Heart Rate Recovery Predicts Memory Performance in Older Adults

Ann Pearman · Margie E. Lachman

Abstract The current study examined cardiovascular reactivity and recovery during memory testing in a sample of 28 younger and 28 older adults. Heart rate (HR) levels were measured before, during, and after a memory test (word list recall). Contrary to prediction, older adults did not have a blunted cardiovascular response to memory tasks compared to younger adults. Word list recall performance was predicted by both Age and an Age × HR recovery interaction. As expected, younger adults performed better on the word list task than older adults. In addition, older adults with better posttest HR recovery performed significantly better than older adults with poor posttest HR recovery, whereas HR recovery differences in younger adults were inconsequential. These relationships were not affected by subjective appraisals of anxiety and task difficulty. Overall, cardiac dysregulation, seen here as low HR recovery, represents an important, potentially modifiable, factor in memory performance in older adults. In addition to being beneficial to overall health, interventions designed to help older adults regulate their HR responses may help offset certain memory declines.

Keywords Cardiovascular reactivity · Heart rate recovery · Heart rate reactivity · Age-differences · Memory

Introduction

Associations between memory declines and aging are well-documented; however, wide variability in the nature and magnitude of performance decrements has been found (e.g. Hertzog et al. 2003; Salthouse 2004). This variability has led to a search for non-cognitive and potentially modifiable factors that contribute to individual differences in memory performance across the lifespan (e.g., Berner et al. 2006; Lachman 2006; Stein et al. 2002). One area of focus has been physiological responsivity, which has been found to be alternatively helpful or detrimental to cognitive performance depending on age, task, and setting (Jennings et al. 1990; Wright et al. 2005). The present study was designed to compare young and older adults’ HR reactivity and recovery on a word list recall task.

Cardiovascular Response and Memory

Cardiovascular response has several components, including both reactivity and recovery. Reactivity is the reaction of the cardiovascular system to a challenge; whereas, recovery is the response of the cardiovascular system after the challenge. Both reactivity and recovery can be reported in terms of time (i.e. how long it takes to respond or how long it takes to return to baseline) or magnitude (i.e. difference between baseline and reaction or difference between posttest and reaction). There are indications that there are age-related differences in cardiovascular response to cognitive challenges.

Many studies have shown that HR reactivity to a variety of cognitive tasks is significantly blunted in older adults when compared to younger participants (Barnes et al. 1982 [verbal paired associates]; Ditto et al. 1987 [serial subtraction]; Jennings et al. 1988 [verbal paired associates];
Steptoe et al. 2005 [paired associates and matrix reasoning]), while a few other studies found greater cardiovascular reactivity to cognitive stressors in older adults (Boutcher and Stocker 1996 [Stroop task]; Uchino et al. 2005 [serial subtraction]). Although Boutcher and Stocker (1996) found greater absolute cardiovascular changes in older (M age = 59 years) compared to younger adults (M age = 21 years), older adults still had significantly smaller relative cardiovascular responses. So, while HR responses clearly have tremendous variability and seem to be dependent on type of task, the preponderance of evidence suggests lower HR reactivity to cognitive challenges in older vs. younger adults.

Only a few of the aforementioned studies used cognitive tests as actual outcome variables, as opposed to using them exclusively as stressors designed to elicit cardiovascular response. Jennings et al. (1990) studied HR changes and actual memory performance (specifically, a digit span task) in younger (M = 21.5 years) and older adults (M = 67.5 years) and found that the older adults who performed best showed the most heart rate reactivity during the tasks. However, using a sample of only older adults (M age = 70.5), Wright et al. (2005) found no association between heart rate reactivity and performance on a verbal paired associates memory task.

The research to-date on age-related cardiovascular recovery differences has equally equivocal results. While some studies suggest that HR recovery is impaired in older adults following mental challenges (Boutcher and Stocker 1996 [Stroop task]; Kudielka et al. 2004 [social stress and mental arithmetic]), other studies have found that in relatively healthy older adults, HR recovery remains intact (Forcier et al. 2006 [cognitive and emotional stressors]; Uchino et al. 2005 [social stress and arithmetic]).

Similar to the studies on HR reactivity, many studies have used cognitive challenges exclusively as stressors and not as outcome variables. However, Wright et al. (2005), in their sample of older adults, found that individuals with the highest heart rate recovery (rapidly decreasing HR levels) following a verbal paired associate free recall task performed significantly better than those who did not recover as efficiently.

Self-Assessments and Memory

The experience of stress and/or anxiety has also been shown to impair the performance of both younger and older adults on memory tests (Andreoletti et al. 2006; Klein and Boals 2001). It has also been suggested that older adults may be even more susceptible than younger adults to the negative effects of anxiety on memory because of already diminished cognitive and physiological resources (Andreoletti et al. 2006; Li et al. 2004). As mentioned previously, it is also notable that many studies of HR reactivity and recovery use cognitive tasks as a method of inducing what is often termed a “stress response” in both younger and older adults. The underlying assumption in these studies seems to be that cognitive tasks are anxiety provoking. With the exception of Wright et al. (2005), most of these studies do not examine levels of perceived difficulty and anxiety that may vary between age groups. We include measures of self-assessed anxiety and task difficulty as a way of both understanding and controlling for age differences in task experience.

Current Study

The current study was conducted to examine the contributions of cardiovascular response of both younger and older adults to performance on a word list recall task. We predicted that older adults would have lower basal heart rates and blunted cardiovascular responses (lower reactivity and recovery) to the memory task in comparison to the young adults. In terms of actual memory performance, we hypothesized that the actual cardiovascular response differences would contribute to the age-related variance in memory performance. We also included a post-test self-assessment of anxiety and task difficulty to examine and control for their contribution to performance above and beyond HR response.

Methods

Participants

A sample of university undergraduates was recruited through flyers and classroom announcements. A sample of high functioning, community-dwelling older adults was recruited through both a participant database and local advertisements. Volunteers were excluded if they met one or more of the following self-reported criteria: stroke in the last 5 years, serious head injury, Parkinson’s disease, did not have full use of both hands, less than a high school education, reported being in poor health compared to others their same age, were on prescription stimulants, or were not native English speakers. Volunteers were also excluded from the study if they met the following examiner-based criterion: two or more errors on a modified-for-telephone version of the Short Portable Mental Status Questionnaire (Pfeiffer 1975). Twenty-eight younger adults and 29 older adult volunteers participated. One older adult participant was not administered the word list task due to experimenter error—and was excluded from this report. The final sample, therefore, consisted of 28 younger adults and 28 older adults. The mean age of the young adult sample was 19.79
(SD = 1.17) ranging from 18 to 23 years. The mean age of the older adult sample was 71.66 (SD = 6.61) ranging from 60 to 85 years. Participants were paid $25. Sample characteristics are further detailed in Table 1.

In terms of education, the older adult sample was highly educated with all participants having graduated from high school and 60% of participants having a bachelor’s degree or higher. Because the younger adult sample consisted entirely of undergraduate students, we did not provide an age-group comparison of education (i.e. all students had high school diplomas but none had bachelor’s degrees), nor did we use education in our analyses.

### Experimental Measures

### Health

Because of the known effect of poor health on overall cardiovascular functioning, we included several self-rated assessments of health, including chronic conditions, functional limitations, self-reported health, and impairments in daily functioning. Participants reported whether they had experienced any chronic conditions (asthma, tuberculosis or COPD, heart disease, bone/joint disease, high blood pressure, high cholesterol, sleeping problems, diabetes, neurological disorders, and cancer) during the past year. Total number of chronic conditions was obtained by counting the number of reported illnesses. Participants also reported if they had difficulty performing several daily activities (lifting or carrying groceries, bathing or dressing, climbing several flights of stairs, climbing one flight of stairs, walking more than one mile, walking one block, bending or kneeling, vigorous activity, moderate activity) on 4-point Likert-type scales (1 = none to 4 = a lot). Our measure of functional limitations was the mean score of these nine activities (a = .89). Self-reported health was the participant’s subjective assessment of their own health ("Compared to other’s your age, how would you rate your own health?") on a 1–5 scale with higher numbers indicating poorer health (1 = excellent, 5 = poor). Impairments in daily functioning was also a single item question ("Are your daily activities in any way impaired because of...")

### Table 1  Study sample characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Young adults (n = 27)</th>
<th>Older adults (n = 27)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Age</td>
<td>19.79</td>
<td>1.17</td>
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<tr>
<td>Sex, N female (%)</td>
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<td></td>
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<tr>
<td></td>
<td>19</td>
<td>68</td>
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<tr>
<td>Health</td>
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<tr>
<td>Number of chronic illnessesᵇ</td>
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<tr>
<td>Self-rated healthᶜ</td>
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<td>Functional limitations</td>
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<tr>
<td>Daily impairmentsᵈ</td>
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<td>.39</td>
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<tr>
<td>Total health compositeᵉ</td>
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<td>.36</td>
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<tr>
<td>Cardiovascular medicationsᶠ</td>
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<td>Heart rate (HR) measurements</td>
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<td>Pretest HR</td>
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<td>Word list HR</td>
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<td>Posttest HR</td>
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<td>Subjective assessments</td>
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<td>Task anxietyᵍ</td>
<td>1.89</td>
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<tr>
<td>Task difficultyᵍ</td>
<td>2.50</td>
<td>.79</td>
</tr>
<tr>
<td>Word list recall</td>
<td>23.56</td>
<td>2.61</td>
</tr>
</tbody>
</table>

ⁿ Test for mean age group differences significant at p < .05
ᵇ Chronic illnesses include asthma, tuberculosis, heart disease, bone/joint disease, high blood pressure, high cholesterol, sleeping problems, diabetes, neurological disorders, and cancer
ᶜ Self-rated health = Rate your overall health compared with others your age (1 = excellent to 5 = poor)
ᵈ Daily impairments = Are your daily activities impaired because of your health? (1 = not at all to 5 = a great deal)
ᵉ Health composite = Mean of z-scores of self-rated health, daily impairments, number of chronic illness, and functional impairments with higher scores indicating poorer health
ᶠ Cardiovascular medications include beta blockers, calcium channel blockers, and ACE inhibitors
ᵍ Subjective task ratings were on five-point scales where 1 = low and 5 = high
your health?” measured on a 1–5 scale with higher numbers indicating more impairment (1 = not at all impaired, 5 = very much impaired). As a measure of overall health, we standardized these four variables and computed a mean health variable composite in which higher scores indicate worse health (\( \alpha = .78 \)).

**Medications**

Many older adults are on medications to control high blood pressure (Ahmed and Calhoun 2007; Psaty et al. 1995). Furthermore, many of these medications are known to affect both cardiovascular response and cognition (Adsett et al. 1989; Jennings et al. 2008; Krantz et al. 1988; Nielson and Jensen 1994). We, therefore, included cardiovascular medications as a covariate in our analyses. Lists of current medications were provided by each participant and were then coded by the researchers for presence (1) or absence (0) of cardiovascular medications. The following types of medications were included in the cardiovascular medication category: angiotensin converting enzyme (ACE) inhibitors (e.g. lisinopril), calcium channel blockers (e.g. veraprinil), and beta blockers (e.g. atenolol).

**Memory Task**

The word list recall task, developed by Hertzog et al. (1990) consisted of 30 categorizable nouns. This is a commonly used task to measure free recall (see Dixon and de Frias 2004; Hultsch et al. 1990; Lachman et al. 2006; MacDonald et al. 2004). The list contains six words from each of five taxonomic categories (flowers, metals, sports, animals, trees), which were developed using norms from Howard (1980). Words were presented in two columns on a sheet of paper in the same random order for all participants. Each participant was given two trials. Participants studied the list for 3 min during the first trial and 1 min during the second trial. For both trials, participants were given as much time as needed to write down as many words as they could remember. No participant took longer than 4 min for the recall phase. The mean score for number of words correctly recalled across the two trials was calculated with a possible range from 0 to 30.

**Subjective Assessments**

A subjective task assessment was taken immediately following the word list test. The subjective assessment included a rating of both anxiety and task difficulty. Participants were asked to respond about their anxiety level during the task and perceived task difficulty on a 5-point scale (1 = low, 5 = high).

**Cardiovascular Measures**

Heart rate (HR) was continuously measured with a fingertip photoplethysmograph (PPG) sensor placed on the middle finger of the participant’s non-dominant hand with a Velcro piece. The MEDAC System/3™ is an integrated instrumentation and software package for non-invasive monitoring of a range of physiological measures from the autonomic nervous system. The MEDAC program takes measurements every 1/100th of a second and calculates HR in beats/minute (bpm). We instructed all subjects to keep their hand and fingers still during the recording phase, and the experimenter noted any extreme movements.

**Procedure**

Participants were tested individually in a laboratory room at a small private university in the Northeast. Research assistants who were trained by a clinical psychologist conducted the evaluations. After written informed consent was obtained, physiological sensors were attached. All participants were given a brief period (approximately 5 min) to acclimate to the testing room environment before the recording was started. After this brief period of stabilization, we continuously recorded the data during the rest of the session, which lasted approximately an hour. Following acclimation, participants filled out a series of demographic questionnaires and were then given the memory task and the subjective task questions. The memory task portion of the study lasted approximately 12 min total.

**Data Reduction and Analyses**

Heart rate recordings were averaged by time period yielding a pretest mean, a during-task mean for word list recall, and a posttest mean. The pretest mean was derived from the HR measurements taken during the period immediately prior to the memory test during which the participants were filling out a brief questionnaire. This time period lasted approximately 1 min. Similarly, the posttest mean was derived from the HR measurements taken during the period immediately following the memory test during which the participants were filling out a similar brief questionnaire. This time period also lasted approximately a minute. The during-task mean was derived from the HR measurements taken during the entire testing sequence (both administrations of the word list task). Although the amount of time taken on this task did vary by participant (\( M = 677.91 \) s, SD = 164.24 s), these times were unrelated to our outcome variables (reactivity, recovery, word list recall) and were, therefore, not included in further analyses.
Reactivity was calculated by subtracting the previous time period value from measurement taken during the memory task. Higher reactivity scores indicate greater responsivity to the task. Task recovery was calculated by subtracting the time period value immediately following the memory task from the measurement obtained during the task. A higher recovery value, therefore, indicates larger task recovery. This method of calculating reactivity and recovery is similar to Wright et al. (2005).

Repeated measures analysis of variance was used to examine the pattern of HR during the memory test with age group as the between subjects factor and with health and cardiovascular medication usage as covariates. Predictors of word list task performance were analyzed using a hierarchical linear regression. Word list recall was the dependent variable with the following variables as independent variables: Step 1—Age, health, medications, and pretest HR, Step 2—Cardiovascular response (HR reactivity and recovery), Step 3—Interactions (Age × HR reactivity, Age × HR recovery), Step 4—Subjective assessments (Anxiety and Difficulty ratings).

Although sex has been identified in previous studies as a potential influential variable on heart rate (e.g. Labouvie-Vief et al. 2003), we did not find any gender relationships in our preliminary data analyses and, therefore, did not include it in this report.

Results

The means and standard deviations of the sample variables are shown in Table 1. There were significant age group differences on the health variable with the older adults reporting significantly worse health than the younger adults. No younger adults were on cardiovascular medications, while 13 older adult participants (46%) were. In addition, older adults rated the memory task as significantly more anxiety provoking and more difficult than the younger adults. Contrary to prediction, younger and older adults did not differ significantly on pretest HR.

Cardiovascular Responses to Memory Task

Using a repeated measures ANOVA for the three HR measurements (pretest, word list recall, posttest) and controlling for both health and cardiovascular medications, there was a main effect of time \( F(2,104) = 6.39, p \leq .01 \), which specifically showed a significant quadratic trend \( F(1,52) = 14.71, p \leq .001 \). This quadratic effect verifies that the cognitive task was adequate to alter cardiovascular response in both groups. There were, however, no significant effects of age, poor health, or medications. In addition, the age × time interaction was not significant, which suggests that, contrary to hypothesis, older adults were not less responsive than younger adults on the memory task.

Performance on Memory Task

Table 2 shows the regression coefficients for the analysis of word list recall. The overall regression of word list recall was significant, \( R^2 = .65, F(10,44) = 8.30, p < .001 \). Step 1, which included age, baseline HR, cardiovascular medication, and health was significant, \( R^2 = .46, F(4,50) = 10.46, p \leq .001 \). Age was significantly related to memory performance, whereas baseline HR, health, and cardiovascular medication use were not. Step 2, which included HR reactivity and HR recovery, was not significant overall. Step 3, which included the age × HR reactivity and age × HR recovery interaction terms, was significant, \( ΔR^2 = .08, F(2,46) = 4.52, p \leq .05 \). Within this step, only age × HR recovery was significantly related to memory performance. The last step of the analysis, which included the subjective task assessments, was also significant, \( ΔR^2 = .06, F(2,44) = 3.82, p \leq .05 \). However, neither of the two variables added unique variance to the dependent variable. Importantly, the age × HR recovery interaction remained significant after the addition of these variables, which suggests that the relationship between poorer task recovery in older adults and poor memory performance was independent of subjective task appraisal (how people felt about the task and their performance).

<table>
<thead>
<tr>
<th>Step/predictors</th>
<th>Incr ( R^2 )</th>
<th>Cum ( R^2 )</th>
<th>Adj ( R^2 )</th>
<th>( β )</th>
<th>Final ( β )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Background variables</td>
<td>.46***</td>
<td>.46*</td>
<td>.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>−.72***</td>
<td>−.60***</td>
<td></td>
<td></td>
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<tr>
<td>Pretest HR</td>
<td>−.03</td>
<td>−.09</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Health</td>
<td>.24</td>
<td>.23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medications</td>
<td>−.13</td>
<td>−.09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Cardiovascular response</td>
<td>.06</td>
<td>.51</td>
<td>.45</td>
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<tr>
<td>HR reactivity</td>
<td>.16</td>
<td>.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR recovery</td>
<td>.25</td>
<td>.24*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Interactions</td>
<td>.08**</td>
<td>.59</td>
<td>.52</td>
<td></td>
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<tr>
<td>Age × HR reactivity</td>
<td>.12</td>
<td>.10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age × HR recovery</td>
<td>.30**</td>
<td>.33**</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4. Subjective assessments</td>
<td>.06***</td>
<td>.65</td>
<td>.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>−.12</td>
<td>−.12</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Difficulty</td>
<td>−.21</td>
<td>−.21</td>
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</tbody>
</table>

\( HR \) heart rate in beats/min

\( * p < .05; ** p < .01; *** p < .001 \)
To illustrate the interaction effect, we divided the sample into two HR recovery groups (heart rate recovery mean ± 1 SD) and age groups (see Fig. 1). Older adults with poor (low) HR recovery performed significantly worse than the older adults with good (high) HR recovery, whereas the effect of HR recovery on young adults’ performance was negligible.

**Exploratory Analyses**

As an alternative method of analyzing HR recovery, we also created a standardized residual by regressing posttest HR on pretest HR and during-task HR. Using this variable in the previous regression analysis with word list recall as the dependent variable, we still found a significant HR recovery by age interaction ($\beta = .32, p < .01$). We also regressed our original change score measure of recovery on pretest HR (to control for pretest differences in HR) and again found that HR recovery predicted word list recall ($\beta = .33, p < .01$). These findings strengthen our results of posttest recovery predicting performance on a word list test in older adults.

**Discussion**

The primary aim of the present study was to compare the HR responses of younger and older adults during and after memory task. Given previous findings, we hypothesized that older adults would have blunted cardiovascular responses to the memory task compared to the younger adults and that age-differences in cardiovascular reactivity and recovery would contribute to the variance in memory performance. These hypotheses were partially supported.

**Age Differences in HR Response**

Contrary to our prediction, older adults did not have a blunted HR rate response to the memory task. Both groups showed similar patterns of increases in HR during the task and decreases in HR following the task. Although there were between-group differences on during-task HR level and posttest mean HR level, these differences were fully explained by the inclusion of the health and cardiovascular medication variables. Sample differences in health and cardiovascular medications may also explain the lack of response differences between younger and older adults. However, another possible explanation is that the non-blunted reactivity in the older adults was due to their experience of more anxiety or perhaps more engagement (which we did not measure) during the task than the younger adults, which may have effectively increased their reactivity to the same level as younger adults.

**Heart Rate Reactivity and Memory Performance**

Heart rate reactivity was not related to word list recall performance in either young or older adults. Similarly, Wright et al. (2005) found no relation between HR reactivity and memory tasks, specifically verbal paired associates. These findings differ from the Jennings et al. (1990) study that has shown higher HR reactivity to be important in the cognitive performance, specifically short-term memory and attentional tasks, of older adults. Notably, the task that we used in our study (word list recall) is different in nature from the tasks used in the Jennings et al. study and similar in nature to the Wright et al. (2005) study. Perhaps on tasks that demand more immediate attentional resources and quicker responses (such as short-term memory tests), older adults are indeed more reliant on their cardiovascular systems to rapidly oxygenate the frontal regions of the brain (Chung and Lim 2008).

**Heart Rate Recovery and Memory Performance**

Similar to the Wright et al. (2005) study and in accordance with our predictions, we found that older adults with better...
HR recovery performed better on free recall memory task than did older adults with poorer heart rate recovery. These relations were independent of health, cardiovascular medication, and baseline HR.

In their review article, Thayer and Lane (2007) described impaired HR recovery following challenges as a form of cardiac dysregulation and reported that this dysregulation was often predictive of increased mortality and morbidity. However, whether this dysregulation is the result or the cause of older adults’ difficulties in memory performance remains to be seen. Wright et al. (2005) suggested that “physiological resilience, manifested in more rapid post-task cardiovascular recovery, appears to be associated with more effective memory function in older people” (p. 836). Another possibility is that the HR recovery findings are not due to cardiovascular dysregulation but to a more general age-related deterioration of cardiovascular and brain systems (Fahlander et al. 2000; Thayer and Lane 2007). Further studies are needed to disentangle the mechanism of this effect.

It is notable that even with the addition of self-reported anxiety and perceived task difficulty, HR recovery remained significant for the older adults. This suggests that HR recovery is independent of subjective task appraisal. That is, the effects of HR recovery scores on memory are not merely due to the heightened subjective emotional reactions of the older participants while taking the test. Of note, recent research by Key et al. (2008) has also shown an interaction of anxiety with HR recovery (i.e. more anxious participants had poorer HR recovery). Although examining potential interactions between age, subjective responses, and cardiovascular responsivity was beyond the scope and size of this study, this certainly provides an interesting direction for future work.

Study Limitations

One limitation of our study is the small sample size which limits the number of comparisons we could make and the number of interactions we could test. A larger sample size would also have allowed us to examine potential age-related variations within the older adult group. Another limitation of our data is its correlational nature. Although we have suggested that heart rate responsivity contributes to memory performance in older adults, it may also be the case that the performance of older adults and their emotional reaction to that performance affects cardiovascular recovery and not the reverse. Given that the addition of the subjective assessments did not alter the HR recovery and memory link, we believe this is not the case. Another potential limitation is that we were unable to report rapidity of HR response. Rapidity of HR recovery has previously been shown to be positively related to memory in older adults (Wright et al. 2005). We believe, however, that our finding combined with the Wright et al. findings suggests that both strength and speed of HR recovery are important to memory processes in older adults. Finally, we were solely reliant on participants’ self-reports of health problems and medication usage. A more complete physical exam prior to the study could possibly provide a more interpretable set of findings with regard to cardiovascular health.

Implications and Conclusions

Difficulty with HR recovery has numerous implications for older adults, including impaired memory and increased mortality risk. It has been shown, however, that biofeedback training and other interventions can have a positive impact on older adults’ cardiovascular recovery processes. For instance, Sokhadze (2007) found that soothing music after a stressor increased HR recovery. Other potentially modifiable factors, such as alcohol use, affect and anxiety, and exercise, also are known to contribute to poor HR recovery (Britton et al. 2008; Key et al. 2008; Thayer and Lane 2007). It is, tentatively, suggested that interventions that help improve HR recovery may also benefit older adults’ memory functioning. That is, improving HR recovery may have the effect of improving not only general well-being and health, but may also improve cognition. Intervention studies are needed to test this hypothesis.

Overall, this study furthers our understanding of age differences in cardiovascular responsivity associated with memory testing and performance. Consistent with other work on variability and aging-related outcomes, lower heart rate recovery was related to poorer memory performance for older adults, but not younger adults. Future studies are needed to investigate the processes that may lead to this differential response and effect in young and older adults.

References


