Little Evidence for Links Between Memory Complaints and Memory Performance in Very Old Age: Longitudinal Analyses From the Berlin Aging Study

Ann Pearman and Christopher Hertzog
Georgia Institute of Technology

Denis Gerstorf
Humboldt University of Berlin

Cross-sectional and longitudinal relationships between memory complaint and memory performance were examined in a sample of old-old participants from the Berlin Aging Study (BASE; N = 504, ages 70 to 100, age \( M = 84.7 \) at study onset). Participants were measured 4 times over the course of 6 years. Similar to many previous studies, initial cross-sectional memory complaints were predicted by depression and neuroticism, but not memory performance. Subjective age also predicted memory complaint independent of other variables. Latent growth curve models based on age and time in the study revealed that memory complaints did not change in level with age or time, and manifested no reliable random effects (individual differences in change). These models also detected no significant relationship between changes in memory and either initial memory complaint or changes in memory complaint over age or over time. None of the covariates that predicted initial memory complaints were related to changes in memory complaints over time. An autoregressive latent variable model for memory complaints, consistent with a conceptualization of complaints as judgments constructed from beliefs and other influences in the moment, did detect a concurrent effect of memory on memory complaints at the third occasion, controlling on initial complaints. These results suggest that for the oldest-old, changes in memory complaints may not primarily reflect monitoring of actual age-related memory changes, but rather are affected by other variables, including age-based memory stereotypes, neuroticism, depression, and concerns about aging.

Keywords: aging, memory complaints, memory, depression, neuroticism, oldest-old

Understanding people’s complaints about memory problems has long been of interest to researchers (for a recent overview, see Hertzog & Pearman, 2013). Diagnostic approaches for assessing clinically meaningful memory loss in old age such as age-associated memory impairment (Feher, Larrabee, Sudilovsky, & Crook, 1994) or the currently favored construct of mild cognitive impairment (MCI; Petersen & Negash, 2008) include memory complaint as a key criterion. An inevitable question is whether memory concerns of older adults actually map onto their objective memory status. The criteria for MCI diagnosis implicitly assume memory complaints of older adults actually map onto their objective memory status. The criteria for MCI diagnosis implicitly assume that subjective memory complaints are valid indicators of actual memory problems. However, there is compelling evidence that subjective memory complaints are more strongly related to neuroticism, depression, anxiety, and other personality traits than they are to memory status per se (e.g., Niederehe & Yoder, 1989; Pearman & Storandt, 2004). Furthermore, memory complaints can be regarded as an aspect of self-referent beliefs, which could derive from self-schemas, internalized implicit theories about aging, and other bases for self-construal having nothing to do with the process of monitoring one’s own actual memory functioning (e.g., Cavanaugh, Feldman, & Hertzog, 1998; Lineweaver & Hertzog, 1998; McFarland, Ross, & Gilhooly, 1992).

Whether longitudinal changes in subjective memory complaints correlate with objective memory status and change remains an open question (see Hertzog & Hultsch, 2000; Hertzog & Pearman, 2013). Some have argued that changes in subjective memory may be more highly correlated with actual changes in memory than seen when the correlation of subjective memory and memory performance is computed from cross-sectional data (i.e., at a single point in time; see Herrmann, 1982; Jonker, Geerlings, & Schmand, 2000). Individuals may lack appropriate standards for making absolute or relative assessments of their memory status compared to other persons, but they could calibrate to changes in their own memory by accurate recollection of their past levels of memory performance (Rabbitt & Abson, 1990). This argument holds out the hope that incident memory complaints will predict future memory change in older adults, particularly if complaints are sensitive to subclinical memory pathology (e.g., Erk et al., 2011; Johansson, Allen-Burge, & Zant, 1997; Hertzog & Pearman, 2013; van Norden et al., 2013) that might become manifest at a later point in time.
point in life. It also suggests that changing complaints will be more highly associated with concurrent changes in objective memory than complaints and memory at a single point in time. There is an emerging literature suggesting that longitudinal changes in memory complaints are related to longitudinal changes in memory performance, but the observed relationships are small to moderate in magnitude, and vary considerably across studies (for details, see below). Such outcomes would support the utility of assessing memory complaints even if their concurrent validity in cross-sectional studies is weak to nonexistent.

The primary question for this study was whether we could identify longitudinal relationships between changes in subjective memory complaints and changes in memory performance in a probability sample of old and very old adults. We also were particularly interested in the question of whether the relationship of memory complaints to memory performance differs in very old age. One could argue for age differences in correlations in either direction. Selective survival in a population prone to high rates of morbidity and mortality could lower the complaint–memory correlation by eliminating persons with memory problems from the old population. In contrast, extended experience with memory successes and failures during a period of life characterized by normative memory loss could increase the relationship of complaints to memory performance, but it could also decouple complaints from memory if changing complaints were based on stereotypes about aging (Hummert, 2011) rather than monitoring of actual memory change (e.g., McDonald-Miszczak, Hertog, & Hultsh, 1995).

To evaluate the linkage of memory complaints and memory in the oldest-old, we used data from the Berlin Aging Study (BASE; Baltes & Mayer, 1999). BASE began with a cross-sectional sample of older men and women from ages 70 through 100 (mean age at study inception = 85 years), followed by repeated longitudinal assessment of survivors over time. Unlike most studies of memory complaints and aging, BASE provides extensive information about memory complaints in people over the age of 80. Although there are some studies that examine memory complaints in the oldest-old (Johansson et al., 1997; Zelinski, Burnight, & Lane, 2001), these studies have not examined changes in memory complaint over time or covariates predicting complaints, such as personality and subjective age. Before describing the BASE sample and the available BASE data on memory performance and memory complaints, we review the existing literature on cross-sectional and longitudinal studies of subjective memory complaints.

Cross-Sectional Studies of Subjective Memory and Objective Memory

There have been many cross-sectional examinations of the relationship between objective and subjective memory. The seminal work by Kahn, Zarit, Hilbert, and Niederehe (1975) was the first to identify a dissociation between memory complaints and actual memory performance, showing that memory complaints were more related to depressive affect than to memory performance. Since that time, studies have shown either a small relation between objective and subjective memory (e.g., Gagnon, Dartigues, Mazaux, & Dequege, 1994; Gilewski, Zelinski, & Schaie, 1990; Jonker et al., 2000; Lam, Lui, Tam, & Chiu, 2005; Pearman & Storandt, 2004; Zelinski et al., 2001) or no relation between them (Jungwirth et al., 2004; O’Connor, Pollitt, Roth, & Brook, 1990; Pearman & Storandt, 2005). In a recent meta-analysis, Beaudoin and Desrichard (2011) evaluated the cross-sectional relationship of memory self-efficacy (as measured by self-rated memory ability and memory status) to memory ability (as measured by a variety of memory tasks) based on data from over 100 different studies. They reported a weighted correlation of .15 between these two variables. Memory complaint scales show high convergent validity with self-reported memory ability or self-efficacy (Hertzog, Hultsch, & Dixon, 1989; Jopp & Hertzog, 2007), so it seems likely that individual differences in memory complaints based on cross-sectional data have some limited predictive validity for individual differences in memory performance.

Longitudinal Studies of Subjective Memory and Objective Memory

If one presumes that people are capable of monitoring their own memory functioning, then one would expect that slopes of change in memory functioning should be reflected in slopes of change in subjective memory over the same time period. Studies of the relationship between changes in subjective and objective memory have not generally detected a stronger relationship of changes in both constructs than has been observed in cross-sectional data (e.g., Lane & Zelinski, 2003; McDonald-Miszczak et al., 1995; Mol, van Boxtel, Willems, & Jolles, 2006; Taylor, Miller, & Tinklenberg, 1992). However, detection of correlated change in two variables can be a challenge when the variance in change is small to moderate in magnitude (e.g., Hertzog, Lindenberger, Ghisletta, & von Oertzen, 2006).

Studies that use latent variable approaches, including growth curve models, are optimal for evaluating correlated slopes of change over time across persons (e.g., Ferrer & McArdle, 2010; von Oertzen, Hertzog, Lindenberger, & Ghisletta, 2010). There have been several recent longitudinal studies that have set out to examine this question using a variety of modeling techniques. Parisi and colleagues (2011) used parallel process growth curve modeling on a subset of the ACTIVE participants (mean age = 73.8 years, SD = 6.0) to examine if baseline objective memory scores associate with subjective memory ratings over time (5 years). Initial level of objective memory performance was associated with subjective memory complaint (r = .29). They found the rate of decline in objective memory to be related to older age, being a man, and having less education, but it was not related to subjective memory. Furthermore, objective memory at baseline did not seem to predict trajectories of change in subjective memory. However, after adjusting for age, education, race, and physical and mental health status, change in subjective memory was positively related to change in objective memory (r = .44). People who showed greater performance declines in memory than their peers were more likely than their peers to report perceiving their memory to decline.

Similar outcomes were detected by Mascherek and Zimprich (2011) using the ILSE sample (mean age = 62.9 years at Time 1, SD = .91 at Time 1). They conducted second-order latent growth curve modeling to investigate the mutual development of memory problems and memory complaints over the course of 12 years. The latent correlation between the slopes of these two variables (.39) was significantly greater than the correlation between their latent...
initial levels (.23). However, considering that the latent variable approach disattenuates (corrects) these correlations for measurement error, the estimated change slope correlation was moderate in size.

Hohman, Beason-Held, Lamar, and Resnick (2011) used mixed methods models with the Baltimore Longitudinal Study (mean age = 66.82 years, SD = 6.9) to examine if cognitive complaints predict longitudinal declines on objective memory over a period of 11.5 years. They found that higher initial levels of cognitive complaints predicted greater decline in both immediate and delayed free recall, but the overall magnitude of the effect appeared to be small.\(^1\) Thus, recent longitudinal studies have detected a positive relationship between subjective memory and objective memory change over time in samples that include young-old participants under the age of 70, which has been interpreted as indicating that people do, to a degree, accurately monitor their own memory functioning, with other influences (such as individual differences in criteria for rating level of memory function) attenuating these relationships in cross-sectional data.

**Correlates of Subjective Memory in Older Adults**

Self-reported affect and personality have been found to be robust predictors of subjective memory in older adults. The aforementioned Kahn et al. (1975) paper found that memory complaint varied only by depressive symptoms, not actual memory. Other studies have confirmed the relationship between negative affect and memory complaint in healthy older adults (see Jonker et al., 2000 or Reid & MacLullich, 2006 for a review). In fact, one of the questions on the Geriatric Depression Scale (Yesavage et al., 1982) is whether the patient feels they have more problems with memory than their peers, thus treating memory complaint as a symptom of depression. In addition, Smith, Petersen, Ivnik, Malec, and Tangalos (1996) found that baseline memory complaints predicted increases in depressed mood over the course of 5 years with only a small relationship to objective memory.

Multiple facets of personality have also been identified as significant correlates of subjective memory complaint. Reid and MacLullich (2006) found that the Big Five personality trait of neuroticism was most consistently identified as a personality predictor of memory complaint (rs ranging from .38 to .59). Pearman and Storandt (2004 & 2005) also showed that both neuroticism and conscientiousness predicted subjective memory, (see also Slavin et al., 2010; Vestberg, Passant, Risberg, & Elfgren, 2007). Lane and Zelinski (2003) is the only study we are aware of that has used hierarchical linear models to examine the longitudinal relationship between personality and subjective memory. They found that neuroticism predicted intercepts but not slopes in subjective memory. Age was the only independent predictor of slopes. It is still an open question, then, whether neuroticism predicts or moderates changes in subjective memory.

Another way of understanding memory complaints and their weak association with memory performance may be provided by examining the construct of subjective age. Subjective age is a variable that has been shown to be related to a number of variables in older adults, including subjective health (e.g., Stephan, Caudroit, and Chalabaev, 2011), mastery (Infurna, Gerstorf, Robertson, Berg, & Zarit, 2010), and reduced mortality rates (e.g., Kotter-Grühn, Kleinspehn-Ammerlahn, Gerstorf, & Smith, 2009). It has been conceptualized as an attitude about aging that allows people to create psychological distance between themselves and potential and actual age-related losses (e.g., Weiss, & Freund, 2012; Weiss & Lang, 2012). If people perceive themselves to be old and also believe that memory exhibits profound normative declines during adulthood (e.g., Lineweaver & Hertzog, 1998), they may believe that their memory is worse than it actually is. Consistent with this hypothesis, Stephan et al. (2011) found that memory self-efficacy was strongly correlated with subjective age. They suggested that the known link between high subjective age and low life satisfaction may be partly driven by negative evaluations of one’s memory due to feeling older. Endorsement of statements that memory decline is inevitable in old age has been shown to correlate with low perceived memory ability and low perceived control over memory (Lachman, Bandura, Weaver, & Elliott, 1995). Higher subjective age is also related to depressive affect (e.g., Mock & Eibach, 2011) and neuroticism (Hubley & Hultsch, 1994) both of which correlate with memory complaint. It is therefore an open question as to whether these three constructs overlap in their predictions of memory complaints in older adults, or whether they have independent relations to them.

**The Current Study**

Using data from the BASE, the questions we addressed were as follows:

- In this oldest-old sample, what is the cross-sectional relationship between memory performance and memory complaints? Consistent with many studies of persons under the age of 80, we predicted that the relationship between actual memory performance and memory complaint would be low and that memory complaints will be more strongly related to other variables such as neuroticism, depression, and subjective age.
- Is there a relationship between memory performance and memory complaints across time in the oldest old? Because of the recent growth-curve studies suggesting a relationship between the slopes of memory performance and memory complaint over time in middle-aged and young-old samples, we predicted that memory complaint slopes and memory performance slopes would also be related in our sample of oldest-old participants.

**Method**

Longitudinal data on memory complaints from the BASE collected over three measurement occasions (T1, T2, T3) covering a 6-year period was used for this study. In-depth descriptions of the sample, variables, and procedures are published elsewhere (Baltes & Mayer, 1999; Gerstorf, Lövdén, Röcke, Smith, & Lindenberger, 2007; Smith & Delius, 2010). The sample and measurement information described here will be a brief overview.

**Sample and Measurement Schedule**

At the first measurement occasion (T1), the sample consisted of 516 participants (mean age = 84.92 years, SD = 8.66, range: 70–103). The representative sample, obtained from the city reg-

\(^1\) The authors provided no effect size estimate, but the borderline significance test, \(t(973) = -1.98, p = .048\), suggests a small effect.
memory, was stratified by age and gender, resulting in 43 men and 43 women in each of six age brackets (70–74, 75–79, 80–84, 85–89, 90–94, 95+ years). These 516 participants completed a 14-session intensive assessment protocol. Selectivity analyses indicated that even though there was a positive selection bias on a number of variables, the amount of observable initial selection bias did not exceed 0.5 SD units for any of the variables under consideration (Lindenberger et al., 1999). Over time, sample attrition was due primarily to mortality which is expected given the advanced age of the sample. In addition, at each measurement occasion, an average of 10% of participants voluntarily dropped out of the study, primarily because of poor health and proximity to death. Included in the current report were all 504 participants who provided valid data on the measures under study here.

T1 was conducted between mid-1990 and June 1993. The longitudinal part of BASE involved multiple measurement occasions (T1, T2, T3, T4, T5, T6, T7), each scheduled about 2 years apart. However, at the second, fifth, sixth, and seventh waves of measurement, the primary memory complaint measure used in this study was not collected. Therefore, this article reports mainly on data on the measures under study here.

Measures

Memory complaint. Current memory complaint was measured with four items—three from the BASE psychiatric battery, specifically the Geriatric Mental State Interview (GMS; Gurland, Copeland, Sharpe, & Kelleher, 1976), and one from the BASE psychological battery. The GMS is a widely used psychiatric assessment tool for use with older adults (see Copeland et al., 2002 for review). The GMS memory complaint items included “Over the past month, have you had difficulty with your memory?,” “Over the past month, have you had trouble remembering names and faces?,” and “Over the past month, have you had trouble remembering where you have placed things?” These three questions were all answered on a 0 to 2 scale with 0 = no problems, 1 = some problems, and 2 = frequent problems. The BASE psychological battery also included a question regarding subjective memory complaints. The question “How would you judge your memory at the moment?” was answered on a 1 (deficient) to 5 (very good) scale. This item, labeled here as current subjective memory (CSM) was not administered at T1, but was collected thereafter. For analyses with latent variables, we used all four memory-complaints items (see below). For the multilevel regression model, a composite score was created of the three GMS items so that memory complaints could be measured equivalently at all occasions of measurement, especially T1, where the CSM item was not collected. These four questions are similar to items used in many memory complaint studies (e.g., Herzog & Rogers, 1989; Mol et al., 2006; Zimprich, Martin, & Kliegl, 2003).

Correlates. We included age, gender, and education as sociodemographic correlates to statistically control for their interindividual differences in level and change in memory complaint. Age was used as a continuous variable (mean centered at 85 years). Gender was coded as 0 = men and 1 = women and in the analyses effect-coded. Years of education was used as a continuous variable. Substantive correlates of interest included memory performance, neuroticism, subjective age, and depression. Episodic memory was measured by three tests: Free Recall, Paired Associates, and Memory for Text. Free recall from the Enhanced Cued Recall test (ECR: Grober, Buschke, Crystal, Bang, & Dresner, 1988) was part of the BASE psychiatric protocol. In the test phase of the ECR, participants learned 16 words in response to category cues followed immediately by a free recall test of those words. We opted not to use the selective reminding portion of this test as an additional measure, given statistical dependencies between the free recall and selective reminding scores. The other two tests were from the standard BASE cognitive assessment measuring episodic memory (for details, see Lindenberger, Mayr, & Kliegl, 1993). For Paired Associates (Lindenberger et al., 1993), participants were shown eight pairs of words and were then asked to complete each pair by naming the second word. There were two trials for a total of 16 words. Memory for Text (Engel & Satzger, 1990) is a story recall task presented both aurally and visually. Participants were asked six questions about the story immediately following presentation. In analyses with a memory composite variable, all three memory tests were rescaled to T scores standardized to the cross-sectional BASE sample at T1 (M = 50, SD = 10) and then averaged.

To assess neuroticism, six items from the neuroticism subscale of the NEO-FFI (Costa & McCrae, 1985) were used. Responses were given on a 5-point Likert scale (5 = applies very well to me, 1 = does not apply to me at all). The mean of the six items was calculated with higher scores indicating higher levels of neuroticism. Subjective age was measured with the question “How old do you feel?” Participants were shown an age scale ranging from 0 to 120 years and were asked to choose an age that they felt (see Kotter-Grühn et al., 2009). Depressive symptoms were measured with the Hamilton Depression Scale (Hamilton, 1967), which is an observer-rating scale based on a structured interview. A sum score of the 21 items was calculated with lower scores indicating fewer depressive symptoms.

Statistical Procedures

In a first step, we examined cross-sectional predictors of memory complaints among 70+-year-old participants in the BASE. To do so, we used multiple regression analyses and regressed memory complaints at T1 on sociodemographic characteristics (age, gender, and education), memory performance, depressive symptoms, neuroticism, and subjective age. Analyses were carried out both in the full T1 sample and in a reduced sample that excluded participants who had been diagnosed with dementia at T1. Given that individuals with dementia diagnoses had possibly been informed of their memory disorder by attending physicians, any alignment of their subjective complaints with objective memory performance might not be due to accurate monitoring of memory.

To gain maximum leverage on individual differences in memory change, we included memory measures from BASE’s T4. The memory complaints questions from the psychiatric interview were not available at T5, however.
In a second step, we examined age-related changes in memory performance and also in memory complaints and investigated the role of sociodemographic characteristics (gender and education), depressive symptoms, neuroticism, and subjective age as well as memory performance or memory complaints, respectively. This analysis was conducted only on the reduced sample of persons who had no dementia diagnosis at T1 to ensure that correlations of change in memory complaints and memory could not be attributed to a subset of the sample showing dementia-related change. To do so, we first fitted a separate growth curve (i.e., multilevel) model for memory performance in terms of chronologically age-graded change and modeled individual differences in how memory performance changed from age 70 to age 100 years under age-convergence assumptions (Sliwinski, Hoffmann, & Hofer, 2010). This model was specified as

\[
\text{memory}_i = \beta_{0i} + \beta_{1i}(\text{age}_i) + \epsilon_{it},
\]

where person \(i\)'s memory performance at time \(t\), \(\text{memory}_i\), is a function of an individual-specific intercept parameter, \(\beta_{0i}\), individual-specific linear slope parameter, \(\beta_{1i}\), that captures the rate of change per year and residual error, \(\epsilon_{it}\). Following standard multilevel/latent growth modeling procedures (Ram & Grimm, 2007; Singer & Willett, 2003), individual-specific intercepts, \(\beta_{0i}\), and slopes, \(\beta_{1i}\), and \(\beta_{2i}\), (from the Level 1 model given in Equation 1) were modeled as

\[
\beta_{0i} = \gamma_{00} + u_{0i}, \quad \text{and} \quad \beta_{1i} = \gamma_{01} + u_{1i},
\]

(i.e., Level-2 model) where \(\gamma_{00}\), and \(\gamma_{01}\), are sample means, and \(u_{0i}\), and \(u_{1i}\), are individual deviations from those means that are assumed to be normally distributed, correlated with each other, and uncorrelated with the residual errors, \(\epsilon_{it}\).

We proceeded in an analogous fashion and fitted a separate growth curve model for memory complaints. A quadratic slope was examined for both variables, but was not significant in any model. Hence, we report models with linear slopes only.

Of primary interest to us was the extent to which the between-person variance in the trajectories was related to the covariates. These covariates were effect-coded/centered so that the regression parameters indicated the average trajectory (across all individuals) and the extent of differences associated with a particular variable (rather than for a particular group). The age-related change model for memory complaints took the form

\[
\beta_{0i} = \gamma_{00} + \gamma_{01}(\text{women}_i) + \gamma_{02}(\text{education}_i) + \epsilon_{0i},
\]

\[
+ \gamma_{03}(\text{memory/complaints}_i) + \gamma_{04}(\text{depressive symptoms}_i) + \gamma_{05}(\text{neuroticism}_i) + \gamma_{06}(\text{subjective age}_i) + u_{0i},
\]

\[
\beta_{1i} = \gamma_{10} + \gamma_{11}(\text{women}_i) + \gamma_{12}(\text{education}_i) + \gamma_{13}(\text{memory/complaints}_i) + \gamma_{14}(\text{depressive symptoms}_i) + \gamma_{15}(\text{neuroticism}_i) + \gamma_{16}(\text{subjective age}_i) + u_{1i},
\]

Models were fit to the data using SAS (PROC MIXED; Littell, Miliken, Stoup, & Wolfinger, 1996). The time variable was centered at age 85 years. As a consequence, intercept means, intercept variances, intercept-slope covariances, as well as the effects of the correlates were interpreted to indicate effects at age 85 years. We note that the inclusion of the covariates into our models not only served to examine their role for age trajectories in memory and complaints, respectively, but these factors are also attrition-informative variables and so helped to accommodate longitudinal selectivity under the assumption that incomplete data were missing at random (Little & Rubin, 1987; McArdle, 1994).

In a third set of analyses, we estimated occasion-based latent variable growth curve models to compare our results to other recent studies finding correlations of change slopes for memory complaints and memory (e.g., Parisi et al., 2011). We estimated these latent variables at each occasion of measurement and then fit a second-order latent growth curve model for both memory and memory complaints to evaluate the correlation of their change slopes over time (e.g., Sayer & Cumsille, 2001), using MPlus (Version 7.0; Muthén & Muthén, 2007). As detailed below, we

### Table 1

**Descriptive Statistics and Correlations for the Study Measures**

<table>
<thead>
<tr>
<th>Correlates</th>
<th>Full sample (n = 504)</th>
<th>Dementia-free sample (n = 406)</th>
<th>Intercorrelations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>1. Memory complaints (0–2)</td>
<td>0.31</td>
<td>0.41</td>
<td>0.27</td>
</tr>
<tr>
<td>2. Age (70–103)</td>
<td>84.73</td>
<td>8.63</td>
<td>83.33</td>
</tr>
<tr>
<td>3. Men</td>
<td>0.51</td>
<td>0.50</td>
<td>0.52</td>
</tr>
<tr>
<td>4. Education (8–17)</td>
<td>10.78</td>
<td>2.33</td>
<td>10.90</td>
</tr>
<tr>
<td>5. Memory (33–73)</td>
<td>50.18</td>
<td>8.06</td>
<td>52.29</td>
</tr>
<tr>
<td>6. Depressive symptoms (0–30)</td>
<td>5.67</td>
<td>6.12</td>
<td>5.55</td>
</tr>
<tr>
<td>7. Neuroticism (1–5)</td>
<td>2.37</td>
<td>0.77</td>
<td>2.35</td>
</tr>
<tr>
<td>8. Subjective age (18–102)</td>
<td>71.81</td>
<td>13.90</td>
<td>71.47</td>
</tr>
</tbody>
</table>

*Note.* Scale range in parentheses. Intercorrelations for the full sample (n = 504) are presented below the diagonal; those for the dementia-free sample (n = 406) are presented above the diagonal. Intercorrelations .09 and above reliably different from zero at p < .05 for the full sample and those .10 and above reliably different from zero at p < .05 for the dementia-free sample.
also estimated occasion-specific models that did not specify a latent growth curve for memory complaints.

An overview of descriptive statistics and intercorrelations for the measures under study is provided in Table 1. It can be seen that (a) memory performance and memory complaints were only weakly correlated and (b) there were significant correlations between several of the covariates which confirms the need to examine them jointly to identify unique effects.

Results

Cross-Sectional Predictors of Memory Complaints

Results from cross-sectional models for predictors of memory complaints are presented in Table 2. Age, gender, and education did not predict memory complaints (all $p > .10$), and the predictive effect of memory performance was reliably different from zero, but small ($\beta = -.11$) and was not significant in the reduced sample of participants who had not been diagnosed with dementia ($\beta = .01$). It appeared that awareness of dementia or perhaps merely the dementia diagnosis generated the relationship in the full sample. In contrast, depressive symptoms, neuroticism, and subjective age were associated with memory complaints (all $p < .05$), and the regression coefficients for these variables did not differ appreciably between solutions for the full sample and for the reduced sample of participants who had not been diagnosed with dementia. The covariates accounted for a little over 10% of the variance in memory complaints. This outcome extends typical findings of participants who had not been diagnosed with dementia. The left-hand panel of Table 3 reports analyses for the memory variable (see Hertzog, von Oertzen, Ghisletta, & Lindenberger, 2008).

A subset of correlates predicted memory intercepts. Women outperformed men at age 85 ($\gamma_{01} = 2.995$, higher education related to better memory performance at age 85 ($\gamma_{02} = 0.562$), and participants who reported feeling younger also performed marginally better than those who reported feeling older ($\gamma_{06} = -0.051$, $p = .052$). In contrast, none of the other correlates (subjective memory, depressive symptoms, and neuroticism) were found to predict age trajectories in memory performance (all $p > .10$). Hence, there was little indication that age-related changes in memory were predicted by subjective memory complaints. None of the correlates interacted with age in predicting memory performance.

The model examining age trajectories in memory complaints is presented in the right-hand panel of Table 3. In contrast to memory performance, no average age-related changes in memory complaints were found. Furthermore, there were no reliable individual differences in age-related slopes of change in memory complaints. This result was consistent with the nonsignificant likelihood ratio test of random effects in slopes variance, $\chi^2 = 4.05$, df = 2, $p > .25$.

Consistent with the original cross-sectional models, reporting more depressive symptoms ($\gamma_{04} = 0.007$), higher neuroticism ($\gamma_{05} = 0.089$), and feeling older ($\gamma_{06} = 0.003$, all $p < .05$) were each associated with reporting more memory complaints at age 85, whereas gender and memory performance were not associated with level of age-related change in memory complaints. Individuals with higher education reported more age-related change in memory complaints ($\gamma_{12} = 0.002$). However, memory performance at T1 did not predict memory complaints at age 85 and was not associated with age-related changes in memory complaints.

Age Trajectories in Memory Performance and Memory Complaints

As noted earlier, longitudinal data are critically important for evaluating whether memory complaints are sensitive to within-person changes in memory that cannot be estimated with cross-sectional data. We used longitudinal BASE data to address the key questions of whether longitudinal changes in subjective memory would be observed, and investigated the possible role of the correlates in predicting changes in memory complaints. We also evaluated longitudinal changes in memory performance and whether these changes were predicted by T1 memory complaints.

The results of the relevant models are presented in Table 3. The left-hand panel of Table 3 reports analyses for the memory composite variable, scaled in $T$ score units standardized to the cross-sectional BASE sample at T1 ($M = 50$, $SD = 10$). The linear component of decline for memory performance ($\gamma_{10} = -0.265$) indicated an average loss of a quarter of a standard deviation in episodic memory per 10 years of increasing age. There were reliable random effects (individual differences in memory) at age 85, but no reliable individual differences in age-related memory decline. This latter outcome was confirmed using nested unconditional growth curve models to generate a likelihood-ratio $\chi^2$ test of improvement in model fit to random effects when adding the intercept-slope covariance and the slope variance to a model containing random effects for intercepts and residuals only, $\chi^2 = 0.27$, df = 2, $p > .25$. Given the latent variable analysis we report below, this outcome probably reflected limited statistical power of univariate latent growth curve models to detect slope variance with the composite memory variable (see Hertzog, von Oertzen, Ghisletta, & Lindenberger, 2008).

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Memory complaints</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Full sample (n = 504)</td>
<td>Dementia-free sample (n = 406)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.038</td>
<td>-.038</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-.038</td>
<td>-.043</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>.002</td>
<td>-.019</td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td>-.107</td>
<td>.014</td>
<td></td>
</tr>
<tr>
<td>Depressive symptoms (HAM-D)</td>
<td>.230*</td>
<td>.196*</td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>.110*</td>
<td>.145*</td>
<td></td>
</tr>
<tr>
<td>Subjective age</td>
<td>.190*</td>
<td>.101*</td>
<td></td>
</tr>
<tr>
<td>Total $R^2$</td>
<td>.129</td>
<td>.108</td>
<td></td>
</tr>
<tr>
<td>$F$ (df1, df2)</td>
<td>10.5 (7, 496)</td>
<td>6.9 (7, 398)</td>
<td></td>
</tr>
</tbody>
</table>

Note. HAM-D = Hamilton Depression Scale.

*p = .079.

*p < .05.
Table 3
Separate Growth Models Over Chronological Age for Memory Performance and Memory Complaints

<table>
<thead>
<tr>
<th></th>
<th>Memory</th>
<th>Memory complaints</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>SE</td>
<td>Estimate</td>
</tr>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>51.841*</td>
<td>0.329</td>
<td>0.281*</td>
</tr>
<tr>
<td>Linear slope</td>
<td>-0.265*</td>
<td>0.037</td>
<td>-0.002</td>
</tr>
<tr>
<td>Women</td>
<td>2.995*</td>
<td>0.620</td>
<td>-0.057</td>
</tr>
<tr>
<td>Education</td>
<td>0.562*</td>
<td>0.135</td>
<td>0.009</td>
</tr>
<tr>
<td>Memory</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Subjective memory</td>
<td>-0.620</td>
<td>0.893</td>
<td>—</td>
</tr>
<tr>
<td>Depressive symptoms</td>
<td>-0.081</td>
<td>0.059</td>
<td>0.007*</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>-0.310</td>
<td>0.502</td>
<td>0.089*</td>
</tr>
<tr>
<td>Subjective age</td>
<td>-0.051*</td>
<td>0.026</td>
<td>0.003*</td>
</tr>
<tr>
<td>Education × Linear slope</td>
<td>0.002</td>
<td>0.014</td>
<td>0.002*</td>
</tr>
<tr>
<td>Memory × Linear slope</td>
<td>—</td>
<td>—</td>
<td>0.000</td>
</tr>
<tr>
<td>Subjective Memory × Linear slope</td>
<td>0.103</td>
<td>0.099</td>
<td>—</td>
</tr>
<tr>
<td>Depressive Symptoms × Linear slope</td>
<td>-0.001</td>
<td>0.007</td>
<td>—</td>
</tr>
<tr>
<td>Neuroticism × Linear slope</td>
<td>-0.013</td>
<td>0.055</td>
<td>-0.003</td>
</tr>
<tr>
<td>Subjective Age × Linear slope</td>
<td>-0.002</td>
<td>0.003</td>
<td>-0.000</td>
</tr>
<tr>
<td>Random effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variance of intercept</td>
<td>25.980*</td>
<td>2.711</td>
<td>0.505*</td>
</tr>
<tr>
<td>Variance of linear slope</td>
<td>0.011</td>
<td>0.030</td>
<td>—</td>
</tr>
<tr>
<td>Covariance intercept, linear slope</td>
<td>0.122</td>
<td>0.165</td>
<td>—</td>
</tr>
<tr>
<td>Residual variance</td>
<td>14.823*</td>
<td>1.163</td>
<td>0.076*</td>
</tr>
<tr>
<td>AIC</td>
<td>5,120</td>
<td>521</td>
<td>5,084</td>
</tr>
</tbody>
</table>

Note. N = 406 participants who provided 721 observations for subjective memory (T1: n = 406; T3: n = 192; and T4: n = 123) and 814 observations for memory performance (T1: n = 406; T3: n = 193; T4: n = 128; and T5: n = 87). Standard errors in parentheses. AIC = Akaike information criterion; \(-2LL = -2\) log likelihood, relative model fit statistics.

\( * p < .052. \)

\( * p < .05. \)

Taken together, these models indicate substantial differences in the behavior of the memory and memory complaints variables. First and as illustrated in the two panels in Figure 1, memory performance and memory complaints showed vastly different age trajectories. On average, episodic memory manifested reliable age-related decline in performance, but in the aggregate, memory complaints were relatively stable. Second, the two variables were predicted by different sets of correlates. Finally, there was no indication of relationships of either variable to changes in the other variable. This result is inconsistent with findings of Hohman et al. (2011) that initial memory complaints predict subsequent longitudinal memory changes in older adults.

Latent Variable Models With Multiple Indicators

Our failure to find longitudinal relationships between memory performance and memory complaints in old and advanced old age was inconsistent with recent studies using latent growth curve analysis to demonstrate latent slope correlations between these two variables (Mascherek & Zimprich, 2011; Parisi et al., 2011). Although this outcome could reflect differences in samples, and, in particular, the greater age of the BASE sample participants, there were also major methodological differences in the models. The other recent studies used latent variable structural equation models, which have greater statistical power to detect individual differences in change (von Oertzen et al., 2010). Furthermore, they examined change over occasions of measurement (i.e., time in study), not using the type of age-based convergence model that is easy to specify in multilevel regression models but difficult to implement in structural equation models (see McArdle & Hamagami, 2001). In principle, these differences could be important because different metrics of elapsed time in longitudinal data, including chronological age, have different interpretations and can generate very different results (e.g., Ram, Lövdén, Röcke, Smith, & Lindenberger, 2010).

Hence, we decided to also evaluate an occasion-based latent variable model that used multiple indicators of memory performance. The three memory tests, free recall, paired-associates, and text memory, were used to define the Memory latent variable. We used the three GMS memory complaints items and the memory complaint item (CSM) from the psychological battery as four indicators of a latent Memory Complaints variable. Given that the CSM complaint item was not collected at T1, we used its T2 measure to help define Memory Complaints at T1, assuming considerable stability of individual differences in complaints over the brief interval from T1 to T2 (M = 1.9 years). As will be seen shortly, this assumption was consistent.
detected a reliable mean change in the Memory latent variable (estimated slope = −0.388, SE = 0.125; indicating a 0.4 SD unit average change over a 10-year interval, z = 3.11, p = .002) and a significant random effect in memory slopes (individual differences in change), estimate = 0.22, SE = 0.09, z = 2.34, p = .018. Chronological age at initial test predicted the memory change slopes as well. These results suggested that individual differences in late-life memory decline were successfully captured by the model.

However, the growth curve model was not well-defined for the Memory Complaints latent variable, with no evidence of either mean change in complaints, estimate = 0.004, SE = 0.006, z = 0.79, p = .43, or individual differences in change in subjective memory complaints, estimate = 0.00, SE = 0.00, z = 0.16, p = .87. Not surprisingly, then, there was also no reliable covariance of slopes between the Memory and Memory Complaints latent variables (estimated covariance = −.003, SE = .004, z = −0.81, p = .42. However, the intercepts of these two variables at T1, controlling on the covariates, were reliably related, estimated covariance = −.314, SE = .121, z = −2.60, p = .009, with lower memory performance associated with higher memory complaints (the standardized residual correlation was −.22), a different result from the age-based multilevel regression models reported above. Nevertheless, these outcomes certainly indicated no substantial relationship of changes in the two variables over time.

The inability to estimate a reliable latent growth curve for Memory Complaints suggested that the model’s assumption that memory complaints are monitoring actual levels of memory function as they change with age is not viable (see Hertzog & Nesselroade, 2003, for a discussion of implicit assumptions about the nature of change in such models). This led us to specify an alternative model for the data that did not assume cumulative, incremental change in memory complaints that derived from age-related changes in memory. This model preserved the latent growth curve specification for Memory, but specified only an autoregressive model for Memory Complaints across occasions of measurement. This model is consistent with the view that memory complaints are constructed judgments at the current moment of assessment (e.g., Cavanaugh et al., 1998) that have considerable stability of individual differences because of consistency in the variables that influence complaint reports at different points in time. We also specified contemporaneous effects of Memory to Memory Complaints at T3 and T4 to test the hypothesis that a degree of awareness of current memory status would influence concurrent memory complaints.

We focus first on the measurement model that defines the two latent variables. A model with no longitudinal equality constraints fit the data well, $\chi^2 = 554.56$, df = 376, CFI = .905, RMSEA = .034 (as indicated by a 95% confidence interval for RMSEA with an upper bound of .040, less than the .05 criterion for excellent model fit proposed by Hu & Bentler, 1999).
Table 4 reports the factor loadings from the model, the rescaled (standardized loadings), and the squared multiple correlations (SMC; communalities) for each item. Both latent variables were well-defined by the indicators, with the standardized loadings ranging roughly from .6 to .7 (although the GMC item complaining about problems remembering names and faces produced smaller loadings and SMCs). In particular, the loadings for the four-item subjective memory factors were roughly comparable in magnitude to those of the memory tasks, indicating that the Memory Complaint measure was reasonably well-defined by the indicators. Although the goodness-of-fit tests rejected the hypothesis of metric invariance in the loadings (Meredith & Horn, 2001), the estimated factor loadings were highly similar across occasions of measurement.

Table 5 reports the key parameter estimates of interest from the structural regression model. First, the Memory Complaint latent variable was highly stable over time with essentially perfect stability of individual differences between T3 and T4. Despite this, Memory at T3 concurrently predicted Memory Complaint at T3 (in the expected direction, with higher memory ability associated with lower complaints). However, the corresponding effect was in the opposite direction for T4 (the small positive coefficient might have been an epiphenomenon, given that the high stability of complaints from T3 to T4 leading to a vanishingly small residual variance for complaints at T4, the major component of the standard error for the regression coefficient).

Second, it was interesting that, unlike the latent growth curve model, that the effect of the Memory latent intercept on Memory Complaint at T1 was not significant. This outcome could indicate that the intercept-intercept relationship seen in the latent growth curve model was inflated by the specific concurrent relationship of the two variables at T3 that was modeled separately in the model of Table 5. Given standard logic about autoregressive models, one can interpret the T3 concurrent effect as indicating that memory functioning at T3 indirectly predicts shifting individual differences in complaints from T1 to T3 (e.g., Kessler & Greenberg, 1981).

Third, eliminating the latent growth curve specification for Memory Complaint resulted in more robust estimates of Memory slope effects. The residual variance in memory slopes (individual differences in change) was reliable, estimated variance = \( .277, SE = .099, z = 2.80, p < .001 \). This residual slope variance remained after age predicted individual differences in slopes of Memory change (see Table 5). The magnitude of this age-related effect was substantial (standardized coefficient of \(-.46\)), indicating greater amounts of memory decline in older participants.

Fourth, the pattern of covariate relationships to Memory Complaints and Memory at T1 mirrored earlier findings. Again, both variables were predicted by entirely different variables (Memory by age, education, and gender; Memory Complaints by neuroticism, depression, and subjective age), underscoring the argument that memory complaints are not merely based on monitoring memory ability.

Discussion

There are several important findings in this study that support, contradict, and add to previous literature on subjective memory complaint. The principal finding is that memory complaints in the oldest-old are not a veridical reflection of individual differences in objective memory performance, being instead predicted by neu-
To the contrary, the disparity in outcomes might indicate that memory complaints’ predictive validity for memory peaks in late midlife and early old age. In studies of metacognitive beliefs that focus on early old adulthood (i.e., the young-old), there tends to be more variability in the onset of observed memory and cognitive decline (e.g., Hultsch, Hertzog, Dixon, & Small, 1998; Schaie, 2005), perhaps as a function of both variable onset of normal aging and increasing incidence of memory pathology (Sliwinski, Hofer, & Hall, 2003). However, as people enter their 70s and 80s, memory decline tends to be more normative (Rönnlund, Nyberg, Bäckman, & Nilsson, 2005). If memory complaints are influenced by people noticing the onset of meaningful changes in their memory, that process should be more variable in middle-aged and young-old samples and might be more likely to contribute variance to memory complaints in people between the ages of 55 and 70. Of course, such speculation needs to be thoroughly tested in future research with studies that span a larger age range than is available in BASE. An alternative account of the differences in results between studies is that the occasion-specific latent growth curve approach misspecifies the nature of the relationship between memory complaints and memory performance at any age, but that the consequences of said misspecification are most noticeable in very old age. The latent growth curve model implicitly assumes that memory complaints are cumulative and incremental (see Hertzog & Nesselroade, 2003), with a positive correlation of slopes predicted by the degree of accurate monitoring of memory as it changes with aging. In contrast, one can argue that memory complaints are locally constructed in the moment (Cavanaugh et al., 1998), are imperfectly based on current or recent experiences of memory problems, and are influenced by many variables that are at best weakly connected to memory and age-related memory change. For instance, internalized implicit theories about aging and memory may strongly influence memory complaints in older adults (e.g., Lineweaver & Hertzog, 1998; McDonald-Miszczak et al., 1995; McFarland et al., 1992). Experiments that manipulate the ease of retrieval of personal information also influence self-rated autobiographical memory (e.g., Winkielman, Schwarz, & Belli, 1998) in ways that argue for contextual influences on self-ratings and underscore their status as constructed judgments (Schwarz, 2010). The strong stability of individual differences in memory complaints seen in this study (see also McDonald-Miszczak et al., 1995) doesn’t argue against the constructed-judgment view; such stability can be construed as consistency over time in the belief content that is accessed and constancy in the process by which it is accessed. In any case, conjectures about how memory complaints are constructed ultimately must be tested in future studies that evaluate the experiential basis for memory complaints and capture the rating behaviors involved (e.g., Vestergren & Nilsson, 2011).

The one shred of evidence we detected for older adults’ memory complaints being linked to memory performance came from the latent variable model which abandoned the latent growth curve specification and treated memory complaints as influenced by concurrent memory performance at $T_3$. One could argue that the same relationship was not observed at $T_1$ because of the need to control for individual differences in memory complaints at $T_1$ (study onset) that are governed by other variables, such as neuroticism, to allow the memory–memory complaint relationship, as argued by Herrmann (1982) and others. This effect did not occur.

---

**Table 5**

**Structured Regression Coefficients for Model With Memory, Memory Complaints, and Predictor Variables**

<table>
<thead>
<tr>
<th>$\beta$</th>
<th>SE</th>
<th>z</th>
<th>p</th>
<th>$\beta^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory$<em>{t1}$ $\rightarrow$ MCOMEM$</em>{t1}$</td>
<td>-.005</td>
<td>.005</td>
<td>-1.03</td>
<td>.30</td>
</tr>
<tr>
<td>Memory$<em>{t3}$ $\rightarrow$ MCOMEM$</em>{t3}$</td>
<td>-.015</td>
<td>.004</td>
<td>-3.44</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>MC$<em>{t1}$ $\rightarrow$ MC$</em>{t3}$</td>
<td>.839</td>
<td>.097</td>
<td>8.64</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Memory$<em>{t4}$ $\rightarrow$ MCOMEM$</em>{t4}$</td>
<td>.011</td>
<td>.005</td>
<td>2.28</td>
<td>.023</td>
</tr>
<tr>
<td>MC$<em>{t3}$ $\rightarrow$ MC$</em>{t4}$</td>
<td>.950</td>
<td>.124</td>
<td>7.65</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Age $\rightarrow$ MemoryIntercept</td>
<td>-.307</td>
<td>.039</td>
<td>7.95</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Gender $\rightarrow$ MemoryIntercept</td>
<td>2.802</td>
<td>.638</td>
<td>4.39</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Education $\rightarrow$ MemoryIntercept</td>
<td>.572</td>
<td>.138</td>
<td>4.14</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Age $\rightarrow$ MemorySlope</td>
<td>-.028</td>
<td>.012</td>
<td>-2.32</td>
<td>.020</td>
</tr>
<tr>
<td>Depression $\rightarrow$ MC$_{t1}$</td>
<td>.008</td>
<td>.004</td>
<td>2.08</td>
<td>.038</td>
</tr>
<tr>
<td>Neuroticism $\rightarrow$ MC$_{t1}$</td>
<td>.117</td>
<td>.032</td>
<td>3.65</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Subjective Age $\rightarrow$ MC$_{t1}$</td>
<td>.003</td>
<td>.002</td>
<td>2.08</td>
<td>.038</td>
</tr>
<tr>
<td>Age $\rightarrow$ Neuroticism</td>
<td>.005</td>
<td>.004</td>
<td>1.09</td>
<td>.275</td>
</tr>
<tr>
<td>Gender $\rightarrow$ Neuroticism</td>
<td>.221</td>
<td>.073</td>
<td>3.02</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Education $\rightarrow$ Neuroticism</td>
<td>-.057</td>
<td>.016</td>
<td>-3.585</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Age $\rightarrow$ Depression</td>
<td>.035</td>
<td>.030</td>
<td>1.14</td>
<td>.253</td>
</tr>
<tr>
<td>Neuroticism $\rightarrow$ Depression</td>
<td>4.422</td>
<td>.345</td>
<td>12.80</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Age $\rightarrow$ Subjective Age</td>
<td>.815</td>
<td>.064</td>
<td>12.69</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Neuroticism $\rightarrow$ Subjective Age</td>
<td>.791</td>
<td>.862</td>
<td>.92</td>
<td>.359</td>
</tr>
<tr>
<td>Depression $\rightarrow$ Subjective Age</td>
<td>.270</td>
<td>.105</td>
<td>2.58</td>
<td>.010</td>
</tr>
</tbody>
</table>

Note. $\beta^*$ = standardized $\beta$; MC = memory complaint; $t_1 - t_4$ = Times 1–4.
at \( T_4 \) (in fact, a small effect in the opposite and unexpected direction was found). Given that the residualized BASE sample manifested extremely high stability of individual differences in memory complaints between \( T_3 \) and \( T_4 \), we are inclined to dismiss the \( T_4 \) concurrent effect as artifact and treat the \( T_3 \) concurrent effect as being small but interpretable. Hence there is a hint in these data that monitoring current memory status may influence concurrent memory complaints (adjusting for prior level of complaints), but it is not the case that individual differences in episodic memory change, as measured by typical memory tasks, are robustly reflected in memory complaints or in changing memory complaints in the oldest-old.

As already noted, the mean pattern of memory complaint change in the BASE sample is markedly different than the pattern for memory, indicating relative stability in memory complaints over time. Why would older adults manifest stable levels of subjective memory in the face of empirically demonstrated memory decline? Consistency across time in how memory complaints are constructed could account for this effect as well. Alternatively, perhaps the oldest-old have shifting criteria for what is a potential memory concern after they reach old age (see Rabbitt, Maylor, McInnes, & Bent, 1995), similar to phenomena that have been identified as influencing subjective health in this age range. That is, older adults often rate their health as excellent or good, even though they have multiple illnesses or chronic conditions (e.g., Quinn, Johnson, Poon, & Martin, 1999; Zikic et al., 2009). This suggests that people may use a sliding standard of comparison when being asked to rate their health, comparing it to more negative outcomes in peers or fears about possible end-of-life pathologies. By analogy, as people reach into oldest-old age, their standards for what might represent good memory may change. These and other adaptive strategies for promoting positive self-evaluations appear to be robust and effective throughout old and very old age until people reach the very last stages of life (Gerstorf et al., 2010). In addition, the perceived importance and significance of memory failures may change as older adults’ personal circumstances evolve (e.g., transitions to retirement). Finally, it is an open question as to whether typical memory tests have ecological validity for the type of memory problems experienced by older adults (see Hertzog & Pearman, 2013, and Rabbitt et al., 1995, for discussion of these and additional possibilities).

This study is consistent with the broader literature suggesting that older adults’ memory complaints are more strongly linked to depression and neuroticism than to memory itself, while linking these phenomena to memory complaints in the oldest-old. The relationship between depressive affect and subjective memory complaint has been long established in the psychological literature, but this study is relatively unique in two respects: (a) the use of a clinician rating scale of depression rather than mere reliance on self-report and (b) the finding that depression remained significant even when controlling for trait neuroticism. Many of the studies examining the link between depression and memory complaint have used self-report depression scales, such as the CES-D or the Geriatric Depression Scale. Given that these scales have content overlap with neuroticism items (particularly its depression facet) and the biases in both types of scales introduced by the self-report method, it is not surprising that a large portion of the variance between typical depression scales and neuroticism scales is shared in common. Perhaps as a consequence, earlier studies (e.g., Pearman & Storandt, 2004; Pearman, 2009) have found that depression was not a significant predictor of memory complaint when controlling on neuroticism. Using a clinician-rated depression scale reduces shared method variance between measures of depression and neuroticism, revealing their independent influences.

The fact that the clinician-rated depression scale remained significant when controlling for neuroticism suggests that clinical levels of depression are an important influence on memory complaints in later adulthood. Given that depressive symptoms in older adults typically include aspects other than dysphoric mood (e.g., somatic complaints, cognitive slowing, and apathy), it is easy to imagine that an older adult with depression may actually both experience and report day-to-day memory problems due to the symptomatology of depression as opposed to actual memory decline.

The finding that neuroticism is a significant predictor of memory complaints extends the previous literature (e.g., Pearman & Storandt, 2004; Lane & Zelinski, 2003) into very old age. Given that neuroticism is related to morbidity (Chapman, Duberstein, & Lyness, 2007), mortality (Wilson et al., 2005; Shipley, Weiss, Der, Taylor, & Deary, 2007), and incidence of memory pathology (Wilson, Begeny, Boyle, Schneider, & Bennett, 2011) in old age, it was certainly possible that the BASE sample would have manifested a lower relationship between complaints and neuroticism, but it did not. There are several possible explanations for this finding. The first is that, in general, older adults may also become habituated to their age-related cognitive changes, but that this effect is moderated by neuroticism. For instance, noticing that one has trouble remembering someone’s name for the first time may seem quite alarming to a middle-aged adult, whereas having many years of that type of forgetfulness may inure older adults to concern about its possible implications. High neuroticism may prevent people from becoming habituated to memory changes.

People high in neuroticism may be more likely to construe memory errors and failures as highly significant, remaining more concerned and even vigilant about possible memory loss and memory pathology (e.g., Cutler & Hodgson, 2001). Another potential explanation is that people high in neuroticism are consistently more likely to complain about all types of things, including memory across the adult life span. As people get older and forgetting becomes more normative, they may routinely complain about memory failures. Finally, individuals high in neuroticism may be more attuned to noticing memory failures, causing them to rate their subjective memory as worse. For instance, someone who is low in neuroticism may forget where they put their mobile phone, look for it, find it, and go about their day. Someone high in neuroticism may forget where they put their mobile phone, worry about what it may mean, look for it, worry more about what it means, rendering the failure more accessible when they are asked to rate their memory functioning.

An important contribution of this paper to the memory complaint literature is the finding that subjective age was related to memory complaint in the oldest-old, independent of both depression and neuroticism. This outcome replicates the relationship reported by Stephan et al. (2011) and extends it into the last stages of life. Subjective age has been conceptualized as an attitude about aging that may influence how people interpret possible age-related losses (Weiss, & Freund, 2012) and that lower subjective age may help block susceptibility to age-related stereotypes (Elbach, Mock,
MEMORY COMPLAINTS IN VERY OLD AGE

& Courtney, 2010). Given that memory loss and memory pathology are common stereotypes about aging (see Hummert, 2011), it is certainly possible that people with higher subjective age experience memory failures in everyday life as diagnostic of advanced aging. Alternatively, stereotyped beliefs about degraded memory performance in old age may actually influence people to see themselves as older whenever they experience memory failures. In this sense, subjective age may act in these data as a kind of proxy for implicit theories and stereotypes about memory and aging. Certainly, further work is needed to investigate the causal mechanisms behind this finding.

Limitations and Outlook

Limitations of the study include people (e.g., sample and population), measurement of memory complaints, ecological validity of memory measurements, and data/design (e.g., frequency and spreading of occasions). Regarding the persons sampled, it would be highly instructive if future research were to conjointly examine participants across the adult life span, particularly in midlife, old age, and very old age, so as to address problems with narrow population selection (e.g., oldest-old) and whether selective survival plays a role in diluting the relationship of memory complaints to memory (probably because it changes the predictive validity of certain risk factors for incident heart disease, e.g., Thygesen, Johansen, Keiding, Giovannucci, & Grønbaek, 2008). For example, it appears possible that people who have memory problems may be aware of them in their 50s and 60s but are faced with higher morbidity and mortality hazards and are thus less likely to survive into very old age.

Another limitation is the rather brief and global measurement of memory complaint with only three general GMS questions and a global concurrent memory complaint rating rather than a longer subjective memory complaint scale that covers a variety of specific situations (e.g., Gilewski et al., 1990). However, such a lean assessment approach is relatively common in the literature, as evinced by many studies using only one or a few items to measure memory complaint (e.g., Crowe et al., 2006; Hong, Zarit, & Johansson, 2003; Johansson et al., 1997; Riedel-Heller, Matschinger, Schork, & Angermeyer, 1999); moreover, primary care physicians also tend to rely on a single-item question (e.g., Waldorff, Siersma, & Waldemar, 2009). Nevertheless, the complaints questions were global, rather than domain specific or context specific (Hertzog, Park, Morrell, & Martin, 2000), which may increase the likelihood that they were tapping participants’ general beliefs about themselves and age-related memory decline rather than a specific incidents of memory failure (Cavanaugh et al., 1998). This feature could have increased the relationship between complaints and the noncognitive predictor variables (i.e., depression, neuroticism, and subjective age).

Concerning ecological validity, there can certainly be concerns that the tests used in this study do not correspond to the type of memory failure older adults typically experience (see Hertzog & Pearman, 2013). Some have argued that memory tasks that isolate recollection processes yield better predictive validity for memory complaints (e.g., Guerdoux, Dressaire, Martin, Adam, & Brouillet, 2012), while others argue that measurement of memory problems in the natural ecology is ultimately needed to validate everyday memory complaints (e.g., Hertzog & Härtl, 2000). Nevertheless, objective memory performance decline is highly related to onset of dementia, which suggests that the traditional memory tests capture important and relevant aspects of episodic memory. There are few if any ecologically grounded memory assessments in use currently, particularly in longitudinal studies.

Finally, the interval between the times of measurement (approximately 2 years) did not allow for close tracking of changes in either memory or memory complaint nor for the identification of intradividual variability in memory complaints (e.g., Neupert, Mroczek, & Spiro, 2008). Given the view of memory complaints as locally constructed judgments, one might anticipate moment-to-moment fluctuations in concerns about memory (possibly as a function of everyday memory failures) despite the fact that memory complaint measures show considerable stability of individual differences. The present results reinforce the possible value of investigations of within-person fluctuations in memory complaints as a function of specific events involving forgetting, particularly those that are perceived as stressful and consequential (e.g., Garrett, Grady, & Hasher, 2010).

Conclusions

It appears that subjective memory complaints in the oldest-old have a minimal linkage to memory performance or changes in memory performance in late life. In the oldest populations, memory complaints are clearly more linked to mental health, personality, and attitudes about one’s own aging.

References


MEMORY COMPLAINTS IN VERY OLD AGE


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Received August 15, 2012
Revision received July 8, 2013
Accepted January 14, 2014