THE DIAGNOSTIC UTILITY OF SUBJECTIVE MEMORY QUESTIONNAIRES IN NORMAL AND PATHOLOGICAL AGING

By

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Memory complaints are common in later life; however, there are reasons to question the veridicality of such complaints because of self-report biases and depressive symptoms. In previous studies of subjective memory beliefs in older adults, some research suggests that these subjective perceptions may be related to objective memory performance, while other investigations suggest that other factors might attenuate this relationship. There is some evidence that with increasing cognitive impairment, increasing anosognosia may further reduce the relationship between objective and subjective memory. However, in persons with Mild Cognitive Impairment (MCI), there may be a brief window characterized by high daily memory failures and relatively intact cognition; perhaps during this window, the objective and subjective relationship actually becomes quite strong. In the present study, a sample of healthy community-dwelling older adults (N = 66, mean age = 74.9 years, mean education = 16.0 years) completed a
neuropsychological assessment. Two questionnaires regarding subjective memory beliefs were also administered: Metamemory in Adulthood Questionnaire and Memory Functioning Questionnaire. In addition, each participant identified an informant who completed an interview of participants' functioning (CDR). Each participant was grouped via a consensus conference to either normal control or MCI groups. Correlations revealed, even when controlling for depressive symptoms, that subjective capacity beliefs were related to most cognitive domains, including verbal and visual memory. Evidence suggested that there was a greater breadth of correlations between cognition and subjective beliefs in normal controls, but a greater specificity and magnitude in this relationship for the MCI elders. Subsequent analyses were conducted to predict cognitive status group membership. Subjective beliefs alone predicted impairment status in over 60% of the participants. When cognitive and CDR scores were added as predictors, 95% of the participants were classified correctly, with the unique predictive contribution of subjective belief disappearing. Thus, the results indicate that subjective memory questionnaires may be useful in identifying individuals at risk for cognitive impairment; however, they do not replace a neuropsychological examination and/or an informant interview.
The purpose of the current study was to explore the relationship between subjective memory beliefs and objective cognitive performance and to determine the diagnostic utility of subjective memory questionnaires in normal and mild cognitively impaired older adults. Also of interest was whether informant reports of memory problems were related to the participants’ objective cognitive performance.

While psychological aging research is a relatively new field of inquiry, researchers have been interested in the interplay of the concepts of cognition and self-beliefs for decades. Despite the recognition given to the topic over the years, there have been inconsistencies in findings over time. This could partly be due to differences in the measurement of subjective memory beliefs, which have ranged from asking participants for simple verbal responses to one or two questions to the use of extensive questionnaires to assess multiple dimensions of the subjective belief construct.

Despite the numerous studies conducted on the relationship between subjective memory beliefs and objective memory performance in the elderly, there is an odd bifurcation in the populations studied. In some studies, the emphasis has been on subjective belief in normal elders. In other studies, the focus has been on subjective awareness in persons with a diagnosis of dementia. There is little known about the stage “in between” these time points, which includes elders with mild cognitive impairments. The present study examines the question of the relationship between subjective memory beliefs and objectively assessed ability in a sample that includes both mild cognitively
impaired and normal older adults. This study also goes beyond person-centered subjective-objective relations (which have dominated this literature to date) by also gathering informant ratings, adding another layer to the question of the relationship between subject (other) perceptions and actual performance. The following chapter provides an overview of the theoretical and empirical work in this area and then the following chapter details the study design.
CHAPTER 2
REVIEW OF LITERATURE

The Science of Self-report

Psychological research has relied heavily on self-report as a primary source of data (Schwarz, 1999). Self-report measures are widely used because of ease of administration, cost-effectiveness, and the ability to survey large numbers of people efficiently; however, their diagnostic significance has continually been in question (Baldwin, 2000). Minor changes in the order of questions, their wording, or their context can result in major changes in responses (Schwarz, 1999). In the 1940’s, scientists began to notice systematic biases in the self-report of various behaviors, which provided serious implications for the validity of self-report research (Bachrach, 2000). It is now widely known that self-report may contain response error, which can be a product of social desirability or an error in judgment or perception.

Self-report about one’s memory and cognition is often studied under the label of “metacognition.” This highlights the critical issue, which is what individuals across the lifespan know and believe about their cognitive functioning and its control. Advantages and disadvantages of self-report in this metacognition literature have been summarized in several comprehensive reviews (e.g., Hertzog & Hultsch, 2000; Marková & Berrios, 2000). Succinctly, these reviews have suggested that the main disadvantages of subjective reports about memory are (a) unknown veridicality or honesty of responses and (b) their unknown utility in a wide range of adults, particularly in those with neurological compromise, where anosognosia (unawareness of deficit) can be a common
problem. Despite this, substantial effort has been employed to design several well-constructed self-report measures of metacognition and subjective memory, and a relatively sizable number of publications suggests that these have been effectively used in the elderly population (Hertzog & Hultsch, 2000).

Blair and Burton (1987) examined ways in which responders report frequency judgments in self-report measures, with most evidence pointing to the use of frequency estimations rather than episodic recall of events. The general notion is that, when rating themselves, individuals use fairly schematized general estimations about themselves (assess how often certain memory failures occur), rather than thinking back to specific episodic representations about their memory functioning (recollect exact situations and contexts in which memory failures took place). Routine daily episodes of memory are not particularly memorable, so it is unlikely that one will recall specific behavior episodes unless the criterion behavior is relatively rare and/or of considerable importance. Thus, in self-ratings, the assumption is that the typical self-review process involves frequent behaviors blending into more general memory representations. Self-ratings are assumed to generally lack the specific time and space indicators needed for episodic recall. Blair and Burton (1987) also suggest that estimations are likely to be used in situations where long time frames are in question and also in situations where the question is worded “how many times” rather than “how many.” Using such frequency estimations rather than episodic recall is of great consequence for self-reported behaviors, as individuals may not accurately portray their behavior, reasons for which this may occur will be described below.
The Importance of Self-report in Old Age

Self-report measures have been used to examine a variety of constructs in old age (e.g., depression, self-efficacy), and have also been useful in developing theories of changes over the life course. One such developmental theory, proposed by Brandtstädter (1999), is invoked to explain affective resiliency in older adults. The general observation is that, in older adults, despite the growing and normative incidence of losses and negative life events (e.g., death of close others, cognitive and physical losses, economic change), measures of emotional well being remain remarkably stable into old age, apparently relatively unaffected by aging (Staudinger, 2000). Brandtstädter’s theory posits that individuals at all ages continually balance positive and negative developmental changes by using both protective and compensatory means. One such protective mechanism is the tendency to positively compare oneself to the image one has of their peers (e.g., my eyesight isn’t what it used to be, but in comparison to my neighbors, my eyesight is satisfactory; Schulz & Fritz, 1987).

In old age, the argument is that developmental decline in functioning can lead to a discrepancy between the desired (who I want to be) and actual self (who I am). This discrepancy can cause personal distress; and in order to mitigate the distress, elders have to come to terms and somehow accept or transform those elements that are perceived as counterfactual (Brandtstädter, 1999). Thus, the relative salience of “bad things” for one’s self-concept may be minimized, and “good things” may be attended to relatively more. This is important because an individual’s perceived ability to maximize gains and minimize losses in self-evaluation is thought to be indicative of successful personal development across the lifespan (Chapman, Skinner & Baltes, 1990).
Brandstädter and Renner (1990) have developed a three-part model that explains how older adults use adaptive and protective processes to maintain integrity despite the inevitable losses that occur in the aging process. First, assimilative coping eliminates the discrepancy of personal skill versus task demand by changing the situation at hand so that it better fits with one’s personal goals. In older adults, examples of this coping style could include the use of hearing aids when hearing declines or engaging in mnemonic strategies to maintain a desired level of cognitive performance. This coping strategy is characterized by persistence in the standards set for oneself earlier in life, yet is dependent on the resources currently available.

On the other hand, accommodative coping, the second piece of their model, adjusts one’s personal goals or behavior to fit the situation at hand. This may be useful when the standards set for oneself are no longer personally feasible because of developmental decline and it becomes necessary to restructure one’s goals to ease frustration and distress. This process may be difficult for some older adults because certain personal goals are so central to one’s identity that they are hard to let go of, however such accommodative flexibility becomes an extremely important source of resiliency in old age.

Third, immunizing coping involves the tendency to protect oneself against self-discrepant evidence by mechanisms such as self-serving attributions, where functional loss is attributed to external things rather than one’s own deficits. This change in attributions often alters one’s reference points for comparison and reflects what is considered “normal” at a given age. The model posits that the three parts work synergistically despite their seemingly antagonist nature.
Schulz and Heckhausen (1996) proposed a similar model for maximizing development across the life course that includes four principles. The first principle of the model is to maintain diversity in activities to reduce the weaknesses that may arise from specialization. The second principle is to selectively spend time and resources to develop broad skills. The model’s third principle is to compensate and cope with failures, both normative or not. The last principle is to manage the trade-offs between different domains of functioning and skills. These principles all work together to maximize one’s developmental potential and resiliency in later life.

Age stereotypes may also facilitate the development of affective resiliency in older adults, despite the negative connotation often given to stereotypes in lay parlance. The effect of societal age stereotypes on older adults is buffered by the protective mechanisms they serve, like the tendency to positively compare oneself to the image one has of their peers (“Old people decline; I haven’t declined much; therefore, I am better off than most old people”; Schulz & Fritz, 1987). Thus, age stereotypes are used by the elderly as a way of protecting their self-image by making downward social comparisons. Fiske and Taylor (1991) have described age stereotypes in a social cognitive perspective as schemas that assist in the processing and interpretation of new information in social interactions with peers. They argue that these stereotypes are not inherently negative, but rather are self-serving.

**Common Concerns of Older Adults**

In late life, the most widely studied self-perception constructs are those concerning age-related self-reported cognitive problems. This is due to the fact that such perceived problems are rather common in older adults, estimated to be present in 35-40% of community-dwelling, non-demented elders (Grut et al., 1993). This perception of
cognitive change from previous level of ability concerns older adults, which can be due in part to the surge of public information on Alzheimer’s disease (AD) and other progressive dementias in popular media. Many older adults fear AD because their complete identity and independence is at risk of being stolen from them. This fear is externalized in the form of complaints to their peers and family about their declining abilities, with such behavior perpetuating societal fear.

Older adults tend to overestimate the incidence of Alzheimer’s disease (Gatz & Pearson, 1988) and on the Alzheimer’s Likelihood scale (Lachman, Bandura & Weaver, 1995) those perceived to be at most risk for disease had lower perceptions of their memory ability and deeper beliefs about an inevitable loss of memory function. One hypothesis about why this might occur is that concern about memory loss may reflect a lack of perceived control over the aging process, which will be described in more detail below. Some believe that adults of all ages have pessimistic stereotypes and beliefs about how aging effects memory (Camp & Pignatiello, 1988). Research has corroborated this; studies have looked at memory ratings of typical persons at different age points and found that people perceive memory as declining with age (Ryan, 1992; Ryan & Kwong See, 1993). Many older adults may perceive a deficient memory as unavoidable and then not behave in ways to maximize their everyday memory functioning. Others may believe that memory ability is determined by how much effort one puts into a task and are thus more likely to efficiently use their memory when needed (Soederberg Miller & Lachman, 1999).

As a counterpoint to rather pervasive pessimism of the aging process, however, Baumeister (1989) proposes that optimal psychological functioning is related to moderate
distortion in both the perception of the self and the world. His theory, the optimal margin of illusion, states that seeing things slightly better than they really are and choosing downward social comparisons aids in personal happiness, is adaptive, and rather widespread. These illusions are a way of coping and can become a self-fulfilling prophecy when people seek to verify their inflated views of themselves.

Many investigators have identified self-evaluation as one of the most important features of memory in older adults (Cavanaugh & Green, 1990). Three types of self-evaluations are of specific interest and will be described in detail: subjective memory complaints, subjective memory beliefs, and memory self-efficacy. Given the centrality of these concepts, and their similarities and differences from one another, the next section of this proposal attempts to define and further discuss each in greater detail.

**Subjective memory complaints**

Subjective memory complaints, as they are described in many published articles, are considered relatively brief and unstructured responses to questions from healthcare providers or others about the state of their memory ability. The response is usually considered a complaint if the responder provides an answer stating that they are having some type of difficulty with their memory. These complaints typically include both a specific concern about a changing ability as well as the frequency and context of the problem. These complaints typically reflect perceived decline and the anticipation of its worsening. Such complaints may be spontaneous and uncued. It is the often-spontaneous nature of these complaints, and their subjective linkage to perceived functional or everyday losses and impairments, that has caused researchers interested in Mild Cognitive Impairment to view such complaints as very important presenting symptoms. This is discussed in further detail below.
As noted earlier, memory complaints are common in older adults. However, there is research to suggest that the frequency of complaints do not vary in adulthood, with about 30% of adults aged 25-75 identifying general problems with their memory (Soederberg Miller & Lachman, 1999). But there is data to suggest that some types of memory complaints, namely remembering names and phone numbers, are more prevalent in older adults than in younger adults. Conversely, younger adults have more memory complaints than older adults about mundane tasks such as remembering to pay bills, take medicine, and keep appointments (Cohen, 1993).

**Subjective memory beliefs**

Self-reported complaints are often specific negative evaluations about one’s memory functioning and how it may be adversely affecting one’s daily function. In contrast, subjective memory beliefs are more general, and not necessarily valenced, cognitions we hold about ourselves as rememberers (Hertzog, Lineweaver & McQuire, 1999). It has been proposed that these self-beliefs develop less from actual recalled instances of forgetting than from one’s more general philosophy about one’s memory. Importantly, these beliefs may or may not reflect actual impairment, but, alternatively, they may signal other conditions, most typically depression. Interestingly, subjective beliefs are widely measured, but there is little known data regarding the accuracy of beliefs under conditions of cognitive impairment. A question, developed further below, is whether impairment (with its presumed accumulation of specific negative behavioral episodes involving memory, and the presumed associated development of memory complaints) transforms the accuracy of subjective beliefs. In other words, in impaired participants, do subjective beliefs about memory become de facto memory complaints? Thus, it is important to determine whether subjective perceptions about memory can
differentiate those with and without actual memory difficulties (Collins & Abeles, 1996). In addition, the separability of subjective memory beliefs from more domain general self-beliefs (including depression) must be assessed.

**Memory self-efficacy**

Memory self-efficacy has been defined as one’s belief in one’s ability to mobilize the cognitive resources needed to manage task demands and one’s confidence in doing so. This definition requires both motivation and perseverance in exerting effort (Bandura, 1986; Bandura, 1989). Self-efficacy judgments are made from one’s past mastery or failures of the certain ability, the modeling received from others in one’s environment, the encouragement or lack thereof from others, and one’s arousal and mood state (Bandura, 1997). Errors in beliefs about ability are often overestimates of actual ability, which is of benefit to the self so more challenging tasks will be undertaken. Bandura’s theory of self-efficacy also states that normal adults distort reality in ability more than anxious or depressed adults, even when they have identical skills. The realists (anxious and depressed adults) are unlikely to do anything to change their situation, whereas the distorters (normal adults) will take action (Bandura, 1989).

Of course, the Brandstädterian perspective mentioned earlier suggests that realism, per se, may be on the wane in later adulthood. Life-span theory would predict, in the face of objective losses, like when memory ability tends to decline, more self-protective processes (like downward social comparisons) will be used, and less “truthful self-evaluation” of one’s competence in real-life contexts will occur. This perspective would predict, for example, that instead of only looking at instances when memory has failed, older adults tend to compare their memory failures to the amount of memory failures in their peers. This actually leads to the paradoxical prediction that, in the face of objective
memory losses, memory self-efficacy might actually increase or remain stable in later life, reflecting this underlying adaptive resiliency process.

A common term in self-evaluation research is "response shift," where a change occurs in the meaning of one’s self-evaluation. This can be a result of a change in internal standards of capacity, a redefinition of a target construct, or a change in the importance of components that make up the construct (Schwartz & Sprangers, 1999). These changes could be resultant from social considerations, such as an older person being more likely than a younger person to report difficulty in performing a task because of reduced social expectations and consequently lower self-expectations.

Self-evaluations are also affected by metamemory, which essentially is thinking about memory and the knowledge one has about cognitive abilities and how they work. It is a multidimensional construct involving complex and dynamic processes, and is also mediated by factors like personality and social context. Hultsch et al. (1988) has identified four dimensions of metamemory. Memory knowledge is factual knowledge about memory processes (e.g., recognition is typically easier than recall). Memory monitoring is self-awareness of how one’s memory is used and the current state of one’s memory (e.g., accuracy of performance). Memory-related affect is the feelings related to memory situations (e.g., anxiety about a particular memory). Memory self-efficacy is one’s sense of mastery in memory (e.g., beliefs about capacity or change in one’s memory). As indicated by this last dimension, self-efficacy is related to metamemory in that metamemory involves beliefs that result from the self-evaluation of ability. The main difference is that self-efficacy is a call to action, not simply a belief (Cavanaugh & Green, 1990).
Flavell and Wellman (1977) introduced the production deficiency hypothesis. It relates to older adults and posits that deficient metamemory knowledge may be one source of the relatively inefficient memory task strategies observed in older adults during memory task performance in clinical and laboratory settings. Other studies have proposed related hypotheses, including that older adults may use incorrect mnemonic strategies—again owing to metacognitive deficits—and thus not perform optimally (Hertzog, Dixon & Hultsch, 1990). Also related to metacognition, there is a recurring finding that even when older adults are taught mnemonic strategies and their application in real life, older adults consistently do not use such strategies (Willis & Schaie, 2002; Kausler, 1994).

**Relationship of control beliefs and self-report**

As noted earlier, concern over memory loss may reflect a lack of perceived control over the aging process (Lachman, Bandura & Weaver, 1995). Soederberg Miller and Lachman (1999) have conceptualized control as beliefs about one’s ability to bring about some particular outcome as well as what other factors that may be responsible for that outcome (e.g., things in one’s environment). They have also focused on both general and domain specific control beliefs. In some ways, control beliefs may appear to be similar to self-efficacy as described earlier, and the terms are often used interchangeably. Older adults report less control over their memory than younger and middle-aged adults (Dixon & Hultsch, 1983; Lachman, Bandura & Weaver, 1995). This is important because those who believe that they have some control should receive some advantages of these beliefs—increased motivation to learn and subsequently use a broader repertoire of strategies in cognitive tasks. Those with lower control beliefs may think that effort in learning new strategies is futile because of the underlying view that memory function is a
dispositional trait (and therefore relatively unchangeable by personal effort; Hertzog, Lineweaver & McQuire, 1999). Older adults tend to perceive less internal and more external locus of control in memory and intellectual abilities. However, when older adults do perceive an internal locus, they tend to make internal attributions about their impaired abilities rather than about what skills they do have (Lachman & McArthur, 1986).

**Ways of Studying Memory Self-report**

Beliefs about one’s memory can influence many psychological constructs (e.g., self-esteem, life satisfaction, negative affect, and anxiety about aging; Hertzog, Lineweaver & McQuire, 1999). Many approaches to measuring memory beliefs have been developed because of the widespread notion that beliefs about one’s ability can influence actual performance (Cavanaugh & Green, 1990), which is one of the main foci of research in this domain. However, some (Hertzog & Dixon, 1994) have argued that such beliefs are a noteworthy phenomenon in their own right since they can impact everyday functioning, even if the beliefs are not accurate of cognitive abilities. Approaches to measurement in this research have been varied.

**Questionnaires**

One approach is a questionnaire format that asks multiple items about the domain(s) of interest (Berry, 1999). Most such measures include factor analytically derived scales of multiple constructs related to subjective memory beliefs (e.g., beliefs about memory stability, mnemonic strategy use, and frequency of forgetting) and these measures have been the most widely used and studied instruments in this field of study. In the present study, our work has used an extension of such questionnaires, not only to capture a person’s own beliefs about their memory and how it is changing, but also to
have an informant also answer many of the same questions about the participant (See Methods section for more detail.). Two of the most common questionnaire approaches to assessing subjective memory beliefs are described next.

**Memory Functioning Questionnaire**

The Memory Functioning Questionnaire (MFQ; Gilewski, Zelinski & Schaie, 1990) is a 64-item scale and was developed to assess seven dimensions: single-item rating of general memory problems, retrospective function, frequency of forgetting, remembering while reading, remembering past events, seriousness of forgetting, and mnemonics usage. These dimensions make up 4 scales: Frequency of Forgetting, Seriousness of Forgetting, Retrospective Functioning, and Mnemonics Usage. The items are rated on a 7-point Likert scale with higher ratings meaning more positive self-report and less mnemonics usage. Some advantages to the scale are: sound psychometric properties of the scale (See Methods section) and it is relatively brief to complete. A disadvantage to using a scale of this type however is that responders may get into a response set and continually circle the same answer without considering the question, responders may have memory problems sufficient enough that they cannot recall how often they have certain difficulties, and social desirability may also factor into the responders’ answers.

**Metamemory in Adulthood Questionnaire**

The Metamemory in Adulthood Questionnaire (Dixon, Hultsch & Hertzog, 1988) is a 108-item scale and measures eight dimensions of metamemory: strategy, capacity, change, anxiety, task, achievement, and locus of control. There are two types of questions asked in this questionnaire: opinions about memory-related statements (e.g., I can’t expect to be good at remembering zip codes at my age.) answered with a 5-point
agreement scale and questions about how often one does certain things that may be related to memory (e.g., When you try to remember people you have met, do you associate names and faces?) on a 5-point scale. The same advantages and disadvantages as the MFQ apply here, although this measure takes longer to complete. Anecdotally, many responders find the questionnaire somewhat frustrating because there appears to be repeating questions even though the questions are worded slightly different.

Both of these scales are sensitive to age differences and show convergent and discriminant validity. Work of a few research groups have indicated that memory self-efficacy is a real construct that can be measured reliably and validly. They have also shown that it is distinct from personality and other psychosocial variables (Hertzog, Hultsch & Dixon, 1989).

**One-question approach**

Some studies use a one-question approach to assessing subjective memory complaints instead of long questionnaires. St. John and Montgomery (2002) used the question, “Please tell me if you have had memory loss in the past year. You can just say yes or no.”, in their research. Others have used the questions on the Clinical Dementia Rating Scale (CDR; Morris, 1993; i.e., Do you have problems with your thinking or memory?; Has there been a decline in your memory in the last year?) to elicit subjective complaints about memory for research purposes, however these types of questions rarely tap personal beliefs about memory.

**Relationship of Self-report and Depression**

Evidence has shown that other features may affect memory self-efficacy, such as depression (Gilewski & Zelinski, 1986). In late life, the prevalence of depression is 1-2% in the general population and estimated to be present in 12-25% of those in hospitals or
nursing home settings (La Rue et al., 1996). The clinical presentation of depression in the elderly differs from that of younger adults. Older adults are less likely to admit dysphoria, guilt, or suicidal ideation than younger adults. Instead, older adults often present with somatic symptoms and lack positive feelings (Gatz & Pearson, 1988). The vegetative symptoms of depression in the elderly may be difficult to explain because they may mimic or be a precursor to various medical conditions that are common in the elderly. Compared to non-depressed older adults, depressed elderly perform more poorly on tasks of attention, visuospatial abilities, memory processing, and overall cognitive functioning (Kramer-Ginsberg, Greenwald & Krishnan, 1999). Lockwood and colleagues (2002) have also noted that depressed older adults display executive dysfunction (e.g., impaired initiation, inhibition, task switching, processing speed, and mental manipulations) when compared to non-depressed older adults. Because of the proposed relationship of memory self-report and depression as well as the relationship between depression and cognition, it is important to rule out the possibility that depression mediates the relationship between memory self-report and cognition.

Some studies have shown that depressed patients are more likely to complain about their memory (Grut et al., 1993). However, sometimes the etiology of a mood disturbance could result from the self-awareness of one’s cognitive decline. This is a situation where it may be difficult to determine whether the mood or cognitive symptoms developed first. Others (Camp, 1986; Cavanaugh & Murphy, 1986) suggest that depression has an indirect effect on cognitive performance that is mediated by performance expectations.
Larabee and Levin (1986) found that memory self-ratings were largely related to affective state rather than to objective memory performance. In a study by Kahn et al. (1975), they concluded that complaints were a manifestation of depression rather than to cognitive performance. Verhaeghen, Geraerts, and Marcoen (2000) have offered a different view of memory ratings and depression, namely that it may not be the depression per se that leads to complaints. They suggest that a chief outcome of depression, reduced speed and attention, may be responsible for actual memory problems as well. Thus, the relationship between subjective memory and depression may reflect the true cognitive losses that occur in affective disorders.

Clinicians have also become aware of this association and have included diminished ability to think or concentrate (either subjective complaint or from an informant) as a symptom of depression in the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1994). In this sense, some believe that memory complaints resulting from depression should resolve with the alleviation of a depressive episode. Molinari (1991) concluded that depressed persons emphasize memory complaints while those with AD and other memory disorders attempt to minimize memory difficulties. One such memory disorder of interest is Mild Cognitive Impairment, because it is conceptualized as an intermediary state between normal aging and dementia.

**What is Mild Cognitive Impairment?**

One memory disorder relatively new to the literature, Mild Cognitive Impairment (MCI) (Petersen et al., 1999; Petersen et al., 2001), has not received much attention in the metacognition literature. Individuals with MCI are at an increased risk for the development of AD. While other presentations of MCI exist (e.g., single impairment in a
cognitive domain other than memory), the focus of our work is on amnestic MCI (AMCI). AMCI patients have a mild memory problem that exceeds what is expected for their age (perform ≥ 1.5 SD below age and education corrected norms) while other cognitive domains (e.g., working memory or language abilities) are generally preserved. The criteria also requires: a subjective memory complaint, intact activities of daily living (ADLs; i.e., bathing, dressing), and not meet the criteria for dementia. MCI differs from normal aging where there is a more general, but slight decline in most cognitive domains over the later decades of life. Moreover, MCI differs from dementia where there is a more pronounced decline (perform >1.5 or 2 SD below age and education corrected norms) in at least two cognitive domains, most often memory and another domain, as well as impairments in ADL functioning. Many researchers believe that MCI is a precursor to the clinical manifestation of Alzheimer pathology, notably because 10-15% of those diagnosed with AMCI “progress” to AD each year compared to 1-2% of the general population (Petersen et al., 2001).

AMCI assessment should include extensive neuropsychological testing including (but not limited to) the domains of verbal and visual memory, working memory, processing speed, attention, and language ability. A depression screening should also take place to rule out the possibility of low-test scores due to inattention or lack of motivation. AMCI assessments should also include an informant interview to assess activities of daily living, memory failures in the home environment, and the patient’s judgment and problem solving abilities. A common interview used for this purpose is the Clinical Dementia Rating Scale (Morris, 1993) where impairments are rated from 0 (no impairment) to 3 (severe dementia), with 0.5 usually representing MCI. Neuroimaging,
genetic, and neuropathology markers for AMCI are still under investigation at this time. Due to the likely progressive nature of AMCI, follow-up assessments should take place every 6-12 months (Petersen et al., 2001).

It should be noted that the MCI information provided herein has been that proposed by Petersen and colleagues at the Mayo Clinic in Rochester, MN. While this model has been accepted by the American Academy of Neurology via an evidence-based practice parameter review (Petersen et al., 2001), the American Association of Neuroscience Nurses, and the American Geriatrics Society, it is important to note that this model is not accepted by all in the fields of psychology, psychiatry, and neurology. In fact over the years, there have been many iterations of similar concepts, including: benign senescent forgetfulness (Kral, 1962), age-associated memory impairment (Crook, Bartus, Ferris, & Whitehouse, 1986), age-associated cognitive decline (Levy, 1994), age-related cognitive decline (American Psychiatric Association, 1994), and cognitive impairment-not demented (Ebly, Hogan & Parhad, 1995).

**Subjective Complaint and MCI.** Some findings indicate that older persons complaining about their memory actually perform within normal limits in an assessment based on norms for standardized tests—what some like to call “worried well.” However, other studies have found a relationship between memory complaints and memory performance.

There has been a growing literature involving a lack of insight in patients with degenerative diseases of aging (i.e., AD, Parkinson’s disease). Recent consensus in the field defines insight not only as awareness of symptoms or a disease process, but rather a multidimensional concept including the ability to elaborate on the experience, re-label the
symptoms as pathological, or have knowledge of the deeper effects the symptoms or
disease will have on their environment (Marková, & Berrios, 2000). The term
anosognosia has been used to describe this lack of insight into one’s memory deficits. It
originated back in 1914 by Babinski to describe stroke patients with unawareness of
hemiplegia, but the term is now used to describe unawareness of many neurological
syndromes. Anosognosia has been operationally defined as either a discrepancy between
self and other report of functioning or a discrepancy between self report and objective
performance on tasks (Kotler-Cope & Camp, 1995).

There has been a recent focus on localizing the specific structural or functional
brain system(s) responsible for impaired insight, however the results of studies have been
mixed thus far. There have also been conflicting studies of insight at different stages of
dementia. One study of severe AD found that awareness remained for behavioral
problems compared to cognitive problems (Kotler-Cope & Camp, 1995). Anderson and
Tranel (1989) found that unawareness was related to the degree of intellectual
impairment. Based on clinical observation, Roberts (1984) claimed that a failure to
acknowledge memory difficulty is more indicative of AD, whereas spontaneous memory
complaints are more indicative of depression or mild cognitive impairment, lending
support to the diagnostic utility of patient subjective report. Others (Wilson & Evans,
1996) have reported that self-report of memory impairment is not useful in identifying
mildly impaired persons and the focus should shift to longitudinal study of self-report to
determine what predicts subsequent decline. Despite this change in focus, it is thought
that insight remains during the mild stages of dementia and then diminishes as the disease
progresses (Freidenberg, Huber & Dreskin, 1990). Thus it is believed that patients with
mild cognitive impairment, a proposed precursor of AD, may still have insight into their memory problems (see our proposal in Figure 2-1).

Figure 2-1. Level of awareness of deficits by stage of development

**Relationship of Subjective Beliefs and Cognition**

There has been inconsistent evidence to date about the link between subjective memory beliefs and actual memory performance. The literature on concepts relating to this has been expanding over the years, and interestingly has bridged many different areas within psychology. Cognitive psychologists are interested due to the bridge between metacognition and motivation and learning. Neuropsychologists are interested because of the unawareness of deficits following brain injury or development of neurodegenerative disease. Social and personality psychologists are attracted due to the established concept that cognitive processes do not occur in isolation of personality and social contexts. And lastly, lifespan developmental psychologists are interested in the change in metacognitive beliefs across the life course.

**Research Supporting Relationship Between Subjective Beliefs and Cognition**

Carr et al. (2000) found that informant-reported (i.e., from spouse, child) complaints at baseline predicted onset of memory problems at longitudinal follow-up, but only for those who were not demented at time of baseline. Within five years, 45% of
participant’s whose informants reported memory problems at baseline progressed to dementia. This finding suggests that informants may be identifying those at risk even before clinical assessments can detect memory problems.

Jonker et al. (1996) found that individuals that both complained of memory problems and had objective memory problems had an increased risk of performing poorly on tasks of delay recall, factual memory, orientation, and attention compared to those without complaints of memory problems or objective memory performance problems. They concluded that subjective memory complaints might be an indicator of true impairment that needs further assessment and possible treatment.

Schmand and colleagues (1996) investigated whether subjective memory complaints would predict the onset of dementia in a three-year time period. Stepwise logistic regression analysis revealed that age predicted dementia more than subjective memory complaints, however once age was accounted for in the analysis the complaints did significantly predict dementia onset. Nevertheless, when the analysis was repeated with objective memory performance scores as the predictors and accounted for age, objective memory performance was found to be the most powerful predictor of dementia. The authors conclude that subjective memory complaints may “announce” dementia within 3 years, however memory performance may be a better predictor. St. John and Montgomery (2002) conducted a similar study and found that subjective memory loss was associated with higher risk of dementia five years later.

La Rue et al. (1996) examined the relationship of subjective memory ratings and cognitive performance in participants with relatives of early onset-AD patients (diagnosis before age 65) and with relatives of late onset-AD patients (diagnosis age ≥ 65 years).
An interesting finding was that there was better congruence between memory ratings and test performance in those with early AD relatives than for those with late AD relatives. They interpreted this finding as either a difference in the type of monitoring of one’s own memory that occurs or due to chance because of a small sample.

In a review article to determine whether memory complaints are predictive of dementia, Jonker et al. (2000) examined literature in this field and made three conclusions based on the review: a) memory complaints in young-old participants generally related to depression, anxiety, or personality factors, b) memory complaints in old-old should be acknowledged as a possible early sign of dementia, especially in those with cognitive impairments, and c) memory complaints in those with a high education level may also be a sign of future dementia even if there is no current cognitive impairment noted.

**Research Not Supporting Relationship Between Subjective Beliefs and Cognition**

Schmidt, Berg and Deelman (2001) found that the correlations between subjective memory performance and objective memory performance were low to modest (< 0.38). Once age was controlled for, the number of such correlations dropped substantially. However, this study was conducted in with a small Dutch sample and used neuropsychological measures that are not widely used in the United States.

West, Boatwright, and Schleser (1984) found no relationship between memory complaints and memory performance on several types of memory tests. However, the sample was select in that there was a restricted range in memory complaints due to the recruitment strategies employed.

Thus, the evidence on the relationship between subjective memory beliefs and objective measures of cognitive performance is equivocal. Collins and Abeles (1996)
state, “…[equivocal findings are] not surprising since memory complaints are especially common in the elderly and since the incidence and prevalence of actual progressive memory disorders is relatively low” (p. 31). Another reason to believe that the evidence is equivocal is that there has been inconsistency in measurement. There have been several questionnaires used to elucidate the subjective beliefs, as well as studies that use only a one or two-question approach. There have also been substantial differences in the objective tests used to examine cognitive performance.
CHAPTER 3
STATEMENT OF THE PROBLEM

The proposed study aims have been selected to investigate the inconsistency of whether or not subjective memory beliefs are related to actual cognitive performance, as well as look at the congruence of elders’ memory beliefs and what those that know them well say about their memory. Interestingly, most of the work in this area has focused on normal aging rather than pathological aging. This study extends prior research into the pathological aging arena by including mild cognitively impaired participants. The current MCI literature has relied on spontaneous memory complaints in its diagnosis, which is psychometrically problematic (i.e., a single, open-ended item) and may or may not have been cued by the practitioner. Thus, this study employed several standardized questionnaires to see 1) if individual differences could be better captured when cued the same way across all participants and 2) whether or not they contribute unique variance to understanding who may have MCI. The implications for this work are potentially important, in that if one’s perceptions of one’s memory actually predicts one’s performance, relatively simple subjective screeners could potentially become an efficient way of facilitating early identification of incipient memory disorders.

Aim 1. Relationship Between Subjective Memory Complaints and Memory Performance

1a. To Investigate if Subjective Memory Beliefs Are Related to Objective Measures of Memory and if so, Does it Vary By Level of Cognitive Functioning.

I hypothesize that memory beliefs will be correlated with the memory performance variables such that lower levels of belief reflect poorer memory performance. I further
hypothesize that correlations between objective and subjective function will be stronger for those in the Mild Cognitive Impairment group, since persons with MCI are expected to have more functional behavioral episodes of memory failure in their recent history. Thus, they are expected to have higher levels of reality-based subjective memory complaint, and these complaints, it is predicted, will lead to worse, more episodically based, beliefs about one’s memory. Expressed differently, it is predicted that persons with AMCI will have poorer subjective memory functioning, by diagnosis poorer memory performance, and a stronger congruence between their beliefs and performance than in unimpaired elders.

1b. If There is a Significant Relationship Between Memory Beliefs and Objective Measures of Memory, Does the Relationship Change Once Depressive Symptoms are Accounted For?

I hypothesize that some of the association between objective memory and subjective beliefs is in fact due to depression, and that the relationship will be attenuated—but not completely removed—by controlling for depression.

Aim 2. Determine Diagnostic Utility of Subjective Memory Questionnaires

I hypothesize that group status (whether they are assigned to the normal control or impaired group based on a consensus conference, to be explained below in the Methods) will be predicted by memory beliefs. Those cognitively impaired should have rated themselves as having memory difficulties, as some literature asserts that insight should not be impaired at this mild level of cognitive functioning (Freidenberg, Huber & Dreskin, 1990).
Aim 3. Investigate if Subjective Memory Complaints are Related to Informant Report of the Participant’s Memory Problems

I hypothesize that there will be a significant relationship between the participants’ and informants’ report of memory problems, however it will be of modest magnitude as Carr and colleagues (2000) reported that agreement between subject and informant report of memory complaint was 61.4% in normal controls, 77.3% in those with possible dementia (CDR = 0.5), and 74.7% in those with dementia.

Aim 4. Investigate if Informant Reports of Memory Problems are Predictive of Group Assignment

I hypothesize that informant report will predict group membership because informants should be aware of the frequency and extent of the participants’ memory lapses.
CHAPTER 4
METHODS

Participants

Sixty-six community-dwelling volunteers age 65 years and older participated in this study, with 49 subsequently classified as normal controls and 17 classified as having amnestic Mild Cognitive Impairment (AMCI). Details of the consensus procedure by which these groupings were achieved are provided below. Table 4-1 shows the demographic information for each group. There was no significant difference between the two groups on any demographic measure; however there was a near-significant difference in the sex distribution of the two groups ($p = 0.06$), with a higher proportion of males in the MCI group. Participants were recruited in multiple ways, including through several articles in a local senior newspaper, signs at local hospitals, and from the participant pools of other aging investigators at the University of Florida. The exclusion criteria for participation included (1) history of neurological disease (i.e., Parkinson’s disease, Alzheimer’s disease, or epilepsy), (2) history of drug or alcohol abuse, (3) history of psychiatric hospitalization, (4) current cancer treatment, or (5) stroke or heart attack within the last year. These criteria are common in neuropsychological studies of older adults in order to rule out potential non-MCI/ non-Alzheimer pathology causes of memory impairment.
Table 4-1. Mean (SD) or N (%) of demographic data of the two groups.

<table>
<thead>
<tr>
<th></th>
<th>Total Sample (N = 66)</th>
<th>Normal Controls (N = 49)</th>
<th>MCI (N = 17)</th>
<th>p- value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>74.89 (5.41)</td>
<td>74.59 (4.91)</td>
<td>75.76 (6.76)</td>
<td>0.44</td>
</tr>
<tr>
<td>Education</td>
<td>16.00 (2.64)</td>
<td>16.00 (2.61)</td>
<td>16.00 (2.78)</td>
<td>1.00</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td>0.06</td>
</tr>
<tr>
<td>Males</td>
<td>26 (39.40)</td>
<td>16 (32.70)</td>
<td>10 (58.80)</td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>40 (60.60)</td>
<td>33 (67.30)</td>
<td>7 (41.20)</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>White</td>
<td>63 (95.50)</td>
<td>47 (96.00)</td>
<td>17 (100.00)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>3 (4.50)</td>
<td>2 (4.00)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>MMSE</td>
<td>28.27 (1.50)</td>
<td>28.65 (1.25)</td>
<td>27.18 (1.67)</td>
<td>0.00</td>
</tr>
<tr>
<td>Subjective Health</td>
<td>1.83 (0.85)</td>
<td>1.78 (0.72)</td>
<td>2.00 (1.17)</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Participants for this study were recruited in the service of a larger study. Thus, while not related to the goals of the present investigation, all participants for this study were recruited to, and initially agreed to take part in, a 30-day program of in-home daily cognitive assessments; all data in this present study come from an initial screening neuropsychological assessment for this larger study. For the current study, data of all participants who completed the initial screening assessment were considered, regardless of whether the participants actually went on to the 30-day program. However, 17 individuals in this screening sample did not complete the subjective questionnaires or had extensive other missing data, and could therefore not be included in the analyses in this paper. Compared to those included in the sample, those excluded differed significantly on the Mini-Mental Status Exam (MMSE; Folstein, Folstein & McHugh, 1975; excluded participants had lower scores). However, there was no difference in age, education, or Clinical Dementia Rating Scale (CDR) score. Thus, the analyses in this paper are based
on a somewhat cognitively advantaged subset of the total sample. The study was approved by the Institutional Review Board of the University of Florida and informed consent was obtained prior to participation.

Measures

The main aim of this study was to examine the relationship between memory performance and memory beliefs in older adults; however, there was also an interest in collecting further information about the accuracy of participants’ memory beliefs by also collecting data from an informant (i.e., a concurrent “real world” observer of the participant) for each target participant. Thus, measures of both the participant and their personally identified informant were collected as described below.

Participant Measures

All participant measures are listed in Table 4-2. The full battery of measures employed for this study was chosen to assess both verbal and visual memory. Detailed assessment of memory was necessary in order to determine if participants’ met the impaired memory criteria for amnestic MCI (operationalized as at least 1.5 standard deviations below published normative means, adjusted for age and education; Petersen et al., 2001). The domains of attention, working memory, speed of processing, and language were also assessed in order to better characterize the possibility of dementia, which is determined by either: a) memory impairment and at least one other impaired domain, or b) two impaired domains other than memory.
Table 4-2. Measures administered to participants by domain assessed.

<table>
<thead>
<tr>
<th>Cognitive Domain</th>
<th>Measure</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjective Memory Beliefs</td>
<td>Memory Functioning Questionnaire (MFQ)</td>
<td>Gilewski, Zelinski &amp; Schaie, 1990</td>
</tr>
<tr>
<td></td>
<td>Metamemory in Adulthood Questionnaire (MIA)</td>
<td>Dixon, Hultsch &amp; Hertzog, 1988</td>
</tr>
<tr>
<td>Daily Functioning</td>
<td>Clinical Dementia Rating Scale (CDR)</td>
<td>Morris, 1993</td>
</tr>
<tr>
<td>Memory</td>
<td>Hopkins Verbal Learning Test (HVLT)</td>
<td>Brandt &amp; Benedict, 2001</td>
</tr>
<tr>
<td></td>
<td>Rivermead Behavioral Memory Test (RBMT)</td>
<td>Wilson, Cockburn &amp; Baddeley, 1985</td>
</tr>
<tr>
<td></td>
<td>Brief Visuospatial Memory Test (BVMT)</td>
<td>Benedict, 1997</td>
</tr>
<tr>
<td>Overall Cognitive Functioning</td>
<td>Mini-Mental Status Exam (MMSE)</td>
<td>Folstein, Folstein &amp; McHugh, 1975</td>
</tr>
<tr>
<td></td>
<td>Telephone Interview for Cognitive Status (TICS)</td>
<td>Brandt, Spencer &amp; Folstein, 1988</td>
</tr>
<tr>
<td>Pre-morbid Intelligence</td>
<td>North American Adult Reading Test (NAART)</td>
<td>Blair &amp; Spreen, 1989</td>
</tr>
<tr>
<td>Language</td>
<td>Boston Naming Test (BNT)</td>
<td>Kaplan, Goodglass &amp; Weintraub, 2001</td>
</tr>
<tr>
<td></td>
<td>Control Oral Word Association (COWA)</td>
<td>Benton &amp; Hamsher, 1989</td>
</tr>
<tr>
<td>Attention, Working Memory, Psychomotor Speed</td>
<td>Trail Making Test A and B (Trails A, Trails B)</td>
<td>Reitan, 1992</td>
</tr>
<tr>
<td>Everyday Problem Solving Ability</td>
<td>Everyday Problems Test (EPT)</td>
<td>Willis &amp; Marsiske, 1993</td>
</tr>
<tr>
<td>Mood</td>
<td>Geriatric Depression Scale (GDS), Center for Epidemiological Studies-Depression Scale (CES-D)</td>
<td>Yesavage &amp; Brink, 1983, Radloff, 1977</td>
</tr>
</tbody>
</table>

**Subjective memory belief measures**

**Memory Functioning Questionnaire (MFQ).** The first measure of subjective memory administered was the MFQ (Gilewski, Zelinski & Schaie, 1990). This scale was chosen in order to determine participants’ subjective beliefs about their memory as reported in a common standardized questionnaire. The measure has been shown to be
internally consistent (Cronbach’s alpha range 0.83-0.94 for each scale) and invariant with age and longitudinal analysis (Gilewski, Zelinski & Schaie, 1990). As described earlier, the MFQ contains 4 factor-derived scales: Frequency of Forgetting, Seriousness of Forgetting, Retrospective Functioning, and Mnemonics Usage.

**Metamemory in Adulthood Questionnaire (MIA).** The second questionnaire was the MIA (Dixon, Hultsch & Hertzog, 1988). The MIA was also chosen to also assess participants’ subjective beliefs about their memory. As noted earlier, the MIA contains 7 factor-derived scales: Strategy, Capacity, Change (stability), Anxiety, Task Knowledge, Achievement, and Locus of Control. This scale differs from the MFQ in the type of response required, contains a broader range of beliefs, and has been unexplored in older adults with MCI to our knowledge. This questionnaire has been shown to be internally consistent (Cronbach’s alpha range 0.71-0.93), valid with diverse samples and with other scales measuring the same concept (Dixon, Hultsch & Hertzog, 1988). The MFQ and MIA scales have correlated in previous study (see Hertzog, Hultsch & Dixon, 1989).

**Data reduction of subjective belief measures**

Exploratory factor analysis, followed up by a confirmatory factor analysis was conducted to reduce the number of subjective belief variables of interest, as there are 11 scales between the two measures. Table 4-3 shows the factor loadings for this analysis. The fit of the model is adequate: $\chi^2(41, N=66) = 85.97, p < 0.00 \ (GFI=0.83, NFI=0.75, CFI=0.85, RMR=0.12)$. A three-factor solution was the best fit, which was useful for reducing the complexity of the subjective memory dimensions.
We have labeled the first factor, “Perceived Capacity” to reflect individuals’ overall judgment of how well they are doing, how much their memory has changed, and how worried they are about their memory and forgetting. The second factor, “External strategy use,” reflects the frequency and extent to which individuals endorse using mnemonic strategies. The third, which we labeled “Internal Management and Motivation,” reflects scales measuring individuals’ achievement motivation, locus of control, and perceived knowledge about how to achieve a good memory. The analyses will use these composite factors for the subjective belief measures.

**Table 4-3. Factor loadings for the subjective memory questionnaire scales.**

<table>
<thead>
<tr>
<th></th>
<th>Perceived Capacity</th>
<th>External Strategy Use</th>
<th>Internal Management/Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability</td>
<td>0.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of Forgetting</td>
<td>0.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retrospective Functioning</td>
<td>0.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity</td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>-0.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seriousness of Forgetting</td>
<td>0.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategy Use</td>
<td></td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>Mnemonics</td>
<td></td>
<td>-0.93</td>
<td></td>
</tr>
<tr>
<td>Achievement</td>
<td></td>
<td></td>
<td>0.92</td>
</tr>
<tr>
<td>Locus of Control</td>
<td></td>
<td></td>
<td>0.49</td>
</tr>
<tr>
<td>Task Knowledge</td>
<td></td>
<td></td>
<td>0.27</td>
</tr>
</tbody>
</table>

**Daily functioning measure**

The Clinical Dementia Rating Scale (CDR; Morris, 1993) was used to measure the daily functioning of the participants. This scale is a semi-structured interview asked of an informant who knows the participant well. The participant was also asked in
interview format some of the same memory questions that the informant was asked. The participant also answers questions of orientation, judgment and is asked to solve certain problems. The CDR contains 6 scales (Memory, Orientation, Judgment/Problem Solving, Home/Hobbies, Community Affairs, and Personal Care), which are each rated by the interviewer on a scale from 0 (No Dementia) to 3 (Severe Dementia). An algorithm is then used to produce an overall score from 0 to 3. Inter-rater reliability of the CDR has been established with videotapes in previous studies elsewhere with Kappa=0.62 for the overall score, and Kappas ranging from 0.33 to 0.88 for the individual scales (Rockwood, Strang & MacKnight, 2000). Validation studies (e.g., Morris, McKeel, Fulling, Torack & Berg, 1988) determined that clinical research criteria of AD, including CDR score, was indicative of Alzheimer pathology at autopsy. While the whole interview was completed in this study, only the Total score was used in this analysis.

**Memory measures**

**Hopkins Verbal Learning Test (HVLT).** The HVLT (Brandt & Benedict, 2001) is a list-learning task containing semantically related items. A list of 12 nouns was read out loud to the participant three times and each time the participant was asked to recall all of the words they could remember. The participant was not cued that they were to remember the list, however after a 20-minute delay they were asked once more to recall all of the words from the list. Then recognition was examined by reading the participant 24 nouns, some of which were semantically related to the items originally presented, and they were to indicate if the word was on the list. The HVLT has established test-retest reliability ranging from 0.39 to 0.74 for each derived variable in a sample over 65 years old. The HVLT has 94% sensitivity and 100% specificity for distinguishing AD and normal elderly adults (Petersen et al., 2001). The scores used in
this analysis from the HVLT were: the Total score (the sum of correctly recalled words on Trial 1 through Trial 3), the Delayed recall score, and the Retention score [(Delay / Higher of trial 2 or 3) * 100].

**Rivermead Behavioral Memory Test (RBMT).** The third objective memory measure was the RBMT (Wilson, Cockburn & Baddeley, 1985). The RBMT is a story recall task in which a story of 21 propositions was read to the participant and then they were immediately asked to recall as much of the story as possible. Each proposition correctly recalled was scored one point. If partially correct, the score was one-half point. Inter-rater agreement of the scoring of the RBMT has been established elsewhere at 100% (Wilson, Cockburn & Baddeley, 1985). It has moderate correlations with other established tests of memory, including Warrington’s Recognition Memory Test, the Weschler Memory Scale, and the Rey Auditory Verbal Learning Test (Schmidt, 1996). The score used in the analysis was the total recall score.

**Brief Visuospatial Memory Test- Revised (BVMT-R).** The BVMT-R (Benedict, 1997) is a visual learning and recall task. The participant was shown a sheet with six figures on it three times for ten seconds each time. After each presentation, the participant was to draw what they could remember onto a sheet of paper. After the third trial, the participant was told to remember the figures. Delayed recall was then tested 25 minutes later. Recognition was tested by presenting 12 figures to the participant and they were asked whether each figure was on the original sheet. The score for the immediate and delay conditions were based on both accuracy of each drawing as well as placement on the page for a total of 12 points for each recall trial. Inter-rater reliability in scoring the BVMT-R was established elsewhere at 0.90 (Benedict, 1997). Indices of learning and
delayed recall are correlated with other tests of explicit memory including the HVLT.
The scores used in this analysis from the BVMT-R were: the Total score (the sum of
scores on Trial 1 through Trial 3), the Delayed recall score, and the Learning score (the
highest score of Trial 2 or 3 minus Trial 1).

**Overall cognitive functioning measures**

**Mini-Mental Status Exam (MMSE).** This test has been widely used as a
measure of overall cognitive functioning in older adults. The MMSE (Folstein, Folstein
& McHugh, 1975) is a 30-point test that examines orientation, language ability, memory,
and attention. The MMSE has high test-retest reliability of between 0.80 and 0.95 within
two months. It shows modest to high correlations with other brief screening instruments
like the Short Blessed Test (Katzman, Brown & Fuld, 1983) and the Mattis Dementia
Rating Scale (Mattis, 1988). The score used in the analysis was the total score (using
serial 7’s rather than the World backwards score).

**Telephone Interview for Cognitive Status (TICS).** This is a brief test of
cognitive functioning developed for situations where in-person screening is impractical or
inefficient. The TICS (Brandt, Spencer & Folstein, 1988) is similar to the MMSE, but has
a more comprehensive memory assessment, designed for identifying dementia. Research
has demonstrated that it is as reliable and valid as face-to-face administration. It has a
sensitivity of 94% and specificity of 100% for distinguishing normal controls and
demented individuals (Brandt, Spencer & Folstein, 1988). The score used in this analysis
was the total score.

**Pre-morbid intelligence measure**

**North American Adult Reading Test (NAART).** The NAART (Blair & Spreen,
1989) was developed to measure pre-morbid intelligence in adults suspected to have
compromised cognition. It consists of 61 irregular rare words that the participant pronounces. It has been found to correlate between 0.40 and 0.80 with other measures of intelligence. Test-retest reliability of the NAART has been established at 0.92 within one year. The score used in this analysis was the number of words correctly pronounced.

**Language measures**

**Boston Naming Test (BNT).** The BNT (Kaplan, Goodglass & Weintraub, 2001) is a confrontation-naming task that assesses the ability to generate the name of pictured objects. Administration began at item 30 with those beforehand considered correct unless the 8-item basal was not reached, at which time the participant was presented item 29 and worked backwards until the basal was reached. Axelrod and colleagues (Axelrod, Ricker & Cherry, 1994) have established concurrent validity of the BNT with the Visual Naming Test of the Multilingual Aphasia Examination. The score used in this analysis was the total number of words named without semantic cuing.

**Control Oral Word Association (COWA).** To assess the spontaneous production of words, the COWA (Benton & Hamsher, 1989) was administered. The participants are given a letter and are to generate words beginning with that letter within a limited time frame. Snow and colleagues (1988) report test retest reliability of 0.70 in older adults and inter-rater reliability near perfect. The score used in this analysis was the total number of words generated across the three letters (C, F, and L). Category fluency, or verbal association fluency, was measured using the category of Animals. The score used in this analysis was the total number of animals generated within the one-minute time limit.
Attention, working memory, and psychomotor speed measure

**Trail Making Test A and B ( Trails A, Trails B ).** This is a task requiring concentration, psychomotor speed, visual scanning and sequencing, and cognitive flexibility. In Trails (Reitan, 1992), the participants have to draw a line to connect the circles in the prescribed order. Snow and colleagues (1988) report test retest reliability of 0.64 for Trails A and 0.72 for Trails B in older adults. The scores used in this analysis were the time to complete Trails A and the time to complete Trails B (both in seconds).

**Everyday problem solving measure**

**Everyday Problems Test (EPT).** The EPT (Willis & Marsiske, 1993) is a 28-item task that asks questions about materials commonly seen in everyday life (e.g., medicine labels, recipes, and mail order forms) to assess problem solving ability with common stimuli. The EPT has a Cronbach alpha reliability coefficient of 0.89 (Willis & Marsiske, 1993) and test-retest reliability of 0.87 (Ball et al., 2002). The score used in this analysis was the total score.

**Data reduction of cognitive measures**

With 16 neuropsychological measures of interest, data reduction was again employed because of the large number of variables in a sample of this size. Exploratory and confirmatory factor analytic results (see Table 4-4) suggested the existence of five over-arching cognitive factors. The fit of the model was adequate: $\chi^2 (91, N=66) = 134.44$, $p < 0.01$ ($GFI=0.82$, $NFI=0.82$, $CFI=0.93$, $RMR=0.08$). Clearly, there were strong visual and verbal memory factors. Separate factors reflecting trails and language were also identified. A fifth factor, labeled here as “general cognition” included the Mini-Mental Status examination, as well as a measure of complex everyday problem solving. The analyses will use these composite factors for the neuropsychological measures.
Table 4-4. Factor loadings for neuropsychological measures.

<table>
<thead>
<tr>
<th></th>
<th>Visual Memory</th>
<th>Verbal Memory</th>
<th>Trails Time</th>
<th>Language</th>
<th>General Cognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>BVMT Total</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BVMT Delay</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BVMT Learning</td>
<td>0.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVLT Total</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVLT Delay</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVLT Retention</td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rivermead</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TICS</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trails A Time</td>
<td></td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trails B Time</td>
<td></td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAART</td>
<td></td>
<td>0.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BNT Total</td>
<td></td>
<td>0.56</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFL Total</td>
<td></td>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td></td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMSE</td>
<td></td>
<td></td>
<td>0.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPT Total</td>
<td></td>
<td></td>
<td>0.82</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: BVMT = Brief Visual Memory Test; HVLT = Hopkins Verbal Learning Test; TICS = Telephone Interview for Cognitive Status; NAART = North American Adult Reading Test; BNT = Boston Naming Test; MMSE = Mini-Mental Status Exam; EPT = Everyday Problems Test.

Mood measures

Geriatric Depression Scale (GDS). The GDS (Yesavage, 1983) was administered to the participant at the initial assessment because of the established relationship that subjective memory beliefs are associated with depressive symptoms (Kahn, Zarit, Hilbert & Niederehe, 1975; Blazer, Hays, Fillenbaum & Gold, 1997). The GDS was administered to rule out depressive symptoms as a mediator of any relationship between subjective beliefs and cognition. The GDS is a 30-item self-report scale of yes/no questions about symptoms of depression (e.g., Do you feel that your life is
empty?). This measure has been shown to be a reliable and valid measure of depressive mood in older adults. The score used in the analysis was the total number of symptoms endorsed.

**Center for Epidemiological Studies- Depression Scale (CES-D).** The CES-D (Radloff, 1977) is a 20-item instrument developed by NIMH to detect clinical depression in adults. It asks about how often you felt certain ways within the past week, rated on a four-point scale. It contains four factors: depressive affect, somatic symptoms, positive affect, and interpersonal relations. Again, this measure was administered to rule out any possibility that depressive symptoms were mediating the relationship between subjective beliefs and cognition. The score used in the analysis was the total score.

**Informant Measures**

Each participant had to identify someone that could answer questions about their daily functioning to serve as an informant, which was usually a spouse (78.3%) or a child (15%). This procedure was included to gather information about how participants function outside the standard setting of neuropsychological testing in their own environments. This procedure is common in assessing older adults for memory impairment, as those afflicted with impairments may be biased in answering such questions or have difficulty recalling or making judgments about their behavior. The informant of the participant answered questions of the CDR interview (described above).

Demographic information of the informant and information about the informant/participant relationship were collected (e.g., How long have you known him/her, how often do you currently see him/her, etc.). Eighty percent of the informants lived with the participant and 81.7% reported seeing the participant on a daily basis. The mean (SD) age of informants was 68.43 (14.24), with a range of 22-82 years old.
Informant-rated versions of the Metamemory in Adulthood and Memory

**Functioning Questionnaires.** The informants were also given two questionnaires to answer about the participant. The first, the MIA, was revised so that the informant was answering questions about how the participant feels about their memory (e.g., My partner thinks it is important to work at sustaining his/her memory ability.) and how often they use certain tools to aid their memory (e.g., Does your partner ask other people to remind him/her of something?). Two scales were dropped from this version (task and locus of control scales) due to the nature of the items. The second questionnaire was the MFQ, also to be answered by the informant about the problems that the participant has with their memory (e.g., How often do names present a problem for your partner?). The informant also completed scales of the instrumental activities of daily living of the participant, but that data is not included in this analysis.

**Procedures**

**Telephone Screening**

All participants completed a consent procedure and telephone screening that included questions that would exclude participants who did not meet the inclusion criteria (See Figure 4-1). This screening included the TICS to aid with the identification of individuals who were severely impaired. Participants who were eligible for the study and interested in participating were then scheduled for a screening visit.

![Figure 4-1. Participant procedures. (Data from Daily Protocol not presented herein.)](image)
Neuropsychological Screening

Participants were assessed in person by one of three graduate students in clinical psychology affiliated with the study. The participants were administered a two to three hour neuropsychological assessment, which included the measures described above. This visit was considered a screening visit for the larger daily in-home cognitive assessment program, as that protocol had stricter neuropsychological inclusion criteria. The questionnaire measures of subjective memory were administered to participants after the neuropsychological assessment, and were often sent home with the participant in order to decrease the likelihood of fatigue from testing. Prior research (Lane & Zelinski, 2003) indicated that MFQ scoring patterns did not differ when administered either prior to or after completing memory tasks. Because the MFQ and MIA have shown adequate correlations and are thought to measure the same construct (Hertzog, Hultsch & Dixon, 1989), it was believed that the MIA would also not differ as a function of when it was administered.

Informant Interview

The CDR interview with the informant was completed either at the time of the participant’s assessment, during a subsequent visit, or if necessary over the telephone. The questionnaires were administered to the informant at the same time as the CDR interview or mailed to the informant if the interview was conducted over the telephone. The informants were not told about the participants’ performance on the objective measures.

Group Membership

Participants were classified as unimpaired normal controls or probable amnestic Mild Cognitive Impairment (MCI) by a consensus conference. Each case was presented
to the consensus members (which consisted of one Ph.D., one post-doctoral fellow, one pre-doctoral clinical psychology student, and two pre-masters clinical psychology students) with identity masked and with information about demographics and neuropsychological assessment data. The neuropsychological data examined by the consensus members included, but was not limited to, memory since a goal was to exclude persons with dementia. In addition, the Clinical Dementia Rating Scale (CDR) and a composite representing subjective complaints from the MFQ were also considered. These variables were chosen in conjunction with the Petersen criteria for MCI (Petersen et al., 2001). If all members of the consensus panel agreed on group placement, that placement prevailed. If at least one member disagreed, a discussion would take place about how the participant fit the criteria, and then a revote took place. At this point, the majority vote stood.
CHAPTER 5
RESULTS

The results are presented in four sections to reflect each question posed in this study.

Aim 1

To answer the first proposed research question, a correlation matrix was obtained (see Table 5-1). For the relationship between the subjective memory factors and the objective cognitive factors, the Perceived Capacity factor was the only subjective memory factor related to the objective cognitive factors; it was significantly related ($p < 0.05$) to all of the cognitive factors (with magnitudes between 0.34 and 0.50) except the Trailmaking factor ($r = -0.22$). The other two subjective memory factors showed no relationship with objective cognition. It is important to note that while the highest relationship with the Capacity self-rating was with Verbal Memory (0.50), the general nature of the correlations with Capacity suggest that it may not be a very specific indicator of memory functioning, but may capture more general cognitive status.

Table 5-1. Correlations between subjective memory beliefs and objective performance measures.

<table>
<thead>
<tr>
<th></th>
<th>Visual Memory</th>
<th>Verbal Memory</th>
<th>Trails</th>
<th>Language</th>
<th>General Cognition</th>
<th>Depression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity Factor</td>
<td>0.39*</td>
<td>0.50*</td>
<td>-0.22</td>
<td>0.38*</td>
<td>0.34*</td>
<td>-0.40</td>
</tr>
<tr>
<td>External Factor</td>
<td>-0.12</td>
<td>-0.21</td>
<td>-0.08</td>
<td>0.01</td>
<td>-0.17</td>
<td>0.10</td>
</tr>
<tr>
<td>Internal Factor</td>
<td>-0.03</td>
<td>-0.02</td>
<td>-0.10</td>
<td>-0.11</td>
<td>-0.04</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Note: *p- value < 0.05.
On inspection, there is some indication (in terms of absolute magnitude) that subjective Capacity beliefs may be particularly related to Verbal Memory. We examined this question post hoc, by testing whether the relationship of Capacity to Verbal Memory was significantly different from its correlation with Visual Memory (the next highest cognitive correlate). When the difference between correlations were compared, it was found to be non-significant ($t = -1.30, p = 0.10$). (We note that, had we used a one-sided test, this difference would have reached significance). While the correlations were not significantly different from one another, the results are certainly supportive of a trend toward a disproportionately higher Capacity-Verbal Memory correlation.

As noted earlier, some investigators have dismissed the subjective-objective relationship in memory as “nothing more than” depression. Table 5-1 above shows the bivariate relationship between a unit-weighted composite of the GDS and CES-D and our subjective factors. In this study, there is clearly a relationship between depression and subjective Capacity beliefs. Not reported in the table above was the relationship between the depression composite and the cognitive factors. The depression composite was significantly related ($p < 0.05$) to visual memory ($r = -0.25$), verbal memory ($r = -0.30$), and speed ($r = 0.37$).

Because of these obtained depression/subjective memory relationships, and because of the known relationship between depression and subjective memory beliefs, the same correlations were obtained controlling for our GDS/CES-D composite. The correlations generally held, as shown in Table 5-2 below, with all of the significant subjective memory and objective performance correlations remaining. Thus, in this sample,
depressive symptoms were not “driving” the relationship between subjective beliefs and objective cognitive performance, and do not substantially alter it.

Table 5-2. Correlations between subjective memory beliefs and objective performance measures controlling for depressive symptoms.

<table>
<thead>
<tr>
<th></th>
<th>Visual Memory</th>
<th>Verbal Memory</th>
<th>Trails</th>
<th>Language</th>
<th>General Cognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity Factor</td>
<td>0.32*</td>
<td>0.42*</td>
<td>-0.05</td>
<td>0.33*</td>
<td>0.31*</td>
</tr>
<tr>
<td>External Factor</td>
<td>-0.13</td>
<td>-0.23</td>
<td>-0.07</td>
<td>0.01</td>
<td>-0.18</td>
</tr>
<tr>
<td>Internal Factor</td>
<td>-0.01</td>
<td>-0.01</td>
<td>-0.14</td>
<td>-0.09</td>
<td>-0.06</td>
</tr>
</tbody>
</table>

Note: *p*-value < 0.05.

One of the major questions of this study, based on previous research, was whether the relationship between objective cognitive performance and subjective memory beliefs might vary by impairment status (see Tables 5-3 and 5-4). As we argued above, it was predicted that persons with AMCI would have poorer subjective memory functioning, by diagnosis poorer memory performance, and a stronger congruence between their beliefs and performance than the unimpaired elders. The results in this study supported this prediction as the normal controls revealed a significant relationship ($p < 0.05$) between the Capacity factor and the memory factors (0.35 and 0.32) as well as language (0.39), and the results for the MCI group revealed a significant relationship between the Capacity factor and the Verbal Memory, however very strongly (0.61).

Inspection of correlation tables 5-3 and 5-4 revealed one important finding. The correlation of the Capacity factor with Verbal Memory is greater in the impaired group than in the unimpaired group (where it was already the strongest correlate). This could be taken as tentative support for the idea that those having memory difficulties have greater **insight** into their functioning than the unimpaired group. To test this further, the
correlations of Verbal Memory with Capacity were compared between groups ($t = -1.23$, $p = 0.11$). Although the correlation in the unimpaired group did not differ significantly from the correlation in the impaired group, there appears to be a trend in that direction; again, had this been a one-tailed test, $p$ would have equaled 0.055.

Table 5-3. Relationship between subjective memory beliefs and objective performance measures in the unimpaired group (N= 49).

<table>
<thead>
<tr>
<th></th>
<th>Visual Memory</th>
<th>Verbal Memory</th>
<th>Trails</th>
<th>Language</th>
<th>General Cognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity Factor</td>
<td>0.35*</td>
<td>0.32*</td>
<td>-0.18</td>
<td>0.39*</td>
<td>0.19</td>
</tr>
<tr>
<td>External Factor</td>
<td>0.18</td>
<td>0.06</td>
<td>-0.07</td>
<td>0.17</td>
<td>-0.06</td>
</tr>
<tr>
<td>Internal Factor</td>
<td>-0.20</td>
<td>-0.02</td>
<td>-0.05</td>
<td>-0.23</td>
<td>-0.05</td>
</tr>
</tbody>
</table>

Note: *$p$- value < 0.05.

Table 5-4. Relationship between subjective memory beliefs and objective performance measures in the impaired group (N= 17).

<table>
<thead>
<tr>
<th></th>
<th>Visual Memory</th>
<th>Verbal Memory</th>
<th>Trails</th>
<th>Language</th>
<th>General Cognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity Factor</td>
<td>0.13</td>
<td>0.61*</td>
<td>-0.36</td>
<td>0.10</td>
<td>0.34</td>
</tr>
<tr>
<td>External Factor</td>
<td>-0.14</td>
<td>-0.17</td>
<td>-0.13</td>
<td>-0.23</td>
<td>-0.01</td>
</tr>
<tr>
<td>Internal Factor</td>
<td>0.04</td>
<td>-0.36</td>
<td>-0.24</td>
<td>0.21</td>
<td>-0.16</td>
</tr>
</tbody>
</table>

Note: *$p$- value < 0.05.

We note that the sample size for this study was relatively small, and we wondered whether low power might have harmed our ability to detect significant correlation magnitude differences between groups. In investigating power, we noted that power calculations for the difference of a correlation in two independent samples have only been well developed for the "equal N" case, which was not our situation. Instead, the exact power was calculated for the obtained correlation difference under two scenarios:
N=17 (lower bound estimate, based on number of MCI cases) and N=33 (average sample size in the MCI and non-MCI groups). Statistical power in the first case was estimated at 0.17, and in the second case, it was estimated at 0.32. Thus, the current study design likely had insufficient power (conventionally, powers of 0.80 and higher are considered optimal) to detect the correlation difference between the groups. Nonetheless, there is at least a tentative suggestion, which must be replicated in a larger sample, that the correlation between verbal ability and Capacity is stronger in persons with MCI.

Aim 2

Discriminant function analysis was used to determine if subjective beliefs alone explain our group assignment decisions. Table 5-5 shows the models used in the analysis and the canonical loadings and classification rates for each of the models. The first analysis was done using only the 3 subjective factors (Capacity, External Strategies, and Internal Management/ Motivation) to predict group assignment (Model 1). About two-thirds of the participants were classified correctly. The loadings showed, not surprising from the earlier correlational data, that the Capacity factor seemed to be the most important factor (loading = 0.76) in making assignments, although there was a fairly strong and independent contribution from the external mnemonic factor (loading = -0.53).

Since clinicians would never use subjective memory data alone in making judgments about whether or not a patient had a memory impairment, the next analysis examined the systematicity of our decision making process by using all the measures from the consensus conference in a discriminant function analysis. The results (Table 5-5, Model 2) showed that this model correctly classified all but three of the participants, or 95%, suggesting strong systematicity in our decision-making. Upon inspection of what factors were most important in making these correct group assignments, only three
factors had canonical loadings above 0.4: Verbal Memory, CDR rating, and Visual Memory. Subjective memory had near-zero loadings. Thus, we had to consider the question of whether or not there would be any cost to dropping the subjective factors from our group assignment algorithm, since they did not appear to be contributing anything substantial to the classification. In the next step of the analysis, when the subjective factors were dropped, the results (Table 5-5, Model 3) showed that the classification statistics did not change at all, suggesting that after accounting for cognition and the CDR, subjective memory ratings really do not add anything unique.

Table 5-5. Canonical loadings and classification statistics for discriminant function models.

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive 1 (Visual)</td>
<td>0.49</td>
<td>0.51</td>
<td></td>
</tr>
<tr>
<td>Cognitive 2 (Verbal)</td>
<td>0.75</td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td>Cognitive 3 (Speed)</td>
<td>0.39</td>
<td>0.34</td>
<td></td>
</tr>
<tr>
<td>Cognitive 4 (Language)</td>
<td>-0.09</td>
<td>-0.11</td>
<td></td>
</tr>
<tr>
<td>Cognitive 5 (Gen Cog)</td>
<td>0.03</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>Subjective 1 (Capacity)</td>
<td>0.76</td>
<td>-0.09</td>
<td></td>
</tr>
<tr>
<td>Subjective 2 (External)</td>
<td>-0.53</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>Subjective 3 (Internal)</td>
<td>0.27</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>CDR</td>
<td>-0.57</td>
<td>-0.52</td>
<td></td>
</tr>
<tr>
<td>% Correctly Classified</td>
<td>63.6</td>
<td>95.2</td>
<td>95.2</td>
</tr>
<tr>
<td>% Sensitivity</td>
<td>52.9</td>
<td>87.5</td>
<td>87.5</td>
</tr>
<tr>
<td>% Specificity</td>
<td>67.3</td>
<td>97.8</td>
<td>97.8</td>
</tr>
</tbody>
</table>
Aim 3

The correlation between each subjective memory factor and each corresponding informant factor was examined to determine if informant ratings were related to the participants’ cognitive performance (see Table 5-6). (The sample size for this and the remaining analyses is reduced from 66 to 52 due to missing informant data.) Only the informant-rated Capacity factor was significantly related to participants’ self-reports. Across all factors, though, there was generally a small positive (i.e., congruent) correlation between self- and informant-ratings, although this reached significance only for Capacity. Thus, informants produced ratings that were relatively independent of participants themselves, although they were generally in the same direction as self-ratings.

Table 5-6. Relationship between informant report and subjective memory beliefs (N=52).

<table>
<thead>
<tr>
<th></th>
<th>Informant Capacity Factor</th>
<th>Informant External Factor</th>
<th>Informant Internal Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjective Capacity Factor</td>
<td>0.53*</td>
<td>-0.16</td>
<td>-0.26</td>
</tr>
<tr>
<td>Subjective External Factor</td>
<td>-0.28*</td>
<td>0.25</td>
<td>-0.03</td>
</tr>
<tr>
<td>Subjective Internal Factor</td>
<td>0.02</td>
<td>-0.11</td>
<td>0.26</td>
</tr>
</tbody>
</table>

Note: *p*- value < 0.05.

Next, to determine whether informant report better reflects “truth” than self-report (i.e., whether informant report is less susceptible to self-enhancing biases, and therefore is more correlated with objective function), we examined whether the informant factors were related to the participants’ objective cognitive performance (see Table 5-7). The Capacity factor was significantly related (p < 0.05) to most of the cognitive factors (with
magnitudes between 0.29 and 0.42), just as when looking at the participants’ memory beliefs. Indeed, the same superiority of correlation with Verbal Memory was again observed.

Table 5-7. Relationship between informant report and objective performance measures.

<table>
<thead>
<tr>
<th></th>
<th>Visual Memory</th>
<th>Verbal Memory</th>
<th>Trails Language</th>
<th>General Cognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity Factor</td>
<td>0.29*</td>
<td>0.42*</td>
<td>-0.26</td>
<td>0.37*</td>
</tr>
<tr>
<td>External Factor</td>
<td>0.19</td>
<td>-0.14</td>
<td>-0.17</td>
<td>-0.22</td>
</tr>
<tr>
<td>Internal Factor</td>
<td>0.16</td>
<td>0.12</td>
<td>0.01</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.29</td>
</tr>
</tbody>
</table>

*Note: *p*-value < 0.05.

**Aim 4**

To determine whether informant data helps to better classify participants into impairment groups, discriminant function analysis was again employed. In this case, the informant data was a truly independent predictor of group assignment, as the informant ratings were not used in the consensus conference. Relative to self-report, the informants classified better by a small margin (Table 5-8, Model 4); they correctly classified about 67%, whereas self-report alone correctly classified about 63%. The Capacity rating by the informants was again the most important factor (loading = 0.71) for achieving correct classification.

Following the same logic as the earlier analyses using self-rated subjective memory, to determine if the informant report added anything unique to neuropsychological data and the CDR when classifying individuals, a combined equation with informant report of memory problems, the objective cognitive factors, and the CDR score was used to predict group assignment (Table 5-8, Model 5). About 90% of the
sample was correctly classified, suggesting that the participants’ memory ratings were better to use when using all of the consensus conference variables.

Table 5-8. Canonical loadings and classification statistics for discriminant function models.

<table>
<thead>
<tr>
<th></th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
<th>Model 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive 1 (Visual)</td>
<td>0.63</td>
<td>0.65</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>Cognitive 2 (Verbal)</td>
<td>0.75</td>
<td>0.64</td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td>Cognitive 3 (Speed)</td>
<td>0.25</td>
<td>0.28</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>Cognitive 4 (Language)</td>
<td>-0.05</td>
<td>-0.08</td>
<td>-0.09</td>
<td></td>
</tr>
<tr>
<td>Cognitive 5 (Gen Cog)</td>
<td>-0.24</td>
<td>-0.16</td>
<td>-0.09</td>
<td></td>
</tr>
<tr>
<td>CDR</td>
<td>-0.44</td>
<td>-0.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Informant Subjective 1  (Capacity)</td>
<td>0.71</td>
<td>-0.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Informant Subjective 2  (External)</td>
<td>-0.32</td>
<td>-0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Informant Subjective 3  (Internal)</td>
<td>0.50</td>
<td>0.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Correctly Classified</td>
<td>67.3</td>
<td>90.4</td>
<td>94.2</td>
<td>94.2</td>
</tr>
<tr>
<td>% Sensitivity</td>
<td>66.7</td>
<td>91.7</td>
<td>91.7</td>
<td>83.3</td>
</tr>
<tr>
<td>% Specificity</td>
<td>67.5</td>
<td>90.0</td>
<td>95.0</td>
<td>97.5</td>
</tr>
</tbody>
</table>

Next, we wanted to determine if the informant report was useful at all in classifying participants, so we dropped the informant rating from the discriminant function, using only the objective factors and CDR to predict group assignment (Table 5-8, Model 6). The classification improved somewhat, so that over 94% were classified correctly. We then conducted the analysis to see if informant data was independently useful in classifying individuals by attempting to replicate our classification solely on the basis of neuropsychological data (Table 5-8, Model 7). The percentage correctly classified was exactly the same (94%) as when the CDR was included, however the sensitivity was reduced (from 92% to 83%) while the specificity increased (from 95% to 98%).
CHAPTER 6
DISCUSSION

The main focus of the study was to examine the relationship between subjective memory beliefs, as measured by questionnaires, and objective cognitive performance. We chose to use psychometric measures of subjective belief, rather than the kind of "spontaneous complaint" used in much clinical research, with the goal of investigating whether a more standardized "screening tool" might be more reliable and valid indicators of objective memory functioning, particularly in those with incipient cognitive impairment. Past research in this area has been equivocal with regard to the accuracy of subjective memory judgments; however a focus on subjective memory and its relationship to objective performance remains important, since a consistent finding in both the normal aging and clinical literatures is that older adults have growing levels of negative memory self-evaluations, and increasing amounts of subjective complaint, with advancing age and impairment. Also of interest was the determination of the diagnostic utility of the subjective memory belief questionnaires, which was examined by discriminant function analyses of our consensus conference group assignment decisions.

If subjective memory beliefs alone could efficiently reproduce, with a high degree of sensitivity and specificity, cognitive impairment group assignments that typically require more complex and labor-intensive multidimensional consensus conference decisions, this would suggest that subjective memory tools might be useful as screening tools for the identification of memory disorders in later life. Lastly, the relationship between informant report of participants’ memory problems and objective cognitive
performance was examined, to ascertain the value of informant information in the
diagnosis of memory disorders. This is important, because some diagnostic systems for
the identification of Mild Cognitive Impairment put strong weight on the necessity of
informant reports of cognitive loss in the identification of the syndrome (Petersen et al.,
2001). Informant ratings are thought to be important in the diagnosis of memory
disorders as it is documented that persons with moderate to severe memory problems
may be unaware of their memory deficits and underreport their symptoms.

This chapter will briefly review the findings of these research questions and discuss
how the findings relate to other studies. Following the review of findings will be a
discussion of how our findings relate to the theoretical ideas guiding this line of research.
Third, study limitations will be discussed, with possible future solutions offered. Finally,
future research stemming from the findings of this study will be proposed.

Review of Study Findings

Due to the number of variables of interest, separate factor analyses were conducted
to reduce the number of subjective memory variables and the number of objective
performance variables. For the subjective memory belief measures, a three-factor
solution was the best fit. The first factor was labeled, “Perceived Capacity” which
reflects individuals’ overall judgment of how well they are doing, how much their
memory has changed, and how worried they are about their memory and forgetting. The
second factor was labeled, “External strategy use,” and reflects the frequency and extent
to which individuals endorse using mnemonic strategies. The third, which we labeled
“Internal Management and Motivation,” reflects scales measuring individuals’
achievement motivation, locus of control, and perceived knowledge about how to achieve
a good memory. The analyses conducted used these composite factors for the subjective belief measures.

For the objective cognitive measures, a second factor analysis suggested the existence of five over-arching cognitive factors, consistent with previous psychometric research in this area. There were strong "Visual Memory" and "Verbal Memory" factors. Separate factors reflecting "Trails A and B" performance and "Language" (i.e., verbal fluency, NAART performance, BNT performance) were also identified. A fifth factor, labeled here as “General Cognition” included the Mini-Mental Status examination, as well as a measure of complex everyday problem solving. The analyses conducted used these composite factors for the neuropsychological measures.

Aim 1

Correlation analysis was conducted to investigate if subjective memory complaints were related to objective measures of memory. The results revealed that only one subjective memory factor, the Capacity factor (which included scales such as the frequency of forgetting certain things, thoughts about how one is currently functioning compared to retrospective functioning, one’s memory Capacity beliefs, and beliefs about memory stability over time), was significantly related to all of the objective performance factors (Verbal Memory, Visual Memory, Language, Speed, and General Cognition), except the Trails factor. The other subjective memory factors (External Strategy Use and Internal Management/ Motivation) were not significantly related to any of the objective factors. As noted earlier, these factors included scales such as strategy use (e.g., When you try to remember something, do you try to remember something similar in order to help you remember? or Do you try to relate something you want to remember to something else hoping that this will increase the likelihood of your remembering later?)
and knowledge about how to do certain things (e.g., It is easier to remember information you need to use immediately than information you will not use for a long time. or Familiar things are easier to remember than unfamiliar things.). With this division, it is somewhat surprising that the Capacity factor had stronger relationships with objective performance than the External and Internal factors, since the latter two dimensions are focused on actual memory strategy use, motivation to remember, and locus of control, which should have been important in completing the objective cognitive tasks. There are two likely explanations for this. First, this pattern of findings is somewhat consistent with a much larger body of social cognitive research in aging that suggests that elders hold more general and schematized self-views, and that their subjective evaluations are typically not episodically based on their specific performances in daily contexts (Blair & Burton, 1987). Second, from a psychometric perspective, the Capacity factor had many more scales; therefore, in comparison to the other subjective belief factors, Capacity may have had greater reliability and more total variability, thereby being more sensitive to individual differences.

The hypothesis for Aim One was that there would be a significant relationship between subjective memory beliefs and objective memory performance such that more negative subjective beliefs would mean poorer performance. This hypothesis was partially supported, since the Capacity factor was related to four out of five objective performance variables. This finding however, suggests a more domain-general relationship between Capacity beliefs and cognition. It does not support the contention (suggested by the developers of the two scales used, MIA and MFQ) that the beliefs assessed are more specifically about memory. Jonker and colleagues (1996) found a
similar pattern to the one shown in this study. As noted earlier, they found that individuals who complained of memory problems and had objective memory problems had an increased risk of performing poorly on tasks of delay recall, factual memory, orientation, and attention, compared to those without complaints of memory problems or without objective memory performance problems. In contrast to the findings of that study however, there are multiple findings that have not found such a relationship between memory beliefs and memory performance (West, Boatwright & Schleser, 1984; Schmidt, Berg & Deelman, 2001).

Also of interest was whether the relationship between subjective memory beliefs and objective memory performance varied by cognitive status. Our motivating question was whether many patients with memory problems are unaware of their deficits (Freidenberg, Huber & Dreskin, 1990). It was important to determine if the relationship found between subjective memory beliefs and objective performance held true for both the normal control and MCI groups. Additional correlation analyses were conducted separately for normal control participants and those with MCI. Overall, the correlational pattern was broader in the normal control group, in that verbal memory, visual memory, language, and general cognition were all significantly correlated with Capacity beliefs in the unimpaired sample. In contrast, only one variable, the verbal memory factor, was significantly related to subjective beliefs (again, the Capacity factor) for the MCI group. In the MCI group, the correlation between Capacity beliefs and Verbal Memory was the singularly highest magnitude ($r = 0.61$) in this study. Intuitively, this seems to support a view that persons with MCI may have had the keenest self-insight into their area of deficit (which, in the consensus conference, was in fact primarily Verbal Memory), a
contention that has been made elsewhere in the literature (Freidenberg, Huber & Dreskin, 1990).

Drawing on these previous studies, our hypothesis had been that correlations would be stronger for those in the Mild Cognitive Impairment group, since it is predicted that they would have more recent, episodically-based memory complaints (and these, in turn, would be negative self-evaluations on our subjective belief measures). Since the assumed more negative self-evaluations of persons with MCI, by this line of thinking, would also have greater accuracy—because they were based on a recent history of real functional memory failures in the everyday world, and since (by diagnosis), persons with amnestic MCI would be expected to perform more poorly on our memory measures, the expected finding was a higher correlation between objective and subjective memory in the cognitively impaired. This hypothesis was somewhat supported, as the impaired group had the strongest relationship between the Capacity self-rating factor and the Verbal Memory factor. Given our low statistical power (due to sample size) this heightened relationship between objective and subjective memory in the cognitively impaired was not significantly higher (although it would have been with just one or two more participants, or had we tested with a one-tailed test). It is important to note that, while only suggestive, we believe this finding represents the first in the recent literature that explicitly examines correlational differences between objective and subjective memory between normal and mildly impaired elders.

Recapitulating, the emerging story seems to be that in those without cognitive impairment, subjective memory beliefs appear to reflect more general and schematized beliefs about cognitive functioning in general. Although there is some evidence that
Verbal Memory is more related to subjective memory beliefs than other kinds of cognition, the evidence is only suggestive in the current sample. In contrast, for persons with MCI, the pattern is much more differentiated. In our MCI subgroup, the specific relationship between verbal memory and subjective belief was much stronger, and was the sole relationship to reach significance. Taken together, while not conclusive, we now infer that—with increasing memory difficulty—older participants may become increasingly accurate in their specific memory self-judgments. This is preliminarily supportive of the use of subjective memory questionnaires as screening tools for cognitive impairment.

A concern, of course, is that depression is known both to decrease memory performance and subjective self-evaluations (Verhaeghen, Geraerts & Marcoen, 2000). To explore the role that depressive symptoms may have played in the relationship between subjective memory beliefs and cognitive performance, partial correlation analyses were conducted to control for depressive symptomatology. Indeed, correlation analysis revealed that the depression composite was significantly related to the visual memory, verbal memory, and speed factors. In addition, consistent with prior research, a depression composite of CES-D and GDS was also significantly related to one of the subjective memory dimensions, Capacity. Interestingly, despite these significant bivariate relations between depression and objective and subjective memory, a reanalysis of the correlation between objective and subjective memory when depression was statistically controlled (i.e., partial correlation analysis) revealed that there was little contribution of depressive symptoms to the relationship between the Capacity factor and objective
cognitive performance; the pattern of correlations obtained when depression was not controlled remained relatively unchanged after the inclusion of the depression covariate. The hypothesis was that some of the association between objective memory and subjective beliefs would in fact be due to depression, and that the relationship would be attenuated—but not completely removed—when controlling for depression. This hypothesis was not supported despite much literature to suggest that the relationship between memory complaints and memory performance is solely related to mood (Jonker, Geerlings & Schmand, 2000; Lockwood, Alexopoulos & van Gorp, 2002). One wonders if depression would have been a stronger contributor to the objective-subjective relationship if our sample had included a wider range of variation in depression. As might be expected from a community-based recruitment of principally healthy elders, very few participants met screening criteria suggestive of even mild suprathreshold levels of depression.

Aim 2

The guiding question of this study was whether subjective memory measures might serve as a useful screening tool for the early identification of real memory problems. Since we had used a traditional consensus conference approach to identify levels of cognitive impairment, we then conducted discriminant function analyses to examine whether subjective memory beliefs might be useful in accurately classifying participants into our MCI or normal control groups. If subjective memory beliefs could explain, with a high degree of sensitivity and specificity, our group assignment decisions, then this would support the notion that subjective memory questionnaires could serve as useful early screeners in the identification of incipient memory disorders. In the course
of conducting our discriminant functions, sensitivity, specificity, and overall correct classification into the group assignments were ascertained.

The results revealed that subjective memory beliefs alone correctly classified about two-thirds of the participants correctly. Not surprisingly, of course, when the other consensus conference variables were entered into the model (objective cognitive performance factors and CDR score), the classification improved and was near perfect (95.2%). Follow-up analyses revealed that when the subjective memory factors were subsequently dropped from the discriminant function analysis, the percent correctly classified remained the same. Thus, the findings suggest a kind of "two-faced" utility for the subjective memory belief scales. On the one hand, they are reasonably efficient in grossly identifying cognitive impairment, yielding a better-than-chance classification of participants into cognitive impairment groups. On the other hand, they misclassify about one-third of participants. In addition, when more "objective" measures are available (i.e., objective memory performance and informant ratings), the subjective memory belief scales contribute nothing unique to the classification of participants.

We interpret these findings as suggesting that the subjective memory belief questionnaires may be useful in screening for memory difficulty; however, a full clinical evaluation of MCI likely does not particularly benefit from these subjective memory ratings. Based on these findings, one wonders if the requirement that elders report subjective complaint of memory problems in the diagnosis of MCI (Petersen et al., 2001) may not be necessary if neuropsychological tests are administered. Of course, the unresolved question is whether spontaneous memory complaint (because it is episodically based on recent real memory failures) would be a more useful contributor to this decision
than our more general and schematized subjective belief measures. Clearly, contrasting
the screening and classification utility of more conventional subjective complaint items
with these more psychometrically refined subjective belief measures is an important next
research step.

These assertions must be made carefully. As discussed in the limitations below
however, a concern is that there was non-independence between the variables used in the
discriminant function and those used in the consensus conference. In other words, our
consensus conference members had subjective memory data available when making
judgments. Thus, the apparent screening utility of the subjective memory beliefs could
be an artifact of the fact that clinicians had this information available when making their
assignments. If subjective memory data had not been available, would it still have been
useful in making assignments? That is an important question, and one that we may be
able to address in future research with this sample. We could conduct a new, "blind"
consensus conference with new raters who do not have subjective memory data available,
and then we can evaluate whether subjective beliefs still are useful even as initial
screening/identification tools. While there are no known studies looking at the
contribution of certain variables to the diagnosis of MCI, these findings are somewhat
related to longitudinal studies looking at risk for developing dementia. Two studies
(Carr, Gray, Baty & Morris, 2000; Schmand, Jonker, Hooijer & Lindeboom, 1996) have
found an increased risk of dementia in those who had memory complaints at baseline.

**Aim 3**

Correlation analyses were conducted to determine if informant report of memory
problems was related to participant report of memory problems. Because a large social
cognitive literature suggests that self-report is often self-enhancing and biased—
particularly in later life—it was important to determine if informants are more veridical in reporting memory problems than the participants. The assumption that informants will be more accurate in rating participants is strongly held, and is used as the justification for the fact that informant reports are typically utilized in the diagnosis of memory disorders. (We note, of course, that because of personal relationships between informants and participants, one should probably not ignore the fact that informants, too, may have biases that distort the accuracy of their judgments, although this is not a central issue in the current work.) The informants rated the participants on modified versions of the same subjective memory questionnaires that the participants had themselves completed (i.e., MIA and MFQ).

The results were remarkably consistent with what had been seen in the self-report data. Only informants' Capacity ratings and the participants’ subjective Capacity ratings were significantly correlated ($p < 0.05$). Informant and participant ratings of Internal and External dimensions were positively related, but of low magnitude ($r < .30$). Our hypothesis had been that there would be a modest relationship between the participants’ and informants’ report of memory problems. This hypothesis was only partially supported, in that only one out of three of the relationships was significant.

Next, correlation analyses were conducted to determine if informant report of memory problems was related to actual participant memory performance. Of course, the relative independence of self- and proxy ratings of memory is not, in and of itself, a concern. Indeed, if one assumes that informants might be more accurate, whereas self-ratings might be more self-enhancing, one could reasonably expect relative independence of self- and proxy ratings. More generally, however, if self or informant ratings are
assumed to be somewhat accurate reflections of the true, objective state of affairs, one would expect some correlation between the two sets of ratings. The evidence in this study is equivocal.

With regard to the relationship between objective and subjectively rated memory (in this case, ratings done by the informants), the correlational findings were similar to that when participants' own self-ratings were used, with the same 4 cognitive factors (Verbal Memory, Visual Memory, Speed, and General Cognition) being significantly related to informant Capacity ratings. Thus, as with participants themselves, it seems that the Capacity dimension of memory self-evaluation is most closely related to actual performance, and that (as with our total sample), there is a relative generality of these ratings. That is, informant ratings of participants' memory do not seem to specifically reflect memory, but more domain-general cognitive functioning.

**Aim 4**

As with the self-rated memory, discriminant function analyses were again used to determine if informant report of memory problems, as assessed by the subjective memory belief questionnaires, yielded higher sensitivity, specificity, and overall classification in the group assignment of participants. The results indicated that the classification based on the informants is rather similar to that seen with the subjective ratings, which is somewhat surprising given the independence of the correlations between the informant and participant subjective ratings.

In order to further test the unique contribution of informant ratings to group classifications, we examined the predictive ability of informant ratings while also controlling for several variables actually used in the consensus conference (i.e., neuropsychological functioning, CDR scores). Not surprisingly, the addition of cognitive
and CDR data again yielded near perfect classification of participants into MCI and unimpaired groups. To determine if the informant ratings contributed any unique variance to the consensus variables, the informant ratings were then dropped from the model, and only neuropsychological and CDR variables retained. Again, there was no loss in the accuracy of participant classification when informant ratings were dropped, suggesting that informant ratings added nothing unique to the classification of participants. Thus, the same pattern seen in the subjective ratings were seen when using the informant ratings. These findings are so similar in the subjective ratings that the interpretation is also similar. Using informant data may be useful in screening for memory problems, but there is little diagnostic usefulness beyond as a screening approach.

The original guiding hypothesis was that informant report would predict group membership because informants should be aware of the frequency and extent of the participants’ memory lapses. This hypothesis was supported in that the informant ratings of memory problems alone correctly classified the majority of the participants, however the pattern is similar to that of the participants’ ratings. Once the other consensus conference variables were included in the model, there was a relatively small contribution of the subjective ratings to the classification of participants.

**Theoretical Implications of Study**

Based on the results of the study, the participants appeared to have answered the subjective belief measures with some accuracy, since there was a relationship between their actual performance on neuropsychological tasks and one of the belief constructs, namely their Capacity beliefs. On the other hand, the relationship was far from perfect,
with the majority of variance not shared between subjective beliefs and objective functioning.

Based on previous research and theory, it does seem that most normal older participants use more general, schematized beliefs about themselves (beliefs which are undoubtedly partly based on real interactions with the world, but beliefs which also become compiled and self-enhancing over time) in making these ratings. The ratings are very general; they relate almost as well to non-memory aspects of cognition as they do to memory.

Indeed, we could probably have inferred from the larger social cognitive research that any relationship between objective and subjective memory might be surprising. Widely held age stereotypes may have influenced responding to the subjective memory questionnaires in several ways. First, prior work has suggested that people of all ages perceive that memory declines with age (Ryan, 1992; Ryan & Kwong See, 1993); thus, people may have rated themselves more poorly in memory with advancing age, regardless of true changes, because of their belief in these stereotypes. Second, the work of Brandstädter and others suggests that the stereotypes may also be used in self-protective ways (i.e., "People decline with age, but I feel I'm still doing better than the average older person, so I'm going to rate myself favorably. I'm definitely better than the average older person"). Third, and related to this idea, there may be an explicit discounting of negative information in the service of well-being maintenance. In the earlier adult lifespan, for example, other work has suggested that positive illusions may be useful and motivating, and aid in the striving for a better self (Baumeister, 1989). In other words, if one believes one is "okay" and "doing fine," that provides a motivational
basis (regardless of the truth of the belief) to keep working to maintain and enhance one's functioning. Lastly, a relatively low association between objective and subjective memory might be expected on the basis of relative lack of awareness, in many older adults, of their true cognitive functioning. Flavell and Wellman (1977) argued that there are widespread deficiencies in individuals' metamemory knowledge. This lack of metamemory has been invoked as a possible account for why many older adults demonstrate inefficient strategy use on cognitive performance tasks, or why they fail to spontaneously use such strategies after having been instructed in them. The same metamemory account, which posits a relative lack of awareness in many elders about their objective status, could also explain why their subjective self-ratings are not more closely related to actual performance.

One of the interesting findings of this study is that the relationship between Capacity beliefs and performance is not specific only to the memory factors, but rather is a more general marker of cognition. Moreover, it is initially difficult to account for the primacy of Capacity in its correlations with performance. Why were Capacity beliefs related to cognition, but not beliefs about Internal management/motivation or External strategy use? As noted, one explanation may be that the Capacity factor may be a more reliable and variable scale, since many more MIA and MFQ scales loaded on that factor. Another explanation is that the type of beliefs that were encompassed in the Capacity factor (the individuals' overall judgment of how well they are doing, how much their memory has changed, and how worried they are about their memory and forgetting) may be a better indicator of inferred performance. The other two self-belief factors reflect
things one "can do" or "does do" in the service of one's memory, but they are less explicitly tied to one's judgment about how well one is actually doing.

The evidence was somewhat supportive of the notion that persons with MCI had the keekest awareness of a verbal memory deficit, which is usually the hallmark symptom of MCI. This corroborates past research (Freidenberg, Huber & Dreskin, 1990) suggesting that persons with MCI may be particularly aware of their memory problems, and that it is only in the moderate to severe range of later cognitive impairment (i.e., dementia, Alzheimer's disease) when anosognosia is often found. Thus, the model of self-awareness and its relationship to objective functioning illustrated in the Introduction to this work may be fairly accurate.

The clinical implications of this study involve the utility of subjective memory questionnaires in clinical practice. Based on our results, it seems reasonable to further investigate the possibility of a memory disorder if a patient has complaints about their memory, especially if an informant corroborates the complaints. To cue such complaints, a subjective memory measure may be used (although we note again, that the association between spontaneous complains and these subjective questionnaires currently remains uninvestigated). Furthermore, while there is some suggestion that subjective memory belief questionnaires appear to be useful as screening tools, they do not seem to contribute unique diagnostic information beyond standard neuropsychological tests.

We did document an association between depressive symptomatology and self-belief. Thus, in at least a subset of participants, poor memory self-belief screening scores could also indicate a mood disturbance that warrants further investigation.
Study Limitations

The first limitation of the study was the sample itself. The participants were a convenience sample from a larger study exploring intraindividual variability in cognitive performance over 30 days. This larger population consisted mainly of healthy, highly educated elders, which is not representative of the general elder population in the United States. Despite the limitations, the sample in this study is similar to that of most cognitive aging studies in the literature. The sample size was smaller than what would have been necessary to have enough power to detect correlational differences between the groups (actual power ranged between 0.17 and 0.32, depending on sample size, in those analyses for which it was examined). It should be noted however that 25.8% of the sample was assigned to the MCI group, which is higher than the rate of MCI in the general population of this age group (1-2%; Petersen et al., 1999). This likely resulted from the recruitment technique of specifically stating that the study was recruiting elders with or without memory complaints or problems.

A second limitation of the study is the absence of a medical or neurological examination to rule out other potential causes of memory problems, such as a vitamin B deficiency or untreated hypothyroidism (Petersen et al., 1999). Without such examinations, it cannot be certain that the memory problems displayed by the MCI participants are caused solely by brain pathology changes. While this study did not endeavor to medically diagnose MCI, the best possible situation for doing so would have been an examination of frontal release signs and reflexes and a thorough laboratory workup to rule out other potential causes of memory impairment. Thus, to the extent that the memory concerns seen in this study might represent more reversible or transitory
conditions, this could have attenuated the relationship between our relatively
dispositional memory self-ratings and actual performance.

Another limitation of this study was the non-independence of the consensus
conference variables and the variables used in the discriminant function analysis. (In an
ideal study, one would have a set of participants classified as impaired, and then an
independent set of variables used to characterize the differences between impaired
groups). Thus, while the discriminant function analyses of the current study were useful
in explicating the apparent weighting algorithm used by the consensus panel in assigning
cases to groups, the generalizability of this algorithm is limited, since the predictors used
in the discriminant functions were not independent of those variables used in the
consensus conference.

Another limitation of the current study is that there has been no investigation of
the overlap between ratings on subjective memory belief measures and spontaneous
memory complaints. It is not certain that the kind of spontaneous memory complaint that
Petersen mentions as definitional for MCI is well captured by the subjective memory
questionnaires. It could be that participants with memory complaints base these
complaints on specific recent, episodic failures, but nonetheless (as the social cognitive
literature suggests is true for most older adults) focus on their overall positives in
answering more general self-belief questionnaires. Thus, there may not be a strong
relationship between spontaneous memory complaints and subjective memory beliefs. It
is intriguing to speculate that, under the assumption that persons with MCI have more
memory complaints, the apparent greater specificity and magnitude of subjective-
objective belief relations in the MCI group (a single bivariate association between
Capacity and Verbal Memory was obtained, \( r = .61 \) may reflect the development of insight. While purely speculative without further research, it may be that when memory complaints reach a certain severity, they do begin to alter and make more specific one's general beliefs about one's memory and cognition. Clearly, further research is needed on this process assumption.

**Future Directions**

In order to rule out the previous limitation, the current lack of evidence that subjective memory beliefs and spontaneous memory complaints are related, as the explanation of the findings, we propose to explore this relationship in future research. The Clinical Dementia Rating includes a section with more traditional single-item memory complaint questions. Participants are asked about whether or not they think they have a memory problem, and if they believe their memory has declined over the last year. While this is not a true *spontaneous* memory complaint, as it has been cued by the examiner, it is open-ended and allows for elaboration of the problem and its’ context. We propose that a further examination of these CDR items, and their associations with both objective functioning and subjective ratings, in persons with and without memory impairment, may be an important first step in trying to understand the how subjective memory beliefs and spontaneous complaint might be related. From an empirical perspective, it is very difficult to evaluate "spontaneous complaint,” because this is a clinical presentation issue, and is not particularly consistent with standardized research protocols that seek to ask the same questions of everybody. Nonetheless, it does suggest that studies of MCI should include an unstructured field in which examiners note any spontaneous complaints when they occur.
We note that the data from the current study were collected in the context of a larger investigation that examined cognitive variability in our participants over the course of thirty days of at-home cognitive testing. Thus, another question of interest is if the 30-days of daily cognitive exercises that most of the participants engaged in might have changed participants’ subjective memory beliefs. We propose to explore the pre-post change in subjective memory beliefs for those participants who completed the 30-day daily program. (In the absence of a control group, of course, there are methodological limitations to this question). Also of interest is whether pre-post change differs by initial cognitive functioning (group assignment). One hypothesis is that subjective beliefs may be more accurate after completing 30-days worth of mental exercise, in that the study would have provided specific recent episodes in which participants could evaluate their explicit memory functioning.

Further exploration of the role of depressive symptoms on subjective memory beliefs also seems to be warranted. Are certain depressive symptoms more related to subjective belief constructs? If so, what are those symptoms and constructs? As developed in the literature review, depression seems to be related not only to subjective memory beliefs, but also to perceived self-efficacy, and one’s self-concept. If certain relationships are found, it may provide a means of intervention to optimize cognitive and social functioning of the elderly.

**Conclusion**

In summary, this study found that there is a relationship between subjective memory beliefs and objective cognitive performance in older adults with and without Mild Cognitive Impairment. Despite this finding, the study demonstrated that, in the classification of participants as having either normal cognition or mild cognitive
impairment, subjective memory beliefs added essentially no unique variance to the classification when also considering cognition variables and the CDR. However, when used alone, the subjective memory belief factors classified about two-thirds of the participants correctly into MCI or unimpaired groups. We take these findings as suggestive that subjective memory questionnaires may be useful as an initial screening measure in order to determine who should receive a thorough neuropsychological assessment, however these questionnaires do not add unique diagnostic significance to standard clinician-administered memory evaluations.
LIST OF REFERENCES


BIOGRAPHICAL SKETCH

Sarah Cook graduated from the University of Pittsburgh with a bachelor’s degree in psychology. She then spent two years working as a research associate at the Alzheimer Disease Research Center at the University of Pittsburgh. There she was involved in research studying the genetic risk for developing psychosis in Alzheimer’s disease as well as family studies of Alzheimer’s disease. Currently, Ms. Cook is working toward a doctorate in clinical and health psychology (with a specialization in clinical neuropsychology) at the University of Florida.