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Measuring Unawareness of Cognitive Decline in a Population of Elderly Individuals: The Cache County Study

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MEASURING UNAWARENESS OF COGNITIVE DECLINE IN A POPULATION OF

ELDERLY INDIVIDUALS: THE CACHE COUNTY STUDY

by

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ABSTRACT

Measuring Unawareness of Cognitive Decline in a Population of

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by

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The metacognitive skills of elderly individuals were examined using a brief, seven-item questionnaire. The construct validity of the questionnaire was examined using two forms of external criteria, the Modified Mini-Mental State Exam (3MS), and informant reports of functional ability. Analysis of Cronbach's alpha coefficients suggested moderate levels of internal consistency for the questionnaire (alpha = .75). Factor analysis (principal components) revealed two factors, one functional and one cognitive. Multiple regression analyses demonstrated that the metacognition questionnaire did not significantly predict 3MS change over a 3-year interval. Logistic regression analyses demonstrated that the metacognition questionnaire significantly predicted informant ratings. The metacognition questionnaire differentially predicted both outcome scores within dementia and no-dementia subgroups. These results provide support for the construct validity of the questionnaire. Future studies will examine the efficacy of brief questionnaires to measure unawareness in the elderly and continue to examine the differences in unawareness between demented and nondemented individuals.

(160 pages)

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Each of us literally chooses, by the way we attend to things, the universe we choose to inhabit.

--William James

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CHAPTER I

INTRODUCTION

As individuals age, many experience a decline in cognitive ability. Elderly individuals may experience a loss in their memory performance, ability to concentrate, or ability to learn new information (Anstey & Low, 2004; Weaver, Maruff, Collie, & Masters, 2006). Despite a decline in performance in these areas, however, many elderly individuals may be unaware of their declining cognitive status. Some may even overestimate their cognitive abilities, and thus compromise their health and ability to function in everyday life (Gil & Josman, 2001; Kalbe et al., 2005). This unawareness has been described as "loss of awareness" or "loss of insight" by researchers in the field, and has recently received considerable attention in the aging literature because of the relationship that loss of insight may have with Alzheimer's disease (AD) and other dementias.

Both awareness and unawareness of memory and cognitive deficits among the elderly carry many important clinical and theoretical implications. For example, research has shown that individuals in the early stages of dementia who maintain their awareness of memory and cognitive impairments are at increased risk for depression, anxiety, and other mood disorders (de Bettignies, Manhurin, & Pirozzolo, 1990; Feher, Mahurin, & Inbody, 1991; Gori et al., 1996; Migliorelli, Teson, & Sabe, 1995; Seltzer, Vasterling, & Buswell, 1995; Starkstein et al., 1997). It is hypothesized that awareness or recognition of memory or cognitive impairment may lead to feelings of loss, shame, or sadness. Losing one's awareness of cognitive decline may reflect brain atrophy and progression from mild cognitive impairment (MCI) to AD, as studies have shown that there are distinct differences in the level of awareness demonstrated in MCI and AD populations (Kalbe et al., 2005; Starkstein, Jorge, Mizrahi, & Robinson, 2006). In patients with AD and other forms of dementia, unawareness of cognitive deficit may decrease the effectiveness of pharmacological treatment due to lack of compliance (Burke & Morganlander, 1999; MacLaughlin et al., 2005), cause additional caregiver distress (Clare, Markova, Verhey, & Kenny, 2005), and lead to other psychiatric disturbances such as aggression, disinhibition, and delusions (Kashiwa et al., 2005; Mizrahi, Starkstein, Jorge, & Robinson, 2006). Unawareness of cognitive deficit may also reduce the effectiveness of nonpharmacologic treatment such as cognitive rehabilitation or psychotherapy in aging populations (Burns et al., 2005; Clare, Wilson, Carter, Roth, & Hodges, 2004; Chodoff, 2006; Koltai, Welsh-Bohmer, & Schmechel, 2001).

As indicated above, accurate assessment of lack of awareness or loss of insight is important in elderly populations because of the impact that loss of insight can play in disease prognosis for individuals with AD or other forms of dementia. Providing clinicians with the necessary tools to assess insight may help in their efforts to treat patients with AD and other forms of dementia as they make treatment and caregiver plans that involve family members and other professionals. Patient involvement is a critical issue in the implementation of any treatment intervention, and accurate assessment of patient insight may give caregivers and clinicians a better idea of the potential for patient involvement in the treatment process. Information pertaining to patient level of awareness may also provide caregivers with the necessary tools and strategies they need to care for or live with aging individuals who suffer from poor insight into their memory or cognitive loss.

Despite the importance of assessing awareness of cognitive deficit in aging populations however, there is no uniform or well-accepted method of measurement. Current methods of assessing awareness in elderly populations include clinical interviews, self and informant reports, and by comparing self and informant reports to objective scores on cognitive tests, such as the Mini-Mental State Exam (MMSE) or Wechsler Memory Scale (WMS; Clare et al., 2005). The assessment of insight or unawareness of memory or cognitive decline is a risky endeavor, and is fraught with conceptual and methodological problems. When the method involves comparing objective scores on tests of neuropsychological performance to self-report questionnaires, many questionnaires used to assess awareness do not accurately reflect the abstract concepts measured on neuropsychological tests. In addition, techniques often suffer from an overreliance on caregiver reports, which have been shown to be influenced by caregiver stress and personality characteristics (Clare et al.; Starkstein et al., 2006).

Despite these problems, however, advances are being made. Several scales have recently been constructed that have demonstrated acceptable levels of validity and reliability, and reflect a multidimensional approach towards the assessment of awareness that overcomes many of the weaknesses inherent in relying solely on one form of awareness assessment (Clare, 2002; Troyer & Rich, 2002). These new methods, however, can be lengthy and cumbersome to administer, and may impact the quality and degree of patient response. Several studies have suggested that equal measures of validity and reliability may be obtained from condensed versions of these instruments, and may possibly diminish the fatigue that may accompany lengthy questionnaires (Gilewski, Zelinski, & Schaie, 1990; Troyer & Rich). A shortened version of these scales with demonstrated levels of reliability and validity would provide clinicians and researchers with a useful and practical tool for assessing awareness in elderly patients, while at the same time free up clinician visit time and clinical resources for other activities such as treatment.

This project examined the psychometric properties of a brief scale used to assess awareness of memory and cognitive decline among participants of a large, population-based study, The Cache County Study on Memory, Health, and Aging (CCSMHA). Several characteristics of this population are advantageous for AD research. For example, longevity rates in this population have been shown to be much higher than the national average, and males especially live on average 10 years longer than do males in the national average (Miech et al., 2002). This population has been shown to have low consumption rates of alcohol and tobacco, both common risk factors for hypertension and heart disease, all which contribute to AD and dementia in late-life and can complicate AD and dementia research (Miech et al.). Overall, the community shows great support for the research, and participation rates have approached 90% (Breitner et al., 1999). In addition, there is a strong family heritage within the community, which results in low in and out migration rates, and therefore ideal for longitudinal studies.

In the Cache County Study, a brief scale was developed from the well-known Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE; Jorm, 2004) and the Memory Functioning Questionnaire (MFQ) developed by Gilewski and colleagues (1990). This scale was administered to a subsample of CCSMHA participants. To examine the psychometric properties of the CCSMHA metacognition questionnaire, I examined the questionnaire's internal consistency by calculating Cronbach's coefficient alpha. To examine the measure's construct validity, the following analyses were completed: (a) a factor analysis of the questionnaire items, (b) a test of the association between metacognition ratings with informant ratings of the participant's cognitive abilities, and (c) a test of the association between metacognition ratings and participant performance on a cognitive measure. To test the hypothesis that metacognitive judgments were less accurate among individuals with dementia, the latter two analyses were run separately for subgroups of demented and nondemented subjects.

CHAPTER II

LITERATURE REVIEW

Background

Cognitive decline in aging populations has been well documented in psychological research. Despite a decline in cognitive performance however, many elderly individuals are unaware of changes in their cognitive abilities. This loss of awareness has been labeled as "loss of insight" or "loss of awareness" by neuropsychological researchers, and can be defined as an individual's loss of awareness of their psychological, physical, or social state (Lezak, 1995). In clinical settings, the term "anosognosia" is used more often to describe patient level of unawareness. This term literally means, "lack of knowledge or awareness of an illness" (Starkstein et al., 2006). Other related terms found in the literature regarding patient level of awareness refers to a patient's level of "metacognition" of memory or cognitive ability, and has been defined as an individual's personal knowledge of "one's own memory skills and ability" (Cavanaugh, 1986). One reason for the apparent difference of terms may be due to the differences in opinion of the etiology of such phenomena (Clare et al., 2005). As has been documented in medical literature, a common term used to indicate unawareness of illness, deficit or loss is "agnosia," or "anosognosia," and implies an organic cause to the deficit in awareness. As has been pointed out by Clare and colleagues, however, the causes of unawareness in AD and other dementias may not be organic, and may be due to psychological or social factors as well, especially because of the negative connotations often associated with failing memory. Despite the differences in the terms used to define unawareness of cognitive and memory ability however, several researchers have indicated that these terms can be used interchangeably, and are indeed used in such fashion in the literature regarding loss of insight of memory and cognitive deficits in aging populations (Agnew & Morris, 1998). The literature suggests that three basic models have been used to explain this phenomenon: (a) the neurological, (b) the psychological, and (c) the sociocultural. In the sections that follow, I will briefly discuss unawareness from these three perspectives, and also the significance and clinical correlates of unawareness, methods of assessment, limitations in the literature, and the purpose of the present study.

Models of Unawareness

As pointed out by Clare and colleagues (2005), defining the exact nature of unawareness in neuropsychological research is a difficult and elusive endeavor as there are many facets and domains to the subjective experience of another. As discussed above, unawareness of one's cognitive faculties can arise from various sources. Attempts to define the exact nature of unawareness in elderly populations are disparate, although most researchers agree that there are three domains in which the crucial elements of the nature of awareness fall: (a) neurological, (b) psychological, and (c) social/cultural (Clare & Wilson, 2006). The nature of unawareness can relate to any one or a combination of these three domains (Clare & Wilson; Clare et al., 2004; Consentino & Stern, 2005).

Neurological models of unawareness are based on the theory that loss of awareness in aging populations occurs with cortical atrophy and overall loss of brain size and volume. Specific brain regions have been shown to be involved in populations with poor awareness of cognitive deficits. For example, several studies have found that the right prefrontal area is a critical region in underlying the critical aspects of self-awareness, particularly when awareness involves making judgments about one's own memory abilities (Kikyo & Miyashita, 2004; Kikyo, Ohki, & Miyashita, 2002; Mangone et al., 1991; Schnyer et al., 2004). Studies have also shown that patients who demonstrate diminished levels of awareness have decreased levels of cerebral blood flow in the right frontal cortex in comparison to age-matched controls with no impairments in awareness (Reed, Jagust, & Coulter, 1993; Starkstein, Migliorelli, & Sabe, 1995; Vogel et al., 2004).

Psychological models of unawareness are built on the theory that recognition of memory or cognitive deficits are repressed by individuals who experience them to avoid pain (Weinstein, Friedland, & Wagner, 1994). Because memory and cognitive loss can be embarrassing, individuals experiencing losses in these areas may adopt a strategy of neglect or denial (Weinstein et al.). Attempts to deny impairments in memory and cognitive function may also help to protect one against the depression that occurs when one is aware of memory and cognitive impairments in late life (Clare et al., 2004). In addition, studies have shown that subjective appraisal of memory and cognitive function may be affected by psychological variables such as personality traits, self-efficacy, personal and psychological well-being and personal physical health (Commissaris, Ponds, & Jolles, 1998; Niederhe, 1998; Pearman & Storandt; 2004).

Social and cultural models of unawareness of cognitive deficit are built on the theory that social and cultural contexts can impact the level of awareness individuals express towards their cognitive and memory deficits. Different cultural and social norms can impact the level of emphasis that one may place on maintaining memory and cognitive health in old age (Clare & Wilson, 2006; Saravanan, Jacob, Prince, Bhugra, & David, 2004). Factors such as *minimization of distress* have been shown to impact an individual's perception of illness, which can be impacted by the one's sociocultural environment and background (Saravanan et al.). This theory has received much less attention in the literature, although certain methods to assess unawareness due to cultural and social causes have been devised (Clare, 2002, Phinney, 2002).

Significance and Clinical Correlates of Unawareness

Unawareness of memory and cognitive deficit is largely considered a symptom of pathological aging. Very few studies have examined level of patient unawareness in nondemented, healthy elderly individuals (Vogel et al., 2004). Of the few studies that have, results have suggested that unawareness of memory and cognitive decline is not part of the normal aging process in healthy individuals (Starkstein et al., 2006). However, even among healthy aging adults, self-reports often reflect inaccurate beliefs about aging and memory ability, and appear to be influenced by culturally based negative stereotypes (Culter & Grams, 1988; Hertzog & Hultsch, 2000). In addition, high educational background and greater development of cognitive reserve appear to act as a buffer against unawareness in old age (Spitznagel & Tremont, 2004).

With the development of disease or pathological processes, aging individuals begin to show signs of marked cognitive decline, and research suggests that for some individuals awareness of these deficits begins to decline as well. Such unawareness of cognitive decline appears even in the prodromal and very early stages of dementia. For example, Vogel and colleagues (2004) found no significant differences in the percentages of unawareness of deficits between individuals with MCI and a group of individuals in the early stages of AD. Among those with MCI, 60% exhibited symptoms of unawareness of memory impairment (Vogel et al.). Several other studies have found significant deficits in patient level of awareness in MCI samples as well (Albert et al., 1999; Collie, Maruff, & Currie, 2002; Kalbe et al., 2005).

Studies of AD and other forms of dementia have suggested that anosognosia (lack of awareness) is quite common in these diseases, even at the early stages of the disease course. Studies have generally shown that anosognosia becomes worse with disease progression (Derouesné et al., 1999; Sevush & Leve, 1993; Starkstein et al., 1997). Despite evidence demonstrating that unawareness is related to disease severity, there are also reports that unawareness in aging is largely idiosyncratic, with some individuals showing more unawareness during the beginning stages of cognitive decline while others show more unawareness during the later stages of cognitive decline (Arkin & Mahendra, 2001).

Precise prevalence rates of unawareness of cognitive deficits in AD and other types of dementia are unknown, however. Of the few studies that have tried to assess prevalence rates for unawareness in AD and other types of dementia, rates have been highly variable. In a prospective longitudinal study of 103 patients with AD, Starkstein and colleagues (1997) noted that approximately half of their sample had anosognosia, with increasing rates for increased disease severity. In a later study conducted by Starkstein and colleagues (2006), rates for anosognosia were found to be significantly different between healthy controls and those carrying a diagnosis of AD. Also, the rates for ansognosia varied according to the disease severity of the patients with AD. Using the Alzheimer's Disease Questionnaire (AD-Q; described later in this review), none of the normal healthy controls from their sample were found to have anosognosia (*n* = 32), while 10% of the patients in the very early stages of AD were found to have significant anosognosia (*n* = 22), 50% of the patients in the moderate stages of AD were found to have significant anosognosia (*n* = 85), and 57% of the patients in the severe stages of AD were found to have significant anosognosia (*n* = 28; Starkstein et al., 2006). In a longitudinal study conducted by McDaniel, Edland, and Heyman (1995), over one fourth (26.6%; *n* = 108) of the individuals with AD from the initial group of 406 showed greater impairments in their level of awareness 1-year after follow-up from their initial baseline measures, indicating that at least in one fourth of their sample the prevalence rates of unawareness in AD increased according to disease severity or duration. Despite these measures however, it is generally recognized that rates of unawareness in aging populations vary according to the type of method and the questions used to assess unawareness (Cavanaugh, 1986; Ecklund-Johnson & Torres, 2005).

There has also been considerable research suggesting that unawareness of impairment is linked with many other factors that can complicate and worsen the quality of life for aging individuals. For example, in a study examining the relationship between levels of unawareness and deficits in executive functioning in accomplishing instrumental activities of daily living (IADL's), Cahn-Weiner, Malloy, Boyle, Marran, and Salloway (2000) found that deficits in executive functioning and awareness of functioning were significant predictors of functional decline in a sample of community-dwelling elderly individuals. Furthermore, measures assessing executive functions and patient level of awareness accounted for more variance in the differential rates of functional decline than other demographic characteristics such as general health status, age, and educational level (Cahn-Weiner et al.). Research also indicates that patients with MCI with associated poor levels of subjective memory and cognitive awareness are at increased rates of conversion to AD or other forms of dementia (Clare et al., 2005; Devenand et al., 2000; Tabert et al., 2002).

There is considerable evidence that suggests that maintained levels of insight into memory and cognitive impairment is associated with greater levels of psychological disturbances in elderly individuals. For example, several studies have suggested that maintained levels of insight into memory and cognitive impairment are associated with greater levels of depression and anxiety in elderly populations (de Bettignies et al., 1990; Feher et al., 1991; Gori et al., 1996; Migliorelli et al., 1995; Seltzer et al., 1995; Starkstein et al., 1997). Lack of awareness of cognitive deficits has also been associated with elevated levels of apathy and delusions in populations with dementia, as individuals experience limited awareness of the intents and actions of others around them (Harwood, Sultzer, & Wheatley, 2000; Lopez, Becker, & Somsak, 1994; Migliorelli et al., 1995; Starkstein et al., 2006). As individuals age, a significant and common stressor is that of loss: loss of family members, loss of identity, loss of health, and loss of mental and cognitive ability, and awareness of the loss of memory and cognitive ability is likely to lead one to feel sad, despondent, and morose (Marris, 1979). Loss of memory and cognitive function is also a great indicator of frustration and worry for the aging (Watkins, Chestson, Jones, & Gilliard, 2006). Individuals who are not aware of their memory or cognitive impairments are not likely to experience depression or anxiety from these losses, as they do not possess the cognitive faculties necessary to recognize these deficits.

Lack of awareness of one's memory or cognitive impairment also appears to hinder the impact of cognitive rehabilitation therapy in patients with memory impairments in the early stages of AD and other forms of dementia (Koltai et al., 2001; Prigatano, 1991, 1994, 1997, 1999). In a recent retrospective study, Koltai and colleagues demonstrated that subjects classified as having good levels of awareness made significantly greater gains in cognitive rehabilitation than subjects classified as having poor levels of awareness. Furthermore, Clare and colleagues (2004) demonstrated in a prospective study that higher levels of patient awareness were related to significant and practical gains in cognitive rehabilitation in patients diagnosed with early-stage dementia.

As noted in the paragraphs above, there is much need to study insight and awareness in aging populations because of the impact that correct awareness assessment may have on AD treatment and knowledge about the symptoms associated with AD. Accurate assessment of patient level of awareness in healthy but aging populations may provide a predictive screening tool to facilitate the early detection of AD or other forms of dementia (Isella et al., 2006). As already mentioned, early detection remains one of the most effective and useful tools for treating patients with AD or other forms of dementia. Being able to correctly assess for impairment in subjective awareness may help ease the frustration of caregivers, provide better information on potential treatment outcomes and disease prognosis, and help facilitate cognitive rehabilitation and identify elderly individuals who would make good candidates for psychotherapy. The interventions listed above are neither worthwhile nor useful if there is no effective tool for the assessment of awareness level in aging populations. Measurement of level of patient awareness and insight is a complex issue however. In the subsequent sections, I present the literature regarding issues of measuring unawareness.

Measuring Unawareness

In the 1997 issue of *Alzheimer's Disease and Associated Disorders*, an editorial was published that faulted many of the studies of unawareness and insight in dementia for "insufficient attention to the variability in unawareness within individuals and within diagnostic groups" (Arkin & Manendra, 2001). Variability is an important factor to consider not only in the etiology and nature of unawareness, but also in the methods and definitions used to measure it. As with all psychological phenomena, the nature of unawareness in aging populations and its correlates vary according to the definitions and ways that researchers employ to measure it. Indeed, one of the main reasons for the disparity in the research on the nature and etiology of unawareness in aging populations stems from the different measures and ways that unawareness has been operationalized and measured (Cavanaugh, 1986; Ecklund-Johnson & Torres, 2005; Mol, van Boxtel, Willems, & Jolles, 2005).

Despite the differences in how unawareness can be measured, however, several common and useful methods have emerged with acceptable levels of validity and reliability. In a thorough review of the literature on assessment of level of awareness in elderly populations, Clare and colleagues (2005) found that measurement techniques for measuring awareness in elderly populations fall within five different domains: (a) clinician rating methods, (b) questionnaire-based methods, (c) performance-based methods, (d) phenomenological methods, and (e) multidimensional methods. These different methods of assessing unawareness in elderly populations are based on a theoretical background as to the etiology and nature of unawareness in the elderly. Performance and questionnaire-based models are based more from the theory that unawareness of memory and cognitive deficit stems from physiological causes whereas clinician rating and phenomenological methods are more flexible and have the ability to not only assess the physiological causes of unawareness but also any social or psychological causes as well (Clare et al.). A detailed discussion of each of these methods with accompanying strengths and limitations is included below.

Clinician Rating Methods

Assessment of a patient's level of awareness through an interview with a trained clinician is one of the most common ways to assess insight and awareness in the elderly (Clare et al., 2005). The procedures used to conduct the interview can vary, with some interviews involving only the patient and others involving both the patient and a knowledgeable informant. The clinical interview method may also use only a patient's past medical records and case history as a source of patient information (Loebel, Dager, Berg, & Hayes, 1990; Reed et al., 1993; Weinstein et al., 1994). The format for the clinical interview varies from a structured interview to a more flexible format using structured questions in an unstructured order, or even from one single question taken from tests with demonstrated validity and reliability (Harwood et al., 2000; Verhey, Rozendaal, Ponds, & Jolles, 1993). These methods for assessing awareness in elderly populations can focus solely on deficits in memory functioning or can be more broad in scope, assessing deficits in awareness of memory and other cognitive abilities, deficits in awareness of impaired activities of daily living, and even awareness of perceived behavioral functioning (Zanetti et al., 1999).

One particular strength of the clinician rating method of assessment is that although it relies on the subjective report of the patient, the method is dependent on a trained and qualified professional to make the final decision as to the patient's overall level of awareness. This can be especially important as other methods relying solely on questionnaires or completed patient reports have received criticism because of the potential for bias in subjective report (e.g., asking for a person to remember how their memory was 3 years ago when their current memory is not good to begin with). However, much of the criticisms of the interview method arise from the interviews being too long and time consuming, too global in scope, and their tendency to produce insufficient levels of reliability (Auchus, Goldstein, Green, & Green, 1994; Feher et al., 1991).

Questionnaire-Based Methods

Another type of method also well represented in the literature on awareness assessment is the employment of questionnaires that capture the subjective experience of elderly individuals and how they appraise their own memory and cognitive abilities. Scores from subjective questionnaire-based measurements are often compared with scores on questionnaires filled out by primary caregivers, family members, or even hospital caregiver staff members that may know the patient well. These scores are then used to calculate discrepancy scores between subject and informant reports. Discrepancy scores are usually calculated by simply subtracting the informant's score from the patient's score, but some have argued that a ratio-based calculation is more effective and representative of the patient's level of awareness (Trosset & Kaszniak, 1996). These scores are then either treated on a continuum of level of awareness or with assigned cut-off points to determine classification of whether the patient is aware or unaware (often a dichotomy) of their memory and cognitive deficits.

One advantage of this method is that it provides standardized methods for assessing awareness in the elderly and produces uniform data sets that are transferable across participants, facilitating the examination of awareness across studies and different clinicians (Rymer et al., 2003). However, this method is not without limitations. The most apparent limitation is the reliance on calculating a discrepancy score between informant and patient. This assumes that the informant is giving an accurate and reliable estimate of the patient's abilities. Research has shown that this is not always the case, although some studies have reported valid and reliable informant or caregiver reports (Jorm, 2004). Factors such as depression and stress can affect caregiver scores on patient's levels of memory, functional, and cognitive abilities (de Bettingnies et al., 1990; Jorm, 1994).

Performance-Based Methods

This method of assessment of awareness in the elderly involves comparing an individual's scores on self-report questionnaires (similar to those described in the two above paragraphs) and their performance on objective tests that measure memory and other cognitive abilities, such as the MMSE or the WMS. As mentioned previously, there are many aspects to awareness, which can focus on an individual's awareness of their degree of functioning in either behavioral or functional (e.g., ability to carry out activities of daily living) domains of living. This can pose certain limitations for performance-based methods, as such methods are generally restricted to assessing awareness of cognitive functioning. This has not been a large problem, however, as this method is most often used by researchers in the field to capture the cognitive and not the behavioral or functional domains of unawareness. For those interested in using this method to measure unawareness of behavioral or functional deficits, self-report can also be compared to objective tests of behavioral and functional performance (Clare et al., 2005).

The comparison of an individual's self-report on objective test measures can also be applied to reports given by caregivers, family members, or hospital personnel. The reports provided by caregivers can be compared against self-reports given by the patient and then again against the patient's scores on objective memory and cognitive tests. This three-way approach is used to assess the accuracy and validity of both the caregiver and the patient's report on level of cognitive functioning, and is especially useful for the employment of the objective measures of cognitive functioning. However, one caution that has been raised in using this method is that the comparison of items on questionnaires and items found on current neuropsychological and cognitive tests may not accurately reflect one another (Clare et al., 2005). Many questions on self-report questionnaires may not match the content domain of neuropsychological tests (e.g., asking how well an individual remembers names of loved ones and comparing that score with a measure of working memory such as Digit Span from the Wechsler intelligence test). This may contribute to inflated discrepancy scores between self-report and objective scores on memory or other cognitive tests, thus leading to spuriously high levels of unawareness (Clare et al.). Current researchers aware of these issues, however, can take steps to avoid these weaknesses, such as using questionnaires that more accurately reflect the abilities measured by neuropsychological tests. In light of these issues, several performance-based scales have recently been developed that contain questions, which accurately reflect the abilities measured by neuropsychological tests (Clare, Wilson, Carter, Roth, & Hodges, 2002).

Phenomenological Methods

The assessment of awareness in elderly populations from a phenomenological methodology consists of conducting patient interviews, examining interview transcripts, and observing patient and clinician interaction to construct the subjective understanding of one's abilities to remember, think, and function. This method is more qualitative in nature, and allows the clinician to be flexible in the approach of awareness assessment and to collaborate with both the patient and caregivers in the assessment of level of patient awareness. It also incorporates more of a psychological, cultural, and social interpretation as to why loss of insight has occurred, and is capable of obtaining a more accurate feel for the subjective experience of an elderly individual who is experiencing memory, functional, or other cognitive loss. As demonstrated by Clare and colleagues (2005), the utilization of phenomenological methods for assessing unawareness in elderly individuals is not common. However, despite the advantages of flexibility and increased patient involvement, the phenomenological approach is subject to interviewer bias, which questions the credibility and trustworthiness of such studies (Elliot, Fischer, & Rennie, 1999). This method also lacks the standard procedures of other methods, thus compounding its problems of validity and trustworthiness.

Multidimensional Methods

As the name implies, the multidimensional method of awareness assessment utilizes many different ways to assess awareness or utilizes a combination of the methods previously discussed. For example, this method may incorporate participant and caregiver discrepancy scores, discrepancy between objective scores and self-reported questionnaires, self-evaluation of task performance (after the task has been performed) and actual task performance, and comparing objective task performance with clinician interviews and ratings of awareness (Clare et al., 2002; Duke, Seltzer, Seltzer, & Vasterling, 2002; Howorth & Saper, 2003; McGlynn & Kaszniak, 1991). Despite the variety of possible methods used however, the most common is having patients and caregivers rate how well they feel they or the person for whom they are caring did on a particular task and then compare those ratings to actual performance (McGlynn & Kaszniak).

The strength of the multidimensional approach allows researchers and clinicians to base their assessments on a broad scope of information. This however is also problematic, as multidimensional methods tend to confound the overall picture of patient level of awareness, overlapping cognitive, functional, and behavioral levels of awareness, which may not all be correlated (Derouesné et al., 1999). Because of the multidimensionality of this approach, patient scores on subjective level of awareness may produce a range of different scores, which may not provide a representative estimate of awareness in specific areas such as memory, cognitive, functional or behavioral impairments (Clare et al., 2005).

Given the overview of the methods of assessment, it should come as no surprise that there are a multitude of scales used to assess level of subjective awareness in the elderly, and each uses one or a combination of two or more of the approaches described above. Currently, among these different methods of assessing awareness there exists no "gold standard," and it is necessary for researchers in the field to acquaint themselves of the strengths and weaknesses of each method (Ecklund & Torres, 2005). Despite the absence of a gold standard method in assessing unawareness however, there are several common instruments used in the literature today that use the methods explained in the above sections. In the following section I will review several of these instruments and present data on their psychometric properties.

Current Awareness Questionnaires

To identify current scales used to assess unawareness in aging populations, I conducted a computerized search of the MEDLINE and PsycINFO databases using the search terms, "awareness in aging," "anosognosia in Alzheimer's disease" and "metacognition in aging." Table 1 provides a list of several scales that have been found in the literature. This table also provides the number of questions contained in each questionnaire and other accompanying methods along with the authors who created the scale. Although many scales appear in the literature, the scales listed in the following

Table 1

List of Awareness Questionnaires

Scale	Method of assessment	Number of questions	Authors
The Contextual Memory Test (CMT)	Objective task followed by personal evaluation of level of performance	2 picture cards; 20 lines drawings each card (40 total)	Gil & Josman (2001)
The Metamemory Functioning Questionnaire (MFQ)	Questionnaire and objective measures	64	Gilewski et al. (1990)
Memory Awareness Rating Scale (MARS)	Questionnaire, objective measures and self-evaluations	26	Clare et al. (2002)
Multifactorial Memory Questionnaire (MMQ)	Questionnaire and objective measures	61	Troyer & Rich (2002)
Metamemory Questionnaire (MQ)	Questionnaire and objective measures	92	Zelinski, Gilewski & Thompson (1980)
Metamemory in Adulthood (MIA)	Questionnaire;	108 [with 7 subscales]	Dixon, Hultsch, & Hertzog (1988)
Awareness in Dementia (AD-Q)	Patient-informant discrepancy	30	Starkstein et al. (1995)

table were among the best developed and most often cited scales in the literature and reviewed in this proposal.

One of the most recent tests created to assess unawareness in elderly populations, the Memory Awareness Rating Scale (MARS), is a comprehensive quantitative measure that utilizes questions pulled from the ecologically-valid Rivermead Behavioral Memory Test (RBMT; Clare et al., 2002). The MARS is divided into two sections, the Memory Functioning Scale (MFS) and the Memory Performance Scale (MPS). The MFS asks about memory in everyday situations such as needing to remember a name, recalling the nightly news, or recognizing familiar faces. The respondents (both the subject and informant) are asked to respond how frequently on a 5-point scale ranging from 0 (always) to 4 (never) that they (or the person for whom they are caring) would be able to remember the information in the given question, and how this compares to the average person of the same age. Therefore, the MFS yields two sets of ratings, one that measures *frequency* of memory difficulties and one that measures how these difficulties relate to the *average experience* of others. The scores are then summed, with higher scores indicating greater levels of memory difficulties and forgetfulness. The MPS asks respondents to rate their performance on a 5-point scale, ranging from 0 (better than average) to 4 (worse than average), on an objective task of memory performance. Again, scores are summed with higher scores indicating greater perceived levels of poor performance and lower scores indicating lower levels of perceived poor performance. The MARS questionnaire contains 26 questions in all, and yields discrepancy scores between subject and informant reports, subject predicted performance and actual performance on objective tests, and informant predicted performance and actual performance on objective tests (Clare et al., 2002).

To examine the reliability and validity of the MARS, Clare and colleagues (2002) conducted a pilot study using the MARS to assess awareness impairment in a group of elderly individuals clinically diagnosed with documented memory problems. In their sample ($n = 12$), Clare and colleagues reported satisfactory levels of internal consistency (MFS = .95 and MPS = .93) and test-retest reliability (MFS = .94 and MPS = .97). In this pilot study using participants with clinical symptoms of memory loss, the MARS yielded acceptable levels of criterion validity when compared with other reliable scales assessing awareness. As noted by the authors, however, this study was only conducted to pilot the

MARS, and one weakness of the study was the low number of participants. In addition, no studies have been found using the MARS with elderly individuals without diagnosed memory problems, and no information exists whether these levels of reliability and validity would remain if the scale were to be administered to populations other than those with documented memory problems.

Two other scales of awareness have also received considerable attention in the literature: the Memory Questionnaire (MQ) and the Metamemory in Adulthood (MIA) questionnaire. These two scales reportedly have acceptable levels of reliability and validity, and have been noted to be among the most frequently used scales in the literature on unawareness of cognitive deficits in aging populations (Gilewski et al., 1990). For example, Gilewski and colleagues reported levels of internal consistency among the four factors that comprise the MQ as being .94, .94, .89, and .83, respectively. These values were generated from data using all age groups (16-89) as participants however, and no reliability scores on samples specifically from elderly populations were provided (Gilewski et al.). Participants in this study were also volunteers from both university and community settings and may not be representative of the general population. As a result, the reported psychometric properties of the MQ may not generalize to other populations.

The MIA questionnaire constructed by Dixon and colleagues (1988) is a 108-item questionnaire that asks participants to rate and describe their memory functioning and general memory capabilities. The MIA questionnaire was designed to reflect a multidimensional perspective of unawareness, and therefore is one of the more lengthy instruments used to assess unawareness in elderly populations (Dixon et al., 1986). The multidimensional approach utilized by the MIA consists of 7 subscales that reflect different domains of unawareness of cognitive ability, such as: (a) perceived cognitive ability, (b) perceived change in cognitive ability, (c) usage of memory mnemonics, (d) knowledge of basic memory processes, (e) perceived motivation towards memory activities, (f) perceived control over memory skills, and (g) perceived anxiety on memory performance. Within the 7 different subscales, internal reliability has been demonstrated to fall within acceptable ranges, with the most reliable subscale being *perceived changes of cognitive ability* (r = .91) and the least reliable being *perceived control over memory abilities* (r = .75; Dixon et al.).

There is evidence that the MIA is a valid instrument to assess unawareness, although not exclusively in aging populations. In an examination of the convergent validity of the MIA, Gilewski and Zelinski (1988) demonstrated that the MIA was associated with the MFQ, particularly with the self-efficacy memory factor, a construct assessed by both instruments. In another study conducted by Dixon and colleagues (1986), the MIA scales were found to be at least moderately correlated with intelligence, a construct that has been found to be associated with high levels of metacognition, or personal awareness of mental cognition. As mentioned however, these studies conducted to establish the reliability and validity of this scale were not exclusively from elderly populations, as samples were taken from individuals in the community and from male and female university students ranging in age from 18-84 years (Dixon et al., 1988). This can be a significant factor in the development of an instrument's validity, as group differences in age, sex, educational level, or occupational status are conditions that can affect validity coefficients (Anastasi & Urbina, 1997). To date, no studies have been found examining the psychometric properties of this instrument focusing solely on elderly populations.

Limitations of Current Scales

As mentioned in the previous section, many well-developed tests have been designed to assess unawareness in aging populations. One weakness, however, of the currently available methods used to assess unawareness is the length of time and energy required by both clinician and patient to complete each scale. The length of time these tests require stems from the multidimensional nature of awareness, and the associated complexities that arise in attempting to measure it. As mentioned by Troyer and Rich (2002), most of the instruments used to assess unawareness to date have been created for research purposes, where knowing and defining the exact nature of awareness is part of the overall goal of the instruments devised. In clinical settings however, it may not be as imperative to know the overall meaning entailed in the phenomena of awareness. Concerns with simply not being aware of a single cognitive domain such as failing memory or cognition, of orientation to time and place, or of one's social situation and surroundings may be important enough to warrant treatment without further understanding of the phenomena of unawareness. In other words, for clinical purposes, a complete knowledge of the multiple dimensions of unawareness may be unnecessary. By limiting ourselves to selected dimensions of unawareness and discovering their correlates and impact on the clinical presentation of aging, we may be able to create scales that accurately assess awareness with the desirable attributes of brevity and ease of administration. This would both reduce clinician and patient burden and facilitate the use of such scales.

Several attempts to curtail the length of current unawareness scales have been made. For example, researchers Gilewski and colleagues (1990) attempted to curtail the length of the MQ because of its excessive length and multidimensionality. They claim that most investigators use different versions of the MQ, but never the scale in full because of its length and the complexities in scoring it (Gilewski et al.). Using exploratory factor analysis (principal components), Gilewski and colleagues discovered four significant domains of the original MQ. Factor loadings were considered significant if they were at least .35, and items that did not significantly load on any one factor were eliminated from the scale, cutting the original MQ scale from 92 items to 64. This new version of the scales has since been renamed the Metamemory Functioning Questionnaire (MFQ; Gilewski et al.).

The MFQ has shown high levels of reliability, with calculated internal consistency estimates (Cronbach's alpha) of the four factors being .94, .94, .89, and .83, respectively (Gilewski et al., 1990). The MFQ also appears to have maintained its multidimensionality, even after eliminating items that did not load on factor loadings. Despite the strength of the MFQ in maintaining its multidimensionality however, it may be able to be curtailed even further. As pointed out by Gilewski and colleagues, some of the dimensions of the MFQ such as the *Seriousness of Forgetting* dimension and the *Mnemonics Usage* dimension may be very different from each other, as the former better reflects insight into memory impairment and the latter better reflects memory conservation and composition techniques. In addition, although important for the theoretical aspect of unawareness, it had been indicated that the *Mnemonics Usage* dimension is less reflective of actual awareness of memory and cognitive abilities (Gilewski et al.).

In a recent attempt to create a scale used to assess awareness in the elderly, Troyer and Rich (2002) also stated the necessity of keeping instruments that assess awareness in the elderly short and concise. These researchers created the Multifactorial Memory Questionnaire (MMQ), a brief screening instrument used to assess the level of awareness in elderly populations with an average administration time of less than 10 minutes. This instrument has also been found to have adequate levels of validity and reliability (Troyer & Rich). As indicated by these researchers, shortening questionnaires used to assess unawareness in elderly populations can carry many benefits for clinical use, as they may increase patient compliance and test validity. Lengthy questionnaires have been found to increase the possibility of fatigue effects that confound the assessment of unawareness, especially in elderly populations as they are more prone to mental and physical fatigue than younger populations (Troyer & Rich). Furthermore, as has been suggested by several researchers (Clare et al., 2005), the performance-based method of unawareness assessment is best used when more than one comparison is made between informant and subjective scores on awareness and objective scores of memory or cognitive abilities. Most instruments in the literature use only one comparison of scores, either a subjective or informant report of cognitive ability with scores on objective tests. To date no instruments for unawareness assessment have used more than one comparison of scores, thus leaving these scales susceptible to the confounding effects of caregiver or subjective affective state discussed previously. Therefore, there is a need for reliable and valid screening tools to assess diminishing awareness or metacognition in elderly populations.

Summary

Psychological research has demonstrated that cognitive and memory abilities decline with age. Despite the decline in cognitive and memory abilities however, there are many elderly individuals who remain unaware of such decline. Such unawareness may have many clinical implications, such as contributing to worse prognosis in AD and other forms of dementia, increase levels of caregiver stress and fatigue, decrease the level of patient compliance to medical intervention and drug compliance, and negatively impact an individual's mood or affective state. Therefore, the assessment of an individual's awareness of his/her cognitive and memory abilities is highly useful, and proper assessment of patient awareness may lead to more effective treatment of individuals who have AD or some other form of dementia.

Currently there are several methods utilized to assess awareness in the elderly, each with their associated strengths and weaknesses. Contemporary scales utilize a variety of these methods, and several scales are currently available to assess levels of unawareness in elderly populations. These scales carry several limitations, especially when applied to clinical populations, as most scales have been produced for research purposes and not clinical purposes. This has led to lengthy scales that assess metacognition in the elderly, which are also cumbersome to use. A variety of studies have shown that the current metacognition scales used in practice today can be curtailed without harming their psychometric properties. Shortening current scales used to assess metacognition in the elderly carries several advantages such as reducing the level of participant fatigue, increasing their availability and their ease of use, and making them more amenable to clinical populations.

This project proposed to examine the psychometric properties of a metacognition scale (CCSMHA) used in a population-based study in Cache County, Utah. The scale is a curtailed version of other metacognition scales, as items have been taken from both self- and informant-based measures already established in the field. The properties and characteristics of the CCSMHA metacognition scale are described later in this project. In addition, this project attempts to examine the differences of self-perception of cognitive ability among those who have and have not received a diagnosis of dementia. Below are listed the goals associated with this project.

Research Questions

In this project, the following questions were addressed.

1. I examined the internal consistency of the metacognition scale used in the CCSMHA, (a) across all of the items in the metacognition scale, and (b) comparing rates of internal consistency within the functional and cognitive domains of the scale.
2. I examined the construct validity of the metacognition scale by:
    a. Examining the factor structure of the instrument, and
    b. Examining the relationship between the metacognition scale with two external criteria: subject cognitive performance and informant based ratings of functional ability. Within the second criteria of informant-based ratings I also examined the differences between different informant

relationships, such as informants who lived/did not live with the subject or informants who were the spouse/child of the participant

c. If separate factors were obtained for 2a, then I examined the relationship between each factor with the external criteria of subject cognitive performance and informant based ratings of functional ability

3. I also repeated the above analysis for subjects whose cognitive status was known (i.e., dementia vs. no dementia). Here I predicted that the correlation between actual cognitive performance and reported cognitive performance (either from self or from informant) would be more discrepant in individuals diagnosed with incident dementia versus those without dementia.

CHAPTER III

METHODS

This project utilized extant data from the CCSMHA. The CCSMHA is a longitudinal study on the memory, health, and aging process of elderly individuals residing in Cache County, Utah. The data used in this project were collected over two waves of dementia screening and assessment. Permission to conduct the investigation was obtained from the Utah State University Institutional Review Board (Appendix I) and the CCSMHA steering committee. In this section, I will provide an overview of the larger study, providing information on subject characteristics, data collection procedures, and the assessment tools. I will focus on the procedures of the first two dementia screening and assessment waves (Wave 1: 1995-1996; Wave 2: 1998-1999) of the CCSMHA as data gathered from these waves were the basis for the present investigation.

CCSMHA Dementia Screening and Assessment

In the methodology of the Cache County Study, all elderly residents located in Cache County, Utah, aged 65 and older as of January 1st, 1995 (*N* = 5,677; Breitner et al., 1999) were invited to undergo a multistage dementia screening and assessment protocol. The cognitive screening within the Cache County Study consisted of a revised version of the Modified Mini-Mental State Exam (3MS; Teng & Chui, 1987; Tschanz et al., 2002). Individuals whose sensory and education adjusted screening scores fell below 87 out of 100, or selected as a subsample to complete all stages of screening and assessment, were then studied further using the Dementia Questionnaire (DQ), an informant-based interview (Silverman, Breitmer, Mohs, & Davis, 1986). The designated subsample was sampled according to an iterative process to match each identified case of AD according to age, gender, and Apolipoprotein E (ApoE) genotype. The results of the DQ were rated by a neuropsychologist in consultation with a senior geropsychiatrist and neuropsychologist. Elderly individuals who were rated as suspicious for dementia or with significant cognitive decline were then invited to undergo a comprehensive clinical assessment, conducted by a research nurse and neuropsychological technician. The nurse and neuropsychological technician administered a battery of neuropsychological tests and neurological exams, along with a brief seven-item metacognition questionnaire. A detailed description of the seven-item metacognition questionnaire is provided in the next section. Additionally, an informant named by the participant completed the Dementia Severity Rating Scale (DSRS; Clark & Ewbank, 1996), which identified the participants' competence in the major functional and cognitive domains affected by dementia. The neuropsychological technician also administered the IQCODE to the informant to obtain structured information on the participant's functional abilities. Data collected from neuropsychological and neurological tests were then reviewed by a geropsychiatrist and neuropsychologist, and they assigned preliminary diagnoses of dementia, other cognitive disorders, or no impairment according to *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., DSM-II-R; American Psychiatric Association, 1987) dementia criteria. Diagnoses were given without knowledge of 3MS, IQCODE, or metacognition scores. Subjects diagnosed with dementia were then classified into severity stages of dementia using the Clinical Dementia Rating Scale (CDR; Hughes, Berg, Danziger, Coben, & Martin, 1982; Morris et al., 1993). Additionally, participants who were diagnosed with dementia or its prodrome were invited to undergo additional laboratory testing and neuroimaging using magnetic resonance imaging (MRI). Those with dementia diagnosis were also invited to have a visit from a geropsychiatrist.

A final diagnosis of dementia was assigned after a review of all available information at consensus conferences consisting of experienced clinicians in geropsychiatry, neurology, and neuropsychology, and a diagnosis of Alzheimer's disease followed the criteria provided the National Institute of Neurological and Communicative Disorders and Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA; McKhann et al., 1984). Diagnosis of other types of dementia followed other standard research protocol. All study procedures were identical in each wave, with the exception of a slight modification of screening cut-off scores in Wave 2.

Study Participants

The subject's data included in the present project were those who completed the Wave 2 clinical assessment and the metacognition questions. Prevalent dementia subjects were those whose dementia onset preceded the start of Wave 1 and were not reassessed in Wave 2. There were 356 individuals with dementia identified in the prevalence wave, and therefore not eligible for subsequent waves. This left 4,614 individuals eligible for Wave II. Approximately 73.9% (3,411) participated in the screening wave, with 495 deceased and 708 declining participation. Of these 3,411 participants, 854 participants completed the DQ and were selected for a clinical assessment. Of the 854 subjects that were eligible for a clinical assessment, 693 (81%) subjects completed the clinical assessment, with 687 (80%) completing the CCSMHA metacognition questionnaire. The 687 therefore comprised the subjects for the present project. Questionnaires were considered complete if participants answered 5 of the 7 questions. Table 2 summarizes the characteristics of the participants who completed the CCSMHA metacognition questionnaire at Wave II. A summary of the characteristics of the subjects for the present project is presented in Table 2.

Table 2

Summary of Participant Characteristics

	Completed metacognition questionnaire				Did not complete metacognition questionnaire			
Sample characteristics	Number	%	Mean	*SD*	Number	%	Mean	*SD*
Gender								
Male	296	42.7			2	33.3		
Female	397	57.3			4	66.6		
Years of education	686		13.24*	3.0	6		10.83*	2.2
Subject age at clinical assessment	687		81.53*	7.1	6		88.5*	5.9
Education/sensory adjusted 3MS score	672		84.89	11.6	3		70.33	7.5
3MS delta score from Wave I to Wave II	670		3.95	8.3	2		9	13.2

* significant at the .05 level.

Assessment Tools

Metacognition Questionnaire

At each clinical assessment, a research nurse administered the CCSMHA metacognition questionnaire to each participant in the study. This brief instrument consists of seven items that ask participants to rate their current cognitive ability relative to 3 years ago. The format and content of the first six items of the CCSMHA metacognition questionnaire were adapted from the IQCODE developed by Jorm (2004). Question 7 was adapted from the MFQ developed by Gilewski and colleagues (1990). The seven questions differ in nature, as some questions (#4,5,6) assess *functional* changes within the past 3 years and questions (#1,2,3,7) assess *cognitive* changes occurring within the same time interval. Thus, the overall item content of the CCSMHA metacognition questionnaire contains three questions of functional status and four questions of cognitive status. Both of the instruments from which these questions were adapted have been reported to be reliable and valid instruments in assessing metacognition in the elderly (Gilewski et al.; Jorm).

Examples of the items in the CCSMHA metacognition questionnaire include: *"Compared with three years ago, how are you at remembering events, appointments, and objects," "Compared with three years ago, how are you at keeping your train of thought, or finding the right words,"* and *"In general how is your memory now compared to the way it was 3 years ago*?*"* Respondents are asked to rate each item on a 5-point Likert scale ranging from 1 to 5, with the individual items being: (1) much better, (2) a bit better, (3) not much change, (4) a bit worse, or (5) much worse. The items and format of the CCSMHA metacognition questionnaire are provided in Appendix A.

The mean of the metacognition items was used to scale the questionnaire's value. I used the mean for the following reasons: (a) because using the sum of the metacognition questionnaire resulted in a smaller sample than using the average of the metacognition items (n = 647 vs. 667, respectively), and (b) to increase similarity between metacognition and IQCODE score, as the IQCODE questionnaire is also measured as an average value (Jorm, 2004). I considered a metacognition questionnaire complete if at least 5 of the 7 items were complete, thus allowing me to retain participants with missing values on only one or two items of the questionnaire. Items were considered missing and were therefore not included in the mean score if study participants responded with "don't know," "refused," or if the item value was missing. Cognitive and functional domain scores were also computed using the mean score of the items in the respective domain. However, the mean scores for the cognitive and functional domains required all items within the respective domains to be complete.

Modified Mini-Mental State Exam (3MS)

As part of the broad screening in Wave 2, all study participants were asked to complete a 3MS (Teng & Chui, 1987), which is a modified version of the MMSE. The 3MS contains a ceiling of 100 points, in contrast to the original 30 points available on the MMSE, thus increasing its sensitivity to the upper and lower ranges of cognitive performance (Teng & Chui). The screen assesses orientation, immediate, delayed, and recognition memory, remote and working memory, verbal fluency, confrontation naming, receptive language, and constructional praxis. Studies have shown that the 3MS demonstrates high levels of internal consistency (r = .91), interrater reliability (r = .98), and correlations with the original MMSE (r = .95; Bassuk & Murphy, 2003). By subtracting Wave 2 3MS scores from Wave 1 3MS scores, I was able to calculate a 3MS delta score, which was used in the analyses of this project. In addition, the 3MS scores used in this project were corrected for sensory impairments, following the formula described by Breitner and colleagues (1999), by discarding items that were confounded by sensory deficits and calculating the percent correct of the remaining items.

Informant Questionnaire of Cognitive Decline (IQCODE)

The IQCODE was administered to an informant at the Wave 2 clinical assessment. The IQCODE is an informant-based questionnaire that serves as a widely used screening test for dementia. The IQCODE asks informants to indicate how much change has occurred in the cognitive and functional activities of the person of interest. For example, items addressed included: (a) Compared with 10 years ago, how is he/she at remembering the names, faces of family members? (b) Compared with 10 years ago, how is he/she at remembering important dates, facts? and so forth. In the CCSMHA, the instrument was modified to ask about cognitive or functional abilities relative to 10 years ago, and if this was a change, again relative to 3 years ago. The IQCODE has demonstrated high levels of reliability and research has shown that it measures a single factor of cognitive decline (Jorm, 2004). Research has also shown that the IQCODE performs at least as well for screening cognitive decline as traditional cognitive screening tools, and has also demonstrated ecological validity in predicting incident dementia (Jorm). One particular strength of this instrument is that it is relatively unaffected by a respondent's education or premorbid intellectual level, or by a culture's dominant language, although responses on the IQCODE may be affected by respondent's affective and emotional level (Jorm). This instrument is particularly useful when the subject is unable to undergo direct cognitive testing or for screening populations who are of low educational background and literacy (Jorm).

On brief examination, the three measures described above appear to represent common content. As illustrated in Table 3, there is considerable content overlap between the three scales. However, it is notable that on the 3MS, there are no direct questions assessing the functional domain. This is perhaps best explained by the fact that the 3MS is considered a measurement of cognitive status. A copy of the IQCODE and 3MS are found in Appendices C and D.

General Medical Health Rating

The General Medical Health Rating (GMHR; Lyketsos et al., 1999) is a scale to rate the overall health of an individual, taking into account the number of medications, medical conditions, and overall appearance. This measure was developed specifically for use with dementia patients, and contains a range of 1 (poor) to 4 (excellent). The GMHR has been shown to demonstrate adequate psychometric properties (interrater agreement = .94%).

In the Cache County Study, the GMHR was determined through a consensus between the research nurse, neuropsychologist, and geropsychiatrist after discussion of

Table 3

Overlap of Metacognition, 3MS, and IQCODE Items

Item	CCSMHA metacognition questionnaire	3MS	IQCODE
Cognitive subdomain			
Language	√	√	√
Memory	√	√	√
Orientation		√	√
Functional subdomain			
Household chores	√		√
Managing finances			√
Managing appliances	√		√

the research nurse's observations, results of a brief physical and neurological exam, and a report of medical conditions and medications. A copy of the GMHR is included in Appendix E.

Statistical Analysis

In order to address research question #1, the reliability of the CCSMHA metacognition questionnaire was calculated by computing Cronbach's coefficient alpha, a measure of internal consistency. This measure of reliability provides intercorrelation scores among the different items comprising the CCSMHA metacognition questionnaire, and measures the degree to which each item within the questionnaire is consistent with the others. This method is appropriate to use for the current study as it has been shown to be an appropriate method for both continuous and ordinal data (Cronbach, 1990). In accord with the research questions listed previously, Cronbach's coefficient alpha was conducted both on (a) all seven items within the metacognition scale, and (b) within the different cognitive and functional items that comprise the scale.

To address the research question regarding the validity of the CCSMHA metacognition questionnaire, factor analysis was conducted on the seven items of the questionnaire. Factor analytic procedures consisted of two main components: (a) extracting the factors, and (b) rotating and interpreting the factors (Norušis, 2003). Currently there are many different forms of statistical algorithms for extracting factors from a correlation matrix (Tabachnick & Fidell, 2001), but principal components and principal axis methods are those most commonly used. In this analysis, principal components was selected over principal axis for several reasons. One main reason for this was because of the different nature of each statistical procedure. First, studies have shown that the principal components method is often reserved as a form of data reduction procedure, whereas principal axis factoring is often reserved for analyzing the factor structure of a group of variables (Green & Salkind, 2005). In the current project, due to the limited number of variables contained in the questionnaire under investigation, I did not consider the questionnaire a broad enough measure to assess entire domain of the phenomenon of what it means to "be aware," or in other words what comprises "metacognition." Moreover, current research suggests that principal axis factoring should not be used in studies where domains may have less than four variables that are used to define them. Variable numbers less than four may not constitute a broad enough range to assign a "domain" value (Green & Salkind).

For this study, item correlation was not assumed between the cognitive and functional items. One may argue that awareness of cognitive and functional loss in late life can be conceptually independent constructs due to the differences in social acceptability between these two phenomena. Although when measured objectively, cognitive loss may be correlated with functional loss in elderly populations, this may not hold true when measuring the perceptions of loss in each of these areas, because functional loss may be more socially acceptable than cognitive loss. Therefore, for these analyses, independence of constructs was assumed. As traditional methods of factor rotation consist of orthogonal and oblique methods, with orthogonal methods assuming no correlation and oblique assuming correlation between items, the appropriate rotation for these analyses was orthogonal. Several forms of orthogonal rotation exist, but varimax rotation was used as it provided the best fit for the data. This form of rotation is the most commonly used rotational method used in the social sciences today (Green & Salkind, 2005). This form of rotation also produces factor loadings that are the most interpretable out of all the different types of rotations (Kleinbaum, Kupper, & Muller, 1988). Using varimax rotation produced the most interpretable results, although other forms of rotation were also used with similar results as those obtained with varimax rotation. Factor scores differ from the mean scores of the cognitive and functional domains in that they weigh how each item loads on the different cognitive and functional factors; taking simple averages within these two domains does not.

To address research question #2 as a further examination of the construct validity of the metacognition questionnaire, regression analyses were conducted to determine the relationship between the questionnaire and two forms of external criteria, 3MS delta scores and IQCODE group membership. For the 3MS delta scores, multiple regression analyses were conducted. Due to the highly skewed distribution of IQCODE scores, the responses were represented in two categories; one “no change” group and one “worse” group. The association between IQCODE and metacognition questionnaire was examined via logistic regression.

Last, to examine whether the relationship between the metacognition questionnaire and each of the 3MS and IQCODE scores differed by participant cognitive status, the above analyses were repeated separately for participants diagnosed without dementia and those with dementia.

CHAPTER IV

RESULTS

Internal Consistency of the Metacognition Questionnaire: Cronbach's Alpha

Before calculating Cronbach's alpha of the metacognition questionnaire, I examined descriptive statistics of the completed 687 questionnaires. Overall, the response distributions for the seven questions were relatively similar for questions 1, 2, 3, and 7, and all were skewed towards the direction of "worsening abilities." The distributions for questions 4, 5, and 6, were also highly skewed, with fewer participants responding in the "worse" direction.

Overall, the response rates on each question were relatively similar. Question #6 however, did elicit fewer responses than other questions. For example, on question # 1 ("remembering events, appointments and objects"), only 6 subjects responded to the item as either "don't know" or "refused"; whereas, on question #6 ("keeping up with household chores") 26 subjects responded in similar fashion. One may speculate that participants were uncertain how to respond if they were experiencing potential motor or sensory impairments that impacted their ability to perform household chores. However, there were no differences between the average 3MS baseline scores, delta scores, age, or gender between those who did and did not complete the item. The frequencies of the individual responses, mean, and standard deviations for all seven items of the metacognition questionnaire are listed in Appendix F. A correlational table is also provided in Appendix B listing each metacognition item and its relationship to both the 3MS and IQCODE.

Cronbach's coefficient alpha calculated for all seven items was 0.75 (n = 655). This level of internal consistency is traditionally considered moderate, with high levels of internal consistency falling 0.8 and above and poor levels of internal consistency falling below 0.70 (Norušis, 2003). However, for the small number of items, the value may be considered relatively high as higher estimates of reliability occur with greater numbers of variables (Sattler, 2001). The reliability coefficient for the four cognitive questions within the overall scale was also moderate at 0.76 (n = 679), and the reliability coefficient for the three functional questions was poor at 0.58 (n = 662). To examine whether the overall reliability was diminished due to any given item, Cronbach's coefficient alpha was also calculated with each individual item systematically removed from the analysis. Cronbach's coefficient alpha varied from a low of .68 to a high of .75. The highest correlation achieved is very similar to the alpha level attained for the entire questionnaire. Therefore, the internal consistency for the entire questionnaire was not adversely affected by the unreliability of any single item.

Construct Validity of the Metacognition Questionnaire: Factor Analysis

Before conducting the factor analysis on the CCSMHA questionnaire, a correlation matrix of all seven items was produced. Although there clearly were significant correlations between each of the items, many of these correlations were small and only appeared significant due to the large sample size that was used in the study.

Table 4 contains a correlational matrix presenting the pairwise correlations of the seven metacognition items.

As shown in Table 4, 12 of the 21 unique correlations fell below .30, a value that suggests a weak relationship between variables (Anastasi & Urbina, 1997). Principal components factor analysis with varimax rotation clearly produced two factors. Table 5 presents the results of this analysis.

As displayed in Table 5, the eigenvalue range of the seven components comprising the metacognition scale ranged from .39 to 2.84. As reported by Norušis (2003), eigenvalues smaller than one should not be interpreted as they account for no more variance than the original variables themselves. Table 5 also illustrates the amount of variance the first two factors account for following rotation: 32.2 and 25.1% for factors 1 and 2, respectively. Therefore, following rotation, the first two factors of the metacognition questionnaire account for over 57 % of the total variance of the complete questionnaire. Another form of displaying this data can be found in a Scree plot presented in Appendix G.

Table 6 represents the results of each metacognition question and their factor loadings. The majority of the items loaded more heavily on a single factor. Item 3 was somewhat ambiguous, with loadings on factor 1 and 2 of 0.616 and 0.335, respectively. However, because this question loaded nearly twice as much on factor 1 as factor 2, the question is still considered to load heavily on factor 1. Based on the item loadings on the factors, I have interpreted the results to suggest one *cognitive* and one *functional* factor. As can be seen from Table 6, questions 1, 2, 3, and 7 loaded highly on factor one. All four of these questions relate to the cognitive disposition of the individual completing the

Table 4

Correlations for All Seven Metacognition Items

Item	Correlation	"Remembering events, appointments, and objects"	"Remembering names and faces"	"Keeping train of thought/finding right word"	"Finding way around familiar places"	"Operating gadgets and machinery"	"Keeping up with household chores"	"Memory now compared to three years ago"
"Remembering events, appointments, and objects"	Pearson correlation	1.00	.39**	.37**	.17**	.25**	.15**	**.58
	Sig. (2-tailed)		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	N	687	686	683	681	671	664	683
"Remembering names and faces"	Pearson correlation	.39**	1.00	.38**	.16**	.24**	.16**	.43**
	Sig. (2-tailed)	< 0.01		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	N	686	689	685	683	672	666	686
"Keeping train of thought/finding right word"	Pearson correlation	.37**	.38**	1.00	.22**	.31**	.27**	.46**
	Sig. (2-tailed)	< 0.01	< 0.01		< 0.01	< 0.01	< 0.01	< 0.01
	N	683	685	686	680	671	665	682
"Finding way around familiar places"	Pearson correlation	.17**	.16**	.22**	1.00	.38**	.20**	.26**
	Sig. (2-tailed)	< 0.01	< 0.01	< 0.01		< 0.01	< 0.01	< 0.01
	N	681	683	680	685	671	665	681
"Operating gadgets and machinery"	Pearson correlation	.25**	.24**	.31**	.38**	1.00	.41**	.26**
	Sig. (2-tailed)	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01	< 0.01
	N	671	672	671	671	674	664	670
"Keeping up with household chores"	Pearson correlation	.15**	.16**	.27**	.20**	.41**	1.00	.23**
	Sig. (2-tailed)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
	N	664	666	665	665	664	667	664
"Memory now compared to three years ago"	Pearson correlation	.58**	.43**	.46**	.26**	.26**	.23**	1.00
	Sig. (2-tailed)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
	N	683	686	682	681	670	664	689

** Correlation is significant at the 0.01 level (2-tailed).

Table 5

Factor Analysis Results, Principal Components

	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
Component	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1.00	2.84	40.62	40.62	2.84	40.62	40.62	2.25	32.18	32.18
2.00	1.16	16.61	57.23	1.16	16.61	57.23	1.75	25.05	57.23
3.00	0.80	11.37	68.60						
4.00	0.65	9.32	77.92						
5.00	0.62	8.79	86.71						
6.00	0.55	7.79	94.50						
7.00	0.39	5.50	100.00						

Note. Extraction method: principal component analysis.

questionnaire, and, therefore, the first factor, which accounts for the majority of the scale's variance, also produces the largest eigenvalues (see Table 5), and was interpreted as the "cognitive" factor. Questions 4, 5, and 6 all loaded highly on factor 2. As all three

Table 6

Rotated Component Matrix

	Component	
Metacognition question	1	2
1. Remembering events, appointments, objects	.795	.087
2. Remembering names and faces	.727	.082
3. Keeping train of thought, finding right words	.616	.335
4. Finding way around familiar places	.131	.664
5. Operating gadgets or machinery	.195	.787
6. Keeping up with household chores, hobbies, interests	.104	.729
7. Memory compared with 3 years ago	.804	.188

of these questions relate to the functional disposition of the individual completing the questionnaire, this factor has been interpreted as the "functional" factor. This pattern of loadings was exemplified throughout the questionnaire, and suggests little item overlap between the two factors, a desirable quality of a questionnaire (Tabachnik & Fidell, 2001).

As a result of the factor analysis, factor scores were calculated for each participant. Factor scores represent "a weighted combination of its scores on each of the input variables" (Kachigan, 1986). Therefore, an individual who scored high on metacognition questions #1, #2, #3 and #7 would have a high factor score on factor 1. Conversely, if an individual scores low on these same questions, then they would receive a low factor score for factor #1. Factor scores were computed for each subject on both factor 1 and 2. These factor scores were used as part of the regression analyses regarding Research Question #2.

Construct Validity: Relationship Between Metacognition and 3MS Delta Scores

Of the 687 participants who completed the metacognition questionnaire, 667 had complete 3MS scores at both Waves 1 and 2, and were included in the analyses. Table 7 displays the descriptive information for participants with complete 3MS data and for those who did not. There were no significant differences in age (T = 1.241, df = 685, p = .313) within these two groups. Those lacking the second of the pair of 3MS scores scored slightly worse on baseline 3MS scores (T = -2.092, df = 12.141, p = .058), and

Table 7

Subject Characteristics of Participants Who Did and Did Not Complete 3MS Delta Scores

	Participants who had complete 3MS delta scores				Participants who did not have completed 3MS delta scores			
Sample characteristics	Number	%	Mean	*SD*	Number	%	Mean	*SD*
Gender								
Male	288	43.2			6	30		
Female	379	56.8			14	70		
Years of education	666		13.27*	3.0	20		11.95*	2.7
Subject age at clinical assessment	667		81.53	7.0	20		83.10	7.4
Education/sensory adjusted 3MS score	667		89.03	6.6	13		82.15	11.9
GMHR score	667		2.98	.6	20		2.6	.6

* significant at the .05 level.

completed fewer years of education (T = -1.976, df = 684, p = .049). There were no significant differences in gender between the two groups, χ^2 (1, N = 687, 1.38, p = .24).

To examine the construct validity of the CCSMHA metacognition questionnaire, multiple regression analyses were conducted in which I regressed 3MS delta scores onto the metacognition scores and the demographic variables age, gender, GMHR score, and education. Prior to presenting the results of these regression analyses, however, it is necessary to discuss the assumptions of multiple regression. According to Cohen, Cohen, West, and Aiken (2003), the assumptions of multiple regression are (a) the independent and dependent variables are linearly related, (b) the outcome variable should follow a normal distribution, and (c) the standardized residuals should follow a normal distribution.

To examine the first assumption, a scatterplot was conducted between the metacognition mean and the 3MS delta score. Although no clear relationship arose from the scatterplot, a curve estimation analysis was conducted between the following types of relationships: linear, quadratic, and logistic. A curve estimation analysis conducts a simple analysis of variance (ANOVA) between the independent (metacogntion) and dependent variables (3MS delta score) based on each type of relationship. The results suggested that a linear relationship was the best fit for the data (linear relationship: $F = 3.75$, $df = 665$, $p = .053$; quadratic: $F = 3.29$, $df = 665$, $p = .07$; logistic: $F = 2.53$, $df = 664$, $p = .08$). To examine the second and third assumptions, a frequency distribution showed that the dependent variable and standardized residuals followed a normal distribution. Figure 1 shows the frequency distribution of the 3MS delta score.

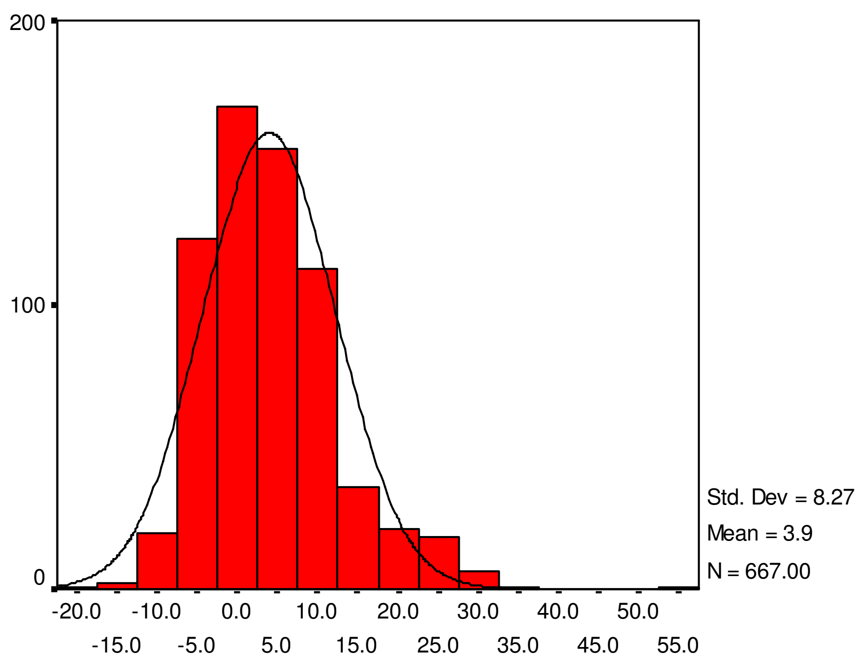

Figure 1. Frequency distribution of 3MS delta scores.

I also ran exploratory pairwise correlations between each predictor variable and the dependent variable (3MS delta score). These results are presented in Table 8. As shown in Table 8, the metacognition score was not highly correlated with 3MS delta scores ($r = 0.075$, $n = 667$, $p = .53$). This value did not change significantly when using the sum rather than the average of the metacognition items ($n = 647$, $r = 0.077$, $p = .40$). The metacognition score did not correlate with education ($n = 686$, $r = .04$, $p > .05$), but did weakly (albeit significantly) correlate with GMHR ($n = 687$, $r = -0.107$, $p = .005$) and age at baseline ($n = 687$, $r = 0.076$, $p = .046$).

Table 8

Correlations Between Metacognition Scores, Demographics, and 3MS Delta Scores

Item	Correlation	3MS: Delta score	Mean of metacognition items	Subject education	GMHR rating	Subject age
3MS:Delta score	Pearson correlation	1	.075	-.140**	-.192**	.171**
	Sig. (2-tailed)	.	.053	.000	.000	.000
	N	667	667	666	667	667
Mean of metacognition items	Pearson correlation	.075	1	.040	-.107**	.076*
	Sig. (2-tailed)	.053	.	.295	.005	.046
	N	667	687	686	687	687
Subject education	Pearson correlation	-.140**	.040	1	.084*	-.198**
	Sig. (2-tailed)	.000	.295	.	.028	.000
	N	666	686	686	686	686
GMHR rating	Pearson correlation	-.192**	-.107**	.084*	1	-.106**
	Sig. (2-tailed)	.000	.005	.028	.	.005
	N	667	687	686	687	687
Subject age	Pearson correlation	.171**	.076*	-.198**	-.106**	1
	Sig. (2-tailed)	.000	.046	.000	.005	.
	N	667	687	686	687	687

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Pearson's product coefficients were also calculated for both the functional and cognitive domains of the metacognition questionnaire and their relationship with the 3MS delta score. These results are presented in Table 9.

Table 9

Correlations Between Cognitive and Functional Domains, Demographics, and 3MS Delta Scores

Item	Correlation	3MS: Delta score	Mean of 4 cognitive items	Mean of 3 functional items	Subject education	GMHR score	Subject age
3MS: Delta score	Pearson correlation	1	.034	.124**	-.162**	-.194**	.156**
	Sig. (2-tailed)	.	.391	.002	.000	.000	.000
	N	643	643	643	642	643	643
Mean of 4 cognitive items	Pearson correlation	.034	1	.397**	.052	-.047	.012
	Sig. (2-tailed)	.391	.	.000	.188	.226	.767
	N	643	655	655	654	655	655
Mean of 3 functional items	Pearson correlation	.124**	.397**	1	.000	-.126**	.082*
	Sig. (2-tailed)	.002	.000	.	.990	.001	.036
	N	643	655	655	654	655	655
Subject education	Pearson correlation	-.162**	.052	.000	1	.077*	-.215**
	Sig. (2-tailed)	.000	.188	.990	.	.049	.000
	N	642	654	654	654	654	654
GMHR score	Pearson correlation	-.194**	-.047	-.126**	.077*	1	-.111**
	Sig. (2-tailed)	.000	.226	.001	.049	.	.005
	N	643	655	655	654	655	655
Subject age	Pearson correlation	.156**	.012	.082*	-.215**	-.111**	1
	Sig. (2-tailed)	.000	.767	.036	.000	.005	.
	N	643	655	655	654	655	655

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

As displayed in Table 9, only the mean score of the functional items was significantly correlated with 3MS delta scores ($n = 643$, $r = .124$, $p = .002$), while the relationship between the cognitive items and 3MS delta scores was not ($n = 643$, $r = .034$, $p > .05$). This suggests that the mean score of the functional items had a much stronger relationship with 3MS delta scores than the mean score of the cognitive items. To further explore the nature of the relation between metacognition questionnaires and external criteria of 3MS delta scores, I examined the correlation between each item and the outcome reference.

The first regression analysis was conducted using the metacognition score of all seven items as the predictor variable and the delta score on the 3MS as the criterion variable. The results from this analysis showed that the metacognition score was a significant predictor of 3MS delta scores ($T = 2.058$, $p = .04$). However, despite the significance of the metacognition mean in predicting the 3MS delta score, the overall R^2 value was very low ($R^2 = .006$), suggesting that the metacognition score explained little of the variance in 3MS delta scores. In the final model, the additional covariates of age, gender, education, and GMHR rating score were added. With covariates, metacognition scores were no longer statistically significant in predicting delta scores on the 3MS ($T = 1.491$, $p = .136$). To determine which covariate diminished the relationship between metacognition and 3MS delta, several analyses were conducted in which each covariate was added individually to the simple model. The GMHR score accounted for the largest portion of variance in the final model, and decreased the significance level of the metacognition score to a degree that it no longer was significant. Table 10 shows that each of the demographic variables, with the exclusion of gender, significantly predicted

Table 10

Final Regression Model: Metacognition Mean, Demographic Variables, 3MS Delta Scores

	Unstandardized coefficients		Standardized coefficients		
Model	*B*	Std. Error	Beta	*T*	Sig.
(Constant)	-3.383	5.343		-.633	.527
Metacognition	1.325	.888	.056	1.491	.136
Subject education	-.275	.107	-.099	-2.559	.011
Subject age	.144	.045	.123	3.186	.002
GMHR rating	-2.244	.512	-.166	-4.381	.000

Note. $R = .275$, $R^2 = .076$, Adjusted $R^2 = .069$, Standard error of the estimate = 7.982.

3MS delta scores. The results suggest that less education, older age at baseline, and poorer GMHR scores (health rating scores) were associated with greater 3MS decline. A poor rating on the GMHR (indicating poor health) was the strongest predictor of 3MS decline ($T = -4.381$, $p = < .01$). The results from this analysis are listed below in Table 10.

Multiple Regression: Cognitive Domain and 3MS

Multiple regression analyses were conducted using the mean of the four cognition questions as predictors of cognitive change. The cognitive domain mean did not significantly predict 3MS delta scores ($T = .858$, $p = .391$). This result did not change with the inclusion of demographic covariates ($p = .136$). Demographic variables that were significantly related to the 3MS delta score were education ($p < .05$), subject age ($p < .01$) and GMHR rating score ($p < .001$). Similar to the results with all metacognition items, the strongest predictor within the model of 3MS delta scores was GMHR scores. The results of the final model using the cognitive domain score and all demographic variables in predicting 3MS delta scores are presented in Table 11.

The above analyses were repeated, substituting the factor score from the cognitive domain in place of the four-item cognitive mean as the predictor variable. The same covariates were tested in the model. The results of this analysis were similar to those of the four-item cognitive mean, in that the cognitive factor score did not significantly predict 3MS delta scores (T = .296, CI(95) = -.509, .689, p = .78).

Multiple Regression: Functional Domain and 3MS

In analyses of the functional domain (mean of 3 functional items), the functional mean was highly significant in predicting 3MS delta scores (T = 3.17, p = .002), and

Table 11

Final Regression Model: Cognitive Domain Mean, Demographic Variables, 3MS Delta Scores

	Unstandardized coefficients		Standardized coefficients		
Model	*B*	Std. Error	Beta	*T*	*B*
(Constant)	1.790	5.080		.352	.725
Mean of 4 cognitive items	.544	.661	.032	.823	.411
Subject education	-.328	.106	-.123	-3.104	.002
Subject age	.122	.045	.107	2.719	.007
GMHR score	-2.233	.501	-.171	-4.453	.000

Note. R = .271, R^2 = .073, Adjusted R^2 = .066, Standard error of the estimate = 7.706.

remained so in the presence of the demographic covariates. Despite this significant result, however, the R^2 value in the model is low, meaning that the functional domain explained approximately 8% of the variance in the 3MS delta scores. All demographic variables were also significant predictors of 3MS delta scores with the exception of gender. The strongest predictor in the model was GHMR scores with the second strongest predictor being the functional mean. The results of the final model are presented in Table 12.

The above analysis was repeated, substituting the factor score from the functional domain in place of the three-item mean and tested with demographic covariates. The results were similar to those obtained with the three-item mean, with functional domain factor scores significantly predicting 3MS delta scores ($T = 2.76$, CI(95) = .242, 1.44, $p = .006$).

Table 12

Final Regression Model: Functional Domain Mean, Demographic Variables, 3MS Delta Scores

	Unstandardized coefficients		Standardized coefficients		
Model	*B*	Std. Error	Beta	*T*	Sig.
(Constant)	-3.797	5.356		-.709	.479
Mean of 3 functional items	2.431	.921	.102	2.639	.009
Subject education	-.329	.105	-.123	-3.125	.002
Subject age	.113	.045	.099	2.525	.012
GMHR score	-2.088	.502	-.160	-4.158	.000

Note. $R = .287$, $R^2 = .083$, Adjusted $R^2 = .075$, Standard error of the estimate = 7.668.

Construct Validity: Relationship Between Metacognition and IQCODE

To examine the relationship between informant reports of cognitive change with that of the subject's report, a complete IQCODE was necessary. Of the original 687 subjects with completed metacognition questionnaires, 490 (71.3%) had a complete informant IQCODE (considered complete if 20 of the 26 questions were completed). The primary reason for missing IQCODE questionnaires was due to the difficulty in obtaining an informant who felt knowledgeable enough to complete the IQCODE. Although participants in the study would provide an informant to participate in the clinical assessment where the IQCODE was administered, the informant often refused the questionnaire due to unfamiliarity with the participant. Table 13 displays a comparison between the samples of participants lacking the IQCODE with those with completed IQCODE questionnaires. *T* tests were conducted on the quantitative variables age, level of education, 3MS baseline scores, and 3MS delta scores between the two groups. There were no significant differences in age ($T = 1.006$, $df = 685$, $p = .315$) or level of education ($T = .658$, $df = 685$, $p = .511$) between the two groups. However, participants who had complete IQCODE scores also scored higher on their baseline 3MS scores and exhibited less decline on the 3MS between Waves 1 and 2 ($T = -3.493$, $df = 678$, $p = .001$; and $T = 3.547$, $df = 277.93$, $p = < .001$, respectively, equal variances not assumed). There were no significant differences in gender between those who had and had not complete IQCODE scores, χ^2 (1, $N = 687$, .014, $p = .906$).

Table 13

Completed IQCODE and Missing IQCODE

	Completed IQCODE				Missing IQCODE			
Sample characteristics	Number	%	Mean	*SD*	Number	%	Mean	*SD*
Gender								
Male	209	42.7			85	42.5		
Female	281	57.3			115	57.5		
Years of education	490		13.19	3.0	199		13.38	3.0
Subject age at clinical assessment	490		81.41	7.1	200		81.91	7.0
Education/sensory adjusted 3MS score	484		89.51**	6.5	196		87.54**	7.2
GMHR score	490		3.03	.62	197		2.84	.58

** $p < .01$.

Informant characteristics of those completing IQCODE questionnaires were examined. The majority of individuals serving as informants were more often spouses or adult children of the participants (88.8 % combined), and female (71.2%). Table 14 below describes the different types of informants that completed the IQCODE.

A frequency distribution of IQCODE scores was also conducted. However, this distribution revealed a severe violation to one of the assumptions of multiple regression, in that the distribution of the outcome variable (IQCODE scores) did not follow a normal curve. An illustration of the distribution of scores is presented in Figure 2.

As can be seen from Figure 2, there are extreme elevations on value 3 (no change). In an attempt to alleviate the skewness of the distribution, several data transformations were attempted. These transformations included square-root transformations, natural log transformations, and log base 10 transformations. No significant improvements in the

Table 14

IQCODE Informant Characteristics

Sample characteristics	Informant relationship to subject	
	Number	%
Gender		
Male	133	27.1
Female	349	71.2
Spouse	244	49.8
Child (son or daughter)	184	37.6
Sibling	16	3.3
Friend	25	5.1
Paid caregiver	9	1.8
Other (neighbor or nephew)	4	.8
Total	482	98.4

data were made following these transformations. Because there was no theoretical basis to divide the data into count statistics, Poisson or Negative binomial regression were not attempted.

As an alternative approach, I classified the IQCODE scores into two groups: (a) those rated as improved or no change (hereafter labeled as “no change”; mean range of value 0-3.49), and (b) those rated as a decline in level of functioning (hereafter labeled as “worse,” mean range of value 3.5-5). This cut-off score was determined by dividing the two scores that, distinguished between no change and worsening abilities (a score of 3 indicated no change, whereas a score of 4 or greater indicated at least some change; 3+4 = 7/2 = 3.5). As displayed from the distribution of scores in Figure 2, there were few to no IQCODE scores that fell below the mean score of 3, indicating very few informants felt that the participants in the study were improving in their cognitive abilities. Therefore, there was no group labeled as “improvement,” and any questionnaires

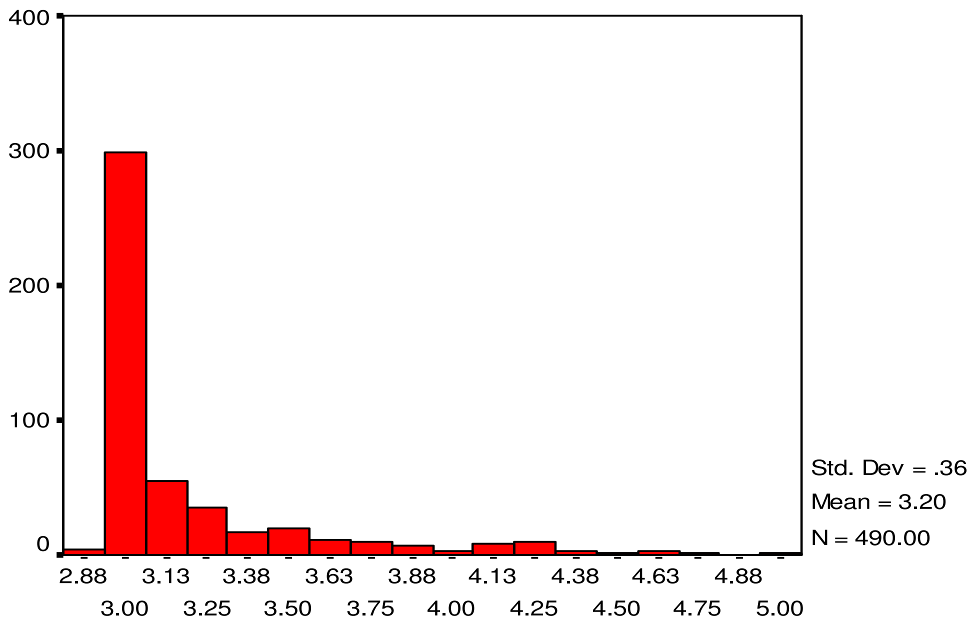

Figure 2. Distribution of IQCODE scores.

reporting an improvement in cognitive abilities was categorized in the "no change" group. Based off the groupings of the outcome variable, it was determined that the most appropriate statistical method to test the association between the metacognition questionnaire and IQCODE scores was logistic regression.

Logistic regression analysis showed that within the demographic variables used in this study, higher levels of education significantly predicted the "no change" IQCODE group outcome (OR = .864, CI(95) = .79, .95, p = .002), higher GMHR scores significantly predicted the "no change" IQCODE group outcome, (OR = .49, CI(95) = .32, .75, p = .001), and higher age at baseline visit significantly predicted the "worse" IQCODE group outcome (OR = 1.093, CI(95) = 1.05, 1.14, p < .001). IQCODE relationship to the subject (i.e., spouse, child) did not significantly predict IQCODE group outcome (OR = 1.302, CI(95) = .91, 1.87, p = .15), when using "other" (grandchild, neighbor) group as a comparison group.

Logistic Regression: Metacognition Score and IQCODE

Results of the logistic model with the metacognition questionnaire as the predictor demonstrated that higher metacognition scores (declining functioning) significantly predicted IQCODE group membership in the direction of declining abilities (OR = 2.66, CI(95) = 1.331, 5.31, $p = .006$). This remained significant with the addition of the demographic variables. In addition, lower GMHR scores (poorer health) predicting group membership in the direction of worsening abilities (OR = .49, CI(95) .32, .75, $p = .001$), older individuals significantly predicting group membership in the direction of worsening abilities, (OR = 1.09, CI(95) = 1.05, 1.14, $p < .001$), and lower levels of education significantly predicting group membership in the direction of worsening abilities (OR = .86, CI(95) = .79, .95, $p = .002$). Gender and IQCODE informant relationship to the subject did not have an effect on IQCODE group membership and, therefore, was left out of the final model. Results of the final model using all demographic variables and the complete metacognition score are shown in Table 15. To examine whether the items in the metacognition questionnaire more strongly predicted the IQCODE items on which they were based, I repeated the above analyses only restricting the IQCODE items to the four similar items of the metacognition questionnaire. The results were largely similar to that of the entire IQCODE analysis ("worse" group; OR = 2.21, CI(95) = 1.14, 4.27, $p = .018$).

Table 15

Logistic Regression: Final Model Using Metacognition Score and All Demographics

Item		*B*	S.E.	Wald	*df*	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1	Metacognition score	.892	.369	5.847	1	.016	2.440	1.184	5.028
	Subject education	-.118	.051	5.292	1	.021	.889	.804	.983
	Subject age	.074	.020	13.765	1	.000	1.076	1.035	1.119
	GMHR score	-.555	.226	6.037	1	.014	.574	.369	.894
	Constant	-8.185	2.395	11.676	1	.001	.000		

Note. Predicted model accurately classified 85% of the participants into the no change and declining groups.

Logistic Regression: Cognitive Domain and IQCODE

To examine the relationship between the metacognition cognitive domain scores and IQCODE group membership, I ran a logistic regression model with the cognitive mean score as the predictor variable with the dichotomous IQCODE groups as the outcome. Results showed that higher cognitive domain scores was not a significant predictor of IQCODE group membership ("worse" group; OR = 1.78, CI(95) = .881, 2.28, $p = .125$). The final model using all demographic variables in the analysis is presented in Table 16. Age, education, and GMHR score all significantly predicted IQCODE group membership, with the strongest predictor being age. Neither gender nor IQCODE informant relationship to subject significantly predicted IQCODE group membership.

I also repeated the above analyses restricting the IQCODE items that were most similar in content to that of the metacognition questionnaire. This revealed that the cognitive domain did significantly predict IQCODE group membership when using only

Table 16

Logistic Regression: Final Model Using Cognitive Domain and All Demographics

Item		*B*	S.E.	Wald	*df*	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1	Cognitive domain mean	.518	.305	2.889	1	.089	1.679	.924	3.051
	Subject education	-.119	.052	5.229	1	.022	.888	.801	.983
	Subject age	.078	.021	13.958	1	.000	1.081	1.038	1.127
	GMHR score	-.564	.235	5.758	1	.016	.569	.359	.902
	Constant	-7.146	2.423	8.699	1	.003	.001		

Note. Predicted model accurately classified 87% of the participants into the no change and declining groups.

the four IQCODE questions used in the metacognition questionnaire ("worse" group; OR = 1.84, CI(95) = 1.08, 3.13, $p = .025$). In addition, the above analysis was also repeated using the factor score from the cognitive domain as the predictor variable along with all covariates. The results of this analysis were largely consistent with the above results, and cognitive factor score did not predict IQCODE group membership (OR = 1.086, CI(95) = .84, 1.41, $p = .533$).

Logistic Regression: Functional Domain and IQCODE

To examine the relationship between the functional domain and the IQCODE, I ran a logistic regression between the mean of the three functional items and the IQCODE. In bivariate models, higher functional mean scores significantly predicted IQCODE group membership ("worse" group; OR = 4.38, CI(95) = 2.22, 8.66, $p = < .001$). When adding the demographic variables, the functional domain remained a significant predictor of IQCODE group membership, and, in the final model, the functional domain was the most significant predictor among the other variables examined (see Wald statistics below). Also, GMHR score and education also significantly predicted IQCODE group membership, with higher GMHR scores (indicating better health) and higher levels of education significantly predicted IQCODE group in the direction of "no change." Gender and IQCODE informant relationship to the subject were again not significant predictors of IQCODDE membership and were therefore left out of the final model. The results from the final model are listed in Table 17.

When the above analysis was restricted to using only the mean of the four IQCODE questions most closely resembling the metacognition items, the functional domain also significantly predicted IQCODE group membership ("worse" group; OR = 2.22, CI(95) = 1.12, 4.38, $p = .022$). I also replaced the functional domain score with the functional factor score and ran a similar analysis. The results of this analysis was similar to the results reported above, in that the factor scores for the functional domain significantly predicted IQCODE group membership ("worse" group; OR = 1.532, CI(95) = 1.23, 1.91, $p = < .001$).

Summary of Construct Validity Analyses Among Entire CCSMHA Sample

In summary, the results of multiple and logistic regression analyses demonstrate that the functional domain score significantly predicted both 3MS delta scores and IQCODE group membership, and that the full metacognition score predicted only IQCODE group membership and not 3MS delta scores. A summary of the primary results is presented in Table 18.

Table 17

Logistic Regression: Functional Domain Mean and All Demographics

Item		*B*	S.E.	Wald	*df*	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1	Functional domain	1.416	.374	14.327	1	.000	4.119	1.979	8.574
	Subject education	-.131	.053	6.069	1	.014	.877	.790	.974
	Subject age	.074	.021	11.967	1	.001	1.076	1.032	1.122
	GMHR score	-.465	.240	3.759	1	.053	.628	.392	1.005
	Constant	-9.796	2.543	14.836	1	.000	.000		

Note. Predicted model accurately classified 86% of the participants into the no change and declining groups.

Table 18

Summary Table of Final Model Results

Variable	Significant predictor	
	Yes	No
Outcome: Changes in 3MS scores		
Entire metacognition questionnaire		√ $p = .136$
Metacognition – cognitive domain		√ $p = .411$
Metacognition – functional domain	√ $p = .009$	
Outcome: Informant ratings on IQCODE		
Entire metacognition questionnaire	√ $p = .016$	
Metacognition – cognitive domain		√ $p = .089$
Metacognition – functional domain	√ $p < .001$	
Outcome: IQCODE based on four items		
Entire metacognition questionnaire	√ $p = .018$	
Metacognition – cognitive domain	√ $p = .025$	
Metacognition – functional domain	√ $p = .022$	

Construct Validity: Relationship Between Metacognition and 3MS Delta Scores with No-Dementia and Dementia Subgroups

In this final section, I repeated the series of analyses examining metacognition and 3MS and IQCODE scores separately for participants with and without dementia. It was hypothesized that the associations between subject metacognition scores and 3MS delta and IQCODE scores would be higher among individuals without dementia than individuals with dementia. Before these analyses were conducted, however, simple descriptive analyses were conducted on the no-dementia and dementia subgroups. Table 19 provides descriptive data on these two groups.

Individuals without dementia versus those with dementia did not differ in education ($T = -1.07$, $p = .285$, $df = 684$). Individuals with dementia were significantly

Table 19

Sample Characteristics: No Dementia and Dementia Subgroups

	No dementia				Dementia			
Sample characteristics	Number	%	Mean	*SD*	Number	%	Mean	*SD*
Gender								
Male	241	45.0			53	34.9		
Female	294	55.0			99	61.1		
Years of education	534		13.31	3.0	152		13.01	3.0
Subject age at clinical assessment	535		80.88**	7.1	152		83.83**	6.2
3MS delta score	530		1.63**	6.2	137		12.91**	9.1
Education/sensory adjusted 3MS score	534		90.58**	5.4	146		82.96**	7.7
GMHR score	535		3.03**	.6	152		2.8**	.6

** *p* value < .01.

Older ($T = 4.976$, $p < 0.01$, $df = 273.62$; equal variances not assumed), were rated with poorer health (lower GMHR scores; ($T = -4.047$, $p < .001$, $df = 228.7$; equal variances not assumed), had lower baseline 3MS score ($T = -11.28$, $p < .001$, $df = 186.2$; equal variances not assumed), and higher 3MS delta scores ($T = 13.5$, $p < .001$, $df = 168.6$; equal variances not assumed) than individuals without dementia. Chi-square analyses demonstrated that there were significantly more females in each of these groups than males, χ^2 (1, $N = 687$, 5.01, $p = .025$).

Individuals with dementia consisted of those diagnosed with possible or probable AD, AD with other type of dementia, AD with vascular dementia, vascular dementia, and other dementia (such as Parkinson's Disease, Huntington's Disease, Lewy Body Dementia). The majority of the dementia cases were AD cases, however, there were also a significant number of Vascular Dementia ($n = 19$, 12.5 %) and Other ($n = 30$, 19.7 %) dementia cases as well. Table 20 lists the different forms of dementia and their frequency in the dementia subgroup studied within this project.

Table 20

Dementia Subgroup by Dementia Type

Dementia type		Frequency	Percent	Valid percent	Cumulative percent
Valid	Possible/probable AD	89	58.6	58.6	58.6
	Alzheimer's disease with other dementia	5	3.3	3.3	61.8
	AD-vascular dementia	9	5.9	5.9	67.8
	Vascular dementia	19	12.5	12.5	80.3
	Other types of dementia	30	19.7	19.7	100.0
	Total	152	100.0	100.0	

Exploratory correlation coefficients were conducted using the metacognition mean score and the 3MS delta score for the different dementia and no-dementia subgroups to examine whether there were any significant changes in the strength of the correlations between the two groups. Tables 21 and 22 present these results.

Inspection of the two tables shows that metacognition scores were significantly correlated with 3MS delta scores only among the no-dementia subgroup. Although the strength of the relationship was relatively weak, the positive relationship between metacognition scores and 3MS delta scores in the no-dementia subgroup suggests that the perception of declining cognition was associated with cognitive decline on the 3MS. By contrast, in participants with dementia, the correlation did not attain the traditional levels of significance of 0.05 ($p = .056$). Even so, there was an inverse relationship in this subgroup. The negative relationship between the metacognition questionnaire and 3MS delta scores demonstrates that the perception of worsening cognition was associated with *less* decline on the 3MS. This inverse relationship is considered an inaccurate evaluation of personal performance, or poor self-awareness.

Correlation coefficients were also calculated between the different metacognition domain mean scores (cognitive and functional) and 3MS delta scores for the different no-dementia and dementia subgroups. As displayed in the tables below, there were significant correlations between the 3MS delta scores and metacognition functional and cognitive mean scores in the no-dementia subgroup ($r = 0.105$ and 0.102, respectively, $n = 521$, $p < .05$). In the dementia subgroup, there was a significant inverse relationship between the 3MS delta score and the cognitive ($r = -0.21$, $n = 122$, $p < .05$), but not

Table 21

No Dementia Correlations

Item	Correlation	Subject education	Subject age	Mean of metacognition questionnaire	GMHR Score	3MS baseline score	3MS delta score
Subject education	Pearson correlation	1	-.191**	.007	.089*	.083	-.166**
	Sig. (2-tailed)	.	.000	.874	.040	.057	.000
	N	534	534	534	534	530	529
Subject age	Pearson correlation	-.191**	1	.094*	-.109*	-.277**	.101*
	Sig. (2-tailed)	.000	.	.029	.012	.000	.020
	N	534	535	535	535	531	530
Mean of metacognition questionnaire	Pearson correlation	.007	.094*	1	-.157**	-.142**	.117**
	Sig. (2-tailed)	.874	.029	.	.000	.001	.007
	N	534	535	535	535	531	530
GMHR score	Pearson correlation	.089*	-.109*	-.157**	1	.171**	-.183**
	Sig. (2-tailed)	.040	.012	.000	.	.000	.000
	N	534	535	535	535	531	530
3MS Delta score	Pearson correlation	-.166**	.101*	.117**	-.183**	-.662**	1
	Sig. (2-tailed)	.000	.020	.007	.000	.000	.
	N	529	530	530	530	530	530

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 22

Dementia Correlations

Item	Correlation	Subject education	Subject age	Mean of metacognition questionnaire	GMHR score	3MS baseline score	3MS delta score
Subject education	Pearson correlation	1	-.208*	.147	.045	.031	-.133
	Sig. (2-tailed)	.	.010	.071	.581	.709	.122
	N	152	152	152	152	146	137
Subject age	Pearson correlation	-.208*	1	-.045	.024	-.172*	.096
	Sig. (2-tailed)	.010	.	.578	.771	.038	.266
	N	152	152	152	152	146	137
Mean of metacognition questionnaire	Pearson correlation	.147	-.045	1	.071	-.049	-.164
	Sig. (2-tailed)	.071	.578	.	.384	.553	.056
	N	152	152	152	152	146	137
GMHR score	Pearson correlation	.045	.024	.071	1	-.049	-.030
	Sig. (2-tailed)	.581	.771	.384	.	.559	.727
	N	152	152	152	152	146	137
3MS delta score	Pearson correlation	-.133	.096	-.164	-.030	.119	1
	Sig. (2-tailed)	.122	.266	.056	.727	.167	.
	N	137	137	137	137	137	137

* Correlation is significant at the 0.05 level (2-tailed).

functional (r = -.054, n = 122, p > .05) domain. Again, this negative relationship in those with dementia presents an inaccurate self-perception of changes in cognitive ability. Tables 23 and 24 present these results.

For each of the analyses to follow, I will first present the results for the no-dementia subgroup, followed by the dementia subgroup.

Multiple Regression: Metacognition and 3MS Delta, No-Dementia and Dementia Subgroups

Multiple regression analyses within the no-dementia subgroup indicated the metacognition score significantly predicted 3MS delta scores (T = 2.718, p = .007). The metacognition score remained significant with the addition of all demographic variables. The strongest predictor of 3MS delta scores in the final model within the no-dementia subgroup was level of education. By contrast, in the analysis restricted only to those with dementia, the metacognition questionnaire did not significantly predict 3MS delta scores (T = -1.929, p = .056). None of the demographic variables that previously attained traditional levels of significance did so in the final model. In fact, variables that previously had been strong predictors of the outcome variable, such as GMHR score and education, were very weak predictors in this model (T = -.247, p = .805, and T = -.870, p = .386, respectively). The results of the final model for the no-dementia subgroup only are presented in Table 25 on page 75.

Table 23

No Dementia Correlation Table

Item	Correlation	Subject education	Subject age	Mean of 4 cognitive items	Mean of 3 functional items	GMHR score	3MS:Delta score
Subject education	Pearson correlation	1	-.188**	.030	-.025	.085	-.168**
	Sig. (2-tailed)	.	.000	.495	.564	.051	.000
	N	525	525	525	525	525	520
Subject age	Pearson correlation	-.188**	1	.048	.113**	-.102*	.105*
	Sig. (2-tailed)	.000	.	.270	.010	.019	.017
	N	525	526	526	526	526	521
Mean of 4 cognitive items	Pearson correlation	.030	.048	1	.415**	-.108*	.102*
	Sig. (2-tailed)	.495	.270	.	.000	.013	.020
	N	525	526	526	526	526	521
Mean of 3 functional items	Pearson correlation	-.025	.113**	.415**	1	-.147**	.105*
	Sig. (2-tailed)	.564	.010	.000	.	.001	.016
	N	525	526	526	526	526	521
GMHR score	Pearson correlation	.085	-.102*	-.108*	-.147**	1	-.168**
	Sig. (2-tailed)	.051	.019	.013	.001	.	.000
	N	525	526	526	526	526	521
3MS delta score	Pearson correlation	-.168**	.105*	.102*	.105*	-.168**	1
	Sig. (2-tailed)	.000	.017	.020	.016	.000	.
	N	520	521	521	521	521	521

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 24

Dementia Correlation Table

Item	Correlation	Subject education	Subject age	Mean of 4 cognitive items	Mean of 3 functional items	GMHR Score	3MS delta score
Subject education	Pearson correlation	1	-.300**	.137	.100	.008	-.152
	Sig. (2-tailed)	.	.001	.123	.259	.930	.096
	N	129	129	129	129	129	122
Subject age	Pearson correlation	-.300**	1	-.169	-.101	-.022	.067
	Sig. (2-tailed)	.001	.	.056	.255	.806	.461
	N	129	129	129	129	129	122
Mean of 4 cognitive items	Pearson correlation	.137	-.169	1	.374**	.169	-.201*
	Sig. (2-tailed)	.123	.056	.	.000	.056	.026
	N	129	129	129	129	129	122
Mean of 3 functional items	Pearson correlation	.100	-.101	.374**	1	-.008	-.054
	Sig. (2-tailed)	.259	.255	.000	.	.930	.555
	N	129	129	129	129	129	122
GMHR Score	Pearson correlation	.008	-.022	.169	-.008	1	-.057
	Sig. (2-tailed)	.930	.806	.056	.930	.	.533
	N	129	129	129	129	129	122
3MS Delta score	Pearson correlation	-.152	.067	-.201*	-.054	-.057	1
	Sig. (2-tailed)	.096	.461	.026	.555	.533	.
	N	122	122	122	122	122	122

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 25

Final Model Results No Dementia

Model for no-dementia subgroup	Unstandardized coefficients B	Unstandardized coefficients Std. Error	Standardized coefficients Beta	*T*	Sig.
(Constant)	1.659	4.605		.360	.719
Mean of metacognition items	1.767	.799	.095	2.212	.027
Subject education	-.312	.091	-.150	-3.432	.001
Subject age	.041	.038	.048	1.105	.270
GMHR score	-1.516	.447	-.146	-3.387	.001

Note. R = .260, R^2 = .068, Adjusted R^2 = .059, Standard error of the estimate = 5.983.

Multiple Regression: Cognitive Domain and 3MS Delta, No-Dementia and Dementia Subgroups

In these analyses, I regressed the 3MS delta score on the cognitive domain score in those with and without dementia. For participants without dementia, the cognitive domain significantly predicted 3MS delta scores (T = 2.33, p = .02), and remained significant with the inclusion of covariates. For the dementia subgroup, cognitive domain scores were inversely related to 3MS delta scores (T = -2.247, p = .026). These results became nonsignificant with the addition of covariates. The results of the final model for the no-dementia and dementia subgroups are presented in Table 26.

The above analyses were repeated using the factor scores from the cognitive domain as the predictor variable along with all covariates. In participants without dementia, the factor score for the cognitive domain did not significantly predict 3MS delta scores (T = 1.85, CI(95) = -.030, 1.03, p = .064). In the subgroup with dementia, the results were similar to those reported using the crude mean cognitive score, an inverse relationship between cognitive domain and 3MS delta scores (*T*= -1.964, CI(95) = -2.99, .012, *p* = .052).

Multiple Regression: Functional Domain and 3MS Delta, Within the No-Dementia and Dementia Subgroups

Separate regression analyses were conducted using the mean score of the functional items from the CCSMHA metacognition questionnaire for both the no-dementia and dementia subgroups. Within the no-dementia subgroup, the functional domain significantly predicted 3MS delta scores (*T* = 2.409, *p* = .016). With the inclusion of the covariates, the level of significance for the metacognition questionnaire dropped to marginal (*T* = 1.894, *p* = .059 [no-dementia]). Within the no-dementia

Table 26

Final Model, Cognitive Domain, and 3MS Delta, No-Dementia and Dementia Subgroups

		Unstandardized coefficients		Standardized coefficients		
Subgroup	Model	*B*	Std. Error	Beta	*T*	*Sig.*
No-dementia	(Constant)	2.163	4.321		.501	.617
	Mean of 4 cognitive items	1.232	.585	.091	2.107	.036
	Subject education	-.314	.091	-.152	-3.450	.001
	Subject age	.050	.037	.058	1.326	.185
	GMHR score	-1.414	.448	-.137	-3.157	.002
Dementia	(Constant)	25.791	15.259		1.690	.094
	Mean of 4 cognitive items	-3.074	1.662	-.171	-1.849	.067
	Subject education	-.310	.282	-.104	-1.098	.274
	Subject age	-.024	.144	-.016	-.167	.867
	GMHR score	-.378	1.257	-.027	-.300	.764

Note. No dementia subgroup: R = .252, R^2 = .063, Adjusted R^2 = .054, Standard error of the estimate = 5.946. Dementia subgroup: R = .274, R^2 = .075, Adjusted R^2 = .035, Standard error of the estimate = 9.002.

subgroup, only education and GMHR score significantly predicted 3MS delta scores. Within the dementia subgroup, the functional domain did not significantly predict 3MS delta scores (*T* = -.59, *p* = .555). This result did not substantially change with the inclusion of the demographic variables (*T* = -.151, *p* = .880 [dementia]). In fact, within the dementia subgroup, none of the covariates significantly predicted 3MS delta scores. The results for the no-dementia subgroup only are presented in Table 27.

I repeated the above regression models substituting the functional factor score from factor analysis for the functional mean domain as the predictor variable, and subsequently tested the covariates. Similar to the results reported above, the functional factor score did not significantly predict 3MS delta scores in either the no-dementia or dementia subgroups (*T* = 1.58, CI(95) = -.121, 1.13, *p* = .114; *T* = .193, CI(95) = -1.026, 1.247, *p* = .847, respectively).

Table 27

Final Model, Functional Domain and 3MS Delta, Within the No-Dementia Subgroups

	Unstandardized coefficients		Standardized coefficients		
Model for no-dementia subgroup	*B*	Std. Error	*B*	*T*	Sig.
(Constant)	1.048	4.741		.221	.825
Mean of 3 functional items	1.748	.923	.082	1.894	.059
Subject education	-.307	.091	-.148	-3.367	.001
Subject age	.046	.038	.054	1.225	.221
GMHR score	-1.393	.450	-.135	-3.094	.002

Note. R = .249, R^2 = .062, Adjusted R^2 = .053, Standard error of the estimate = 5.951 (no-dementia subgroup).

Construct Validity: Relationship Between Metacognition and IQCODE Scores with No-Dementia and Dementia Subgroups

Separate regression analyses were conducted with the no-dementia and dementia subgroups using the IQCODE as the criterion variable, and subsequently testing covariates. In the subjects without dementia, results of logistic regression showed that the higher metacognition scores significantly predicted IQCODE group membership in the direction of worsening abilities (OR = 4.44, CI(95) = 1.33, 14.77, $p = .015$). With the inclusion of the demographic variables, the metacognition score remained a significant predictor of IQCODE groups. IQCODE relationship to the subject (i.e., spouse, child) did not significantly predict IQCODE group outcome in either the no-dementia (OR = 1.01, CI(95) = .52, 2.00, $p = .974$) or dementia subgroup (OR = 1.05, CI(95) = .48, 2.27, $p = .91$) when using “other” (grandchild, neighbor) group as a comparison group.

Among those with dementia, logistic regression analysis showed that the metacognition score did not significantly predict IQCODE groups (“worse” group; OR = 1.21, CI(95) = .416, 3.5, $p = .729$), and remained nonsignificant with the inclusion of the demographic covariates. In fact, within the subgroup with dementia, none of the independent variables significantly predicted IQCODE groups. In neither the no-dementia nor dementia subgroup did gender or IQCODE informant relationship to the subject significantly predict IQCODE membership. The results of the final model for the no-dementia subgroup are presented in Table 28. The final model results from the

Table 28

Final Model Results, Logistic Regression, and IQCODE Scores

Final model	*B*	S.E.	Wald	*Df*	Sig.	Exp(B)	95.0% C.I. for EXP(B) Lower	Upper
Metacognition	1.386	.634	4.789	1	.029	4.000	1.156	13.846
Subject education	-.142	.085	2.798	1	.094	.868	.735	1.025
Subject age	.079	.035	5.168	1	.023	1.083	1.011	1.159
GMHR score	-.462	.419	1.221	1	.269	.630	.277	1.430
Constant	-9.954	4.179	5.672	1	.017	.000		

Note. Predicted model accurately classified 95% of the participants into the no change and declining groups.

dementia subgroup are not shown, as none of the independent variables were significant predictors of IQCODE group.

I also repeated the above analyses with only the IQCODE items that were incorporated into the metacognition questionnaire. Here, the metacognition score did not significantly predict IQCODE group membership using these four questions, within either the no-dementia subgroup ("worse" group; OR = 1.92, CI(95) = .71, 5.17, $p = .2$), or the dementia subgroup ("worse" group; OR = 1.75, CI(95) = .53, 5.78, $p = .36$).

Logistic Regression: Cognitive Domain and IQCODE Groups,

Within the No-Dementia and Dementia Subgroups

To examine whether the cognitive domain of the metacognition questionnaire predicted IQCODE group membership, I used the cognitive domain mean as the predictor variable and IQCODE groups as the dependent variable for those with and without dementia. For those without dementia, the cognitive domain mean did not significantly predict IQCODE groups ("worse" group; OR = 2.17, CI(95) = .779, 6.044, p = .138). The results were largely the same when adding demographic variables in the model. Only subject age significantly predicted IQCODE groups, with increases in age significantly predicting "worse" IQCODE group membership. Within the dementia subgroup, logistic regression analysis also revealed that the cognitive domain mean did not significantly predict IQCODE membership ("worse" group; OR = 1.38, CI(95) = .557, 3.416, p = .486). These results did not change when testing covariates. None of the demographic variables or IQCODE informant relationship to the subject significantly predicted IQCODE membership. The results of the final model for the no-dementia subgroup only are displayed in Table 29.

In an analysis restricting the IQCODE to only the four items reflected in the metacognition questionnaire, I found results similar to those with the full IQCODE, in that the cognitive domain mean did not significantly predict IQCODE group membership

Table 29

Final Model Results, Cognitive Domain Mean and IQCODE Scores

							95.0% C.I. for EXP(B)	
Final model	*B*	S.E.	Wald	*df*	Sig.	Exp(B)	Lower	*B*
Cognitive domain mean	.827	.531	2.426	1	.119	2.286	.808	6.470
Subject education	-.132	.083	2.532	1	.112	.876	.744	1.031
Subject age	.083	.035	5.813	1	.016	1.087	1.016	1.163
GMHR score	-.579	.419	1.910	1	.167	.561	.247	1.274
Constant	-8.262	4.035	4.193	1	.041	.000		

*Predicted model accurately classified 95% of the participants into the no change and declining groups.

in either the no-dementia ("worse" group; OR = 1.8, CI(95) = .83, 3.92, p = .137) or dementia subgroup ("worse" group; OR = 2.02, CI(95) = .73, 5.6, p = .179). The results using the factor score from the cognitive domain also revealed that the cognitive domain did not significantly predict IQCODE group membership within the no-dementia ("worse" group; OR = 1.28, CI(95) = .778, 2.117, p = .328) and dementia subgroups ("worse" group; OR = 1.20, CI(95) = .792, 1.82, p = .388).

Logistic Regression: Functional Domain and IQCODE Groups,
Within the No-Dementia and Dementia Subgroups

Logistic regression within the no-dementia subgroups demonstrated that the functional domain mean significantly predicted IQCODE group membership ("worse" group; OR = 6.22, CI(95) = 2.08, 18.57, p = .001). With the inclusion of the demographic variables, the functional domain remained a significant predictor of IQCODE group membership. Age was a significant predictor of IQCODE group membership, although not to the extent of functional domain scores (see Wald statistic in Table 30).

Within the dementia subgroup, a logistic regression analysis showed that the functional mean did not significantly predict IQCODE group membership ("worse" group; OR = 1.75, CI(95) = .56, 5.45, p = .335). As with other analyses within the dementia subgroup, none of the covariates significantly predicted IQCODE group membership. Gender and IQCODE informant relationship to the subject did not significantly IQCODE membership. The results of the final model for the no-dementia subgroup only are presented below in Table 30.

Table 30

Final Model Results, Functional Domain Mean and IQCODE Scores

							95.0% C.I. for EXP(B)	
Final model	*B*	S.E.	Wald	*df*	Sig.	Exp(B)	Lower	*B*
Functional mean	1.577	.587	7.226	1	.007	4.839	1.533	15.277
Subject education	-.143	.084	2.917	1	.088	.867	.736	1.021
Subject age	.073	.035	4.262	1	.039	1.076	1.004	1.153
GMHR score	-.467	.420	1.239	1	.266	.627	.275	1.427
Constant	-9.916	4.065	5.951	1	.015	.000		

Note. Predicted model accurately classified 95% of the participants into the no change and declining groups.

When using the four matching IQCODE questions in the outcome variable, the functional domain score did not significantly predict IQCODE group membership in either the no-dementia ("worse" group; OR = 1.51, CI(95) = .534, 4.29, $p = .44$) or dementia subgroups ("worse" group; OR = 1.26, CI(95) = .39, 4.09, $p = .705$). The above analysis was also conducted using the factor score from the functional domain as the predictor variable along with all covariates. The results of this analysis revealed that higher factor scores for the functional domain significantly predicted IQCODE group membership in the direction of worsening abilities ("worse" group; OR = 1.73, CI(95) = 1.180, 2.531, $p = .005$) within the no-dementia subgroup but not within the dementia subgroup ("worse" group; OR = 1.284, CI(95) = .88, 1.878, $p = .198$).

Summary of Construct Validity Analyses Conducted Separately for No-Dementia and Dementia Subgroups

In summary, the results of multiple and logistic regression analyses suggested that the metacognition questionnaire was, overall, a significant predictor of outcome variables within the no-dementia subgroup but not within the dementia subgroup. Table 31 provides a summary of the primary results from the no-dementia subgroup, while Table 32 provides a summary of the primary results from the dementia subgroup.

Table 31

Summary Table for No-Dementia Subgroup

	Significant predictor: No-dementia group	
Variable	Yes	No
Outcome: Changes in 3MS scores		
Entire metacognition questionnaire	√ p = .027	
Metacognition – cognitive domain	√ p = .036[a]	
Metacognition – functional domain	trend, p = 0.059	
Outcome: Informant ratings on IQCODE		
Entire metacognition questionnaire	√ p = .029	
Metacognition – cognitive domain		√ p = .119
Metacognition – functional domain	√ p = .007	
Outcome: IQCODE based on four items		
Entire metacognition questionnaire		√ p = .20
Metacognition – cognitive domain		√ p = .137
Metacognition – functional domain		√ p = .440

[a] Results with factor scores were not significant.

Table 32

Summary Table for Dementia Subgroup

	Significant predictor: Dementia group	
Variable	Yes	No
Outcome: Changes in 3MS scores		
Entire metacognition questionnaire	Trend, $p = 0.056$[a]	
Metacognition – cognitive domain	Trend, $p = 0.067$[a]	
Metacognition – functional domain		√ $p = .880$
Outcome: Informant ratings on IQCODE		
Entire metacognition questionnaire		√ $p = .729$
Metacognition – cognitive domain		√ $p = .486$
Metacognition – functional domain		√ $p = .335$
Outcome: IQCODE based on four items		
Entire metacognition questionnaire		√ $p = .360$
Metacognition – cognitive domain		√ $p = .179$
Metacognition – functional domain		√ $p = .705$

[a] In the opposite direction as the results obtained in the no-dementia subgroup.

CHAPTER V

DISCUSSION

In this study, I examined the reliability and validity of the CCSMHA metacognition questionnaire. Specifically, I sought to answer two main research questions:

1. Does the CCSMHA metacognition scale have acceptable rates of reliability and validity?

2. As evidence of construct validity, are metacognitive judgments less accurate in demented versus nondemented participants?

The discussion that follows includes a summary of the results and an interpretation of the findings for each research question. In addition, the strengths and limitations of the current project, as well as directions for future research, are discussed.

Previous research suggests that brief forms of metacognition and unawareness questionnaires may be as reliable as their longer and more complex parent forms (Gilewski et al., 1990; Troyer & Rich, 2002). The results of this project demonstrate that the CCSMHA metacognition questionnaire attained moderate levels of internal consistency according to traditional standards ($r = .75$). This overall level may, however, be considered a relatively good level of internal consistency for such a small number of items. One factor that contributes to higher estimates of internal consistency of an instrument is the number of items used, with smaller numbers of test items usually leading to smaller Cronbach reliability coefficients (Sattler, 2001). Curtailed versions of other forms of metacognitive questionnaires still consist of a relatively large number of items, and investigators report higher levels of reliability than those obtained in this study. For example, Gilewski and colleagues used factor analysis to examine the dimensions of their questionnaire, and discovered four different factors. Internal consistency coefficients of each factor were .94, .94, .89, and .83. The instrument, although reduced from 92 questions to 64, still consisted of a much larger number of questions than the seven used in the CCSMHA questionnaire. With only seven items in the CCSMHA metacognition questionnaire, achieving high levels of internal consistency estimates was more challenging.

Based on principal components factor analysis discussed later, two factors were identified in the metacognition questionnaire, one cognitive and one functional. Different levels of internal consistency estimates were obtained for the two factors. For the four cognitive questions within the CCSMHA questionnaire, moderate rates of reliability were obtained ($r = .76$). Internal reliability coefficients, however, for the three functional questions were much lower, and suggested poor internal consistency ($r = .58$). In view of these results, it was surprising that the reliability coefficient was not higher for the four cognitive questions, as the reliability coefficient for all seven items was .75, and was likely reduced by the lower reliability of the functional items.

One main reason for the difference between the level of cognitive and functional reliability coefficients may be due to the nature of the questions being asked. For example, decline in certain activities may have been the result of auditory, tactile, visual, or other physical disability rather than a loss of cognitive ability. As shown in Appendix H of this project, the three functional questions were answered at lower rates than the cognitive questions, which may indicate some degree of uncertainty among those who skipped these items. For those who did respond, the possible ambiguity may have led some individuals to "guess" in their answers, such that the specific construct of functional ability was not being addressed. Research has also shown that instruments with homogenous items tend to have higher levels of internal consistency than instruments with less homogenous items (Anastasi & Urbina, 1997). It certainly can be argued that the cognitive items in the questionnaire are more similar with each other than the functional items, as the functional items appear less homogeneous in content than the cognitive items.

To examine the validity of the CCSMHA metacognition questionnaire, factor analysis was conducted on the questionnaire along with Pearson's correlation coefficients between each of the seven items. As expected, each of the seven items was positively correlated one with another. This would be the expected direction of the relationship between each item, as it is most likely that individuals who rated themselves more negatively (or positively) in one area would likely also rate themselves in the same direction in another area. The strength of these associations, however, depended on which items were correlated. As evident from the results of this project, the cognitive items from the questionnaire were more strongly associated with each other than with the functional items and vice versa (i.e., the functional items were more strongly correlated with each other than with the cognitive items). This also was to be expected as some questions such as 1 (Remembering recent events, appointments, etc.) and 7 (Memory now compared to 3 years ago) are much more related to one another than other questions such as 2 (Remembering the names and faces of friends and relatives) and 6 (Keeping up with household chores, hobbies, etc.). These raw associations were upheld in principal components analysis, which revealed two domains within the questionnaire. Based on the item loadings, the first domain was defined as the cognitive domain, and the second domain as the functional domain. These results were anticipated based on the items' face validity and the instrument from which they were adapted, which represented items with both cognitive and functional content (Jorm, 2004).

In examining other aspects of the instrument's validity, within the overall CCSMHA subsample, regression analyses showed that the metacognition questionnaire was a significant predictor of 3MS delta scores and IQCODE scores. The analyses conducted with the 3MS delta score as the outcome variable, however, only showed that the questionnaire was a significant predictor without all covariates. In modeling the metacognition questionnaire along with the covariates, the metacognition questionnaire no longer predicted 3MS delta scores. This apparently was due to the high amount of variance explained by GMHR scores, which was the strongest predictor of 3MS delta scores, but also related to the metacognition scores. There are several reasons to suggest why GMHR scores may have been related to both 3MS delta scores and metacognition scores. For instance, research has shown that having a serious medical illness can negatively impact one's cognitive ability (Gunther, Jackson, & Wesley, 2007), which may be accurately reported in metacognitive judgments. In addition, having a serious medical illness may lead to feelings of depression, which can also negatively affect cognitive ability. Depression may also lead an individual to view oneself with a negative self-perception, and therefore may have a distorted view of self, which would negatively affect metacognition scores. The association between metacognition scores and the IQCODE, however, were not confounded by the inclusion of all covariates within the model, even GMHR scores. Thus, metacognitive judgments independently predicted IQCODE ratings, even when controlling for current health status. The differences in results obtained with the two different outcomes (3MS vs. IQCODE) are considered to be a result of the limited range of IQCODE scores within the study. Such differences could also be the result of informant reports factoring out the effects of poor health whereas cognitive scores on the 3MS amenable to such adjustments.

When dividing the metacognition questionnaire into functional and cognitive domains, the functional domain was the only significant predictor of 3MS delta scores and IQCODE group membership while the cognitive domain was not. The functional domain score remained significant in predicting both outcomes even with the inclusion of the demographic variables. Although it is uncertain why the functional domain significantly predicted 3MS delta scores while the cognitive domain did not, there may be several reasons to explain this finding. One model of unawareness focuses on the social and cultural contexts that impact an individual's acceptance of cognitive or memory changes. Currently there is a social stigma and lack of cultural acceptability towards memory and cognitive loss in the elderly. This has been shown to lead individuals to repress memory or cognitive deficits in order to avoid experiencing pain (Weinstein et al., 1994). A denial of cognitive symptoms could potentially have a greater negative impact on the relationship between the mean score for the cognitive items in the questionnaire and 3MS delta scores (or informant functional ratings), thus weakening any statistical association between the two variables. Arguably, the functional items, which focus more attention on specific physical abilities as opposed to the cognitive items, which focus more attention on cognitive abilities, may be less vulnerable to the influence of social stigma associated with cognitive loss.

Alternatively, another reason for the discrepant findings between cognitive and functional metacognition domain scores may be due to the opposite phenomenon explained above, an exaggeration of report of memory symptoms, as opposed to a denial of symptoms. In the last few years, research has demonstrated that rates of AD and other forms of dementia are increasing at alarming rates (Herbert, Scherr, Bienias, Bennett, & Evan, 2003). This has led to a heightened cultural sensitivity and awareness regarding these illnesses, and also regarding memory and cognitive abilities within the elderly in general. Because of this heightened sensitivity, some elderly individuals may complain of memory or other cognitive loss without a valid basis for such loss. Indeed, much research has been done within this area in the last few years, and has demonstrated that memory complaints in the elderly may have no clinical meaning (Minett, Dean, Firbank, English, & O'Brien, 2005). Therefore, one reason why the functional and not the cognitive domain of the CCSMHA metacognition questionnaire achieved significance in predicting 3MS delta scores is because many subjects within the study may have been complaining of their memory or cognitive abilities while not exhibiting any real problems (thus not showing any significant changes on the 3MS or IQCODE). This would have artificially inflated the metacognition cognitive mean (suggestive of greater cognitive decline) while the individual showed no real decline on the 3MS delta score or as rated on the IQCODE. As with the denial of symptoms discussed above, this would have reduced the relationship between the predictor and criterion variables. Indeed, Pearson correlation coefficients between the cognitive domain and the 3MS delta score were lower than the coefficients between the functional domain and 3MS delta scores.

In dividing the CCSMHA subsample into no-dementia and dementia subgroups, I expected to find differences in the ability of the questionnaire to predict 3MS delta scores and IQCODE group membership. As mentioned in the literature review section previously, loss of awareness is considered by many researchers to reflect cortical atrophy and overall loss of brain volume in individuals with dementia. Indeed, researchers suggest that temporal, executive, and parietal structures all begin to fail at some point with the progression of dementia. Each of these structures has been shown to be involved in the process of being aware, and deterioration of these structures is likely to lead to impairments in awareness (Ansell & Bucks, 2006).

In agreement with the literature noted above, the metacognition questionnaire predicted both 3MS delta and IQCODE scores differently in the no-dementia and dementia subgroups. Within the no-dementia subgroup, the metacognition questionnaire significantly predicted 3MS delta and IQCODE scores. However, within the dementia subgroup, the metacognition questionnaire did not significantly predict either 3MS delta or IQCODE scores. At most, "trends" ($p = 0.067$, $p = 0.56$) were observed in the dementia subgroup, but were, however, in the opposite direction as the results obtained in the no-dementia subgroup.

Moreover, not only did the analyses within the dementia subgroups not achieve traditional levels of significance, but in each analysis using the 3MS delta as the outcome variable the relationship between the dependent and independent variables switched from positive to negative (albeit still nonsignificant). A negative relationship between the dependent and independent variables reflect a poor sense of self-awareness, a characteristic of the dementia subgroup but not the no-dementia subgroup. The ability of the metacognition questionnaire to differentially predict outcome variables between no-dementia and dementia subgroups provides evidence for the construct validity of the questionnaire.

When dividing the metacognition questionnaire into the cognitive and functional domains within the no-dementia and dementia subgroups, the findings were largely the similar to those obtained when using the whole CCSMHA subsample, in that the functional domain significantly predicted outcome score (both 3MS and IQCODE group membership). However, one main difference was that the functional domain was only able to marginally predict 3MS delta scores in the no-dementia subgroup whereas in the whole CCSMHA subsample the results were highly significant ($p = .009$). One may speculate that this may have resulted from the potential restricted range of functional domain scores within the no-dementia subgroup, as individuals with significant health problems may have been factored out as they were placed in the dementia subgroup. One other difference in the analyses using the 3MS delta score as the outcome variable was that the cognitive domain score significantly predicted 3MS delta scores in the no-dementia subgroup (not in the dementia subgroup). In the regression analyses using the whole study subsample, the cognitive domain did not predict 3MS delta scores. These discrepant results are likely due to the influence of the dementia subsample where there was no significant relationship between the metacognition questionnaire and 3MS delta scores. Therefore, subjects with dementia included in the analyses using the whole CCSMHA subsample may have reduced the overall relationship between the cognitive subdomain and 3MS delta scores, but when removed from the sample, the results became significant for those in the no-dementia subgroup.

The overall results of this study concur with those of several other studies finding significant differences in the rates of awareness of cognitive abilities between no-dementia and dementia subjects (McGlynn & Kaszniak, 1991; Moulin, Perfect, & Jones, 2000; Souchay, Isingrini, Pillon, & Gill, 2003). Studies have also shown that unawareness of memory or other cognitive impairments may predict conversion from mild memory impairment to AD, suggesting differences in cognitive awareness between these two groups (Clare et al., 2005; Devenand et al., 2000; Tabert et al., 2002). Furthermore, other research has shown that healthy adults are better at predicting the outcome of their memory performance relative to adults with AD (Duke et al., 2002).

Several models have been proposed explaining how insight may decline in AD or other forms of dementia. Perhaps the model that has been most recognized is that proposed by Agnew and Morris (1998). They propose that information regarding recent memory failure first enters into episodic memory. This information then passes to the conscious awareness system (CAS) located in the parietal lobes. Here, the information is compared, with help from the central executive system, with previously stored information regarding one's own memory abilities, how their memory abilities compare with others, and with past memory performance. The information that arises from this comparison is then stored in an area labeled the semantic personal knowledge base or PKB. The information that first enters into the CAS, such as information regarding any recent memory failure, is then compared to the information in the PKB, and if any discrepancy arises, the PKB is then updated via inputs from episodic and semantic memory (Agnew & Morris).

This model illustrates how awareness is consciously controlled and monitored. According to their model of awareness, several forms of unawareness can occur. One that has received considerable attention in the literature is mnemonic unawareness, labeled as mnemonic *anosognosia* by Agnew and Morris (1998). This form of unawareness occurs when comparator mechanisms in the central executive and semantic memory capabilities begin to degenerate, thus negatively impacting the PKB. Thus, according to Agnew and Morris, individuals with this form of unawareness may show awareness of their memory deficits after completing a task, but are unable to create an enduring cognitive awareness of their memory deficits due to their inability to update their PKB.

Agnew and Morris (1998) hypothesize that this form of unawareness occurs most often in the early stages of AD, when episodic memory is still relatively intact (thus able to realize, at least initially, that there has been some form of memory failure). One study conducted by Ansell and Bucks (2006), studied this hypothesis. They found that although subjects with early stage dementia were less able to predict their memory performance outcome than healthy elderly subjects, they were able to improve their performance after exposure to several memory-prediction tasks. Also, in their study they found that gains in memory prediction were largely retained following a very brief delay period. Therefore, in accordance with the model described above, the subjects in this study were able to show awareness of their deficits *following* the memory-prediction task, however, *initially* they showed poor awareness of their overall performance because of their inability to create any enduring awareness of overall memory capability. Such findings are also consistent with previous research in this area (Duke et al., 2002; McGlynn & Kaszniak, 1991; Moulin et al., 2000; Souchay et al., 2003). Ansell and Bucks reported that these findings are likely to be different than those obtained in individuals with late-stage dementia, as individuals with late stage dementia may have a poor ability to initially recognize memory failure due to compromised episodic memory, as opposed to individuals with early-stage dementia whose episodic memory is less severely impaired.

In summary, the results of this project provide support for the original research questions proposed for the project. The results of this project suggest that (a) the CCSMHA metacognition questionnaire possesses adequate levels of reliability as measured by levels of internal consistency, and (b) that the CCSMHA metacognition questionnaire is a valid instrument to use in assessing awareness in elderly populations.

The internal reliability for the questionnaire under investigation can also be considered a weakness of the study. Although the overall reliability of the questionnaire fell within acceptable ranges, the levels obtained for this questionnaire were substantially lower than internal reliability rates obtained for other awareness questionnaires. As discussed previously, part of the lower internal consistency estimates obtained within this study likely reflects the lower number of items, which reduces the reliability coefficient (Sattler, 2001). It is also likely that internal reliability coefficients were affected by potentially different reliabilties in the study subgroups (no-dementia and dementia) and question content (cognitive versus functional). One consideration not examined in this study is to examine the rates of reliability among the different no-dementia and dementia subgroups. As different results were obtained in the two subgroups (no-dementia versus dementia) in the ability of the metacognition questionnaire to predict outcome measures (3MS delta and IQCODE groups), it is also likely that different internal reliability coefficients would have been obtained in the two subgroups as well. The ability of the CCSMHA metacognition questionnaire to significantly predict two forms of external criteria; 3MS delta scores and IQCODE scores, provides additional evidence that it is a valid instrument for detecting levels of unawareness in elderly populations. No other questionnaires in the literature were found that used two forms of criteria for comparison against self-awareness questionnaires. Both methods have been used separately, however, and comprise the q*uestionnaire-based* and *performance-based* methods described in the literature review.

It remains unclear which of either the objective performance-based measures or caregiver assessment questionnaires is the preferred basis against which to compare metacognitive judgments. Both have been found to give valid and similar assessments of unawareness in elderly populations, and it has been suggested that the employment of both methods is preferred in awareness assessment in elderly populations (Clare et al., 2005). Using both criteria as outcome variables to self-assessment questionnaires is advantageous because it can help offset the weaknesses of each method when used separately, such as caregiver bias with caregiver report forms and the potential disparity between question content that that may exist in objective cognitive tests and self-assessment questionnaires. The results of my project would support the use of both methods. When using the complete CCSMHA subsample, the metacognition questionnaire was similar in predicting each outcome (only difference was that the metacognition questionnaire did not significantly predict 3MS scores when general health was considered in the final model). Furthermore, the results of analyses in the no-dementia subgroup suggest that the metacognition questionnaire significantly predicted both the 3MS and informant-based functional outcomes. The results of this project do, however, suggest that comparing similar items on both self-administered and informant-administered questionnaires may be more effective than comparing non-similar items. As seen in the results of this study, the cognitive domain within the metacognition questionnaire was able to accurately predict IQCODE group membership in the whole CCSMHA subsample, but only when using the four similar items within the two questionnaires, and not when the complete IQCODE questionnaire was used.

Despite the evidence supporting the use of the questionnaire in predicting cognitive and functional outcomes, level of subject physical health was the most highly significant predictive variable in nearly every statistical model tested in this project. Such findings suggest that level of physical health is more predictive of cognitive and functional outcomes than responses on self-awareness questionnaires. Therefore, in reference to clinical utility, the results of this study suggest that clinicians need to consider the physical state of health in individuals who report cognitive complaints. Current health status may be more indicative of cognitive or functional decline than complaints of cognitive or functional loss. Also, in reference to the discussion of the social acceptability of cognitive or functional loss above, it may be argued that the loss of physical or functional loss is more socially acceptable than the loss of cognitive or memory function. Because the loss of physical or functional loss may be more socially acceptable, confounding factors such as denial or embarrassment may not be as profound when responding to questions regarding physical or functional loss as compared with cognitive or memory loss. Therefore, physical health status may be a stronger predictor of actual cognitive or functional decline than a self-report of each ability. In addition, the results of this project suggest that in elderly populations, complaints of functional loss may be more related to cognitive decline than complaints of cognitive loss. Changes in functional ability and health status may be important areas for clinicians to query when examining elderly individuals for cognitive impairment.

Strengths and Limitations of the Current Study

There are several strengths to the current study that warrant discussion. One strength was that the overall sample used in this study was population-based, which avoids the potential for referral bias. In addition, due to the longitudinal design of the study, I was able to measure cognitive ability at two time points, and thus derive an overall delta score to use for comparison as opposed to a single measure of cognitive ability. The ability to examine cognitive change has been suggested by researchers as the optimal method to measure awareness of cognitive function, as capturing cognitive *change* is related more to awareness than capturing cognitive ability at a single point in time (Clare et al., 2005). In addition, as discussed previously, a significant strength of this study was that there were two forms of external criteria against which to compare metacognition scores. No studies were found in the literature that employed both criteria, and utilization of this method permits balancing the limitations (discussed previously) of each form of external criterion (objective-based tests of cognitive ability and informant-based questionnaires).

There were also several limitations to this research project as well. First and foremost was the small number of items making up the metacognition questionnaire employed in the CCSMHA. Although this has previously been considered a strength in the study, as the overall study sought to reduce and simplify previously used questionnaires assessing awareness in elderly populations, the number of items may have contributed to lower reliability estimates than what I may have otherwise obtained. Another limitation regarding the number of items within the questionnaire relates to the limited number of domains of awareness the questionnaire was able to capture (only two domains, one cognitive and one functional). Current research suggests that there are multiple domains of awareness. For example, individuals may be aware of their physical, cognitive, social, and affective deficits (Antoine, Antoine, Guermonprez, & Frigard, 2004). Research has also demonstrated that awareness includes not only an individual's ability to passively recognize and monitor performance, but also to proactively behave according to recognition of one's abilities, such as implementing the use of mnemonics or idiosyncratic behaviors that assist in remembering, learning, or adapting to everyday living. The current project does not suppose that the cognitive and functional domains arrived at within this analysis comprise the entire phenomena of being "aware." Rather, the domains assessed are considered two domains of awareness that arose from using a limited number of questions to assess awareness or metacognition. Other questionnaires found in the literature have utilized many more questions in assessing awareness, and therefore are more likely to probe to a greater extent what comprises the phenomena of "being aware."

Another concern may have been the time interval examined in this study (roughly 3 years) in which many individuals may not have experienced significant changes in cognitive status. In fact, as presented in the distribution of IQCODE scores (Figure 1), the majority of IQCODE respondents noted that there had been no change within the last three years of the subject's level of functioning. In addition, as can be seen in Appendix F, most subjects' responses on the metacognition questionnaire also indicate that there was little to no change in their cognitive functioning within the last 3 years. Also, one of the outcome measures used in this study was the 3MS. The 3MS has been traditionally used as only a screening instrument for cognitive decline, and may lack the sensitivity to identify changes in separate domains of cognition. An instrument that more thoroughly assesses multiple cognitive domains may be a more appropriate instrument to use for the purposes of this study.

Finally, an additional limitation of the current study is the extent to which the current findings can be generalized. As described previously, the participants of the CCSMHA were primarily Caucasian and comprise a fairly homogeneous population, and therefore caution should be used when generalizing these findings to populations with greater ethnic and cultural diversity.

Future Directions

Unawareness of cognitive or functional deficits is an important focus for research and clinical activities for several reasons: (a) unawareness of these deficits can have a negative impact on a caregiver's health, level of stress, and patient disease progression and treatment; (b) early detection of unawareness may help distinguish individuals who may or may not transition from mild memory problems to AD or other forms of dementia; and (c) correct assessment of unawareness in dementia may provide researchers with useful insights as to the neuroanatomical sites that are affected in different forms of dementia.

In order to fully research questions in each of these areas, better and more efficient ways of assessing unawareness are needed. There are several different methods employed in the research today used to assess unawareness in elderly populations. Although studies have outlined the strengths and weaknesses of each of these methods, no studies have directly compared each model against one another in being able to predict clinically meaningful outcomes (such as dementia progression, incidence of behavioral disturbances, mild cognitive impairment (MCI) to dementia conversion rates). Research comparing the efficacy of one method over another would help establish standardized methods for assessing unawareness. Many studies have been conducted attempting to replicate the results of other studies, but many have used different methods and criteria for examining unawareness. Employing standardized and widely accepted methods is a worthy goal, and until achieved, research in this area will continue to suffer.

Another question that arose from this project that has not received much attention in the literature, is based upon several studies which suggest there are many different types and etiologies of unawareness. If the construct of "being aware" is a multi-dimensional construct, consisting of various domains, then is it necessary to assess each and every domain for clinically utility? On the other hand, are there some domains of awareness (cognitive, behavioral, functional) that are more predictive of clinical outcomes than others?

Further research in the area of unawareness might include examining its rates amongst the different types of dementia. Past research has indicated that certain forms of dementia can lead to greater rates of anosognostic symptoms than others (Sevush & Leve, 1993; Wagner, 1994). Although this project gave descriptive information regarding different dementia subtypes, this information was not used in the regression analyses. In addition, although several researchers have pointed out the potential differences that may exist between over- and underestimation of abilities, very few studies have examined the differences that may distinguish the two. Research within this area may provide information regarding the different etiology of over- versus underestimation of memory difficulties, and potentially be included in the diagnostic criteria for specific dementing illnesses.

Finally, one area that could prove to be useful to the area of unawareness research in dementia is that of examining the neuroanatomical correlates to unawareness. Current studies suggest that the three primary areas for brain degeneration in patients with unawareness are the parietal lobe, right hemisphere, and the medial and ventral parts of the prefrontal cortex (Ansell & Bucks, 2006). However, exactly what area or combination of areas is most affected in dementia is unclear. Some of these regions may be differentially impacted at different stages of dementia severity. Nonetheless, differences in the involvement of specific brain regions may explain some of the inconsistent findings as to the nature and etiology of unawareness of dementia. In addition, further studies examining the anatomical areas affected in unawareness in dementia may also provide clues and information regarding the different areas of the brain most affected through the debilitating course of dementia and other degenerative neurological diseases.

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APPENDICES

Appendix A:

CCSMHA Metacognition Questionnaire

Metacognition Questionnaire

SECTION L: META-COGNITION

Now I'd like you to remember what your memory was like 3 years ago and compare that to what it is like now. I'll give you some example situations and I want you to tell me whether you've gotten much better, a bit better, have not had much change, have gotten a bit worse or much worse in that situation. (SHOW CARD WITH RESPONSES)

Compared with 3 years ago, how are you at:		MUCH BETTER	A BIT BETTER	NOT MUCH CHANGE	A BIT WORSE	MUCH WORSE	RF	DK
1.	Remembering recent events, appointments, or recalling where you put objects?	1	2	3	4	5	7	8
2.	Remembering the names and faces of friends and relatives?	1	2	3	4	5	7	8
3.	Keeping your train of thought or finding the right words in a conversation?	1	2	3	4	5	7	8
4.	Finding your way around familiar places?	1	2	3	4	5	7	8
5.	Operating gadgets, appliances, or machinery around the house?	1	2	3	4	5	7	8
6.	Keeping up with household chores, hobbies, and other interests?	1	2	3	4	5	7	8
7.	In general how is your memory now compared to the way it was 3 years ago?	1	2	3	4	5	7	8

Appendix B:

Individual Metacognition Item Correlation with

3MS Delta Scores and IQCODE Scores

Table B-1

Individual Metacognition Item Correlation with 3MS Delta Scores and IQCODE Scores

Item	Correlation	3MS:Delta score	IQ Code score for 3yr
Metacognitive question 1: Remembering events, appointments, objects	Pearson correlation	0.029	0.137**
	Sig. (2-tailed)	0.455	0.002
	N	663	488
Metacognition question 2: Remembering names and faces	Pearson correlation	-0.031	0.081
	Sig. (2-tailed)	0.423	0.074
	N	665	489
Metacognition question 3: Keeping train of thought, finding right words	Pearson correlation	0.027	0.066
	Sig. (2-tailed)	0.494	0.147
	N	664	488
Metacognition question 4: Finding way around familiar places	Pearson correlation	0.088	0.144**
	Sig. (2-tailed)	0.023	0.001
	N	663	489
Metacognition question 5: Operating gadgets or machinery	Pearson correlation	0.101	0.146**
	Sig. (2-tailed)	0.009	0.001
	N	661	483
Metacognition question 6: Keeping up with household chores, hobbies, interests	Pearson correlation	0.090	0.096*
	Sig. (2-tailed)	0.021	0.035
	N	655	480
Metacognition question 7: Memory compared with 3 years ago	Pearson correlation	0.078	0.167**
	Sig. (2-tailed)	0.045	<0.001
	N	664	489

* Significant at the .05 level (two-tailed).
* Significant at the .01 level (two tailed).

Appendix C:

IQCODE

INTERVAL IQ CODE

REMINDER: COMPLETE INFORMANT FACT SHEET FIRST

Now I want you to remember what (NAME) was like 10 years ago and to compare that with what (he/she) is like now. I will also ask you to remember what (he/she) was like 3 years ago and compare that with what (he/she) is like now. Ten years ago was in (1996/1997) and our last visit was about three years ago (2002/2003). I am going to give you examples of some situations where (NAME) has to use (his/her) memory or intelligence. I want you to tell me whether (he/she) has gotten much better, a bit better, hasn't changed much, has gotten a bit worse, or much worse in those situations over the past 10 years and also for the past 3 years. **So for these questions, it is important to compare (NAME's) present performance with 10 years ago *AND* 3 years ago.** For example, if 3 years ago (NAME) forgot where (he/she) had left things, and now (he/she) still forgets when (he/she) leaves things, then your answer would be "hasn't changed much." Any Questions?

HAND INFORMANT THE RESPONSE CARD.

1. Compared with 10 years ago, how is (NAME) at recalling conversations a few days later?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE (GO TO 2) 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

1A. Compared with 3 years ago, how is (NAME) at recalling conversations a few days later?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

2. Compared with 10 years ago, how is (NAME) at remembering what day and month it is?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE (GO TO 3) 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

2A. Compared with 3 years ago, how is (NAME) at remembering what day and month it is?

COMMENT:

MUCH BETTER	1
A BIT BETTER	2
NOT MUCH CHANGE	3
A BIT WORSE	4
MUCH WORSE	5
OTHER	6
RF	7
DK	8

3. Compared with 10 years ago, how is (NAME) at remembering things about family and friends? (e.g. occupations, birthdays, addresses)

COMMENT:

MUCH BETTER	1
A BIT BETTER	2
NOT MUCH CHANGE (GO TO 4)	3
A BIT WORSE	4
MUCH WORSE	5
OTHER	6
RF	7
DK	8

3A. Compared with 3 years ago, how is (NAME) at remembering things about family and friends? (e.g. occupations, birthdays, addresses).

COMMENT:

MUCH BETTER	1
A BIT BETTER	2
NOT MUCH CHANGE	3
A BIT WORSE	4
MUCH WORSE	5
OTHER	6
RF	7
DK	8

4. Compared with 10 years ago, how is (NAME) at remembering where things are usually kept?

COMMENT:

MUCH BETTER	1
A BIT BETTER	2
NOT MUCH CHANGE (GO TO 5)	3
A BIT WORSE	4
MUCH WORSE	5
OTHER	6
RF	7
DK	8

4A. Compared with 3 years ago, how is (NAME) at remembering where things are usually kept?

COMMENT:

MUCH BETTER	1
A BIT BETTER	2
NOT MUCH CHANGE	3
A BIT WORSE	4
MUCH WORSE	5
OTHER	6
RF	7
DK	8

5. Compared with 10 years ago, how is (NAME) at remembering where to find things which have been put in a different place than usual?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE (GO TO 6) 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

5A. Compared with 3 years ago, how is (NAME) at remembering where to find things which have been put in a different place than usual?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

6. Compared with 10 years ago, how is (NAME) at remembering things that have happened recently?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE (GO TO 7) 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

6A. Compared with 3 years ago, how is (NAME) at remembering things that have happened recently?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

7. Compared with 10 years ago, how is (NAME) at remembering the names of family and friends?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE (GO TO 8) 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

7A. Compared with 3 years ago, how is (NAME) at remembering the names of family and friends?	MUCH BETTER	1
	A BIT BETTER	2
	NOT MUCH CHANGE	3
	A BIT WORSE	4
COMMENT:	MUCH WORSE	5
	OTHER	6
	RF	7
	DK	8

8. Compared with 10 years ago, how is (NAME) at recognizing the faces of family and friends?	MUCH BETTER	1
	A BIT BETTER	2
	NOT MUCH CHANGE (GO TO 9)	3
	A BIT WORSE	4
	MUCH WORSE	5
COMMENT:	OTHER	6
	RF	7
	DK	8

8A. Compared with 3 years ago, how is (NAME) at recognizing the faces of family and friends?	MUCH BETTER	1
	A BIT BETTER	2
	NOT MUCH CHANGE	3
	A BIT WORSE	4
COMMENT:	MUCH WORSE	5
	OTHER	6
	RF	7
	DK	8

9. Compared with 10 years ago, how is (NAME) at remembering what (he/she) wanted to say in the middle of a conversation?	MUCH BETTER	1
	A BIT BETTER	2
	NOT MUCH CHANGE (GO TO 10)	3
	A BIT WORSE	4
	MUCH WORSE	5
COMMENT:	OTHER	6
	RF	7
	DK	8

9A. Compared with 3 years ago, how is (NAME) at remembering what (he/she) wanted to say in the middle of a conversation?	MUCH BETTER	1
	A BIT BETTER	2
	NOT MUCH CHANGE	3
	A BIT WORSE	4
	MUCH WORSE	5
COMMENT:	OTHER	6
	RF	7
	DK	8

10. Compared with 10 years ago, how is (NAME) at understanding magazine or newspaper articles?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE (GO TO 11) .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	
10A. Compared with 3 years ago, how is (NAME) at understanding magazine or newspaper articles?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	
11. Compared with 10 years ago, how is (NAME) at following a story in a book or on TV?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE (GO TO 12) .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	
11A. Compared with 3 years ago, how is (NAME) at following a story in a book or on TV?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	
12. Compared with 10 years ago, how is (NAME) at learning to use a new gadget or machine around the house?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE (GO TO 13) .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	

12A. Compared with 3 years ago, how is (NAME) at learning to use a new gadget or machine around the house?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

13. Compared with 10 years ago, how is (NAME) at learning new things in general?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE (GO TO 14) 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

13A. Compared with 3 years ago, how is (NAME) at learning new things in general?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

14. Compared with 10 years ago, how is (NAME) at knowing how to work familiar machines around the house?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE (GO TO 15) 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

14A. Compared with 3 years ago, how is (NAME) at knowing how to work familiar machines around the house?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

15. Compared with 10 years ago, how is (NAME) at handling financial matters, e.g. the pension, or dealing with the bank?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE (GO TO 16) 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

15A. Compared with 3 years ago, how is (NAME) at handling financial matters, e.g. the pension, or dealing with the bank?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

16. Compared with 10 years ago, how is (NAME) at handling money for shopping?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE (GO TO 17) 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

16A. Compared with 3 years ago, how is (NAME) at handling money for shopping?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

17. Compared with 10 years ago, how is (NAME) at using (his/her) intelligence to understand what's going on and to reason things through?

COMMENT:

MUCH BETTER 1
A BIT BETTER 2
NOT MUCH CHANGE (GO TO 18) 3
A BIT WORSE 4
MUCH WORSE 5
OTHER 6
RF 7
DK 8

17A. Compared with 3 years ago, how is (NAME) at using (his/her) intelligence to understand what's going on and to reason things through?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	

18. Compared with 10 years ago, how is (NAME) at making decisions on everyday matters?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE (GO TO 19) .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	

18A. Compared with 3 years ago, how is (NAME) at making decisions on everyday matters?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	

19. Compared with 10 years ago, how is (NAME) at adjusting to any change in (his/her) day-to-day routine?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE (GO TO 20) .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	

19A. Compared with 3 years ago, how is (NAME) at adjusting to any change in (his/her) day-to-day routine?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	

20. Compared with 10 years ago, how is (NAME) at remembering things that happened to (him/her) when (he/she) was young?	MUCH BETTER 1
	A BIT BETTER 2
	NOT MUCH CHANGE (GO TO 21) 3
	A BIT WORSE 4
	MUCH WORSE 5
	OTHER 6
COMMENT:	RF 7
	DK 8

20A. Compared with 3 years ago, how is (NAME) at remembering things that happened to (him/her) when (he/she) was young?	MUCH BETTER 1
	A BIT BETTER 2
	NOT MUCH CHANGE 3
	A BIT WORSE 4
	MUCH WORSE 5
COMMENT:	OTHER 6
	RF 7
	DK 8

21. Compared with 10 years ago, how is (NAME) at remembering things (he/she) learned when (he/she) was young?	MUCH BETTER 1
	A BIT BETTER 2
	NOT MUCH CHANGE (GO TO 22) 3
	A BIT WORSE 4
	MUCH WORSE 5
COMMENT:	OTHER 6
	RF 7
	DK 8

21A. Compared with 3 years ago, how is (NAME) at remembering things (he/she) learned when (he/she) was young?	MUCH BETTER 1
	A BIT BETTER 2
	NOT MUCH CHANGE 3
	A BIT WORSE 4
COMMENT:	MUCH WORSE 5
	OTHER 6
	RF 7
	DK 8

22. Compared with 10 years ago, how is (NAME) at composing a letter to friends or for business purposes?	MUCH BETTER 1
	A BIT BETTER 2
	NOT MUCH CHANGE (GO TO 23) 3
	A BIT WORSE 4
COMMENT:	MUCH WORSE 5
	OTHER 6
	RF 7
	DK 8

22A. Compared with 3 years ago, how is (NAME) at composing a letter to friends or for business purposes?

COMMENT:

MUCH BETTER	1
A BIT BETTER	2
NOT MUCH CHANGE	3
A BIT WORSE	4
MUCH WORSE	5
OTHER	6
RF	7
DK	8

23. Compared with 10 years ago, how is (NAME) at knowing about important historical events of the past?

COMMENT:

MUCH BETTER	1
A BIT BETTER	2
NOT MUCH CHANGE (GO TO 24)	3
A BIT WORSE	4
MUCH WORSE	5
OTHER	6
RF	7
DK	8

23A. Compared with 3 years ago, how is (NAME) at knowing about important historical events of the past?

COMMENT:

MUCH BETTER	1
A BIT BETTER	2
NOT MUCH CHANGE	3
A BIT WORSE	4
MUCH WORSE	5
OTHER	6
RF	7
DK	8

24. Compared with 10 years ago, how is (NAME) at understanding the meaning of unusual words?

COMMENT:

MUCH BETTER	1
A BIT BETTER	2
NOT MUCH CHANGE (GO TO 25)	3
A BIT WORSE	4
MUCH WORSE	5
OTHER	6
RF	7
DK	8

24A. Compared with 3 years ago, how is (NAME) at understanding the meaning of unusual words?

COMMENT:

MUCH BETTER	1
A BIT BETTER	2
NOT MUCH CHANGE	3
A BIT WORSE	4
MUCH WORSE	5
OTHER	6
RF	7
DK	8

25. Compared with 10 years ago, how is (NAME) at handling other everyday arithmetic problems, e.g. knowing how much food to buy, knowing how long between visits from family and friends?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE (GO TO 26) .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	

25A. Compared with 3 years ago, how is (NAME) at handling other everyday arithmetic problems, e.g. knowing how much food to buy, knowing how long between visits from family and friends?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	

26. Compared with 10 years ago, how is (NAME) at remembering (his/her) address and telephone number?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE (RECORD END TIME) .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	

26A. Finally, compared with 3 years ago, how is (NAME) at remembering (his/her) address and telephone number?	MUCH BETTER .... 1 A BIT BETTER .... 2 NOT MUCH CHANGE (RECORD END TIME) .... 3 A BIT WORSE .... 4 MUCH WORSE .... 5 OTHER .... 6 RF .... 7 DK 8
COMMENT:	

Appendix D:

Section B: The Modified Mini-Mental State Examination

Section B: The Modified Mini-Mental State Examination**

Now, I would like to ask you some questions to check your memory and concentration. Some of the questions may be easy and some will be harder. Take your time if you need to. We can skip over questions if you don't understand them. Just relax and do your best.

Imp Codes
sight =1
hearing=2
hands=3
other=4

B1. **Who is the president of the United States now?**
RECORD:____________________
CORRECT........................**1**
INCORRECT 0
REFUSED ....7 IMP..... [ ]

B2. **Who was the president before him?**
RECORD:____________________
CORRECT........................**1**
INCORRECT 0
REFUSED ....7 IMP..... [ ]

B3. **Who is the Vice President of the United States now?**
RECORD:____________________
CORRECT........................**1**
INCORRECT 0
REFUSED ....7 IMP..... [ ]

B4. **Who was Vice President before him?**
RECORD:____________________
CORRECT........................**1**
INCORRECT 0
REFUSED ....7 IMP..... [ ]

B5. **Who is the governor of Utah now?**
RECORD:____________________
CORRECT........................**1**
INCORRECT 0
REFUSED ....7 IMP..... [ ]

B6. **There are 3 words on this card that I would like you to remember. Please say the words aloud while you read them. Then I will take the card away, and have you repeat all 3 words.**

[ ] NUMBER OF TRIALS NEEDED

SHOW WORDS AND HAVE PARTICIPANT READ. CORRECT (HIM/HER) IF (HE/SHE) MISREADS. TAKE CARD AWAY.

Now what were those three words?

HAVE PARTICIPANT REPEAT. IF THERE ARE ERRORS, CONTINUE WITH ADDITIONAL TRIALS (UP TO 3 TRIALS).

SCORE FIRST TRY. REPEAT WORDS FOR THREE TRIALS ONLY.

	TRIAL #1	TRIAL #2	TRIAL #3
SHIRT	______	______	______
NICKEL	______	______	______
HONESTY	______	______	______

SCORE (0-3)................ [ ] IMP..... [ ]
REFUSED............ 7

BE SURE TO SAY: **Remember the 3 words because later I will ask you to repeat them.**

[ ] CHECK TO INDICATE REMINDER WAS GIVEN

**Tschanz, JT, Welsh-Bohmer, KA, Plassman, BL, Norton, MC, Wyse, BW, Breitner, JC. (2002). An adaptation of the modified mini-mental state examination: analysis of demographic influences and normative data: The Cache County Study Neuropsychiatry Neuropsychol Behav Neurol 15 (1) 28-38
** Modification of Teng, E.L., & Chui, G.C. (1987). The Modified Mini-Mental State (3MS) Examination. Journal of Clinical Psychiatry, 48 (8), 314-318.

______Out of 8

Imp Codes
sight =1
hearing=2
hands=3
other=4

B7. **Now please count from 1 to 5.**
ASSIST ONLY ONCE IF NEEDED.

ALL RESPONSES 0
IF PARTICIPANT DOES NOT COMPREHEND THIS TASK, CIRCLE 0 ON BACKWARD TASK (BELOW) AND GO TO B8

RECORD: ____ ____ ____ ____ ____
1 2 3 4 5

Now I would like you to count backwards from 5 to 1.

CORRECT **2**
1 OR 2 ERRORS **1**
≥3 ERRORS/CAN'T DO...................... 0 IMP..... ☐
REFUSED 7

RECORD: ____ ____ ____ ____ ____
5 4 3 2 1

B8. **Please spell the word "World."**
ASSIST ONLY ONCE IF NEEDED.

ALL RESPONSES 0
IF PARTICIPANT DOES NOT COMPREHEND THIS TASK, CIRCLE 0 ON BACKWARD TASK (BELOW) AND GO TO B9

RECORD: ____ ____ ____ ____ ____
W O R L D

Now please spell "World" backwards.

SCORE NO. OF LETTERS IN CORRECT POSITION .... ☐ IMP..... ☐
CAN'T DO 0
REFUSED 7

RECORD: ____ ____ ____ ____ ____
D L R O W

B9. **What were the three words that I asked you to remember?** (SHIRT, NICKEL, HONESTY)
IF THE PARTICIPANT DOES NOT GIVE ALL CORRECT ANSWERS, PROMPT AS NEEDED:

RECORD:____________________ ____________________ ____________________
(SHIRT) (NICKEL) (HONESTY)

A) SPONTANEOUS RECALL **3**

1) **One of the words was something you wear.**

RECORD______________________**2**

2) SHOW CARD. HAVE P. READ AND MAKE SELECTION. *SHOES, SHIRT, SOCKS* **1**
CIRCLE WORD.

3) IF STILL INCORRECT RESPONSE, PROVIDE CORRECT ANSWER (**shirt**). ☐

NO RECALL/CAN'T DO 0
REFUSED 7

B) SPONTANEOUS RECALL **3**

1) **One of the words was some money.**

RECORD______________________**2**

2) SHOW CARD. HAVE P. READ AND MAKE SELECTION. *PENNY, NICKEL, DOLLAR* **1**
CIRCLE WORD.

3) IF STILL INCORRECT RESPONSE, PROVIDE CORRECT ANSWER (**nickel**). ☐

NO RECALL/CAN'T DO 0
REFUSED 7

C) SPONTANEOUS RECALL................**3**

1) **One of the words was a good personal quality.**

RECORD________________________**2**

2) SHOW CARD. HAVE P. READ AND MAKE SELECTION. *HONESTY, CHARITY, MODESTY*............................ **1**
CIRCLE WORD.

3) IF STILL INCORRECT RESPONSE, PROVIDE CORRECT ANSWER (**honesty**). ☐

NO RECALL/CAN'T DO..............0
REFUSED 7

SCORE FOR SHIRT .... ☐ IMP.... ☐
SCORE FOR NICKEL ☐ IMP.... ☐
SCORE FOR HONESTY .... ☐ IMP.... ☐

_____Out of 20

ORIENTATION SECTION (B10-B18)

Imp Codes
sight =1
hearing=2
hands=3
other=4

				IMP
B10.	**What year is it?** RECORD:______	CORRECT	**3**	IMP.....
		MISSED BY 1 YEAR	**1**	
		INCORRECT/CAN'T DO	0	
		REFUSED	7	
B11.	**What is the season of the year?** RECORD:______	CORRECT WITHIN A WEEK	**3**	IMP.....
		MISSED BY 1 MONTH	**2**	
		INCORRECT BUT NAMES A SEASON	**1**	
		INCORRECT/CAN'T DO	0	
		REFUSED	7	
B12.	**What day of the week is it?** RECORD:______	CORRECT	**3**	IMP.....
		MISSED BY 1 DAY	**1**	
		INCORRECT/CAN'T DO	0	
		REFUSED	7	
B13.	**What month is it?** RECORD:______	CORRECT	**3**	IMP.....
		INCORRECT BUT WITHIN 3 DAYS	**2**	
		MISSED BY 1 MONTH	**1**	
		INCORRECT/CAN'T DO	0	
		REFUSED	7	
B14.	**What is today's date?** RECORD:______	CORRECT	**3**	IMP.....
		MISSED BY 1 OR 2 DAYS	**2**	
		MISSED BY 3-5 DAYS	**1**	
		INCORRECT/CAN'T DO	0	
		REFUSED	7	
B15.	**What state are we in?** RECORD:______	CORRECT	**2**	IMP.....
		INCORRECT/CAN'T DO	0	
		REFUSED	7	
B16.	**What county are we in?** RECORD:______	CORRECT	**1**	IMP.....
		INCORRECT/CAN'T DO	0	
		REFUSED	7	
B17.	**What town are we in?** RECORD:______	CORRECT	**1**	IMP.....
		INCORRECT/CAN'T DO	0	
		REFUSED	7	
B18.	**Are we in a church, a home or an office?** RECORD:______	CORRECT	**1**	IMP.....
		INCORRECT/CAN'T DO	0	
		REFUSED	7	

IF THE CORRECT ANSWER IS NOT AMONG THE 3 CHOICES, SUBSTITUTE THE CORRECT ANSWER FOR THE 3RD CHOICE, AN OFFICE.

_____Out of 20

EXCEPTION: IF PARTICIPANT IS BLIND, ASK: **"For the next section, I need you to tell me the names of some parts on your upper body. Would it be OK if I tapped you to show you which parts to name?"** IF OK, TAP THE PARTICIPANT'S FOREHEAD, CHIN, ETC. FOR EACH ITEM.

Imp Codes
sight =1
hearing=2
hands=3
other=4

B19. POINT TO YOUR FOREHEAD.
What is this called?

RECORD:____________________________

CORRECT..**1**
INCORRECT/CAN'T DO.......................................0
REFUSED 7
IMP..... [ ]

B20. POINT TO YOUR CHIN.
What is this called?

RECORD:____________________________

CORRECT..**1**
INCORRECT/CAN'T DO.......................................0
REFUSED 7
IMP..... [ ]

B21. POINT TO YOUR SHOULDER.
What is this called?

RECORD:____________________________

CORRECT..**1**
INCORRECT/CAN'T DO.......................................0
REFUSED 7
IMP..... [ ]

B22. POINT TO YOUR ELBOW.
What is this called?

RECORD:____________________________

CORRECT..**1**
INCORRECT/CAN'T DO.......................................0
REFUSED 7
IMP..... [ ]

B23. POINT TO YOUR KNUCKLE.
What is this called?

RECORD:____________________________

CORRECT..**1**
INCORRECT/CAN'T DO.......................................0
REFUSED 7
IMP..... [ ]

Now I have another category and it is animals. Please name as many four-legged animals as you can. You will have 20 seconds.
START TIMER. TELL PARTICIPANT, "**Begin now**".
ALLOW 20 SECONDS. IF NO RESPONSE IN 10 SECONDS, REPEAT THE QUESTION ONCE, RECORD; ALLOW ANOTHER 10 SECONDS, THEN GO TO B25.

SCORE..................... (0-10) [|] IMP...... [ ]
REFUSED.......97

_____Out of 15

Imp Codes
sight =1
hearing=2
hands=3
other=4

B25. **In what way are an arm and a leg alike?**

RECORD:______________________________

____

CORRECT (BODY PART, LIMB, ETC.) **2**
PARTLY CORRECT **1**
INCORRECT/CAN'T DO 0
REFUSED 7

IMP .... ☐

SCORE: IF < 2 POINT RESPONSE, SAY, "BOTH ARE LIMBS OR BODY PARTS. CHECK IF PROMPTED ☐

B26. **In what way are laughing and crying alike?**
NO PROMPT ALLOWED.

RECORD:______________________________

____

CORRECT (EXPRESSION OF FEELING, EMOTIONS, ETC.) **2**
PARTLY CORRECT **1**
INCORRECT/CAN'T DO........................ 0
REFUSED 7

IMP..... ☐

B27. **In what way are eating and breathing alike?**
NO PROMPT ALLOWED.

RECORD:______________________________

____

CORRECT (ESSENTIAL FOR LIFE) **2**
PARTLY CORRECT **1**
INCORRECT/CAN'T DO........................ 0
REFUSED 7

IMP..... ☐

B28. **Please repeat what I say exactly. "The band played and the crowd cheered."**

TRIAL #1
____

____

TRIAL #2
____

____

CORRECT **2**
ONE OR TWO MISSED/WRONG WORDS... **1**
INCORRECT/CAN'T DO........................ 0
REFUSED 7

IMP..... ☐

B29. **Now again repeat what I say exactly, "No ifs, ands, or buts."**
SCORE 1 PT. FOR EACH CORRECT COMPONENT.

TRIAL #1
____

____

TRIAL #2
____

____

NO IFS (0-1)..0 **1**
ANDS (0-1) 0 **1**
OR BUTS (0-1) 0 **1**
INCORRECT/ CAN'T DO....................... 0
REFUSED 7

IMP..... ☐

B30. HOLD UP THE PAPER WITH "CLOSE YOUR EYES" AND SAY **"Please read this and do what it says."** IF PARTICIPANT DOES NOT CLOSE HIS/HER EYES WITHIN 5 SECONDS, POINT TO THE SENTENCE AND SAY "**Read this and do what it says**." ALLOW 5 SECONDS FOR RESPONSE.

OBEYS WITHOUT PROMPTING................................. **3**
OBEYS AFTER PROMPTING...................................... **2**
READS ALOUD ONLY **1**
NO RESPONSE/CAN'T DO.................... 0
REFUSED 7

IMP..... ☐

____Out of 14

Imp Codes
sight =1
hearing=2
hands=3
other=4

B31.	HOLD UP A PIECE OF PAPER AND SAY **"Please take this paper with your right hand, fold it in half using both hands, and put it on your lap."** IF P. HAS USE OF ONE HAND ONLY, SUBSTITUTE: **"Please take this paper with your __ hand, turn it over on the table, and put it on your lap."**	TAKES WITH RIGHT HAND ....0 **1** FOLD IN HALF ....0 **1** PUTS IN LAP....0 **1** CAN'T DO .... 0 REFUSED 7	IMP..... ☐
B32.	HAND P. A PENCIL AND RESPONSE BOOKLET. **Please write a complete sentence on this page.** ALLOW 1 MINUTE, AND ANOTHER 30 SECONDS AFTER PROMPTING (IF NECESSARY). PROMPT IF P. WRITES INCOMPLETE SENTENCE: **Write the sentence, "The band played and the crowd cheered."**	LEGIBLE, CORRECT SENTENCE ....**5** LEGIBLE SENTENCE WITH ERROR(S)....**4** LEGIBLE, CORRECT SENTENCE AFTER PROMPT ....**3** LEGIBLE SENTENCE WITH ERROR(S) AFTER PROMPT ....**2** WRITES NAME OR LEGIBLE, INCOMPLETE SENTENCE AFTER PROMPT ....**1** ILLEGIBLE/CAN'T DO....0 REFUSED 7	IMP..... ☐
B33.	SHOW P. SHEET WITH DRAWING. **Here is a drawing. Please copy the drawing on the same paper.** POINT TO BOTTOM OF THE PAGE BELOW DOTTED LINE. ALLOW 1 MINUTE FOR COPYING.	**SCORE EACH PENTAGON** L R 5 SIDES ....**4** . . . . .**4** 1 UNEQUAL SIDE ....**3** . . . . .**3** OTHER CLOSED FIGURE ....**2** . . . . .**2** 2 OR MORE LINES ....**1** . . . . .**1** CAN'T DO ....0 REFUSED 7	IMP R ... ☐ IMP L ... ☐
		INTERSECTION 4 CORNERS....**2** NOT A 4 CORNER ENCLOSURE....**1** NONE/CAN'T DO ....0 REFUSED 7	IMP..... ☐

____Out of 18

B34. **What were the three words that I asked you to remember** (SHIRT, NICKEL, HONESTY)? IF THE PARTICIPANT DOES NOT GIVE ALL CORRECT ANSWERS, PROMPT AS NEEDED:

RECORD: (SHIRT)	(NICKEL)	(HONESTY)
A) SPONTANEOUS RECALL **3**	B) SPONTANEOUS RECALL **3**	C) SPONTANEOUS RECALL **3**
1) **One of the words was something you wear.**	1) **One of the words was some money.**	1) **One of the words was a good personal quality.**
RECORD______________________**2**	RECORD______________________**2**	RECORD______________________**2**
2) SHOW CARD. HAVE P. READ AND MAKE SELECTION. *SHOES, SHIRT, SOCKS* ....**1** CIRCLE WORD.	2) SHOW CARD. HAVE P. READ AND MAKE SELECTION. *PENNY, NICKEL, DOLLAR* ....**1** CIRCLE WORD.	2) SHOW CARD. HAVE P. READ AND MAKE SELECTION. *HONESTY, CHARITY, MODESTY* .... **1** CIRCLE WORD.
3) IF STILL INCORRECT RESPONSE, PROVIDE CORRECT ANSWER (**shirt**).	3) IF STILL INCORRECT RESPONSE, PROVIDE CORRECT ANSWER (**nickel**).	3) IF STILL INCORRECT RESPONSE, PROVIDE CORRECT ANSWER (**honesty**).
NO RECALL/CAN'T DO .... 0 REFUSED...................................... 7	NO RECALL/CAN'T DO..............0 REFUSED 7	NO RECALL/CAN'T DO .... 0 REFUSED...................................... 7

SCORE FOR SHIRT............... ☐ IMP................. ☐
SCORE FOR NICKEL............ ☐ IMP................. ☐
SCORE FOR HONESTY........ ☐ IMP................. ☐

NOTES:

END TIME ☐☐ : ☐☐

PROXY DETERMINATION

☐ 1. CONTINUE INTERVIEW WITH THE PARTICIPANT

Based on score 1
*Based on judgment............ 2

PAGE #	#CORRECT

____Out of 9

5	
6	
7	
8	
9	
10	
11	
TOTAL	

☐ 2. PROCEED WITH PROXY INTERVIEW

Based on score 1
*Based on judgment............ 2

*Explain ____

____

____

DETERMINATION GUIDELINES

1. IF ORIENTATION SCORE (PAGE 7) IS LESS THAN 15 OR TOTAL 3MS SCORE IS LESS THAN 60: PROCEED TO THE PROXY INTERVIEW.

2. IF THE SITUATION IS AMBIGUOUS: USE YOUR BEST JUDGMENT AND PROCEED WITH EITHER THE PROXY OR PARTICIPANT INTERVIEW, AS YOU FEEL IS APPPROPRIATE.

COMPLETION 1 = Complete *2 = Complete w/Physical impairments *3 =Breakoff or NA-Physical *4 = Breakoff - Cognitive *5= Cognitively Untestable	*6= Refused *7=Other *Specify/Comment___________________________ _ _______________________________________ _______________________________________	PROTOCOL 1=Standard *2=Not Standard (Specify item # & Explain) *Specify / Comment______________________________________ ____ _ 3=N/A

#2 CHECKPOINT	PARTICIPANT WILL COMPLETE INTERVIEW (GO TO BOOKLET 2)..1 PROXY WILL COMPLETE INTERVIEW (GO TO PROXY BOOKLET 1)..2

Appendix E:

GMHR

GMHR RATING

Circle **one** of the numbers between 1 and 4 using the instructions next to each number. Please begin at the top and decide if the person meets each rating in sequence as written. If you are having trouble deciding between two adjacent ratings, rate the lower number.

4	EXCELLENT	no current unstable physical illness, may have 1-2 stable physical illnesses, is on very few medications, and appears healthy and in good physical condition
3	GOOD	may have one unstable physical illness that is being treated or a few controlled physical illnesses, is on few medications, and appears no more than mildly ill
2	FAIR	more than one unstable physical illness and/or numerous chronic medical conditions, several medications, appears moderately ill
1	POOR	several unstable physical illnesses, several medications, appears quite ill, probably in need of hospitalization or terminal/hospital care

Other____

Appendix F:

Frequencies of Individual Responses on each Metacognition Item

Table F-1

Frequencies of Individual Responses on each Metacognition Item

Item #	Response	Frequency	Percent	Valid percent	Cumulative percent
1.	Much better	3	0.35	0.44	0.44
	A bit better	17	1.99	2.47	2.91
	Not much change	375	43.91	54.59	57.50
	A bit worse	262	30.68	38.14	95.63
	Much worse	30	3.51	4.37	100.00
	Total (Mean/*SD*)	687 (3.44/.64)	80.44	100.00	
2.	Much better	1	0.12	0.15	0.15
	A bit better	15	1.76	2.18	2.32
	Not much change	409	47.89	59.36	61.68
	A bit worse	235	27.52	34.11	95.79
	Much worse	29	3.40	4.21	100.00
	Total (Mean/*SD*)	689 (3.40/.61)	80.68	100.00	
3.	Much better	1	0.12	0.15	0.15
	A bit better	5	0.59	0.73	0.87
	Not much change	370	43.33	53.94	54.81
	A bit worse	280	32.79	40.82	95.63
	Much worse	30	3.51	4.37	100.00
	Total (Mean/*SD*)	686 (3.49/.6)	80.33	100.00	
4.	Much better	2	0.23	0.29	0.29
	A bit better	5	0.59	0.73	1.02
	Not much change	628	73.54	91.68	92.70
	A bit worse	46	5.39	6.72	99.42
	Much worse	4	0.47	0.58	100.00
	Total (Mean/*SD*)	685 (3.07/.33)	80.21	100.00	
5.	Much better	1	0.12	0.15	0.15
	A bit better	12	1.41	1.78	1.93
	Not much change	565	66.16	83.83	85.76
	A bit worse	83	9.72	12.31	98.07
	Much worse	13	1.52	1.93	100.00
	Total (Mean/*SD*)	674 (3.14/.45)	78.92	100.00	

(*table continues*)

Item #	Response	Frequency	Percent	Valid percent	Cumulative percent
6.	Much better	1	0.12	0.15	0.15
	A bit better	19	2.22	2.85	3.00
	Not much change	497	58.20	74.51	77.51
	A bit worse	130	15.22	19.49	97.00
	Much worse	20	2.34	3.00	100.00
	Total (Mean/*SD*)	667 (3.22/.54)	78.10	100.00	
7.	Much better	2	0.23	0.29	0.29
	A bit better	12	1.41	1.74	2.03
	Not much change	376	44.03	54.57	56.60
	A bit worse	268	31.38	38.90	95.50
	Much worse	31	3.63	4.50	100.00
	Total (Mean/*SD*)	689 (3.46/.63)	80.68	100.00	

Appendix G:

Scree Plot for Factor Analysis Eigenvalues

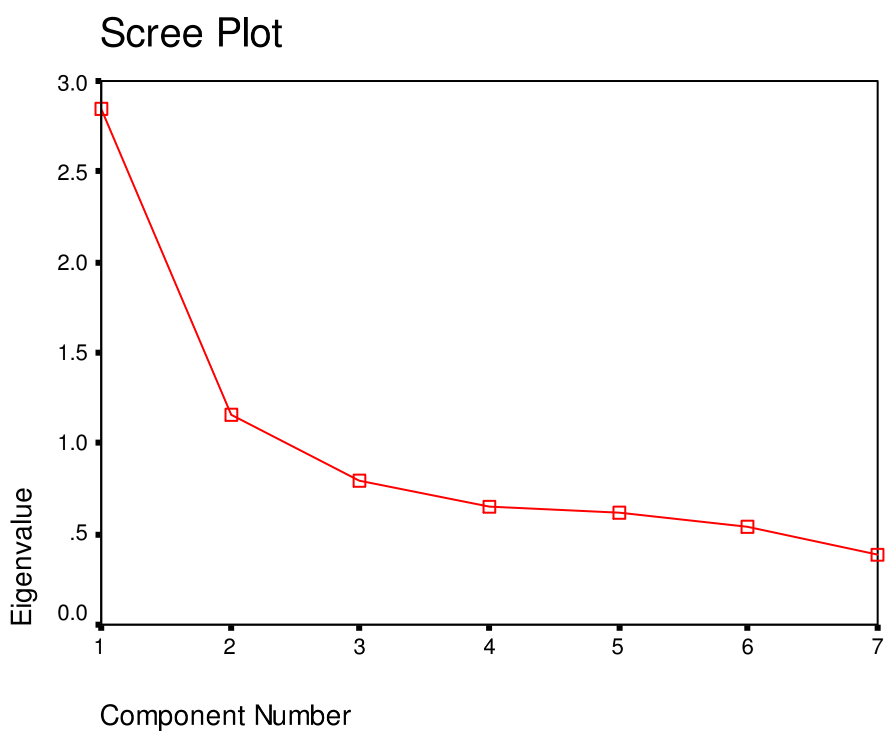
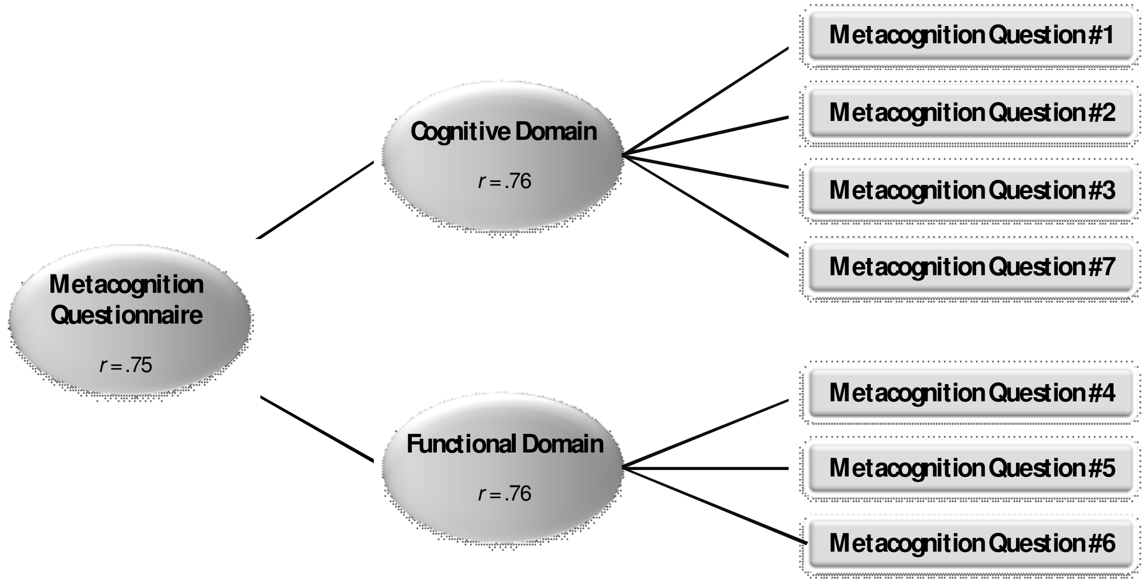


Figure G-1. Scree plot for factor analysis eigenvalues.

The scree plot above suggests that the first two factors account for most of the variance, as the eigenvalues for these two factors both exceed 1. This plot also provides a visual display of components 3-7, which did not obtain an eigenvalue greater than one, and therefore were not retained within the study. This plot also displays the paucity of additional variance that factors 3-7 added to the model, evident here with the relatively flat shape of the line connecting components 3-7.

Appendix H:

Outline of Metacognition Questionnaire



r = internal consistency

Figure H-1. Outline of metacognition questionnaire.

Appendix I:

IRB Approval Letter

Utah State UNIVERSITY

INSTITUTIONAL REVIEW BOARD OFFICE
9530 Old Main Hill
Military Science Room 216
Logan UT 84322-9530
Telephone: (435) 797-1821
FAX: (435) 797-3769

USU Assurance: FWA#00003308
Protocol # 1846

SPO #:
AES #: UTA00

6/1/2007

MEMORANDUM

TO: JoAnn Tschanz
Trevor Buckley

FROM: True M. Rubal-Fox, IRB Administrator

SUBJECT: Measuring Unawareness of Cognitive and Functional Decline in a Population of Elderly Individuals: The Cache County Study

Your proposal has been reviewed by the Institutional Review Board and is approved under exemption #4.

X There is no more than minimal risk to the subjects.
There is greater than minimal risk to the subjects.

This approval applies only to the proposal currently on file. **Any change in the methods/objectives of the research affecting human subjects must be approved by the IRB prior to implementation.** Injuries or any unanticipated problems involving risk to subjects or to others must be reported immediately to the IRB Office (797-1821).

The research activities listed below are exempt based on the Department of Health and Human Services (DHHS) regulations for the protection of human research subjects, 45 CFR Part 46, as amended to include provisions of the Federal Policy for the Protection of Human Subjects, June 18, 1991.

4. Research, involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.