T he engagement of adaptive everyday behaviors is at the cornerstone of successful cognitive aging. Compensation represents a process by which individuals can overcome or mitigate losses or deficits in functioning through a collection of mechanisms (Dixon, Garrett, & Bäckman, 2008). The evidence in the cognitive literature for memory changes in advanced aging (e.g., Hultsch, Hertzog, Dixon, & Small, 1998; Schiefe, 1994) coupled with findings of greater individual differences in episodic memory performance in late adulthood (de Frias, Lövdén, Lindenberger, & Nilsson, 2007) further highlights the applicability and necessity of compensatory strategies to adaptive aging. Efforts to identify individual differences in compensatory behaviors are paramount to promoting cognitive resilience in late adulthood. Prior research has examined a variety of covariates in relation to average use, variability, and changes in memory compensation in older adults, such as (a) mild memory impairment (e.g., Dixon & de Frias, 2007, 2009; Glisky & Glisky, 2008; Prigatano & Kime, 2003), (b) objective memory performance (Dixon & de Frias, 2004), (c) Alzheimer’s disease (Dixon, Hopp, Cohen, de Frias, & Bäckman, 2003), (d) age and gender (Dixon, de Frias, & Bäckman, 2001), (e) psychosocial indicators (e.g., personality, well-being, memory self-efficacy) (de Frias, Dixon, & Bäckman, 2003), (f) select health indicators (de Frias et al., 2003), and (g) psychological stress and subjective memory (Garrett, Grady, & Hasher, 2010).

A well-established, multidimensional self-report tool for assessing everyday memory compensation is the Memory Compensation Questionnaire (MCQ) (Dixon et al., 2001; de Frias & Dixon, 2005). The MCQ consists of five scales representing separate memory compensation strategies: (a) external aids, (b) internal mnemonic strategies, (c) recruitment of other people as memory aids, (d) investment of more effort in recall, and (e) greater time investment. Two general MCQ scales represent the extent of commitment to memory performance and awareness of memory changes in the above five MCQ strategies. Prior investigations using the MCQ have established the underlying structure and measurement (group and temporal) invariance of memory compensation using structural equation modeling (de Frias & Dixon, 2005). The decision to compensate and successfully navigate one’s environment may be bound by person-level resources (e.g., de Frias et al., 2003). The present study examines two underexplored (i.e., physical health and mental health) and two unexplored (i.e., emotion regulation and mindfulness) contextual covariates for everyday memory compensation in older adults.

Previous studies have identified associations between components of health status with level of cognitive performance and changes over time in older adults (Albert, et al., 2009; Jajodia & Borders, 2011; Small, Dixon, & McArdle, 2011; Spiro & Brady, 2008; van Hooren et al., 2005: Wahlin, MacDonald, de Frias, Nilsson, & Dixon, 2006), with mounting evidence suggesting that...
poor mental and physical health are related to cognitive deficits and cognitive change. Studies also show that older adults who complain of memory problems report worse quality of life (e.g., Mol et al., 2007), which may be indicative of poor mental health status. With respect to cognitive adaptation to losses, prior research on everyday memory compensation has found that self-reported health conditions (e.g., infirmities) were related to more frequent use of several memory compensatory strategies, and negative affect predicted greater use of external memory aids (de Frias et al., 2003). Related research has found that adults with high depressive symptoms also reported using more external strategies (Tournier & Postal, 2011).

Poor health status may lead to functional limitations that would necessitate greater compensatory efforts to manage everyday memory. The present study compares self-reports of both physical and mental health status (as indicators of quality of life) in relation to everyday memory compensation in older adults.

The use of emotion regulation strategies may be another potentially useful person-status characteristic of everyday memory compensation. The initiation of compensatory strategies has been related to affective characteristics such as negative affect (de Frias et al., 2003) and perceived stress (Garrett et al., 2010). Emotion regulation refers to processes that individuals use to modulate which emotions they experience, the timing of said emotions, and how these emotions are expressed (Gross, 1998). Exercising adaptive and healthy self-regulation strategies in emotional contexts may be an important precursor to managing parallel challenges, namely memory deficits. Two commonly used emotion regulation strategies are cognitive reappraisal (i.e., selecting which personal meaning to attach to an aspect of a situation) and expressive suppression (i.e., minimizing an outwardly detectable reaction to an emotional situation) (Gross & John, 2003). Individual differences studies show (a) a developmental shift in the frequency of use with reappraisal typically dominating suppression with aging and (b) adaptive consequences for reappraisers (e.g., well-being) (John & Gross, 2004). Selecting or having a predisposition for utilizing healthy emotion regulation strategies in the face of potentially emotionally stressful situations demands cognitive resources for managing memory functioning in everyday contexts. Rumination processing involves repetition, which is also a component of select compensatory strategies, especially internal mnemonics (e.g., repeating someone’s name until you remember it well). The effortful top-down control processes that serve to regulate emotions (e.g., Isaacowitz & Blanchard-Fields, 2012) are also implicated in mnemonic strategy use. For successful cognitive adaptation to be realized, individuals select areas of functioning in their everyday lives that are important to maintain and then compensate for losses by employing strategies. Age-related increases in the importance of emotion-related goals (Charles & Carstensen, 2007; Scheibe & Carstensen, 2010) coupled with well-established memory deficits with aging render the exploration of how individual differences in the use of emotion regulation strategies relate to memory compensation in older adults.

The concept of trait mindfulness may be another covariate of everyday memory compensation. Mindfulness is a complex and adaptive process that necessitates paying attention to the present moment in a receptive and non-judgmental attitude (Brown & Ryan, 2003; Kabat-Zinn, 1994). Interest and the investigation of mindfulness in the psychological literature is growing (e.g., Brown, Ryan, Loverich, Biegel, & West, 2011; Kabat-Zinn, 2003), and the opportunity exists to understand its conceptual space and functional benefits in relation to psychological outcomes. The mindfulness literature reports some benefits in multiple domains of functioning, including treatment of disorders and improvement in health (e.g., Teasdale et al., 2000); psychological well-being in healthy young adults (e.g., Brown & Ryan, 2003); emotion regulation and stress reduction (e.g., Epel, Daubenmier, Moskowitz, Folkman, & Blackburn, 2009); and better cognitive functioning (e.g., see Chiesa, Calati, & Serretti, 2011, for review). Mindfulness consists of two components: attention and awareness (Brown & Ryan, 2003), as experienced in the present moment. Whereas cognitive reappraisal requires cognitive elaboration and evaluation, mindfulness relinquishes the need to manipulate emotions and instead focuses on the acceptance of current experiences and sensations (Farb, Anderson, & Segal, 2012) and serves to minimize rumination (Epel et al., 2009). These differential processes indicate that reappraisal and mindfulness (acceptance) would have differential consequences on everyday compensatory strategy use. In addition, the awareness component of mindfulness would be expected to share conceptual space with other meta-awareness constructs, namely, compensatory behaviors. Metacognitive processes play a critical role in the older adult’s’ decision to implement compensatory behaviors (Bäckman & Dixon, 1992). Prior research using the MCQ (de Frias et al., 2003) has shown that memory self-efficacy (a measure of awareness) was inversely related to everyday memory compensation behaviors in older adults. In sum, mindfulness has been linked to numerous health, psychosocial, and cognitive outcomes, but not yet to everyday memory compensatory behaviors in older adults.

The present study explores the extent to which the frequency of engaging in compensatory behaviors is related to mental and physical health, emotion regulation strategies, and trait mindfulness in a sample of middle-aged and older adults. First, similar to prior research, it is expected that older adults in poorer mental and physical health would be more likely to engage in compensatory behaviors. Second, older adults who adopt healthy emotion regulation strategies (i.e., cognitive change) engage in top-down control processing, which demands cognitive...
resources. As a result, it is expected that greater endorsement of cognitive reappraisal strategies will be positively related to the use of complex memory compensatory strategies (e.g., internal mnemonics). Third, trait mindfulness, which serves to reduce lapses in attention, minimize rumination, and promote acceptance and awareness in everyday situations, will be inversely related to everyday memory compensation. Fourth, the potential moderating effects of age on the above associations with memory compensation will be examined. Of interest is whether the associations are applicable to both middle-aged and older adults or specifically targeted to one portion of the mid-to-late adult life span.

**Method**

**Participants**

A total of 89 community-dwelling adults (62 women and 27 men) were recruited from Dallas, Texas. The participants were 51 to 85 years of age (mean \(M = 64.13\), standard deviation \(SD = 9.02\)), and the average level of education was 15.88 years \(SD = 2.83\). The participants were screened prior to recruitment and were excluded if there was a self-report of concurrent or history of health conditions known to impair cognitive health (i.e., dementia, Parkinson’s disease, stroke, brain injury, schizophrenia) or if they were taking antipsychotic medications. All participants attained scores above 23 \(M = 28.07, SD = 1.78\) on the Mini-Mental Status Examination (Folstein, Folstein, & McHugh, 1975), a screening measure of global cognition. Participants reported their general health as being good to very good (on a scale of 1 to 5) relative to a perfect state \(M = 4.31, SD = 0.63\) and relative to same age peers \(M = 4.39, SD = 0.69\). All participants scored below 15 \(M = 2.62, SD = 3.07\) on the Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer, & Williams, 2001), a screening measure of depressive symptoms and severity. The participants were recruited from the local community via advertisements and online newsletters. The study was approved by the University of Texas at Dallas ethics review board.

**Procedure**

Participants who met initial screening criteria during a telephonic interview were later invited to receive a battery of tests at the University of Texas at Dallas. The full testing session lasted approximately 3 hr and included two rest breaks. The same order of test administration was provided for all participants. Both paper-and-pencil and computerized tasks were administered. There was no missing data for any of the questionnaires used in this study. Participants received a nominal fee for their time. Written informed consent was obtained from all participants before test administration.

**Measures**

**Memory Compensation Questionnaire.**—The MCQ (Dixon et al., 2001) is a self-report instrument that assesses specific strategies, as well as general compensatory beliefs and commitment to compensating for memory losses and deficits. Participants report the frequency with which they engage in strategic-memory behaviors. Responses to each item are coded using a 5-point Likert scale, with higher scores representing more frequent use of the compensatory behavior \(0 = never, 4 = always\). Across the seven scales, Cronbach’s alpha estimates ranged from .7 to .8 (Dixon & de Frias, 2007). Further psychometric properties of the seven MCQ scales are well established and published elsewhere (see de Frias & Dixon, 2005, for factorial validity).

The five MCQ strategy scales are as follows: (a) External (8 items) (i.e., use of external memory aids, such as notes or calendars); (b) Internal (10 items) (i.e., use of mnemonic strategies, such as imagery or rehearsal); (c) Time (5 items) (i.e., investing more time in performing everyday memory tasks, such as reading passages more slowly or asking people to speak slowly); (d) Effort (6 items) (i.e., applying more effort, such as concentrating more or trying harder); and (e) Recruitment (5 items) (i.e., reliance on other people as memory aids, such as asking a friend or spouse to help remember to do something). The remaining two scales measure commitment and general compensatory beliefs: (f) Success (5 items) (i.e., commitment to a high level of success or performance in everyday memory tasks, reflecting a motivation to compensate for deficits and losses); and (g) Change (5 items) (i.e., the extent to which the respondent believes changes have occurred over the last 5–10 years in each of the other domains). For all seven MCQ scales, a higher score indicates more frequent use of the compensatory behavior.

**Medical Outcomes Study 36-Item Short Form Version.**—The Medical Outcomes Study 36-Item Short Form Version (SF-36v2) (Ware, Kosinski, & Gandek, 2000) is a self-report questionnaire that measures eight health domains and two psychometrically based summary scores (i.e., physical component summary [PCS] and mental component summary [MCS]). The eight health domains are as follows: mental health (MH; 5 items); role limitations due to emotional problems (RE; 3 items); general health perceptions (GH; 5 items); vitality (VT; 4 items); physical functioning (PF; 10 items); role limitations due to physical problems (RP; 4 items); social functioning (SF; 2 items); and bodily pain (BP; 2 items). The SF-36v2 time frame used in this study was one-week recall. The SF-36v2 uses norm-based scoring for the scales and component summary scores. For each subscale, higher scores indicate better health. For the present study, the physical health (PCS) and...
mental health (MCS) composite scores were used in the analyses.

*Emotion Regulation Questionnaire.*—The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) is a 10-item self-report measure of an individual’s habitual use of two emotion regulation strategies: cognitive reappraisal (6 items) and expressive suppression (4 items). Each item consists of a 7-point Likert scale (1 = *strongly disagree*; 7 = *strongly agree*). In the present study, internal consistency for both reappraisal (α = .83) and expressive suppression subscales (α = .74) was acceptable; the intercorrelation between the subscales was nonsignificant (r = .07).

*Mindful Attention Awareness Scale.*—The Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) is a 15-item self-report questionnaire that assesses trait mindfulness, namely, open or receptive awareness of and attention to what is occurring in the present moment. Each item consists of a 6-point Likert scale (1 = *almost always*; 6 = *almost never*). A sample item includes, “I get so focused on the goal I want to achieve that I lose touch with what I’m doing right now to get there.” Items reflect inattention across several everyday situations and domains (e.g., cognitive, physical, emotional, general). The scale was scored by computing a mean of the 15 items. Higher scores reflect higher levels of dispositional mindfulness. In the present study, the internal consistency was high (α = .87).

**Data Analyses**

Similar to previous research on memory compensation (e.g., de Frias et al., 2003), a series of concurrent hierarchical regression analyses was conducted separately for each of the seven MCQ scales. The purpose was to examine the independent and relative contributions of the five MCQ memory compensation strategies and the two general MCQ scales. The first cluster of covariates included demographic information (age, gender, and education) (Block 1). The second cluster of correlates was the two mental health and physical health status composites (Block 2). The third cluster of correlates was the two emotion regulation strategies (ERQ Suppression, Reappraisal) and trait mindfulness (MAAS) (Block 3). The fourth cluster of correlates contained the five 2-way age interactions (Block 4). Before creating interaction terms, the age variable was dichotomized into middle-aged (n = 50; 51–65 years) and older adults (n = 39; 66–85 years). A description of the sample as based on the covariates is presented in Table 1. Correlations among all model variables are provided in Table 2.

Alpha levels of p < .05 were specified as the threshold to indicate statistical significance. The results are discussed for those models with a significant change in \(R^2\). Results for the analyses are reported in Table 3.

**RESULTS**

**Demographics**

Gender was a significant predictor such that men more frequently relied on other people as memory aids. Age and education were not significantly associated with MCQ. The demographic characteristics did not account for significant variance in the MCQ scales.

**Health Status**

The physical and mental health composites were significant predictors of memory compensation, accounting for an additional 8%–22% of the variance, after controlling for the background variables. Lower scores on the physical health composite were related to greater reliance on other people for memory assistance and to reporting an increased use of compensatory strategies over the preceding 5- to 10-year period. Lower scores on the mental health composite were related to more frequent reliance on other people for memory assistance, investing more time and effort in carrying out everyday memory tasks, in addition to a greater motivation to succeed on everyday memory tasks.

**Emotion Regulation and Trait Mindfulness**

The emotion regulation strategy of cognitive reappraisal was a significant predictor of memory compensation, specifically the use of internal mnemonic strategies. Expressive suppression was not related to any MCQ scales. Trait mindfulness was related to all five MCQ strategy scales (i.e., External, Internal, Recruitment, Time, and Effort) and to the MCQ Change scale, indicating that higher dispositional mindfulness was related to less frequent use of MCQ strategies (compared to being less mindful). Emotion regulation and trait mindfulness accounted for an additional 10% to 14% of the variance, after controlling for demographic variables and health status.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-36v2: mental health</td>
<td>51.59 (9.47)</td>
</tr>
<tr>
<td>SF-36v2: physical health</td>
<td>49.12 (9.41)</td>
</tr>
<tr>
<td>ERQ: reappraisal strategy</td>
<td>4.98 (1.19)</td>
</tr>
<tr>
<td>ERQ: suppression strategy</td>
<td>3.24 (1.26)</td>
</tr>
<tr>
<td>MAAS: trait mindfulness</td>
<td>4.25 (8.2)</td>
</tr>
</tbody>
</table>

Notes: SF-36v2 = Medical Outcomes Study 36-Item Short Form Version; ERQ = Emotion Regulation Questionnaire; MAAS = Mindful Attention Awareness Scale. Values in parentheses are standard deviations. N = 89.
Moderating Effects of Age

Age moderated the effects of physical health on MCQ Internal and MCQ Effort. Post hoc analyses of simple slopes for levels of age group showed that better physical health was related to more frequent use of internal mnemonic strategies (middle-aged adults: $β = .31, p < .05$; older adults: $β = −.17, p > .05$) and effort investment (middle-aged adults: $β = .26, p < .05$; older adults: $β = −.09, p > .05$) for middle-aged adults only. Age moderated the effects of mental health on MCQ Recruitment and MCQ Effort. Post hoc analyses of simple slopes for levels of age group showed that the effects of poorer mental health on MCQ Recruitment was for the older adults only (middle-aged adults: $β = .05, p > .05$; older adults: $β = −.45, p < .05$). The post hoc simple slopes showed no differential age effects for MCQ Effort (middle-aged adults: $β = .19, p > .05$; older adults: $β = .11, p > .05$).
adults: $\beta = -0.26, p > .05$). Age moderated the effects of trait mindfulness on MCQ Recruitment and MCQ Effort. Post hoc of simple slopes for levels of age group showed that the effects of trait mindfulness on MCQ Recruitment (middle-aged adults: $\beta = -0.61, p < .001$; older adults: $\beta = -0.05, p > .05$) and MCQ Effort (middle-aged adults: $\beta = -0.66, p < .001$; older adults: $\beta = -0.10, p > .05$) was for the middle-aged adults only. Age interactions accounted for an additional 10% of the variance, after controlling for demographic variables, health status, emotion regulation, and trait mindfulness.

**Discussion**

The present study examined concurrent relations among everyday memory compensation and mental and physical health, emotion regulation strategies, and trait mindfulness, along with age interactions, after controlling for age, gender, and education, in middle-aged and older adults. Elaborating on aspects of health in relation to memory compensation used in prior research (de Frias et al., 2003), the present study found that mental and physical health functioning was inversely related to select memory compensation strategies. Specifically, poorer mental health functioning was related to greater recruitment of others for memory assistance (for older adults only), investment of time and effort, and a greater motivation to succeed on everyday memory tasks. Poorer physical health functioning was related to one memory compensation strategy (i.e., recruitment) and to greater perceived changes in the use of compensatory strategies over the preceding 5- to 10-year period. Relying on other people for memory assistance is a form of social resource engagement, and the awareness of the cognitive benefits of collaborative efforts (Dixon, 2011) and social support (e.g., Seeman et al., 2011) among older adults in poorer health is adaptive and supported by related memory compensation research (de Frias et al., 2003). Age moderated the effects of physical health on select memory compensation strategies such that middle-aged adults in better health reported more frequent use of mnemonic strategies and effort investment. That older adults with poor mental health status invest more time and effort in everyday memory tasks is also in line with earlier related research (de Frias et al., 2003) and demonstrates an adaptive avenue for dealing with the cognitive challenges of old age. Indeed, health conditions need not dampen functional capacity (Willis et al., 2006), and the present study suggests that middle-aged and older adults with physical limitations may be aware of their challenges and adjust accordingly by an upward shift in the use of less-cognitively intense compensatory strategies.

Second, the present study found that the emotion regulation strategy of cognitive reappraisal was related to memory compensation, above the variance accounted for by demographic characteristics and health status. Specifically, greater endorsement of cognitive reappraisal strategies (e.g., adopting cognitive change schemas) was related to more frequent use of internal mnemonic compensatory strategies. Emotionally adaptive individuals are adept at mood repair (e.g., by reframing emotionally stressful situations), which places demands on memory resources and elicits rumination to reinterpret stressful experiences (Gross, 2002; Ray et al., 2005). Individuals who report habitual use of cognitive change, or reappraisal strategies that alter the emotional response of an event, maintain the cognitive skills needed to manage other late-life concerns, namely compensating for everyday memory failures. Future research may examine vulnerable aging populations (e.g., adults with depression or mild cognitive impairment) to ascertain whether the cognitive costs of regulating emotionally stressful situations is too high to initiate compensatory efforts in everyday memory. The psychological compensation literature showing that older adults with memory impairment use fewer compensatory strategies than healthy older adults (Dixon & de Frias, 2007) would seem such an investigation especially relevant. Among the established adaptive consequences of emotion regulation (e.g., well-being; John & Gross, 2004; Whitehead & Bergeman, 2013), everyday memory compensation may be added to the spectrum. Of note, both the MCQ Internal and the ERQ Cognitive Reappraisal scales are “mental strategies” that share similar self-regulating mechanisms for successful cognitive and emotional health, thereby strengthening their conceptual space. The present study focused on the cognitive change phase of the process model of emotion regulation (Urry & Gross, 2010), and future research could explore the association between everyday memory compensation and other phases of the emotion regulation cycle (e.g., situation selection, attentional deployment). Another avenue for future research may be to explore other internal or external resources that moderate or mediate the link between emotion regulation and cognitive compensation in aging (e.g., Opitz, Gross, & Urry, 2012).

A third potential resource for memory compensation is trait mindfulness. Results indicated that individuals who have a greater unbiased awareness of their actions (i.e., are more mindful) reported (a) less frequent use of all five memory compensation strategies (than those with lower trait mindfulness), (b) fewer changes in the use of compensatory strategies over the preceding 5- to 10-year period, and (c) age moderated the effect of mindfulness on two memory compensation strategies (i.e., reliance on others and effort investment), such that the association applied to middle-aged adults only for these two MCQ scales. Individuals who are less likely to experience attention lapses due to a heightened sense of awareness may be less prone to memory lapses and therefore have little need to use memory compensatory strategies. Relatedly, because mindfulness lowers rumination and reduces excessive elaborative processing of negative information in the face of emotional
challenge, it may buffer against stresses that limit cognitive resources (Epel et al., 2009), thereby obviating the need to alter the frequency in memory compensatory efforts. The present study demonstrates an informative bifurcation in the frequency of compensatory strategy use: greater memory compensation among reappraisers and less memory compensation among adults who approach stressful events with mindfulness or acceptance. The association between trait mindfulness and the MCQ Change scale may be partially because both constructs share underlying mechanisms (e.g., meta-awareness). The meta-awareness literature has also reported links between adaptive beliefs (e.g., control, self-efficacy) and compensatory memory strategies (de Frias et al., 2003; Lachman, Neupert, & Agrigoroaei, 2011). That trait mindfulness predicts everyday memory compensation (i.e., adaptive behaviors) and provides additional criterion validity to the individual differences approach to mindfulness (Brown et al., 2011). Future research may explore the extent to which individual differences in trait mindfulness are related to everyday memory compensation in clinical samples (e.g., patients with memory impairment or depression). A boost or formal training in mindfulness may reorient vulnerable minds to successfully manage life goals.

Two limitations of the present study are worth noting. First, since participants were screened for clinical depression and were generally healthy, the results may not generalize to older adults with depression or related mental health concerns. Second, the current study measured the mindfulness construct from a psychometric trait perspective. Other approaches (e.g., mindfulness training) may be clinically relevant to older adults and aid in their efforts toward cognitive resilience.

Strengths of the present study are also noted. First, the present study explored new associations among everyday memory compensation and two internal resources: emotion regulation strategies and trait mindfulness in older adults. Second, the aspects of health related to memory compensation were expanded to include health-related quality of life. Third, all participants were well characterized and screened for clinical depression. In sum, this study found new and elaborated person-level resources linked to everyday memory compensation in middle-aged and older adults. Low mental and physical health predicted greater frequency in the use of compensatory strategies. Cognitive reappraisal as an emotion regulation strategy predicted the use of internal mnemonic strategies. High trait mindfulness was associated with less reported use of several forms of compensation strategies. Cognitive resilience in mid- to late adulthood is tempered by the boundaries of health and strengthened by self-regulatory processes and mindfulness landscapes.

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MEMORY COMPENSATION AND AGING

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