third, we explored memory status as a potential time-invariant covariate of individual differences in intraindividual change, comparing it to a covariate of education (marker of cognitive reserve). Because no previous research has investigated long-term patterns of memory compensation use by older adults, we were interested in results showing both variability and stability in longitudinal trajectories.

Statistical Analyses. Concurrent (baseline) and longitudinal analyses of memory compensation were conducted using the five waves of data from VLS Sample 2. Multilevel analyses (using the HLM program; Raudenbush & Bryk, 2002) were used and have been applied previously to VLS data (Dixon & de Frias, 2004). HLM was used in preference to repeated measures analyses of covariances (ANCOVA) because HLM handles missing data such that all available data are used in the estimation process. In HLM more weight is given to (a) cases with more complete data, and (b) cases with greater variability in change. Consequently, this procedure improves reliability of change estimates and statistical power. Attrition effects were examined for this sample, and there were no memory status group differences at baseline for 3, 6, 9, and 12-year continuers.

The Level 1 models were analyzed separately for each of the seven MCQ scales.

Level 1 (within-person model):

$$\text{Memory Compensation}_{ti} = \beta_{0i} + \beta_{1i}\,(\text{Wave}) + r_{ti} \quad (1)$$

At level 1, each person's development is represented by an individual growth trajectory (an intercept, β_{0i}, and a slope, β_{1i}), as described in equation 1. At level 2, these parameters become the outcome variables that depend on stable between-person sources of variation. These variables represent an intercept (β_0) and slope (β_1) as an outcomes model. Separate two-stage models were analysed for each MCQ scale. Age and education (Wave 2) were used as covariates in all HLM models. An illustrative description (using memory status as a level 2 predictor) follows:

Level 2 (between-person model):

$$\beta_{0i} = \gamma_{00} + \gamma_{01}\,(\text{Age}) + \gamma_{02}\,(\text{Education}) + \gamma_{03}\,(\text{Memory Status}) + U_{0i} \quad (2)$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}\,(\text{Age}) + \gamma_{12}\,(\text{Education}) + \gamma_{13}\,(\text{Memory Status}) + U_{1i} \quad (3)$$

In equation 2, a person's score at baseline, $\beta_{0i,}$ was modeled as a function of the average level across all participants in the first wave, γ_{00} (fixed effect), the average group difference in memory compensation for memory status (γ_{03}), the main effects of age (γ_{01}) and education (γ_{02}), plus a random effect, U_{0i} (between-person variance in the intercept). The random effect represents how the individual varies around the grand mean (i.e., initial individual differences) after controlling for initial status, age, education, and memory status. In equation 3, linear average rate of change in memory compensation for a person, β_{1i}, was modelled as a function of the sample average change in memory compensation, γ_{10}, the effect of memory status, γ_{13} (average difference in change), and the effects of age (γ_{11}) and education (γ_{12}), plus a random effect, U_{1i}, that represents between-person variability in the slopes. The random effect estimated whether there remain significant interindividual differences in intraindividual change after controlling for occasion of measurement, age, education, and memory status.

Results

A summary of the HLM findings is presented in Table 1. For all MCQ scales, fixed and random intercepts (except MCQ External) were significantly different from zero (before inclusion of between-person variables). Regarding the first research question, memory status (NIC vs. MMD) was a significant predictor of baseline interindividual differences in level for one general scale (MCQ Change) after controlling for age and education (see Table 1; $\gamma_{00} = 2.30$, $\gamma_{03} = .14$; rows 53 and 56, column 3). Given that the NIC group was coded 0, and the MMD group was coded 1, the γ_{00} coefficient is the average rating for the NIC group, and the γ_{01} coefficient is the mean difference score for the two groups. For example, the mean for the NIC group (M = 2.30) was lower than the mean for the MMD group (M = 2.44 = 2.30 + .14), indicating that relative to the NIC group the MMD group reported greater use of compensatory strategies in recent years (MCQ Change). Years of education (continuous variable) was a significant predictor of initial individual differences in one memory compensation strategy (MCQ Effort) and one general scale (MCQ Success). At baseline, higher education was associated with less effort investment (γ_{02} = -.04), and less motivation to succeed in everyday tasks (γ_{02} = -.06). Regarding research question 2, three MCQ strategy scales were associated with significant longitudinal mean-level change (see Table 1, significant Time effects): MCQ Internal (overall decline), MCQ Effort (overall decline), and MCQ Change (overall increase). Regarding research question 3, one MCQ scale (Effort) was associated with significant longitudinal memory status group effects, after controlling for age and education. As seen in Table 1, memory status was a significant predictor of individual differences in 12-year change (γ_{10} = -.05, γ_{13} = .01; rows 37 and 40, column 3). As indicated in Table 1, whereas the slope for the NIC group was negative (γ_{10} = -.05), it was positive for the MMD group (.04). As shown in Figure 1, the NIC group decreased their effort whereas the MMD group applied more effort over the same 12-year period with the MMD group surpassing the NIC group after the six year mark. Education was a significant predictor of intraindividual changes in three memory compensation strategies (MCQ Internal, Time, and Effort). Higher education was associated with a 12-year increase in internal mnemonics (γ_{12} =.01), and the investment of time (γ_{12} =.01) and effort (γ_{12} = .01) in everyday memory tasks.

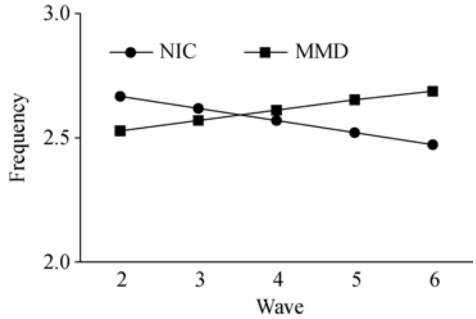

Figure 1. The MMD group increased their compensatory effort whereas the NIC group decreased their effort over a 12-year period.

Discussion

We used five-wave (12-year) longitudinal data from the VLS to examine several aspects of memory compensation in older adults. After defining the two groups—one control group with normal memory functioning (not impaired control, NIC) and one group with mild memory deficits (MMD) — we compared their reported implementation of memory compensation strategies and beliefs at baseline (wave 2) and across the 12-year period. Little is known about the extent to which NIC older adults might compare cross-sectionally to a corresponding MMD group at any point in time, much less across a 12-year period. Moreover, little is known about the extent to which individuals in each of these two important groups might change and vary over the longitudinal waves. The importance of examining awareness of memory change in normal aging and in cognitive impairment is, however, well established (Clare, Wilson, Carter, Roth, & Hodges, 2002; Cosentino & Stern, 2005).

The baseline results showed that, in their response to the MCQ Change scale, the MMD group reported an overall greater recent (past 5-10 years) increase in use of various memory compensation strategies. This result replicates that reported earlier with VLS Sample 2 data (Dixon & de Frias, 2007). Moreover, it underscores the notion that community-dwelling older adults who

Table 1
Mild memory deficit as a source of interindividual differences in level and intraindividual changes in memory compensation (MCQ scales)

MCQ Scale	Effect	Coefficients	t (df = 243)
External	Level effect, γ_{00}	3.29	71.10***
	Age, γ_{01}	−.02	−.21
	Education, γ_{02}	−.01	−.75
	Memory status, γ_{03}	−.09	−.99
	Time effect, γ_{10}	.01	.55
	Age, γ_{11}	−.02	−.84
	Education, γ_{12}	.01	1.59
	Memory status, γ_{13}	−.01	−.34
Internal	Level effect, γ_{00}	2.37	48.08***
	Age, γ_{01}	−.08	−.97
	Education, γ_{02}	−.02	−1.32
	Memory status, γ_{03}	−.17	−1.70
	Time effect, γ_{10}	−.05	−3.77***
	Age, γ_{11}	.04	1.30
	Education, γ_{12}	.01	2.60**
	Memory status, γ_{13}	.03	.77
Recruitment	Level effect, γ_{00}	1.29	19.56***
	Age, γ_{01}	−.19	−1.65
	Education, γ_{02}	.01	.59
	Memory status, γ_{03}	.20	1.50
	Time effect, γ_{10}	.00	.23
	Age, γ_{11}	.08	1.87
	Education, γ_{12}	.00	.55
	Memory status, γ_{13}	.01	.23
Time	Level effect, γ_{00}	1.97	37.93***
	Age, γ_{01}	.07	.76
	Education, γ_{02}	.00	.28
	Memory status, γ_{03}	.01	.14
	Time effect, γ_{10}	−.01	−.57
	Age, γ_{11}	.00	.00
	Education, γ_{12}	.01	2.27*
	Memory status, γ_{13}	.04	.97
Effort	Level effect, γ_{00}	2.67	49.06***
	Age, γ_{01}	−.02	−.25
	Education, γ_{02}	−.04	−2.44*
	Memory status, γ_{03}	−.14	−1.29
	Time effect, γ_{10}	−.05	−2.73**
	Age, γ_{11}	.01	.22
	Education, γ_{12}	.01	2.16*
	Memory status, γ_{13}	.09	2.12*
Success	Level effect, γ_{00}	1.85	26.96***
	Age, γ_{01}	.14	1.18
	Education, γ_{02}	−.06	−3.02**
	Memory status, γ_{03}	.15	1.11
	Time effect, γ_{10}	−.02	−1.01
	Age, γ_{11}	.12	2.45*
	Education, γ_{12}	.00	.34
	Memory status, γ_{13}	.04	.78
Change	Level effect, γ_{00}	2.30	67.77***
	Age, γ_{01}	.07	1.23
	Education, γ_{02}	−.01	−.96
	Memory status, γ_{03}	.14	2.10*
	Time effect, γ_{10}	.04	2.66**
	Age, γ_{11}	.00	.09
	Education, γ_{12}	.00	.52
	Memory status, γ_{13}	−.03	−.90

Notes. Age and education were covariates in all HLM models.
*p<.05; ** p<.01; ***p<.001

are cognitively preclinical but relatively poorer declarative memory performers are apparently aware of their mild memory deficit and report having engaged in relevant memory compensation strategies. They did not report greater baseline use of any of the specific strategies, perhaps reflecting their overall cognitive similarity to the NIC group. Regarding the covariates, an Education effect revealed that more years of schooling was associated with initially lower levels of MCQ Effort (i.e., not trying as hard) and MCQ Success (i.e., less commitment to remember well).

The remaining research questions concerned the five-wave change patterns in reported compensation use. Given the dearth of information about long-term change, all possible patterns were conceivable, including general increases or decreases in use and the presence or absence of memory status group differences in changes. Regarding overall long-term change, we observed decrements in the compensatory use of internal mnemonic devices and in extent of effort invested in everyday memory performance. These two strategies would be among the more resource intensive, but in the absence of corresponding increases in more practical strategies their declining frequency may not be indicative of late-life cognitive resilience. Nevertheless, overall respondents did report that they had increased their general efforts to compensate for memory deficits in the previous 5-10 years (MCQ Change). These overall patterns are reflected in the derived means in Table 2. In our previous study, we found memory status group differences in change patterns for reports associated with MCQ External and MCQ Effort. In the present study, memory status was associated with differential change in MCQ Effort reports. Whereas the NIC group generally showed increases in investment of effort, the MMD group showed 12-year decreases in this strategy. However, considerable long-term stability for both memory status groups was observed (and is illustrated in Table 2). Notably, the memory status groups were developed—for sound methodological reasons—at the first wave and were not adjusted at subsequent waves. It is possible that some individuals may have crossed to the alternative status group (and perhaps even back to the original again). Moreover, it is possible that the survivors of a 12-year longitudinal study are those who are fairly cognitively competent and converging to relative similarity over time. We should also note that one covariate, education, was associated with increases in three MCQ-measured strategies (Internal, Effort, and Time). This result demonstrated a specific commitment by individuals with more years of schooling (regardless of memory status), but not necessarily the most practical memory compensation strategy choices. Perhaps over 12 years for relatively competent older adults, overall cognitive reserve (as represented here by Education; Stern, 2006) has a stronger effect on changes and variability in these reserve-intensive strategies. Methodologically, education (years of schooling) is a status variable that does not change over time, whereas memory status may undergo some transitions.

We conclude with three limitations of the study. First, we did not seek to develop classifications that mapped to external diagnostic categories, but rather we sought to clarify classification-related patterns among community-dwelling and relatively healthy older adults. Therefore, this study is relevant to the vast number of healthy older adults undergoing normal to subclinical memory changes, but not necessarily to those who are entering preclinical conditions indicative of neurodegenerative disease. Further research linking these clinically neighboring groups would be interesting, and might be more likely to generate memory compensation strategy differences. Second, we used the available VLS declarative memory markers to develop the memory status groups, so we did not have external and independent indicators of everyday memory performance to include in the models. Larger samples and fully dynamic models with additional memory measures would contribute further to this literature. Third, the VLS participants are generally healthy and have access to Canadian national health care. We do not generalize to other cultures or health-care communities. It may be particularly interesting to observe cultural differences in memory compensation strategy use, given that some of the strategies we tap are intensely individualized whereas at least one (recruitment of others) is more familial or even community based.

Table 2
Derived mean level performance across five waves by group

MCQ Scale		Wave				
		2	3	4	5	6
External						
	NIC	3.29	3.30	3.31	3.32	3.33
	MMD	3.20	3.20	3.20	3.20	3.20
Internal						
	NIC	2.37	2.32	2.27	2.22	2.17
	MMD	2.20	2.18	2.16	2.14	2.12
Recruitment						
	NIC	1.29	1.29	1.29	1.29	1.29
	MMD	1.49	1.50	1.51	1.52	1.53
Effort						
	NIC	2.67	2.62	2.57	2.52	2.47
	MMD	2.53	2.57	2.61	2.65	2.69
Time						
	NIC	1.97	1.96	1.95	1.94	1.93
	MMD	1.98	2.01	2.04	2.07	2.10
Success						
	NIC	1.85	1.83	1.81	1.79	1.77
	MMD	2.00	2.02	2.04	2.06	2.08
Change						
	NIC	2.30	2.34	2.38	2.42	2.46
	MMD	2.44	2.45	2.46	2.47	2.48

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老年人记忆补偿的长期稳定性和变异性：来自维多利亚纵向研究的证据

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摘　要　两种记忆状况组来自于参与加拿大维多利亚纵向研究(VLS)的老年人原样本。一种是未受损伤的控制组(NIC), 另一种是轻度记忆损伤组(MMD)。在基线水平和纵向水平上(即 5 次追踪或 12 年)比较了他们在日常生活中对记忆补偿技术的使用。我们使用多水平模型(以年龄和教育水平为协变量)来检验基线水平的差异和长期的变化模式。基线的结果表明 MMD 组被试报告了近期在日常生活中使用记忆补偿策略方面有更大的增长。纵向的结果表明记忆补偿的使用在 12 年中具有明显的稳定性, 但是与努力相关的补偿机制存在显著组间差异。教育水平这一协变量(可认为是潜在的认知储备指标)和三种记忆补偿策略随时间的不同变化相关。

关键词　记忆补偿; 轻度记忆损伤; 多水平模型; 维多利亚纵向研究

分类号　B844.4