Comparison of the Reliability of Two Mental Status Questionnaires (MMSE & SMMSE) for use in Screening Cognitive Impairment in Elderly Clients in Chronic Care Units: Implications for Nursing Practice

by

Verna C. Pangman

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COMPARISON OF THE RELIABILITY OF TWO MENTAL STATUS QUESTIONNAIRES (MMSE & SMMSE) FOR USE IN SCREENING COGNITIVE IMPAIRMENT IN ELDERLY CLIENTS IN CHRONIC CARE UNITS: IMPLICATIONS FOR NURSING PRACTICE

BY

VERNA C. PANGMAN

A Thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF NURSING

Abstract

Accurate assessment of cognitive impairment in elderly clients is a concern to health professionals, including nurses in clinical settings. Assessment and detection of cognitive impairment in the elderly is an essential dimension of professional nursing. Based on such assessments, nurses plan specific nursing interventions appropriate for the needs of elderly clients and family members. To conduct such assessments nurses depend on their clinical judgement skills and valid and reliable screening tools to measure cognitive functioning. This study assessed two tools developed for measuring cognitive impairment. The first is the Mini-Mental State Examination (MMSE); and the more recent version is the Standardized Mini-Mental State Examination (SMMSE). One study has indicated empirically that the SMMSE has greater reliability then the MMSE when screening for cognitive impairment in elderly clients, both in a nursing home and in a chronic care hospital unit. This study investigated the correlation and reliability of the two instruments through repeated administrations, at selected time intervals, using a sample of cognitively impaired clients in chronic care units. The convenience sample was comprised of 28 cognitively impaired clients. Each was randomly assigned to one of two equally sized groups. Once weekly, for the first two weeks, group A was administered the MMSE while Group B the SMMSE. After 2 weeks a crossover of both groups occurred to control for order effects. Similarly, during the second 2 week period Group A was administered the SMMSE and Group B the MMSE. The investigator administered the scales at all time intervals. Analysis used both parametric and non parametric techniques. Statistically significant correlations between the 2 scales ($r = .80$ to $.96$, $p < .0001$) were revealed. Test-retest correlation coefficients were also statistically significant ($r = .90$ to $.97$ $p < .001$). The findings suggested that the MMSE scale was the preferred tool. High Cronbach's alpha levels provided strong empirical support for the internal reliability of the MMSE and SMMSE scales. A 2 - way repeated analysis of variance was conducted to confirm that groups were similar through time. Findings indicated a lack of parallelism for the average scores per group over time. Tests for order effects specific to crossover designs were conducted according to Fleiss (1986). Findings from these tests indicated no order effects. Implications for nursing education, practice and research are discussed based on the findings.

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I would like to acknowledge and to extend my sincere gratitude to several people who have helped me to make possible the conception and the completion of this academic thesis.

To the chairperson of my thesis committee, Dr. Lorna Guse, who motivated me to strive continually for excellence in gerontological nursing research, I express my sincere appreciation. Dr. Guse's devotion to reviews of my work, to discussions of my intents, and to guiding me generally has challenged me most positively during the investigative portion of the study and throughout the writing component. Dr. Guse's consistent support is deeply respected and appreciated.

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STATEMENT OF THE PROBLEM

A basic human characteristic is the ability to process information and, on the basis of that information, make constructive decisions. Many elderly people feel threatened at the possibility of losing their cognitive abilities, either associated with the aging process, or through stressors such as cerebral vascular disease.

Cognitive impairment is one of the most pervasive health problems found among the elderly population. This health problem is of concern to health professionals, including nurses in institutional settings. The goals of nursing care in these settings include the intent to improve the quality of life of older adults, to maximize their functional independence and to promote their health. In order to meet these goals nurses must be able to assess accurately the cognitive capacity of elderly clients based on comprehensive clinical assessments of physiological functioning and mental status. These assessments include the use of both subjective and objective methods for the collection of data. Based on such assessments, the strengths and concerns of elderly clients can be identified. Furthermore, nurses can plan specific intervention strategies appropriate for the needs of elderly clients in order to promote their health, independence and quality of life.

Studies have demonstrated that instances of cognitive impairment have been overlooked in acute and chronic care

settings because nurses frequently fail to assess accurately the cognitive functioning of older patients (Gehi, Weltz, Strain, & Jacobs, 1980; Foreman, 1989; Dellasega & Morris, 1993). Research in the area of assessing the mental status of cognitively impaired elderly clients provides a knowledge base for nurses who work in the acute and chronic care settings. To date, evidence indicates that nurses tend to describe cognitive capacity primarily in terms of orientation factors (Williams Ward & Campbell, 1988; Le, Venti, & Levin, 1994). Research on assessment of cognitive capacity is important to direct nurses to carry out comprehensive assessments routinely, systematically, and objectively by using a valid and reliable screening tool to measure cognitive functioning.

A number of tools have been developed especially for the measurement of cognitive impairment (Applegate, Blass, & Williams, 1990). One such screening tool is the Mini-Mental State Examination (MMSE) developed by Folstein, Folstein and McHugh (1975). This instrument is one of the most widely used screening tests of cognitive function (Tombaugh & McIntyre, 1992). Several studies have indicated that the MMSE is a valid tool for screening cognitive impairment. Recently, the Standardized MiniMental Examination (SMMSE) was developed to screen cognitive impairment in elderly clients (Molloy, Alemayehu & Roberts, 1991). Empirical evidence indicates that both tools (MMSE and SMMSE) are reliable. However, one empirical study has indicated that the SMMSE has better reliability (intraclass correlation

.90) compared with the MMSE when screening for cognitive impairment in elderly clients both in a nursing home and in a chronic care unit (Molloy et al. 1991).

The intent of this study was to investigate the correlation and the reliability of the two instruments. The results will shed light whether or not the SMMSE is, in fact, the more reliable of the two instruments.

Statement of the Research Problems

This study has investigated the following questions:

1) What is the correlation between MMSE and SMMSE in measuring cognitive impairment in elderly clients in chronic care units?

2) What are the estimates of reliability associated with MMSE in measuring cognitive impairment in elderly clients in chronic care units?

3) What are the estimates of reliability associated with SMMSE in measuring cognitive impairment in elderly clients in chronic care units?

LITERATURE REVIEW

The literature review is presented in four sections. To begin, a description of cognition and changes in cognitive functioning in the elderly is provided. Second, cognitive impairment in the elderly is introduced with emphasis on definition, etiology/typology and clinical assessment. Third, the prevalence of cognitive impairment and the screening tools used to detect cognitive impairment in institutionalized elderly clients are presented. Finally, the psychometric properties (validity and reliability) of the two screening tools, MMSE and SMMSE, are provided.

Cognition and Changes in Cognitive Functioning in the Elderly

Cognition is a process by which a human being thinks and reasons rationally to come to know the world (Sundeen, 1995). Cognition is composed of several higher mental mechanisms used to acquire, to process, to store, to retrieve, and to apply information. Foreman (1989) claimed that one model of cognition is best understood by the study of memory which is comprised of three components: sensory, short-term,and long-term memory. The first component, sensory memory, is viewed as a perceptual holding system by which selective incoming information is held briefly until it is transformed by the individual into patterns of images or sound, or other types of sensory codes (Foreman, 1989). This transformed information then enters the second

component of memory known as short-term memory where a limited amount of information is held for a brief period. Information to be retained for later retrieval must be encoded and stored in long-term memory; the last component of memory (Ebersole & Hess, 1994). Whether or not information remains accessible depends in part upon how efficiently it was stored and on how useful the individual's present retrieval strategies are.

Foreman (1989) asserted that cognitive changes associated with aging have imposed limitations on the human-processing information system. Age related changes in cognition include changes in attention, language, memory, problem solving, and visual spatial abilities (Nolan & Blass, 1992). Memory is a key cognitive process because to exercise judgment, make decisions, or orient oneself to time and place, one must remember past experiences and points of references. Nolan and Blass (1992) claimed that the study of age related changes revealed that age related changes in cognition vary in nature among the elderly. Consequently, some elderly persons are especially vulnerable to impaired cognition (Foreman, 1989). Changes in cognitive functioning may be due to a variety of factors, i.e. general medical condition, substance (e.g. a drug of abuse), or a combination of these factors. Depending on the stressor, the cognitive impairment may be reversible or characterized by progressive deterioration in functioning (Sundeen, 1995).

Current theory concerning cognitive functioning indicates the importance of implementing strategies to assist the elderly

person to process encoding or retrieval of information that must be remembered to provide self-care (Foreman, 1989; Nolan & Blass, 1992). However, before implementing interventions, a comprehensive assessment of cognitive function is necessary (Danner, Beck, Heacock, & Modlin, 1993). McDougall (1990) stated that cognitive function includes twelve categories as determined by Kane and Kane (1981). These categories are: attention span, concentration, intelligence, judgment, learning ability, memory, orientation, perception, problem-solving, psychomotor ability, reaction time, and social intactness. Cognitive function also refers to a person's ability to act purposefully, to think rationally, and to deal with his or her world in an effective manner. It encompasses the elderly individual's ability to process information in order to make appropriate judgments and to choose among alternatives (Phillips, Chu, Morris, & Hawes, 1993; Strub & Black 1993).

Assessment of cognitive functioning in elderly clients presents a challenge to health care providers. Good assessment techniques include both subjective and objective data collection methods (Campbell, 1995). McDougall (1990) stated that reliable and valid screening tools, like mental status questionnaires with established guidelines, are best suited to measure the presence, absence or severity of cognitive impairment. Screening instruments have shown to be effective in the assessment of the levels of cognitive impairment in the elderly client in the community, and in acute and chronic care units. Screening tools

coupled with subjective measures, such as an accurate health history and observations recorded by the health care team, document areas of strengths and concerns of the elderly client (Campbell, 1995). This total assessment provides a data base that will assist the health care team, the elderly client, and their families in identifying the appropriate health care services needed.

Cognitive Impairment in the Elderly

Definition

Several definitions of cognitive impairment have been suggested. One such definition provided by Folstein, Anthony, Parhad, Duffy and Gruenberg (1985) defines cognitive impairment as a diminished capacity to know the world. Heacock, Walton, Beck and Mercer (1991) claimed that cognitive impairment refers to the physiological disruption of brain structures which involve cognitive function including the capacity to: acquire, process, classify, integrate, store and recall information. One other definition of cognitive impairment is provided by McDougall (1990). He argued that cognitive impairment is a broad construct which refers to disturbances in cognitive function including attention span, concentration, intelligence, judgement, learning ability, memory, orientation, perception, psychomotor ability, reaction time and social intactness. All of the stated definitions suggest one common element, that is, a disruption in cognitive functioning. Folstein et al. (1985) stated that a

standardized definition of cognitive impairment should be developed through various research studies on cognitive functioning in the elderly.

Etiology and typology. The causes of cognitive disorders are multiple in nature. Nolan and Blass (1992) argued that the aging process itself may predispose the individual to some aspects of cognitive impairment. Foreman (1989) stated that a number of physiological, psychological and environmental factors can provoke or increase cognitive disorders. According to Sundeen (1995) and the Diagnostic and Statistical Manual of Mental Disorders (DSM IV) physiological factors are essential elements contributing toward cognitive disorders. Briefly, these physiological factors include: 1) general medical conditions; 2) vascular abnormalities e.g. cerebral vascular disease or subdural haematoma; (3) metabolic disorders e.g. malfunction of thyroid hormone; 4) genetic abnormalities e.g. degenerative brain disease like Huntington's or Pick's Disease; 5) toxic and infectious agents i.e. inflammatory process, such as HIV infection causing impairment to CNS functioning; 6) structural changes i.e. displacement of brain tissue due to trauma or tumours; 7) substance-related disorders e.g. ingestion of multiple drugs in body system or drug abuse; 8) non-specific stressors e.g. unidentified specific stressors related to cognitive disorders or a combination of these factors. As well as the presence of these physiological factors, psychological stress and environmental

agents can further compromise an elderly person's thought process.

Recently, the term "organic mental disorders" has been eliminated from DSM-III-R. Organic mental disorders has now been relabelled cognitive disorders in DSM IV. This group of cognitive disorders indicates a predominant disturbance in cognition or memory and represent a significant change from a previous level of functioning (Tucker, Caine, Folstein, Grant, Lipzin, & Popkin, 1992). This group of disorders includes: delirium, dementia, amnesic disorders and cognitive disorders not other-wise specified. The clinical features of these four conditions, with emphasis on memory or cognition are compared briefly.

The first condition, delirium, is marked by acute onset with fluctuations in levels of attention and orientation. With delirium, recent memory is impaired but the condition is reversible in nature (DSM IV). Dementia, the second condition, is insidious in onset and implies a continuing gradual cognitive decline (DSM IV). Dementia is characterized by the development of multiple cognitive deficits including memory impairment and at least one of the following cognitive disturbances; aphasia (language disturbance), apraxia (inability to carry out motor activities despite intact motor function), agnosia (failure to recognize objects despite intact sensory function) and disturbances in executive functioning (i.e. planning, organizing, sequencing, abstracting) (Tucker et al. 1992). The dementias are listed according to presumed etiology i.e. Dementia of Alzheimer

Type, Vascular Dementia (formerly Multi-Infarct dementia) etc. (DSM IV). The third condition of cognitive disorders may be attributed to amnesic disorders. It is characterized by memory impairment manifested by the inability to learn new information and the inability to recall past events (Tucker et al. 1992). The fourth condition, cognitive disorders not otherwise specified, is a category for disorders that are characterized by cognitive dysfunction. An example is post-concussional disorder following head trauma. This condition is manifested by difficulty in concentration and in learning or memory. A common feature to all four conditions is memory impairment. In addition, extensive individual variation in the conditions of cognitive disorders may be present at any stage of the illness (Wasylenki, Martin, Clark, Lennox, Perry, & Harrison, 1987).

Cognitive impairment in hospitalized elderly clients is often not accurately assessed by health care professionals (Folstein et al. 1975; Garcia, Tweedy, & Blass, 1984; McCartney & Palmateer, 1985; "Patient Care/Clinical Decisionmaking", 1995). The consequence of this action is inappropriate planning and intervention for the elderly client. Care that is grounded in sound assessment will address the strengths and limitations of an elderly client. Care that is not based in accurate assessment can lead to several outcomes including: risk of loss of independence, behavioral difficulties and higher mortality, and higher morbidity (Fields, Mackenzie, Charlson, & Sax 1986; Cooper, Mungas, & Weiler, 1990; Francis & Kapoor, 1992). Mental status

testing should be included in the admission assessment of elderly clients. Foreman and Gabrowski (1992) argued that the prompt identification of cognitive impairment in the elderly client by health care professionals provides the basis of successful interventions. Such interventions can improve the elderly client's condition or significantly slow the progress of the problem (Campbell, 1995).

Clinical Assessment

According to Kane and Kane (1981) comprehensive clinical assessment of the elderly client includes a measure of mental status as well as an evaluation of physical and social functioning. That is, assessment of mental status must be observed in the context of the entire clinical picture. Mental status is the description of the person's psychological/emotional and cognitive functioning (Wasylenki et al. 1987).

Campbell (1995) and Agostinelli, Demers, Garrigan and Waszynski (1994) claimed that a cognitive assessment should shed light on the elderly client's current abilities and disabilities. Assessing an elderly client's cognitive capacity is a crucial factor for four reasons. First, full cognitive capacity (the ability to process, store, and recall information) is one of the major foundations of coping with the world. This ability to cope leads to activities that enhance one's self worth and their feelings of usefulness. Both are valuable assets for the older client. Second, the stress of being a client in an acute or chronic care unit can overwhelm elderly clients who have mild

cognitive deficits. Such overwhelming feelings can increase the likelihood of further cognitive decline and can lead to further cognitive impairment and even to life threatening complications, such as pneumonia. Agostinelli et al. (1994) claimed that health professionals, such as nurses, often encounter elderly clients whose mental status and present level of functioning may change significantly during bouts of acute illness or crisis situations. Third, assessing cognitive capacity allows health care professionals to target specific interventions for elderly clients with varying levels of cognitive impairment (Mace, 1987). The focus of these interventions would be to compensate for the elderly client's deficits and to reinforce their strengths. Finally, when discharge for the elderly client is being planned for return to the community setting or for admittance to a personal care home, health care professionals need to be aware of the client's cognitive capacity (Palmateer & McCartney, 1985; Gallo, Reichel, & Andersen, 1995).

Accurate cognitive assessment must take into account the older adult's sensory deficits, language barriers, and acute health problems. With physical health problems being the root of many cognitive disturbances, it is essential that a complete physical examination supplement the mental status evaluation (Wasylenki et al. 1987). The physical examination must include a collection of diagnostic procedures and laboratory tests as well as a review of the medications the client is taking.

Depending on the suspected condition, a variety of diagnostic procedures may be performed. Typically, the procedures include electroencephalography (EEG), computed tomography (CT scan), and magnetic resonance imaging (Eliopoulos, 1987). A variety of laboratory tests may be conducted as well. These include: complete blood count, serum electrolytes, blood urea nitrogen, blood glucose, bilirubin, blood vitamin level, sedimentation rate, serologic test for syphilis and urinalysis (Eliopoulos, 1987). In addition, a complete review of the medications which the client is taking is critical. Langston Lind (1995) claimed that drug-related problems constitute one of the most common causes of cognitive impairment in the older adult. One such problem is adverse drug reactions causing drug-induced cognitive impairment. Dawling & Crome (1989) argued that age-related changes in drug pharmacokinetics predispose the older adults to adverse drug reactions. These changes include; (a) a decrease in absorption of medications, (b) alterations in distribution of medications, (c) decrease in plasma binding protein, (d) alteration in hepatic metabolism and (e) decrease in renal excretion (Bowen & Larson, 1993). Dowling and Crome (1989) stated that typically the net effect of these changes is an increase in circulating metabolic products and an increased likelihood of adverse drug interactions. However, Hutchinson, Flegel, Kramer, Leduc and Kong (1986) claimed that the greater number of drug reactions appears to be due to an increased number of prescribed medications taken by elderly clients rather than a

direct effect of aging. Consequently, it is important for health care professionals and nurses not only to monitor the number of medications taken by the elderly clients but to maintain close observation for adverse drug reactions which might, in turn, cause drug-induced cognitive impairment (Rice, Jensen, Lyons, & Freeman Murphy, 1994; Weiner & Grey, 1994).

For cognitively impaired elderly clients the delivery of optimal health care is dependent on a team approach requiring assessments from various health professionals who have common goals (Mulkerrin, Nicklason, Sykes, Dewar, Bayer, & Finucan, 1992). One member of such a health team is the nurse. The accurate clinical assessment of mental status, followed by appropriate nursing interventions, is critical in promoting a quality lifestyle for a growing population of elderly individuals (McCartney & Palmateer 1985; Foreman, 1989). A thorough and comprehensive assessment of cognitive changes is vital in implementing effective strategies (Yazdanfar, 1990). In such assessments of cognitive change the data gathered enables nurses to determine needs priorities more accurately and to plan health care more effectively with elderly clients and significant others (Campbell, 1995). Failure, either to recognize changes in cognitive functioning or to implement appropriate strategies, may result in a prolonged hospitalization for the elderly client. Alternatively, premature placement in a personal care home may occur (Fields et al. 1986; Dolamore et al. 1994; Dellasega & Catezo, 1994).

To complete a comprehensive assessment, nurses require an effective screening tool to assess cognitive impairment in the elderly client. The screening tool must be both reliable and valid. Schwamm, Van Dyke, Kiernan, Merrin and Mueller (1987) claimed that one fundamental requirement of any screening tool is that it has high sensitivity (a low rate of false positive results). In addition, the tool must indicate clearly the specific guidelines required to facilitate the process of accurately assessing cognitively impairment in elderly clients. The adoption of such a tool could generate a process whereby valid information about the cognitive functioning of older adults might be easily obtained. Campbell (1995) stated that the screening tools used by nurses are not intended to be diagnostic. Instead, they are intended to determine only the progression of changes in the mental status of the elderly client. The proper use of adequate screening tools facilitates a nursing focus upon specific problems followed by the appropriate intervention strategies. Such a plan of care is important for elderly clients who manifest varying degrees of cognitive impairment in acute and chronic care settings.

McDougall (1990) stated that a variety of reliable, validated screening tools are currently available to assess the presence, absence or degree of cognitive impairment. According to Fields, Fulop, Sachs, Strain and Fillit (1992) and Foreman (1987) the three cognitive screening instruments which have been most used extensively in clinical practice have been: the Folstein

Mini-Mental State Examination (MMSE), the Cognitive Capacity Screening Examination (CCSE), and the Short Portable Mental Status Questionnaire (SPMSQ). Yazdanfar (1990) stated that these mental tests are global in nature yielding a single score in an attempt to quantify the level of cognitive functioning. In brief, the CCSE (Jacobs, Bernhard Delgado, & Strain, 1977) is a 30-item questionnaire developed to diagnose diffuse organic mental syndromes in nonpsychiatric patients. The SPMSQ (Pfeiffer, 1975) is a 10-item, easily administered instrument, that was developed to detect the presence of intellectual impairment in older adults who are either living in the community or residing in institutions. However, Nolan and Blass (1993) and Kane and Kane (1981) claimed that the Mini-Mental State Examination (MMSE) is the most widely used mental status evaluation tool and it provides brief global assessments of cognitive functioning in elderly clients.

The Mini-Mental State Examination, developed by Folstein et al. (1975), is a screening test that provides a brief and objective measure of cognitive function. The tool consists of 11 questions and the range of the total score is 0-30. High scores (24-30) indicate intact cognitive functioning, and low scores (0-23) indicate varying degrees of impaired cognitive functioning (severe to mild). The questionnaire is divided into two sections. The first section requires verbal responses only and assesses orientation, registration, and attention; the maximum score is 21. The second section evaluates the ability to write a sentence

spontaneously, to name objects, to follow verbal and written commands and to copy two overlapping pentagons; the maximum score is 9 (McDougall, 1990). Administration time of the MMSE varies (Albert & Cohen, 1992; Gallo et al. 1995). The guidelines for its administration are subject to interpretation, but the scores obtained for each item can be recorded on the instrument form. Braekhus, Laake and Engedal (1992) claimed that MMSE is a valid and reliable screening tool for the detection of cognitive impairment in elderly adults.

In evaluating the validity of screening tests, the sensitivity and specificity, as well as the predictive value of the tool, must be considered (Larson, 1986). The sensitivity of a test is defined as the percentage of individuals who truly manifest the attribute being considered and are classified accurately by the test. If such is the case the rating is a 'true positive' (Foreman, 1987; Boring, Daniels, Eley, Flanders, & Greenberg, 1993). In contrast, the specificity of a test is defined as the percentage of individuals who truly do not manifest the attribute being considered and are correctly classified by the test. If such is the case the rating is a 'true negative' (Foreman, 1987; Boring et al. 1993; Gallo et al. 1995) stated that the sensitivity and the specificity of a screening test are used to assess the value of its application in the clinical setting.

Gallo et al. (1995) claimed that a related concept is the predictive value of the test result. The predictive value of a

positive test result is the percentage of the individuals with positive test results who truly have the condition of interest. Individuals with a positive result but without the condition, are considered to have false-positive results (Gallo et al. 1995). On the other hand, the predictive value of a negative test result is the percentage of the individuals with negative test results who truly do not have the condition of interest. Individuals, with a negative result but with the condition, are considered to have false-negative results (Larson, 1986). Foreman (1987) claimed that given the nature of the phenomenon and the consequences of not identifying a cognitively impaired elderly client, false positive misclassifications are more acceptable than false negatives.

Foreman (1987) reported that the MMSE administered to a group of elderly clients on a general medical-surgical unit in a hospital setting had a sensitivity of 82% and specificity of 80%. Furthermore, the results indicated that for the MMSE the predictive value of the positive test result was 80% and the predictive value of a negative test result was 82%.

Evidence suggests that MMSE measures cognitive functioning in a consistent manner. Empirical studies have indicated that results from test-retest reliability co-efficient for both cognitively intact and impaired respondents generally fall between .80 and .95 (Tombough & McIntyre, 1992). The MMSE has a high alpha co-efficient of .91 indicating good internal consistency (Albert & Cohen, 1992). This high alpha level

provides evidence that the items in the MMSE scale seem to be measuring the same construct of cognitive impairment (Foreman, 1987; Kay, Henderson, Scott, Wilson, Richwood, & Grayson 1985).

While Molloy et al. (1991) have said that MMSE is a valid and reliable tool they caution that interpretation and scoring of responses on the test are broad, subjective and may vary among raters. Interrater differences among health professionals may affect the reliability of the scores. Molloy et al. (1991) developed more precise guidelines for MMSE administration and in doing so they created a standardized version of the test. The test is called the Standardized Mini-Mental State Examination (SMMSE). The 11 questions found in the tool are time-limited, and the scores range from 0-30. Furthermore, in developing specific guidelines, the tool has become more user-friendly. That is, the guidelines are more clearly outlined by giving instructions and a time limit for each item. The Molloy et al. (1991) findings revealed that SMMSE had higher reliability (intraclass correlation .90) than the MMSE (intraclass correlation .69) in measuring cognitive impairment in a study group of 48 elderly residents from a nursing home and chronic care hospital setting. No results are reported, however, regarding the validity of the SMMSE.

Even though both screening tools separate clients with cognitive impairment from those who are cognitively intact the tools do not replace a complete clinical appraisal in assessing clients with cognitive impairment (Folstein et al. 1975). As part

of the clinical assessment, the health professional, such as the nurse, can use either the MMSE or the SMMSE, to screen different levels of cognitive function in the elderly clients (Dellasega & Morris, 1993; Foreman, 1989; Molloy, McIlroy, Guyatt, & Lever, 1991).

Miller (1995) has claimed that whenever cognitive function is assessed with a traditional psychometric testing such as the MMSE, the educational and occupational level and cultural background of the elderly client must be considered. Furthermore, Galasko, Klauber, Hofstetter, Salmon, Lasker and Thal (1990) claimed that the level of education influences scores on the MMSE. However, one study found no evidence to suggest a difference in validity or reliability of the MMSE between the more educated and the less educated (Jorm, Scott, Henderson, & Kay, 1988). Also Dolamore, Libow, Mulvihill, Olson, Sack, Engberg and Starer (1994) concluded that no significant difference in validity due to educational levels was found between the MMSE and another mental status assessment tool the FROMAJE (Functional, Reasoning, Orientation, Memory, Arithmetic, Judgement and Emotion).

Mace (1987) and Agostinelli et al. (1994) suggested that the scores obtained by the MMSE screening tool measure not only the cognitive status of elderly clients but they offer clues to specific functional abilities and disabilities. For example, the inability of an elderly client to spell the word 'WORLD' backward is claimed to suggest an impairment in attention. Additional

assessment by the nurse of the identified aspect of cognitive impairment (e.g. poor attention) as it relates to function (eg. ability to eat independently) assists the nurse to specify interventions (e.g. use of simple commands) that can maximize the client's functional ability (Agostinelli et al. 1994). However, Dellasega and Cutezo (1994) caution that although screening instruments such as the MMSE are available to assist the nurse in making a cognitive assessment, these instruments fail to capture the functional aspect of the elderly client's cognitive abilities. For example, even though an elderly client may score poorly on a formal exam, he or she may still be able to live independently and to carry out the activities of daily living as well as even more complex tasks such as grocery shopping. Presently, some evidence exists which claims that the quality of life for the cognitively impaired elderly client can be improved by estimating the functional level and by planning interventions based on the MMSE performance (Aske, 1990).

Prevalence and Screening of Cognitive Impairment in Hospitalized Elderly Clients

The proportion of elderly persons in the Canadian population is increasing steadily and is projected to continue to increase during the next 75 years. The "Canadian Task Force on the Periodic Health Examination" (1991) and "Manitoba Study of Health and Aging" (1995) indicated that cognitive impairment becomes increasingly widespread among people who are 65 and older. The

"Manitoba Study of Health and Aging" (1995) estimated that 82 of every 1,000 Manitobans aged 65 and older are affected by dementia (all types). Many of these elderly clients become hospitalized and fare worse than their cognitively intact counterparts. Evidence indicates that during different stages of hospitalization 24% to 80% of elderly clients in general have experienced some form of cognitive impairment (Cavanaugh, 1983; Williams, Campbell, Raynor, Musholt, Mlynarczyk, & Crane, 1985; Erkinjunitti, Autio, & Wikstrom 1988; Dellasega & Shellenbarger, 1992). Results of a study conducted by Fields et al. (1986) indicated that the cognitively impaired patients had a higher rate of mortality than the cognitively intact patients. Consequently, to document cognitive changes over time the use of simple, but valid and reliable mental status tests is imperative.

The "Canadian Task Force on the Periodic Health Examination" (1991), strongly recommended that one of the research priorities should be to develop screening instruments for cognitive impairment in acute and chronic care settings which are more sensitive and more specific than are those currently available. One of the screening tools used widely, in acute and chronic care settings, to assess cognitive impairment in elderly clients is the MMSE (Dellasega & Shellenbarger, 1992). This research reported the reliability of the MMSE and the SMMSE tools when they were used to assess cognitive impairment in elderly clients in a chronic care setting.

Psychometric Properties of Screening Tools - MMSE and SMMSE

Validity and reliability are basic requirements of measurement instruments. These two aspects are considered next in this review of the psychometric properties of the MMSE and SMMSE screening tools for cognitive impairment. Only one study has compared the reliability of the SMMSE to that MMSE (Molloy et al. 1991). The validity of the SMMSE has not been reported in any of the studies reviewed.

Validity

Validity refers to the degree to which an instrument measures what it is intended to measure. Validity is the ultimate requirement of all scales and tests. High reliability in an instrument provides no evidence of its validity for an intended purpose. Three types of validity are: content validity, criterion-related validity, and construct validity. These types of validity correspond either to the kind of validity information to be gathered or to the aim of testing of the instrument in question.

Content validity demonstrates the extent to which the sample of items of an instrument is representative of some domain of content (McMillan, 1992). This type of evidence is usually collected by a panel of experts who judge whether or not the content of the scale is truly representative of the concept being measured (Dadakis Horn, 1981). In a study conducted by Foreman (1987) content validity of the MMSE was determined by reviewing and by summarizing the psychometric and clinical literature about

the mental status questionnaire. Findings revealed that the MMSE measures aspects of mental status.

The second type of validity, criterion-related validity, seeks to establish the relationship between the scores of the instrument and some externally established criterion of an acceptable standard. To determine the sensitivity of MMSE, Anthony, LeResche, Niaz, VonKorff and Folstein (1982) were the first to employ the 23/24 cut-off criterion. This cut-off criterion was based on data originally reported by Folstein et al. (1975) who suggested that a high, if not perfect, level of sensitivity (true positive) would occur if the cut-off criterion was set at 23/24. In the study conducted by Anthony et al. (1982) findings revealed that at this cut-off value (23/24) the MMSE identified correctly 20 of the 23 impaired patients on a general medical ward in a hospital setting (sensitivity of 87% and specificity of 82%). Two other studies of elderly clients in hospital settings using 23/24 value as a cut-off point have reported sensitivity 79%-82% and specificity 80%-86% (Foreman, 1987; Kafonek, Ettinger, Roca, Kittner, Taylor, & German, 1989). However, only the study by Kafonek al. (1989) reported sensitivity of 77% and specificity of 86% when scores were adjusted for physical disability. The same methodology was also used in this study.

The sensitivity of the MMSE for general neurology and psychiatric patients is low, ranging from 21% to 76% (Tombough & McIntyre, 1992). Two reasons are cited for this occurrence. One

reason is that language items are too simple to detect impairments, and the other reason is that MMSE is insensitive to damage in the right hemisphere, causing an increase in false negatives (Dick, Guiloff, Stewart, Blackstock, Bieluwska, Paul, & Marsdan, 1984). Two empirical investigations however, have indicated lowered specificity when psychiatric patients are included in the comparison group. In one such study, Davous, LaMour, DeBrand and Rondot (1987) reported 100% specificity when the control group consisted of patients with neurological disorders, but only 82% specificity when psychiatric patients were used. In the second study, Folstein et al. (1985) reported similar trends of specificity in a community survey.

The last type of validity to be considered is construct validity. Construct validity refers to the extent to which an instrument measures a theoretical construct or trait. Since the MMSE was developed to assess the construct of general cognitive ability, Folstein, et al. (1975) compared MMSE scores to those obtained on the Wechsler Adult Intelligence Scale. A correlation of .78 with the Verbal Scale and .66 with the Performance Scale was found. In their comprehensive review of the MMSE, Tombough and McIntyre (1992) claimed that several studies have confirmed a high correlation between the MMSE and the Wechsler Adult Intelligence Scale.

Reliability

The reliability of a instrument is defined as the extent to which the instrument yields the same results on repeated

measures. The three important components of a reliable scale are stability, internal consistency and equivalence. These three elements will be discussed briefly in relation to the MMSE and SMMSE screening tools.

The stability of the tool refers to the tool's ability to produce the same results with repeated testing. One of the major tests of reliability used to estimate stability is the test-retest reliability. Tombaugh and McIntyre (1992) claimed that several studies provide data on test-retest reliability for the MMSE screening tool. These studies use a test-retest interval of 2 months or less in order to reduce the influence that illness-induced changes might exert on estimates of reliability (Folstein et al. 1975; Dick et al. 1984; Anthony et al. 1982; Jorm, Scott Cullen, & MacKinnon, 1991). Findings from these studies indicated that test-retest reliability co-efficient for both cognitively intact and impaired respondents fell between .79 and .95. These reliability estimates are generally consistent with those reported by Lesher and Whelihan (1986) for other brief cognitive screening tests. A low test-retest reliability coefficient was obtained for delirious subjects in a study conducted by Anthony et al. (1982). However this unusually low coefficient of .56 for delirium patients in the hospital setting reflects the fluctuating course of delirium. Two studies report effects on test-retest reliability which may be due to 'practice effects' (Folstein et al. 1975: Jorm et al. (1991). Jorm et al. (1991) argued that memory regarding the responses is unlikely to be

entirely responsible for the effects on retest because reasonably high test-retest reliability has been reported previously. Nevertheless, Keating III (1987) recommended that investigators modify periodically the three items of: object recall, backward spelling, and serial subtraction particularly in situations in which groups of elderly people congregate and share their medical experiences. At present, only one study has reported SMMSE to have a significant difference in test-retest reliability (intraclass correlation .90) as compared to the MMSE (Molloy et al. 1991).

The second type of reliability is internal consistency or homogeneity. This type of reliability identifies the items within the scale which reflect or measure the same concept. This type of reliability indicates the extent to which the items on the test are complementary to each other. One statistical test used to assess internal consistency of an instrument is Cronbach's alpha. Kane and Kane (1981) reported that the most widely used mental-status screening tools are designed purposely to include items which represent a variety of domains. In such cases, investigators would not expect the tool to be internally consistent. However, the Foreman (1987) findings revealed a high alpha level .96 obtained when the MMSE was used with a mixed group of medical and surgical patients in a hospital setting. This estimate of reliability suggests that MMSE measures just one concept, and that it is consistent over time (Foreman, 1987).

Equivalence is the third type to be considered in estimating the reliability of a measure,and it arises when different observers or raters are using the tool to measure the same variable. That is, if the scale is administered by two different raters, the scores should be highly correlated. Kane and Kane (1981) claimed that inter-rater reliability tests, which are designed to determine whether the results are consistent despite variations in interview styles and techniques have generally not been reported. However, the Molloy et al. (1991) findings showed the inter-rater variance to be reduced 76%, when the SMMSE was used, as compared to the MMSE, to measure cognitive impairment in elderly residents. Specifically, when different raters use the SMMSE scale to measure cognitive impairment in the elderly residents more agreement exists between the ratings of the different raters.

The MMSE has been shown to be reliable and valid in clinical practice and research settings (Foreman, 1987; Crum, Anthony, Bassett, & Folstein, 1993). Currently, the MMSE is the most widely employed screening instrument for cognitive impairment (Roccaforte, Williams, Burke, Bayer, & Wengel, 1992). Empirical investigations remain to be conducted to further assess the reliability and validity of the SMMSE screening tool for cognitive impairment.

Chapter Summary

This literature review has included a presentation of the research findings and points of view of cognition and changes in cognitive functioning in the elderly; cognitive impairment in the elderly; prevalence of cognitive impairment and the screening tools used to detect cognitive impairment in hospitalized elderly clients. Finally, the psychometric properties of the two screening tools (MMSE and SMMSE) used in this research study are presented.

The review indicates that cognitive impairment in the elderly client is a prevalent problem in our society today. Assessing mental status of elderly clients has been found to be important, especially on initial assessment for older adults admitted to institutions. Changes in mental status need to be carefully assessed by health professionals, such as nurses, with a valid and reliable screening tool.

This study compared the reliability of two screening tools (MMSE & SMMSE) for cognitive impairment in elderly clients in five chronic care units in a geriatric care facility.

The purpose of this study was to compare the MMSE and SMMSE scales by determining the following:

1. the correlation between MMSE and SMMSE in measuring cognitive impairment in elderly clients in chronic care units,
2. estimates of reliability associated with MMSE in measuring cognitive impairment in elderly clients in chronic care units,

3. estimates of reliability associated with SMMSE in measuring cognitive impairment in elderly clients in chronic care units.

METHODOLOGY

The methodology used in the study is presented in six sections. The research design used in the study is introduced first to provide a basis for the later sections. A description of the setting and sample of cognitively impaired elderly clients who participated is provided. Next, the properties of the instruments administered in this research study are presented. The procedure used, with emphases on the protocol and on the informed consent process are provided to clarify the research methodology used. Finally, the data analysis used in this study is outlined.

Design

Table 1

The Crossover Design

TIME	1.	2.	**CROSSOVER**	1.	2.
Group A	MMSE	MMSE		SMMSE	SMMSE
Group B	SMMSE	SMMSE		MMSE	MMSE

This design used the repeated administrations of a traditional screening test (MMSE), and a standardized screening test (SMMSE) at selected time intervals of a week apart. A sample of 28 cognitively impaired clients of both sexes in chronic care units were randomly assigned either into Group A or to Group B. Each group was comprised of 14 participants. For the first two

weeks Group A were administered the MMSE, and Group B were administered the SMMSE screening tool. For the second 2 week period Group A were administered the SMMSE and Group B were administered the MMSE screening tool. A crossover of both scales occurred to control for order effects.

According to Fleiss (1986) an important feature to consider when each research participant acts as his or her own control is to address the possible effects of order. Variations in responses over the course of the study can be a function of practice or of fatigue (so-called constant errors). The crossover design, known also as a counter balance design, controls for order effects Counterbalancing is achieved by randomly dividing the group in half and giving each half the tasks in the opposite order (Tuckmann, 1978). In this study the tasks are the two scales being studied. A counterbalanced order e.g. MMSE and SMMSE, SMMSE and MMSE enables the constant errors to be equalized across the experiences.

Setting

The participants in this study were recruited from five chronic care units in a long term care geriatric centre situated in Winnipeg, Manitoba. Two of the units, comprised of 44 beds each, are classified as respiratory units and most of the residents have chronic obstructive pulmonary disease. Three of the other chronic care units, comprised of 61 beds in total, housed long term care residents with chronic conditions such as

cardiovascular disease, arthritis, Parkinson's Disease etc. Each of the five units was managed by a Nurse Unit Manager who was a registered nurse. The long term facility used in the study has a total of 461 in-patient beds where skilled staff provides long term care and a wide range of specialized programs for the patients.

Sample

To be included in the sample, each elderly participant had to meet the following inclusion criteria: age 60 or older as at the commencement of study, able to understand and to speak English, low dosages or no psychotropic drugs. Participants were excluded from the study if they: had acute psychiatric illnesses, had acute illnesses that might interfere with the scores (i.e. high fever), demonstrated recent changes in cognitive function due to current chemical dependency, were on a behavior-management program, had received a Folstein's Mini-Mental State Examination within 30 days prior to the commencement of the study, or had severe sensory/physical deficits and aphasia which might interfere with their ability to answer items on the test. Based on these criteria, 35 cognitively impaired elderly residents were identified by either the nurse unit manager or staff registered nurses from each of the units. Of the 35 eligible residents, six were excluded because the investigator could not obtain a proxy consent. One patient died a few days after being selected.

This study consisted of 28 cognitively impaired elderly participants. The 28 participants included 9 males and 19 females. The mean age was 79 years with an age range from 60-98 years. The sample was predominately female (68%). Of the total sample the majority (89%) had education of grade eight and above. The demographic data for gender, age and level of education are presented in summary form in Table 2.

Table 2

Gender, Age, and Education Levels by Group

I. Gender

Combined Gps A & B	**N**	**%**
male	9	32
female	19	68

II. Ages

	N	**Mean**	**Range**
Combined A & B	28	79 yrs.	60-98 yrs.

III. Education Level Achieved

	Mean with Gr 8 or higher (%)	**Mean with Less than Gr 8 (%)**
Combined A & B	89	11

(See Appendix A for gender, age and level of education by group).

Most participants (43%) were of British descent; 21% were of Slavic background; 10% were of French origin and the remainder 26% were from various ethnic backgrounds. All participants were retired. Their principal occupation prior to retirement was

recorded. Approximately one-third (n = 9) of participants were home-makers and the other two-thirds (n = 19) held various occupations ranging from a high school teacher to a labourer. (Table 3)

Table 3

Ethnic Background and Pre-retirement Occupation by Group

I. Ethnic Background

Group	Ethnicity	n	%
Combined Groups A & B	British	12	43
	Slavic	6	21
	French	3	10
	Icelandic	2	7
	Scottish	2	7
	Aboriginal	1	4
	German	1	4
	Swedish	1	4

Note: Percentages have been rounded so they may not total to 100 %.

II. Occupation

Group	Occupation	n	%
Combined Groups A & B	Homemaker	9	32
	Salesperson	4	14
	Teacher	2	7
	Brewer	1	4
	Counsellor	1	4
	Factory Worker	1	4
	Labourer	1	4
	Mailman	1	4
	Pilot	1	4
	Purchasing Agt	1	4
	Religious Bro.	1	4
	Restauranteur	1	4
	Seamstress	1	4
	Telegrapher	1	4
	Waitress	1	4
	Welder	1	4

Note: Percentages have been rounded so they may not total to 100 %.

(See Appendix B for ethnicity and occupation by group).

The demographic variables of age, gender, education, and occupation are distributed equally across the 2 treatment groups so any differences in outcome measures cannot be attributed to any of these sources.

In December 1994, at the beginning of the study, twelve of the research participants were selected and randomly assigned, using a table of random numbers, either to Group A or to Group B. Subsequently throughout the study the remainder of the sample was randomly assigned in a similar manner to either Group A or to Group B. By April, 1995, each group had 14 participants. Of the 28 cognitively impaired participants, 13 participants displayed high levels of physical impairment. These 13 participants experienced physical difficulties at completing some of the tasks. For example, some of the research participants had difficulty in grasping the pencil. Others had difficulty in moving their arm. A few research participants could not clearly see the bold print on a card which stated 'close your eyes'. Others, on the other hand, found it difficult to hear the researcher ask the questions even though the tone of voice and the enunciation of words by the researcher were audible for other participants. If the researcher observed that the participant was unable to complete the item due to physical impairment then the researcher recorded "physically unable" for that particular item. For these participants after data collection their scores were adjusted for physical disability according to the method used by Kafonek et al. (1989).

Following this method, if 5 single point items were missed then the score achieved for that particular participant was out of 25, rather than 30, which represented the cumulative score e.g. 15/25. To account for weighting based on physical disability, the cumulative score eg. (15/25) was proportioned out of 30 which represented the adjusted score e.g. 18/30. If the research participant scored less than 76% of the total points available, after correction for those that could not be completed because of physical disability, cognitive impairment was diagnosed e.g. 18/30 x 100 = 60%. This cut- off value of 76% is the same as the established cut off point selected in this study. That is, those participants scoring less than 24 points are considered to be cognitively impaired.

Instruments

The MMSE and SMMSE measured cognitive impairment in the 28 elderly participants residing in the five chronic care units.

The similarities and differences between both scales are presented beginning with the MMSE instrument. The MMSE is comprised of two sections which together contain 11 tasks of cognition. The first part assesses the following: orientation to time (year, season, date, day, month) and location (country, province, city, centre, floor) (10 points); registration by immediate recall of 3 words e.g. (ball, car, man) (3 points); attention and calculation by ability to count backwards from 100 by 7s to 65 or if client cannot or will not perform task then by

ability to spell 'world' backward (5 points); short term memory by recall of the three words in registration item (3 points). The second part assesses language by ability to name 2 objects, repeat a sentence, follow a three-stage command, read a sentence out loud and obey what it says and write a sentence (8 points); and constructional ability by performance on a task that requires the client to copy a design (1 point) (Gallo et al. 1995; Cockrell & Folstein, 1988). Scores ranged from 0 to 30. The study by Folstein et al. (1975) indicated that individuals who are cognitively intact often obtain scores ranging from 24-30 with a mean score of 27.6. In order to complete the test successfully, the elderly client must be sensory intact (hearing and vision), and they must demonstrate sufficient musculoskeletal function to hold a pencil or pen and to write (Dellasega & Morris, 1993). (See Appendix C1 for screening tool).

The second test, SMMSE, is a standardized version of the MMSE. The tool is divided into 2 sections containing 11 items of cognition. The first part assesses the following; orientation to time (year, season, month, date, day) and location (country, province, city, centre, floor) (10 points); registration by immediate recall of 3 words e.g. (ball, car, man) or e.g. (bell, jar, fan) for repeated use (3 points); attention and calculation by ability to spell 'world' backward (5 points); short term memory by recall of three words in registration item (3 points). The second part assesses language by ability to name 2 objects, repeat a sentence, read a sentence out loud and obey what it

says, follow a three-stage command, and write a sentence (8 points); and constructional ability by performance on a task that requires the client to copy a design (1 point). Molloy et al. (1991) developed more precise guidelines regarding the scoring procedures and the times required for responding to each item. Scores range from 0 to 30. (See Appendix C2 for screening tool).

Both tools measure cognitive functioning in the elderly client. However, similarities as well as differences in the two instruments exist. One similarity is that a cut off point of 24 distinguishes cognitively impaired elderly clients from non impaired elderly clients. In regarding differences, the 'time' aspect of the orientation task in the SMMSE asks questions from a general to a more specific format, whereas the MMSE does not. In the attention and calculation task the SMMSE does not require the elderly client to do the serial 7s task. Meanwhile the MMSE requires the examiner to begin with the serial 7s. If the client cannot, or will not, complete the task then the task of spelling the word 'world' backward is initiated. See Table 4 for similarities and differences of the MMSE and SMMSE screening tools.

Table 4

I. Screening Tools: Similarities and Differences

	Similarities MMSE–SMMSE	**Differences MMSE**	**Differences SMMSE**
Purpose	Both measure cognitive functioning in the elderly		
Content	11 items: asses orientation, memory, attention, calculation, language, constructional ability		
Administration	easily administrated	5-15 minutes to administer Guidelines provided	6 1/2 minutes to administer Precise guidelines
Psychometric properties		Validity: previously determined Reliability: test-retest r = .79 - .95 Internal Consistency: Alpha = .91 - .96	Validity : NOT determined Reliability: Molloy et al. (1991) Intraclass correlation: SMMSE = .90 MMSE = .69
Score	Maximum 30 scores from 24-30 = NO cognitive impairment	Scores from 18 - 23 represent mild cognitive impairment Scores from 0 - 17 represent severe cognitive impairment (Tombaugh & McIntyre, 1992)	Scores from 20 - 23 represent mild cognitive impairment. Scores from 10 - 19 represent moderate cognitive impairment Scores from 0 - 9 represent severe cognitive impairment (Molloy et al., 1991)

Table 4 (Continued)

II. Screening Tools: Content

CONTENT	MMSE	SMMSE	SCORE
Orientation	year season date day month country province city centre floor	year season month date day country province city centre floor	10
Registration	3 words: ball car man	or ball bell car jar man fan	3
Attention and Calculation	Serial 7s - if cannot or will not perform serial 7s then : Spell "world" backward.	Spell "world" backward	5
Recall	Restate the 3 words from the Registration section	Restate the 3 words from the Registration section	3
Language	Name two objects Repeat a sentence Follow a 3-stage command Read a sentence and obey what it says 'Close your eyes' Write a sentence	Name two objects Repeat a sentence Read a sentence and obey what it says 'Close your eyes' Follow a 3-stage command Write a sentence	8
Constructional Ability	Copy a design	Copy a design	1 Total = 30

In summary, the SMMSE, as compared to the MMSE, is more rigorous in application (time limits) and is more consistent in format (general to specific).

Procedure

This section is divided into two parts. In the first part the protocol of how the study was conducted is introduced. Second, the procedure used to obtain informed consent is provided.

Protocol

Data collection was carried out from December 1, 1994 to April 1, 1995. Prior to the administration of both MMSE and SMMSE, demographic data (age, gender, level of education, occupation, ethnic background) were collected by the researcher: (a) from the registered nurses, who identified the potential research participants, and (b) from a review of the chart of each potential participant. The MMSE was administered following the procedure of Folstein et al. (1975) in which the serial 7's and 'world' backward task that assess attention and calculation are assumed to be interchangeable (Galasko et al. 1990). Research participants were asked to begin with 100 and count backwards by 7. They were asked to stop after 5 subtractions. If they were either unable to or would not complete the task of subtraction the alternative of spelling 'world' backward was offered to them. The SMMSE, developed by Molloy et al. (1991), was administered. The attention and calculation task was assessed by the ability of the research participant to spell world backward without attempting the serial 7s.

The 'practice effects' as reported by Folstein et al. (1975) and by Jorm et al. (1991) were considered. The investigator

modified the object recall item on the SMMSE during the second and fourth week. The main objects used by the researcher were (ball, car and man). Examples of alternate objects are provided in the SMMSE guidelines. The three words used by the researcher were (bell, jar and fan).

The time of administration of both tests for research participants in each group and for the environmental setting was controlled. Participants in both groups had their tests administered by the investigator on Saturdays either in the morning or in the afternoon during each of the four weeks. It was important to keep the test time consistent because the elderly may respond differently during different parts of the day. According to one nurse researcher, Carnevali (1992), the best time for an interview with the elderly client is during the morning hours because cognitive functioning tends to decrease in the late afternoon and evening. The environmental setting was standardized for all research participants by always administering the test in a quiet area e.g., ward lounge, ward conference room, and the client's own room, providing that no other clients were present. Tombough and McIntyre (1992), who reviewed a series of studies using MMSE, argued that the site of testing can also influence retest scores.

Informed consent

An established expectation exists that under no circumstances may an investigator involve a human being as a research participant before obtaining a voluntary informed

consent from either the participant or from their legally authorized representative. As with other age groups, these basic ethical principles, such as: 1) respect for persons, 2) beneficence which identifies the need to minimize risks, and 3) justice which focuses on the need to ensure fairness and equity in the selection of research participants apply to older adults (Harrison, 1993). However, there is a group of elderly who are vulnerable to research abuse because of their increasing dependency and declining cognitive abilities (Neveloff Dubler, 1987). In response to the vulnerability that is found in some elderly, the American College of Physicians published a position paper addressing the use of human research participants who are cognitively impaired as (reported by High, 1992). Briefly, this paper urges investigators to develop mechanisms for allowing research participants to render a consent in advance of becoming impaired or to designate proxies to carry out the intent of their directives by supervising the research participants's taking part in the research study. In instances when no advance directives are given by the research participants and, when no proxy has been appointed by the participants, a legally authorized representative should act as a surrogate. This representative should not consent to any research the participant would have refused, nor consent to any non-therapeutic research presenting more than minimal risks.

The investigator must assume responsibility for obtaining an informed consent in advance before the elderly client's

participation in the project (Shapira, 1994; Resau, 1995). Investigators have a special ethical responsibility toward the elderly who may be experiencing cognitive decline. This responsibility is to assess whether or not the client is capable of being involved in the informed consent process so that the ethical principle of autonomy is upheld. Such an assessment is critical. Evidence indicates that chronic health problems and the impairment of cognitive function can mar the elderly client's competency/decision-making capacity (Buehler, 1990; High, 1987).

High (1992) argued that additional empirical studies are needed to understand, to clarify and to test the best procedures for enhancing the research participation of cognitively impaired clients; and simultaneously to protect the rights and welfare of these research subjects.

Conducting research with cognitively impaired elderly persons presents challenges for investigators. In particular, the challenges include; (a) identifying and assessing potential research participants; (b) obtaining consent from cognitively impaired participants and their proxies; and (c) maintaining the sample (Rapp, Topps-Uriri, & Beck, 1994).

This study involved elderly clients who were either able or were not legally able to give their consent to participate in the study.

Legal person appointed. For those clients who had designated a legally responsible person, either a kin member, some other person or public trustee, the legally responsible person was

contacted by the researcher; first, by letter and secondly, by telephone. (See Appendix D1 for letter of invitation and Appendix D2 for telephone message). The legally responsible person was asked to provide a proxy consent. Ten legally responsible persons gave consent for participation in the study for these participants determined to be not legally able to give consent to participate in the study. (See Appendix E for consent form). Two of the legally responsible persons were the Province of Manitoba's Public Trustees. Each of the trustees was responsible for one elderly participant. In addition, the researcher asked each participant to express a preference whether or not they wished to take part in the project. All participants stated they would take part.

Six legally responsible persons refused to participate for personal reasons. The six legally responsible persons who refused to participate provided the following reasons for non-participation:

1. Four stated that they were anxious that the client may be disturbed by the questions that the researcher would ask. That is the questions may elicit personal information i.e. finances.
2. Two stated that they simply wanted their elderly client to rest peacefully. They did not mind, however, if the researcher only wanted to visit them.
3. All stated that the elderly clients for whom they were responsible were too confused to understand what was going on.

Ten research participants were acquired through this process of obtaining informed consent.

Legal person not appointed. For those elderly participants who had not undergone such a legal procedure of designating a legally responsible person, the next of kin acted as an advocate.

The kin member was contacted by the researcher; first by letter and secondly by telephone, and was invited to share their perceptions of the decision-making capabilities of the elderly participants. (See Appendix F1 for letter of invitation and Appendix F2 for telephone message). In the event that the kin member indicated that he/she had been making decisions regarding the participant's care, that kin member was invited to decide regarding the elderly client's participation in the study. The kin member was asked to sign the consent form. Three kin members provided consent by signing the consent form to enable their elderly family member to participate in the study. In addition the researcher asked each participant to express a preference whether or not they wished to participate in the study. All participants stated they would participate in the study.

If the kin member indicated that the participant had retained some decision-making capabilities, then the elderly participant was approached, with the next of kin present, to seek their participation in the study. Six such participants signed the consent form with the kin member present.

Nine of the elderly participants agreed to participate and signed the consent form without the kin member's presence. The

informed consent signed by the participant without the kin member being present was a necessity for two reasons. One reason was that most of the kin members believed that the participants had retained their decision-making capacities. Consequently, the kin members expressed the belief that as it was the elderly participant's choice to participate or not in the study the kin member's did not see the need to be present when the participant signed the consent form. The second reason was the kin member's mild reluctance to meet with the researcher because of their personal life-style. The researcher respected their decisions of not being present with the participant. However the researcher informed the participant that the next of kin was aware of the study. By using this process of obtaining informed consent fifteen more participants were acquired. The total sample size of research participants who had informed consents was 28. See table 5 for summary of informed consent.

Table 5

Informed Consent to Participate

	n	%
Legal person appointed:		
Kin member:	8	29
Public Trustee:	2	7
Legal person NOT appointed:		
- kin member only:	3	11
- kin member AND Resident:	6	21
- Resident only:	9	32
Totals:	28	100

In summary written informed consent from the client and either the participant's legally responsible party and/or kin member/other was obtained before data was collected. See Appendix 5 for consent form.

Analysis

Descriptive and inferential statistics were used to analyze the quantitative data. Generally, the data analysis utilized the Pearson product-moment correlation coefficient and two non-parametric tests, a Kendall tau and a Spearman rho. The comparison-wise level of significance was set at $p < .05$. To estimate the internal consistency of both scales, the MMSE and the SMMSE, the reliability coefficient Cronbach's Alpha was computed.

Table 1

The Crossover Design

TIME	1.	2.	**CROSSOVER**	1.	2.
Group A	MMSE	MMSE		SMMSE	SMMSE
Group B	SMMSE	SMMSE		MMSE	MMSE

The following research questions were addressed in sequence:

Research Question 1: What is the correlation between MMSE and SMMSE in measuring cognitive impairment in elderly clients in chronic care units?

The Pearson r was computed to assess the correlation between scores on the two screening tests. Since each research participant responded to both the MMSE and SMMSE, the analyses were computed for the entire sample of 28 participants.

a) To compute the first correlation, the MMSE scores and the SMMSE scores taken at each time period, were averaged for each research participant.

b) Further correlations were computed between the two scales.

1) One correlation between the two scales was computed for all participants at the first administration of both scales; and 2) a second correlation was computed for all participants at the second administration of both scales.

The Pearson r test is appropriate to use when both variables to be correlated are expressed as interval or ratio data. The MMSE and SMMSE screening tests are based on interval scales (Polit & Hungler, 1993). Having assumed that the MMSE and SMMSE scores obtained would not be normally distributed, the Kendall Tau and Spearman rho test's were applied to determine whether or not the relationship between the 2 variables (MMSE and SMMSE) is statistically significant (Crum et al. 1993; Mangionne, Seddon, Cook Krug, Sahagian, Campion, & Glyn, 1993). These ranking methods are especially suitable here because they do not require the assumption of normality (Hays, 1988). Performing these tests using the two procedures strengthens the conclusions drawn in that the two results obtained confirm each other.

Research Question 2: What are the estimates of reliability associated with MMSE in measuring cognitive impairment in elderly clients in chronic care units?

To determine the test-retest reliability the Pearson r was calculated.

a) In one analysis, the combined MMSE scores for participants at Time 1 were compared to combined scores for participants at Time 2.

b) In another analysis, before the crossover occurs, the scores of the MMSE scale were compared at Time 1 and Time 2 (Group A).

c) The same analysis was repeated for the MMSE scores after the crossover occurs. That is, the scores of the scale were compared at Time 1 and Time 2 (Group B).

The Kendall tau and Spearman rho test's were utilized inferentially to test whether or not the correlation coefficients differ significantly from 0.

To establish the internal reliability of the MMSE screening scale an internal consistency analysis measured by Cronbach's alpha was carried out to determine whether or not the items in the MMSE have characteristics of a unified scale (Albert & Cohen, 1992).

Research Question 3: What are the estimates of reliability associated with SMMSE in measuring cognitive impairment in elderly clients in chronic care units?

To determine the test-retest reliability the Pearson r was calculated as stated in Research Question 2. Similarly, the same

computations were carried out for the SMMSE scale as was described for the MMSE in Research Question 2.

a) In one analysis, the combined SMMSE scores obtained at Time 1 were compared to combined scores obtained at Time 2.

b) In another analysis, before the crossover occurs, the scores of the SMMSE scale were compared at Time 1 and Time 2 (Group B).

c) A similar analysis was repeated for the SMMSE scores after the crossover occurs. The scores of the scale were compared at Time 1 and Time 2 (Group A).

The Kendall tau and Spearman rho test's were used to test whether or not the correlation coefficients differ significantly from 0.

To establish the internal reliability of the SMMSE screening scale an internal consistency analysis, measured using Cronbach's alpha, was carried out to determine whether or not the items in the SMMSE have characteristics of a unified scale (Albert & Cohen, 1992).

A 2 way repeated analysis of variance was conducted to confirm that groups were similar over time. In addition, tests for order effects specific to crossover designs were conducted according to Fleiss (1986). These tests for order effects were conducted to validate that individual differences across groups were similar.

Chapter Summary

The report of the methodology used in this research study began with the introduction of the research design. Following that descriptions of the setting and the sample of cognitively impaired elderly clients who participated in the study were provided. The properties of the instruments were outlined and the procedure used, with emphases on the protocol and on the process of informed consent, was presented. Finally, a description of the data analysis used in this study was provided. The findings of this research are described in the next chapter.

RESULTS

The results of the study are presented in this chapter. The chapter is divided into four sections. In Section One, three aspects of the sample are described. The medications used by the participants, the adjustments made in scoring for the physically impaired, and the numbers of cognitively impaired and cognitively unimpaired elderly research participants are reported.

In Section Two, the properties of both scales (MMSE & SMMSE) are presented. Through the results of the first research question, the correlations found between the scores on the two scales (MMSE & SMMSE) are provided. Following is the presentation of the outcomes of the second and third research questions. These results portray the reliability (test-retest and internal consistency) of each scale (MMSE & SMMSE) used in the study. Finally, the validity (sensitivity, specificity, and predictive values) of the SMMSE scale is displayed.

In Section Three, the results of the analysis for order effects are provided. A serendipitous finding, ancillary to the research questions, is outlined briefly in Section Four and a summary of the major findings concludes the chapter.

Sample

To qualify for inclusion in the study sample each research participant was required to meet certain inclusion or exclusion criteria. One inclusion criterion for each research participant

was to be on low or no dosages of psychotropic drugs. In this study the most common classifications of psychotropic drugs (drugs affecting mood) prescribed for elderly participants were anxiolytics (drugs relieving symptoms of anxiety), antidepressants (drugs relieving symptoms of depression), antimanic agents (drugs relieving manic episodes), and hypnotics (drugs depressing the central nervous system). Anxiolytics were prescribed for 50% of the research participants. Probably, such a frequency of prescriptions can be attributed to the chronic respiratory condition of most of the research participants (n = 12). Chronic respiratory conditions are life threatening due to respiratory difficulties. In fact it may have been the primary cause of anxiety reactions for those research participants. (Table 6).

Table 6

Most Common Drug Classifications of Psychotropic Medications Taken by Elderly Research Participants (n = 28)

Drug Classification	**n**	**% of Sample**
Anxiolytic	14	50
Antidepressant	9	32
Antimanic Agent	1	4
Hypnotic	1	4

Note: Each percentage was calculated out of the total sample size. Some participants receive multiple drugs.

Table 7 indicates the extent to which each of the 9 most common classifications of drugs were prescribed for the research participants. Many research participants took more than one drug in a given classification. Furthermore, they may have been taking more than one drug in different classifications.

Table 7

Most Common Drug Classifications of Prescribed Medications Taken by Elderly Research Participants (n = 28)

Drug Classification	n	% of Sample *
Analgesics	26	93
Laxatives	21	75
Cardiovascular	17	61
Diuretics	15	54
Stool Softener	13	46
Corticosteroids	12	43
Bronchodilators	11	39
Histamine Blockers	10	36
Electrolytes	9	32

* Each percentage was calculated out of the total sample size. Some participants receive drugs in more than one classification

The high percentage of analgesics (93%) taken by the research participants is possibly related to the occurrence of arthritis. Arthritis is a chronic disorder which results in a limitation of movement and pain. One of the most common analgesics that was taken were the various Tylenol preparations with codeine. A

common side effect of such preparations is constipation. Consequently, it is not surprising that 75% of the research participants were taking laxatives. One further possibility to account for this relatively high consumption of laxatives is that this particular elderly sample was sedentary in nature. In addition, the research participants were taking a high percentage of cardiovascular medications (61%) and diuretics (54%). These consumption rates may be accounted for by the fact that cardiovascular disease was prevalent in this sample.

Of the total sample of 28, 13 research participants had physical disabilities. It was assumed that due to their physical limitations these participants were unable to complete some of the tasks included in the screening tests. This assumption is complicated, however, by the uncertainty as to whether or not these particular participants would have completed the tasks had they been physically able to do so. Notwithstanding, adjustments for differences in cognitive performance were applied to the MMSE and to the SMMSE scores for each time period for the 13 physically impaired participants (Table 8).

Table 8

Raw and Adjusted Scores of Physically Handicapped Respondents on MMSE and SMMSE at Times 1 and 2 (n = 13)

		TIME 1				TIME 2			
		MMSE		SMMSE		MMSE		SMMSE	
Resp No.	Grp.	Raw	Adj	Raw	Adj	Raw	Adj	Raw	Adj
1.	A	**23**	**26**	26	29	20	22	24	27
2.	B	12	13	9	10	12	13	11	12
3.	A	15	16	14	15	15	16	19	20
4.	A	16	19	**21**	**25**	17	20	**20**	**24**
5.	A	20	21	25	26	20	21	21	22
6.	B	3	4	4	5	5	6	1	1
7.	A	1	1	3	4	0	0	2	2
8.	B	17	20	15	17	20	23	18	21
9.	A	10	11	13	14	9	10	8	9
10.	A	17	20	17	20	15	18	16	19
11.	B	12	14	10	12	12	14	12	14
12.	B	7	8	5	6	6	7	3	4
13.	A	11	12	13	14	10	11	8	9

Notes:
1. Both MMSE and SMMSE present the following score ranges to differentiate the cognitively impaired and the cognitively intact:

cognitively intact score range: 24 - 30
cognitively impaired score range: 0 - 23

2. A change of cognitive classification resulted, based upon the adjusted scores, for two participants. Respondent Number 1 and Respondent Number 4 had their classifications changed **from** cognitively impaired **to** cognitively intact. See bolded scores in Table 8.

Adjusting the MMSE and SMMSE scores for physical disabilities using the cut off of 24 points of a possible 30 points changed the cognitive functioning status for 2 research participants. Without adjustment these participants would have been classified as cognitively impaired. With adjustment they became classified as cognitively non impaired.
(See Appendix G for raw scores of MMSE and SMMSE at the two time periods).

The frequency, mean and standard deviation table (Table 9) displays the prevalence of cognitive impairment compared to no cognitive impairment based upon a cut off score at 24 points for each of the MMSE and the SMMSE. Scores were obtained at each time period. Participants scoring greater than, or equal to, 24/30 are classified as not cognitively impaired. Those scoring less than, or equal to 23/30 are classified as cognitively impaired. It is noteworthy that both scales (MMSE & SMMSE), at Time 1 as well as at Time 2, were able to identify several participants as cognitively nonimpaired. As indicated earlier, the recruitment of participants was based on the nurses' assessments of cognitive impairment. The fact that some of participants are screened as cognitively unimpaired may indicate that a misclassification of cognitive impairment by the registered nurses has occurred. In addition the mean and standard deviation of MMSE and SMMSE at Time 1 and Time 2 were calculated.

Table 9

Frequencies (n), Mean Scores (M), and Standard Deviations (sd) of Cognitive Status Scores on MMSE and SMMSE at Times 1 and 2 (n=28)

	MMSE Scale						**SMMSE Scale**					
	Time 1			Time 2			Time 1			Time 2		
NOT Impaired	n 6	M 27	sd 1.55	n 7	M 26	sd 2.67	n 9	M 26	sd 1.73	n 8	M 25	sd 1.69
Impaired	22	15	5.77	21	15	5.82	19	14	4.91	20	14	6.56

(See Appendix H for levels of classification of cognitive impairment for the MMSE and SMMSE at Time 1 and Time 2).

Scales

Table 1

The Crossover Design

TIME	1.	2.	**CROSSOVER**	1.	2.
Group A	MMSE	MMSE		SMMSE	SMMSE
Group B	SMMSE	SMMSE		MMSE	MMSE

Research Question 1

What is the correlation between the MMSE and SMMSE in measuring cognitive impairment in elderly clients in chronic care units?

For the study group of 28 participants the Pearson product moment correlation between the averaged scores of MMSE and SMMSE at Time 1 and Time 2 was computed. The scales were found to be highly correlated with one another (r = .96). The Kendall tau

(.84) and Spearman rho (.95) indicate that the relationship was positive, significant ($p < .05$), and strong. When further correlations were calculated between the 2 scales (MMSE and SMMSE), a high and positive relationship was found between the MMSE and SMMSE at Time 1 (Pearson r = .93) and at Time 2 (Pearson r = .94). The relationships between the 2 scales were significant at Time 1 (Kendall Tau = .81 and Spearman rho = .93, $p < .0001$) and at Time 2 (Kendall Tau = .79 and Spearman rho = .92 $p < .0001$). All of the correlations coefficients were positive and high which indicated not only a strong relationship but a statistically significant relationship between both scales (MMSE & SMMSE). Correlations this high are suggestive of redundant scales (Nunnally, 1975). (Table 10)

Table 10

Correlations Between MMSE and SMMSE Scales (n = 28)

Scores	Pearson r	Spearman rho	Kendall tau
Combined Means Times 1 & 2	.96*	.96*	.95*
Scores at Time 1 Only	.94*	.93*	.81*
Scores at Time 2 Only	.94*	.92*	.80*

* $p < .0001$

Table 11 shows the intercorrelations among the 5 subscales of MMSE and SMMSE at Time 1 and at Time 2. Generally, the findings signify moderate to low correlations between the

subscales indicating that the subscales are measuring different aspects of cognition. This finding is acceptable as cognition is a multifacet concept involving several higher mental mechanisms to acquire, to process, to store, to retrieve, and to apply information.

Specifically, the lowest correlation was found between the **registration** and **attention/calculation** subscales for the MMSE scale, Time 2 and SMMSE scale, Time 1 ($r = .25$ $p > .05$). The item in the **registration** subscale required the participants to listen and to repeat the names of 3 objects stated to them by the examiner. The item specific for the **attention/calculation** subscale in the MMSE scale required the participants to complete the serial seven's or to spell the word world backwards. However, for this item in the same subscale located in the SMMSE scale, the only requirement for the participants was to spell the word world backwards. A low correlation was found between **recall** and **attention/calculation** for the MMSE scale Time 1 ($r = .25$) The item in the recall subscale required the participant to recall the 3 objects stated by the examiner initially in the registration subscale. A problem appears to exist between the **attention/calculation** and **registration** subscale and the **attention/calculation** and **recall** subscale. What seems to occur is that the **attention/calculation** subscale is highlighted on both occasions. In addition, it is noteworthy to mention that the **registration** and **recall** subscales are closely linked with one another. That is, the three objects required of the participant

to repeat in the registration subscale and then to recall in the recall subscale are the same.

The subscales were examined further for low correlation up to and including r = .40. Overall, low correlations between various subscales in the two scales (MMSE & SMMSE) Time 1 and Time 2 were found as follows : (Note: the items which reoccur five times and more are highlighted).

(a) **MMSE Time 1: recall** and language (r = .38); **recall** and **attention/calculation** (r = .36).

(b) **MMSE Time 2: recall** and registration (r = .29).

(c) **SMMSE Time 1: recall** and language (r = .29); **recall** and **attention/calculation** (r = .40).

(d) **SMMSE Time 2: recall** and language (r = .35); **recall** and registration (r = .36); **recall** and **attention calculation** (r = .39); **attention/calculation** and language (r = .34); **attention/calculation** and registration (r = .32).

Two subscales appear to have a low correlations throughout. One is **recall** and the other is the **attention/calculation** subscale. One exception where the attention/calculation subscale is not concern is in the MMSE scale Time 2. An interesting point is that both subscales (**attention/calculation** and **recall**) had the lowest correlations (r = .25) as mentioned above. It appears that the tasks required to complete the items in the two subscales reflect different demands of the research participant.

On the other hand, the moderately high correlation found to be between the (**language** and **registration**) subscales for the

SMMSE scale Time 1 and Time 2 ($r = .76$ $p < .05$). As mentioned above the **registration** subscale item required the participants to listen and to repeat the names of 3 objects stated to them by the examiner. The item included in the **language** subscale involves confrontation naming, repetition, three-step verbal command, written command, writing a spontaneous sentence, and copying a figure. The high correlations may indicate that the tasks required of the research participants to complete the items in the two subscales are somewhat similar. For example, one of the tasks involved to complete the items in both subscales is that of repetition.

Table 11

Scale Intercorrelation Matrices (n = 28)

A. MMSE (Time 1) Scale Intercorrelation Matrix

VARIABLES	Orient'n	Language	Registr'n	Attention	Recall
Orient'n	-	.41 (.0270)	.67 (.0001)	.58 (.0010)	.50 (.0057)
Language		-	.54 (.0029)	.46 (.0135)	.37 (.0466)
Registr'n			-	.39 (.0365)	.25 (.1838)
Attention				-	.35 (.0601)
Recall					-

Table 11 (Continued)

B. MMSE (Time 2) Scale Intercorrelation Matrix

VARIABLES	Orient'n	Language	Registr'n	Attention	Recall
Orient'n	-	.54 (.0029)	.57 (.0014)	.52 (.0037)	.58 (.0012)
Language		-	.56 (.0019)	.52 (.0042)	.46 (.0132)
Registr'n			-	.25 (.1924)	.29 (.1317)
Attention				-	.45 (.0159)
Recall					-

C. SMMSE (Time 1) Scale Intercorrelation Matrix (n = 28)

VARIABLES	Orient'n	Language	Registr'n	Attention	Recall
Orient'n	-	.45 (.0140)	.47 (.0102)	.54 (.0029)	.63 (.0003)
Language		-	.76 (.0001)	.38 (.0403)	.29 (.1315)
Registr'n			-	.25 (.1857)	.48 (.0096)
Attention				-	.40 (.0324)
Recall					-

D. SMMSE (Time 2) Scale Intercorrelation Matrix

VARIABLES	Orient'n	Language	Registr'n	Attention	Recall
Orient'n	-	.59 (.0008)	.52 (.0038)	.55 (.0021)	.68 (.0001)
Language		-	.53 (.0037)	.33 (.0783)	.35 (.0606)
Registr'n			-	.32 (.0924)	.35 (.0637)
Attention				-	.39 (.0402)
Recall					-

In summary, in relation to research question one; (What is the correlation between the MMSE and SMMSE in measuring cognitive

impairment in elderly clients in chronic care units?) the data specifically indicate that the two scales (MMSE & SMMSE) are highly correlated. In many clinical circumstances the use of both scales, in the same situation, would be considered redundant.

Psychometric properties of the MMSE and SMMSE were studied based on: the **test-retest reliability** of the scales, the **internal consistency** of the scales and the **sensitivity, specificity,** and **predictive values** of the SMMSE scale. The reliability issue (test-retest and internal consistency) is addressed by Research Question 2 and 3.

Research Question 2 and 3

What are the estimates of reliability associated with MMSE in measuring cognitive impairment in elderly clients in chronic care units?

What are the estimates of reliability associated with SMMSE in measuring cognitive impairment in elderly clients in chronic care units?

Test-retest. Table 12 presents the test-retest correlations for three selected sets of analysis of the MMSE and SMMSE (a) Time 1 and Time 2 (combined scores), (b) before the crossover and (c) after the crossover. A Pearson product moment correlation was calculated to determine the magnitude of the relationship between the MMSE and SMMSE. Both Spearman rho and Kendall tau were used to determine significant associations between the two scales. All correlations were statistically significant and high (.90 to .97

$p < .0001$). The correlations were found to be higher, although ever so slightly (no more than a difference of .1), for the MMSE compared to the SMMSE scale in all three sets of the analysis in this section.

Table 12

One-Week Test-Retest Reliabilities for MMSE and SMMSE

A. MMSE

EVENTS	n	Pearson r	Spearman rho	Kendall tau
Combined Scores Before and After Crossover	28	.97*	.95*	.87*
Before Crossover	14	.97*	.95*	.86*
After Crossover	14	.97*	.96*	.89*

* $p < .0001$

B. SMMSE

EVENTS	n	Pearson r	Spearman rho	Kendall tau
Combined Scores Before and After Crossover	28	.92*	.91*	.76*
Before Crossover	14	.93*	.88*	.76*
After Crossover	14	.90*	.90*	.81*

* $p < .0001$

Internal consistency. Cronbach's alpha is a widely used reliability statistic. It is computed to determine the internal consistency of a test or the average correlation of items within the test (Brink & Wood, 1989). To examine the internal consistency of the MMSE and SMMSE scales at Time 1 and Time 2, it was concluded that the calculation of Cronbach alpha coefficients for the total instrument would be the most appropriate statistic to use.

In examining the data set, two problems were identified. One problem was the lack of variability found in responses to some of the items. For example, in the MMSE scale at Time 1 and Time 2, the responses of three items (follow a three stage command e.g. take, fold, and place paper) showed no variability. That is, all research participants responded correctly to these items. The responses to one other item (copy a figure) in the SMMSE scale at Time 2 also had no variability. In fact, the research participants did not respond at all to this item.

Conceptually, this lack of variability in responses to those particular items presents a concern. The concern is that based upon the results obtained, those items do not differentiate between impaired cognition and intact cognition. Statistically, this lack of variability in responses to those items negates the need for the calculation of standard scores. Standardization is a process whereby raw scores are converted to standard scores or z scores. Standard scores are expressed relative to a mean of 0 and a standard deviation of 1. The rationale for standardization is

to have items with equal variances so that the items are comparable. The standardized alpha can be obtained based on the standardized scores. As mentioned above, it was somewhat perplexing to find that a few items in the MMSE and SMMSE scales exhibited no variability. This might suggest that these particular items are, perhaps, unnecessary in the scales. As a result the standard scores could not be calculated. Consequently, these items were deleted from the calculations in order to calculate the standardized alpha.

The second problem identified was that some of the items in each of the MMSE and SMMSE scales, had missing values because of the non responses from the physically disabled participants. In the absence of precisely established procedures, statistical consultation revealed that several alternative methods were advocated to deal with such a concern. For this study it was concluded that the best method to replace the missing values was with the mean of the scores of all the research participants. Such a manoeuvre was deemed appropriate because in doing so a larger portion of the sample would be represented. Table 13 compares the results of the Cronbach's alpha found between the MMSE and SMMSE scales at Time 1 and Time 2 for raw and standardized data. The alpha coefficients were acceptable (above .8) at Time 1 and Time 2 for all scales. An acceptable level of .8 was chosen on the grounds that an alpha as high as .8 would indicate that the scale was accurate (internally consistent) (Polit & Hungler, 1993). (Table 13).

Table 13

Reliability Coefficients (Cronbach's Alpha) for MMSE and SMMSE Scales at Times 1 and 2 (n = 28)

		[Alpha Coefficients]	
Scale	**Time**	**Raw**	**Standardized**
MMSE	1	.82	.86
SMMSE	1	.81	.86
MMSE	2	.84	.88
SMMSE	2	.84	.90

Note: Missing values were replaced with the mean of all respondents.

To demonstrate the robustness of the results, and to ensure that the particular approach used to replace the missing data was acceptable, subsequent alpha coefficients were computed. These computations used certain alternative methods for dealing with missing responses observed as part of the data from the physically disabled participants. One such method is that of deleting individuals with missing values from the sample. Another alternative was to replace those missing responses with the mean of the scores attained by the physically impaired individuals. The latter method presented a problem when only one participant responded on a certain item. In this case the investigator would have been forced to make a choice as to whether or not that single score would adequately represent the mean of the group. In calculating the alphas utilizing these two methods the alphas were found to be comparable to those alphas found in method 1.

For the method of deleting individuals with missing values from the sample the alpha for MMSE Time 1 was .79 and the alpha for MMSE Time 2 was .78. For the alternative method which was to replace those missing responses with the mean of the scores attained by the physically impaired individuals the alpha for MMSE Time 1 was .80 and the alpha for MMSE Time 2 was .82.

The item-total correlations, and alphas calculated with each item deleted, are shown in Appendix I. Some of the item-total correlations are low. Two of the items are not only low but are negatively correlated. It should be noted that when these two items #19 and #22 are deleted from the two scales the Cronbach's alpha does not decrease substantially. For example, the alpha level of MMSE scale at Time 1 is .82 when item #22 remains, but the alpha level is .83 with the item deleted. Further precise investigations of such matter seem warranted.

In summary, in relation to research question two; (What are the estimates of reliability associated with MMSE in measuring cognitive impairment in elderly clients in chronic care units?) the high reliability coefficients indicate that responses to both tests (MMSE and SMMSE) are very stable over a short time interval. However, given the higher test-retest reliabilities for the MMSE scale it seems that the MMSE is the preferred scale. In relation to research question three; (What are the estimates of reliability associated with SMMSE in measuring cognitive impairment in elderly clients in chronic care units?) the high

internal consistency of both scales (MMSE and SMMSE) indicates that either tool is acceptable.

Sensitivity, Specificity and Predictive Values

Using the MMSE scale as the gold standard in all comparisons, the SMMSE scale, with the scores adjusted for physical disability, was tested for sensitivity, specificity, and predictive values at Time 1 and Time 2. A cut-off score of less than or equal to 23/30, as suggestive of cognitive impairment, was used to determine the results. As shown in Table 14 the sensitivity of the SMMSE was similar at Time 1 and Time 2. The scale classifies , with nearly identical results (86.3%, 85.7%)at both times, the percentage of participants who were cognitively impaired. That is, the false negative rate is low. However, the specificity of the SMMSE differs at Time 1 and Time 2, (100%, 71.4%). That is, the specificity at Time 2 was lower than at Time 1. The SMMSE scale at Time 2 correctly classifies approximately 71.4% of participants who are cognitively intact. In this case the false positive rate is high. At present there appears to be an absence of any previously determined published findings regarding the sensitivity and specificity of the SMMSE.

Table 14

Sensitivity, Specificity, and Predictive Value of SMMSE Scale

Scale & Time	Sensitivity	Specificity	Predictive Value of Positive Test	Predictive Value of Negative Test
SMMSE 1.	86.3 %	100 %	100 %	66.7 %
SMMSE 2.	85.7 %	71.4 %	90.0 %	62.5 %

Sensitivity and specificity are characteristics of a screening test at specific cut-off points. In addition, it is useful to consider two other measures, the negative predictive value and the positive predictive value. Both values are used to interpret the results of the screening tool. Both negative and positive predictive values are heavily influenced by the prevalence of the attribute in the population that is being tested (Boring et al. 1993). According to Gallo et al. (1995), in a setting where the prevalence of cognitive impairment is presumably higher than in the general elderly population, the negative predictive value is less than the negative predictive value in the general elderly population. Consequently, in a similar setting, the positive predictive value is more than the positive predictive value in the general elderly population. In examining the results of the negative and positive predictive values in this study, where the prevalence of cognitive impairment is higher than in a general elderly population, the findings are found to be consistent with Gallo et al. (1995).

See Appendix J for details regarding the calculation of sensitivity, specificity and predictive values.

Order Effects

This study used a crossover design, sometimes called a counter balance design. This design controls for order effects when the participants act as their own controls (Fleiss, 1986). It is also an experimental design whereby every participant is exposed to two treatments (MMSE & SMMSE) in a balanced fashion. At Time 1 half of the participants receive treatment A (MMSE scale) and the other half receive treatment B (SMMSE scale). At Time 2 the crossover occurs. That is, the first half of the participants now receive treatment B (SMMSE scale) and the other half receive treatment A (MMSE scale). This method of counterbalancing enables the factor of error to be equalized across the experiences. Nevertheless, it remains of importance to assess for order effects.

A 2 way repeated analysis of variance was applied to compare the results of the 2 scales (MMSE & SMMSE) and 2 groups (A & B). The results indicated no overall significant findings between groups and scales. However, a significant interaction effect occurred between groups (A & B)and type of scale (MMSE & SMMSE)($F(1,26) = 6.21$ $p < .02$). This finding indicated a lack of parallelism for the average scores per group over time (Fig. 1), which may be due to practice effects.

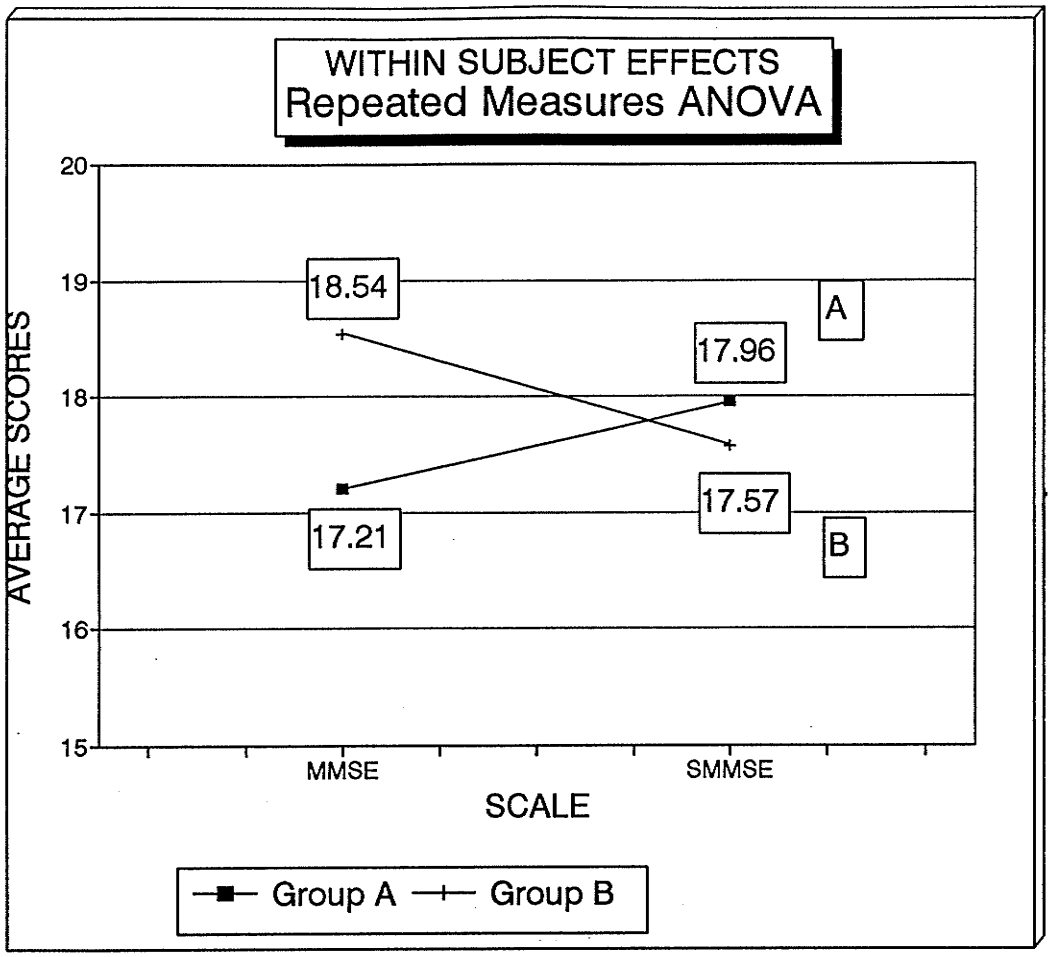

Figure 1. This figure shows the interaction of the average scores for each group over time. This lack of parallelism may be an indirect indication of an order effect, practice effect, or due to differences within people across the two groups.

It is questionable whether or not this finding is due to practice effects. In fact this finding could have been due to the differences in averages per group as opposed to the averages of differences within individuals per group Table 15).

It is questionable whether or not this finding is due to order effects, effects, or differences within people across the two groups (Table 15).

Table 15

Repeated Measures ANOVA

Source of Variat'n	df	SS	MS	F	p
Between Groups	1	3.017	3.017	.03	.87
Within Scale	1	0.160	0.160	.10	.76
Scale X Group	1	10.28	10.28	6.21	.02*

* Significant at $p < .05$

To assess directly for practice effects a 2 way analysis of variance was applied. For this computation, group membership (A & B) and Time (1 & 2) were tested for interaction and main effects. The results indicated no significant interaction or main effects. The practice effects were not statistically significant as revealed in Table 16.

Table 16

Two Way ANOVA

Source of Variat'n	df	SS	MS	F	p
Time	1	10.29	10.29	0.20	.66
Group	1	3.02	3.02	0.06	.81
Time X Group	1	0.16	0.16	0.00	.96
Error	52	2741.75	52.73	-	-

Tests for order effects specific to crossover designs were computed according to Fleiss (1986). The findings indicated that individual differences across groups were not present. (See Appendix K for detailed computations). A high probability exists that no order effects were present.

Serendipitous Finding

A further analysis of the data was conducted to investigate for possible differences of determined cognitive status of both the physically disabled and the physically abled research participants. Initially, each of the research participants had been classified by the registered nurses as cognitively impaired. The overall results of the study indicated that those participants who were physically disabled were rated equally as cognitively impaired by the scales as well as by the nurses. **However, of those participants who were identified as cognitively impaired by the nurses, almost half of these participants were**

rated by the scales as being cognitively intact. These findings were both unexpected and interesting. Specifically, it was speculated after an initial analysis of the results, that nurses may tend to classify physically disabled older adults as cognitively impaired compared to physically able older adults. On the other hand, it seems possible that nurses may systematically misclassify, as cognitively impaired, some elderly participants who are actually cognitively intact.

Although, such an investigation is actually somewhat peripheral to the main thrust of the study, it does seem to suggest an issue which will undoubtedly be of some interest to nurse educators and to nurse practitioners. It seems reasonable to conclude at this time that the matter is of sufficient interest and importance to warrant further investigation.

Chapter Summary

This chapter has provided three main findings obtained from the 28 elderly patients who participated in the study. The properties of the scales, which include results of the correlations and reliabilities, have been considered. The results of the analysis of the validity (sensitivity, specificity and predicative values) of the SMMSE scale were given. Finally, the results of the analysis of order effects are provided followed by a brief reference to a serendipitous finding. A detailed discussion of all of these results is presented in the next chapter.

DISCUSSION OF FINDINGS

This study was designed to determine not only the correlation between the two screening tools (MMSE & SMMSE) but the reliability of two scales (MMSE & SMMSE) which have been designed to measure the presence, absence and severity of cognitive impairment in elderly clients in chronic care units. The findings of this study, as discussed in this section, contribute to the knowledge of the properties of the MMSE and SMMSE scales. In addition, it is argued that these findings promote the practice of selecting a screening tool for use in the assessment of cognitive impairment in elderly clients. Nurses can now be more confident in the use of the two instruments which are not only valid but reliable. It is important to note that screening tools are a part of the total assessment and were never designed to be the sole measure of cognitive function in older adults.

The discussion of this research study is presented in 4 sections. In Section One, the sample is discussed. Included is an interpretation of findings in relation to the several demographic variables (gender, age and education), the medications consumed, the adjustments made in scoring for the physically impaired, and the numbers of elderly research participants who were determined to be either cognitively impaired or cognitively nonimpaired. In the Section two the three research questions are grouped together for discussion of the properties of the scales. It is important

in understanding the effectiveness of the scales to consider the sensitivity, specificity and predictive values of the SMMSE scale. The remainder of this chapter comprises Section Three. Included are the conclusions and the implications of the findings for nursing education and nursing practice. Finally, recommendations for further research, based upon the findings of this study, are considered.

Sample

The one demographic characteristic gathered, gender, in the sample of 28 older adults with cognitive impairment, was found to be similar to that of several other recent studies (Algase & Beel-Bates, 1993; Jorm et al. 1991; Uhlmann, Larson, & Buchner, 1987). Specifically, the percentage of females was higher than the percentage of males. The other demographic variables considered, mainly age, and educational levels, are similar to other samples obtained in hospital or community settings (Williams et al. 1985; Weiler, Lubben & Chi, 1991; Molloy, 1991).

According to Luke (1995) the most common psychotropic drugs prescribed for older adults are antidepressants, antimanic agents, antipsychotics, antianxiety medications and sedative hypnotics. Luke's (1995) observation is supported by the results obtained in this study which indicate that the most common classification of psychotropic drugs were indeed similar. In this study group, a large percentage (50%) of the research participants were taking anxiolytics. Interestingly, nearly half

of the participants had been diagnosed with COPD which includes chronic bronchitis, asthma and emphysema. All of these disorders require much expenditure of energy on the part of the elderly patients to preserve their present pulmonary function (Smeltzer & Bare, 1992). Ebersole and Hess (1995) stated that anxiety is a characteristic symptom in elderly clients especially when they experience difficulty in breathing. This fact may account for the rather heavy prescriptions of anxiolytics to the research participants.

Several of the research participants had multiple health problems e.g. arthritis, strokes. Pain in all stages of arthritis is a serious consideration. Two of the goals for nursing management and intervention in caring for elderly individuals with arthritis is pain management and the promotion of comfort (Kohler, Schweikert-Stary, & Lubken, 1995). It is a common practice that analgesics be prescribed for the symptom of pain in arthritis. Such was the case in this study in that a high percentage of the research participants were, in fact, consuming analgesics.

In addition a high percentage of research participants (75%) were consuming laxatives. These results are similar to those of Rice et al. (1994) whereby institutionalized elders were found to be more likely to take laxatives compared to well elders. As indicated earlier this sample, primarily sedentary in nature, was susceptible to experiencing constipation as a side effect due to the analgesics being consumed.

Ebersole and Hess (1995) claimed that patients with cardiovascular disorders ordinarily take several medications to control heart rate, strength of beat, hypertension and angina. The disorder which frequently occurs in older adults is congestive heart failure. The drug treatment for congestive heart failure includes digoxin and diuretics (Stabb & Compton Hodges, 1996). This likely is the basis on which why over 50% of the research participants in this study were taking cardiac medications and diuretics.

Nearly half of the research participants were found to have physical disabilities. Because of these physical disabilities some participants were unable to complete certain items of both scales (MMSE & SMMSE). Examples of items which were impossible for these elderly participants included; read and obey the sign 'close your eyes', write a sentence, and copy the design. Dellasega and Morris (1993) claimed that since many elderly persons suffer from chronic conditions and disabilities as well as sensory and perceptual impairments, the inability to complete items on the MMSE scale must be taken into consideration. Other studies that possible would include elderly physically disabled participants were reviewed. It is noteworthy that two studies excluded subjects who were physically impaired e.g. aphasic, blind and deaf (Fields et al. 1986; Foreman, Gillies, & Wagner, 1989). Reports have not always eluded to whether or not the research investigators adjusted the scores for the participants who were physically disabled (Dolomore et al. 1994), or had

multiple health problems e.g. arthritis/ rheumatism, stroke (Molloy et al. 1991; Yu, Johnson, Kaltreider, Craighead, & Hu, 1993). One other study did adjust the scores for the physically disabled e.g. aphasia, apraxia (Kafonek et al. 1989). Logically, this adjustment for physical impairment seems to be critical. This present study did adjust the scores for the physically disabled. If the scores had not been adjusted for two research participants they could have been incorrectly labelled cognitively impaired. Consequently, such a label may have resulted in different nursing interventions for these elderly individuals with possible drastic consequences. This finding underlies the importance of reporting physical disabilities and of adjusting scores for studies involving the use of the MMSE and SMMSE screening tools.

In order to complete items on a screening tool it may be advantageous for physically disabled clients to resort to other means of completing the tasks. One method might be for the physically disabled participant to give verbal instructions to the examiner regarding a directive sentence so that the examiner could write it out. Another method would be to create other alternative items which are relevant in measuring cognitive impairment but would not require the participants to engage in utilizing psychomotor skills. Dellasega and Morris (1993) claimed that one approach for elderly participants who are unable to complete the MMSE for noncognitive reasons is the Telephone Interview for Cognitive Status (TICS) developed by Brandt,

Spencer and Folstein (1988). This tool is based on the MMSE and requires no writing or reading by the participants. According to Dellasega and Morris (1993) a major digression from the traditional MMSE is found in the language section. In the (TICS) participants are asked to repeat a phrase and name the "thing you are speaking into as you talk to me." whereas in the (MMSE) they are asked to name two objects and repeat a sentence. In addition, in the (TICS) the following items are excluded: the three step command, read and obey a sentence, write a sentence, and copy the design whereas in the (MMSE) they are asked to perform these tasks which require motor skills.

It appears that the process of subjective recruitment of 28 cognitively impaired participants, by the registered nurses, is not consistent with the results obtained from the rating of the MMSE and SMMSE scales. As indicated, in the results section, a serendipitous finding has suggested that nurses often tend to classify the physically disabled as cognitively impaired in accordance to the ratings on the MMSE and SMMSE scale. A particularly relevant point is that two studies have reported results previously to indicate that a higher prevalence of cognitive impairment exists in those participants who indicate functional impairment (Yu et al. 1993; Weiler et al. 1991). However, both Yu et al. (1993) and Yeaw and Abbate (1993) claimed that a scarcity of relevant empirical data exists to account for the relationship between cognitive status and functional status. The findings which are available are conflicting. Nevertheless,

this study raises more questions as to whether or not a possible relationship between the measurement of cognitive status and functional status exists. That is, those research participants who were physically disabled were more likely to display varying degrees of cognitive impairment.

With regards to the other participants (n = 15) who were not physically disabled, the unexpected serendipitous finding also signified the occurrence of a possible misclassification of their cognitive status. That is, findings indicated that nearly half of these research participants (n = 7) who were classified by the nurses as cognitively impaired were cognitively intact, as indicated by the ratings of the MMSE and SMMSE scales. Such a misclassification as evidenced by the results is undoubtedly of some concern not only to health professionals but to elderly clients themselves.

Several possible reasons may account for this misclassification. One reason may be that the nurses may have been experiencing a shift change. Possibly, the nurses had working for several nights. When they returned to the day shift these nurses may have been unaware that some mildly cognitive clients may have shown an improvement in their cognitive status. Another possible reason is that the nurses may have been on days off and had not seen the patients for awhile. The nurses may have been unaware of the possible changes in the elderly patient's cognitive status. A third reason and probably the most important, is based upon the literature which indicates that nurses tend to

detect cognitive impairment in various elderly patients through the assessment of their orientation levels only (Williams et al. 1988; Le et al. 1994).

The results of a study by Yeaw and Abbate (1993) indicated several findings regarding ways nurses determine whether or not elderly patients are confused. One of the findings is of particular importance. That is, disorientation was designated as the most significant/descriptor used by nurses to label an elderly patient as confused. This particular finding supports the literature regarding nurses who determine confusion in elderly patients primarily through orientation levels. The question arises as to whether or not, on this study, nurses used orientation levels to identify research participants who were cognitively impaired. It should be noted that the terms confusion and cognitive impairment are used here interchangeably as suggested by the literature (Foreman et al. 1989). Another finding from Yeaw and Abbate (1993) study revealed that nurses in their sample did not rely solely on previous data derived from shift reports. Rather, they generated independent assessments based on their own observations.

In conclusion, it is important to note that in both assessments the ratings of cognitive impairment by the MMSE and SMMSE scales, as well as the identification of cognitive impairment by the registered nurses are indicative of only a partial assessment of cognitive impairment in the research participants. This finding may justify the need for a total

assessment of cognitive impairment in the elderly client which would include the use of subjective and objective methods for data collection.

Scales

The primary aim of this study was to examine the correlation between the MMSE & SMMSE scales. In addition this study, has measured the reliability, test-retest and internal consistency of the MMSE and SMMSE scales. Three important findings were obtained: (a) correlations: both MMSE and SMMSE scales were positively correlated to a level of virtual redundancy; (b) test-retest reliabilities: both MMSE and SMMSE scales had high test retest reliabilities, and; (c) Cronbach's alpha: both MMSE and SMMSE scales showed satisfactory alpha levels. The secondary intent of the study was to assess the sensitivity, specificity and predictive values of the SMMSE scale. The results confirmed that the scale measures cognitive function in the clinical setting.

Correlations

Regarding the first notable finding, the high positive correlations of the scales (MMSE & SMMSE) with each other suggest rather strongly that one scale can be substituted for the other in measuring cognitive impairment in elderly clients.

Tombaugh and McIntyre (1992) claimed that the MMSE scale was developed by Folstein et al. (1975) to assess quantitatively the degree of severity of cognitive impairments and to document

cognitive changes that occur over time. Several studies indicate that to a large degree the MMSE has, in fact, been able to fulfil these two goals. Molloy et al. (1991) developed a standardized version of the MMSE scale (the Standardized Mini-Mental Examination, the SMMSE scale). The researchers tightened the guidelines for administration of the SMMSE in measuring cognitive impairment.

The finding in this study, coupled with the evidence regarding both scales provided by Tombaugh and McIntyre (1992) and Molloy et al. (1991) seems to indicate that the interchangeability of the scales is warranted.

Overall the correlations were found to vary from moderately high to low in the 5 subscales of the MMSE and SMMSE when each was used at Time 1 and Time 2. The two subscales which were found to be correlated moderately high were language and registration. According to Galasko et al. (1990) the tasks required to complete the items in both subscales (language and registration) are very easy. In fact, in this study it became evident that the tasks in the language items do not require word fluency. Furthermore they can be completed correctly most times. This accomplishment of tasks by elderly research participants is dependent not only on their level of comprehension but on their level of performance of motor skills. As a result, it was confirmed in the present study that those elderly participants who are physically disabled must have their scores adjusted accordingly to compensate for their physical limitations. In regard to the registration subscale, the

task involved requires the elderly research participant to repeat the names of three objects. This task is relatively simple and does not require much effort by the elderly participant.

The recall and attention/calculation subscales, showed low correlation. A low correlation found here is consistent with other studies with cognitively impaired clients (Galasko et al. 1990; Brandt, Folstein, & Folstein, 1988; Fillenbaum, Heyman, Wilkinson, & Haynes, 1987). The recall of three words usually produced the greatest number of errors. O'Connor, Pollitt, Treasure, Brook and Reiss (1989) claimed that since the recall subscale precedes the attention/calculation, much anxiety is experienced by the research participants. As a result, the participants power of recall may be affected. Furthermore, Ashford, Kolm, Colliver, Bekian and Hsu (1989) claimed that only a few elderly clients who display mild and moderate impairment have been able to recall the three objects after distraction. This clear example supports the notion that a short term memory disorder is the first mechanism to be disrupted by cognitive impairment.

Regarding the attention/calculation subscale not only are the tasks difficult to complete (do serial 7s, spell 'WORLD' backward) for the elderly clients, but it is questionable whether or not the same mental ability is being tested by both tasks. That is, research participants who completely fail the serial 7s task in the MMSE can still score up to 5 points for the attention task by spelling "WORLD' backward. Tombaugh and McIntyre (1992)

claimed that Holzer et al. (1984) reported a correlation coefficient of only .37 between serial 7s and WORLD. Other studies have reported that spelling "WORLD" backward consistently produces higher scores than does counting backward by sevens (Olin & Zelinskin 1991; Galasko et al. 1990; Anthony et al. 1982). Consequently, the attention/calculation item of the MMSE can be improved by either eliminating the serial 7s or by scoring these two tasks independently. Molloy et al. (1991) compared the two tasks of spelling 'WORLD' backwards and calculating serial 7s by participants who were administered the SMMSE scale. The researchers found that the use of serial 7s not only was more difficult task but that the elderly scored lower on this task. Consequently, this provides further evidence that these two tasks are not comparable. In this study, only the task of spelling 'WORLD' backwards was given to the research participants according to the SMMSE scale format developed by Molloy et al. (1991).

It seems reasonable to conclude that the tasks involved to complete the items in the language and registration subscales are obvious and less complicated. However, the recall and attention/calculation subscales produce certain administrative and interpretive difficulties as evidenced not only in this study but in previous studies as well. The most important difficulties are not only in the demands of the tasks that are directed toward the research participants but in the determination of whether or not the same mental ability is being assessed by the two

subscales. In addition, the characteristics exhibited by the research participants (cognitive status, hearing and visual acuity, and physical limitations) as well as the order of administration of items may be factors that influence the level of individual item difficulty.

Test-retest Reliabilities

The high test-retest reliability results of the MMSE and SMMSE scales is the second important finding. In the three sets of analyses; (a) Time 1 and Time 2 combined score, (b) before the crossover, (c) after the crossover, the reliabilities of both scales (MMSE & SMMSE) remained stable from week to week in a 4 week period. It is important to note that the investigator administered the scales at each occasion. This importance is realized when the MMSE was found to have excellent reliability and was designated as a result of findings in this study to be the preferred scale. However, a contributing factor for this high test-retest reliability may have been the short time interval (1 week apart). Sawyer Radloff (1977) claimed that short test-retest time intervals should produce somewhat higher correlations than longer intervals. However, findings in other studies where the same tool was administered to cognitively impaired clients one, and three months apart, indicate that the MMSE is a reliable scale (O'Connor et al. 1989; Fillenbaum et al. 1988).

An additional factor for consideration in assessing study results is that the tests were administered by the same rater (the investigator) on each weekly occasion. In those studies

where test-retest reliabilities were calculated, the researchers do not always specify whether or not the same rater or different raters administered the tests. For example, Jorm et al. (1991), reported that different raters were used to administer the MMSE. However, two other studies (Van Bell et al. 1990; Thal et al. 1986) do not state whether or not the same or different raters administered the MMSE. In other studies reviewed same, or different, raters are reported to have administered the MMSE tool. In all cases, however, the test-retest reliability has been high (Folstein et al. 1975; Dick et al. 1984).

Molloy et al. (1991) claimed that the SMMSE has a higher test-retest reliability (intraclass correlation) than the MMSE when administered by different raters on weekly occasions. The findings in this study do not reflect the Molloy et al. (1991) results. Here, the MMSE showed higher test-retest reliabilities than the SMMSE scale with the same rater administering both scales. It could be speculated that had different raters administered the SMMSE the test-retest reliabilities could have been different. Such differences, had they occured, may be due to the fact that the SMMSE scale is standardized. If such results were obtained then the Molloy et al. (1991) findings would have been supported.

In conclusion, the results of this study show that both scales (MMSE & SMMSE) are reliable. The MMSE scale, however, is more reliable than the SMMSE scale when the same rater administers the scale.

Cronbach's Alpha

The third important finding regarding MMSE and SMMSE shows satisfactory levels of Cronbach's alpha at both periods Time 1 and Time 2. These acceptable levels of consistency indicate that both scales are stable and reliable. The results of the Cronbach's alpha of the MMSE scale in this study support the high alpha of the MMSE obtained in the study conducted by Foreman (1987). The findings mentioned here require a few additional comments of explanation.

First, it is important to comment on the lack of variability of certain items. That is, some of the items found in the language subscale showed no variability. The three items in the MMSE scale, Time 1 and Time 2, were located in 'follow a 3 stage command' e.g. 'take fold and place paper'. In the SMMSE scale, the only item which showed no variability was 'copy a figure'. Galasko et al. (1990) mentioned that the tasks required to complete the items in the MMSE language subscale are easy. In this study all of the research participants were able to complete correctly the tasks of: 'take, fold and place paper'. The ease of completion of these three tasks, which the participants found in this study, supports the Galasko et al. (1990) statement. However, none of the research participants was able to complete the task 'copy a figure' in the SMMSE scale. This particular task appeared to be too demanding for the research participants. The difficulty of the task encountered by the participants may have been associated either with the physical disabilities exhibited

by nearly half of the research participants (n = 13), or with the time limit (1 minute) set to complete the item 'copy a figure' in the SMMSE scale. It seems to appear that all of the above mentioned items could either be modified or discarded because they do not differentiate between impaired cognition and intact cognition. O'Connor et al. (1989) asserted that modifications would be acceptable only if they enhanced the sensitivity and specificity of MMSE in a variety of settings. No comparative studies have as yet been conducted on the matter of item modification. It now seems reasonable to conclude from the finding of this study that if the item 'copy a figure' was changed to 'copy a triangle' the possibility exists that the latter item may enhance the ability of the SMMSE tool to discriminate more precisely between impaired and non impaired cognitive functioning in elderly clients. If such an improvement is found the sensitivity of the instrument would be increased appreciably.

Second, it is noteworthy to mention that 13 participants in this study were unable to respond to some of the items because of physical disabilities. To deal with this problem, the missing values were replaced with the mean of all respondents. In some instances the missing values were replaced with a score of 1 which meant that all respondents were scored as if they had responded to the item correctly. A query arises as to what extent this procedure of replacing non responses with groups mean affected the results of the Cronbach's alpha. It is important to

mention that when as a result of interest, the alpha was calculated for MMSE Time 1, without replacing the missing values, the resulting alpha was approximately the same as was found according to the first decision in the study. That is, the alpha level was found to be .85 when no scores were used for the missing data, and when the data was replaced by the group mean the alpha level was .83.

Third, one of the negatively correlated items is 'copy a figure' in each of the MMSE and SMMSE scales. Apparently, some other attribute is being measured e.g. creativity rather then cognitive function. The other item correlated negatively and low is 'fold paper'. It is interesting to note that this item is found in the SMMSE scale and not in the MMSE scale. A couple of issues regarding this item are questionable and seem worthy of further investigations. One wonders whether the time limit is a contributing factor to the negative correlation. Further,it is uncertain whether or not another attribute is being measured e.g. fine motor skills, rather than cognitive function.

In conclusion this study highlights the need for additional investigation in examining individual items both in the MMSE and the SMMSE scales. The procedure of replacing the missing values with the mean of all respondents does not appear to affect the alpha results. Furthermore, the overall alpha levels of all scales remain relatively stable and high. The alpha levels found in this study provide strong empirical support for the internal reliability of the MMSE and SMMSE scale.

The sensitivity, specificity and predictive values obtained in this study, where the results of the SMMSE scale have been compared to those of the MMSE scale, constitute new data. The SMMSE was found to be equally sensitive as the MMSE in detecting cognitive impairment among the elderly research participants. The specificity, however, of the SMMSE was found to be lower at Time 2 period. Additional investigation to examine further the effectiveness of the SMMSE in other geriatric settings is warranted.

Conclusion

The main finding in this study indicates a high degree of correlation between the scales (MMSE & SMMSE). In addition the results confirm high test-retest reliabilities for consecutive 1 week intervals for 4 week periods. This study provides further confirmation that both tools (MMSE & SMMSE) can be used with reasonable confidence to measure cognitive impairment in elderly clients. However, further research using the SMMSE is warranted as the results may provide the evidence needed to promote its adoption in clinical settings. Furthermore, the investigator found that, in administering the SMMSE scale, the adherence to the time limit for each item was uncomfortable as well as frustrating. It seemed necessary to pay greater attention to the time frame than to the uniqueness of each elderly participant. This predicament did not occur during the administration of the MMSE scale. The investigator concludes that the MMSE scale is

more user friendly of the two to administer even though the SMMSE demonstrates certain advantages, i.e., more consistent in format, (general to specific), more specific guidelines and more rigorous in application. However, the investigator recommends that if the rigorous application of the time aspect were to be omitted from the standardized scale, it would be the preferred scale.

The other interesting finding indicates the necessity of both subjective and objective methods of data collection for the total assessment of a cognitively impaired client. That is, the nurse's ability to identify and to measure cognitive deficits, not only by using clinical judgement, but by administering screening tools is critical for the provision of quality nursing care.

In fact, the challenge during the 1990's is not only for the nurse but for all health care providers to assess, to implement, and to evaluate a variety of strategies to reduce the impact of cognitive impairment upon the clients and their families.

A few limitations prevail in this study: a random sample was not selected and the scales were administered by the same researcher rather than by multiple administrators as may be the more common in clinical situations. The generalizability of the finding is limited by the lack of representativeness of the cognitively impaired sample (all from one facility) and the small sample size.

Implications for Nursing Education

The findings of this study suggest certain implications for nursing education. One particular implication is the manner in which student nurses are taught methods and processes for the assessment of elderly clients who are cognitively impaired. Variations exist in nursing curricula related to the content on cognitive impairment. Few faculty members who teach cognitive impairment receive training in the use of screening tools. This lack of experience may instigate a reluctance to venture into the teaching of objective measurement processes. It is speculated that screening tools intended to assess cognitive function may need to receive greater emphasis than is the case presently. Nurse educators must now take the initiative to ensure that student nurses 'come to know' the importance of using screening tools as part of the total assessment of cognitive impairment.

Implications for Nursing Practice

The results of this study raise several important issues for nurses given that cognitive impairment in elderly clients is recognized as a major health problem. One such issue is that through an improved and thorough assessment of cognitive status, using screening tools, can provide more effective nursing care to elderly clients with cognitive impairment and their families. A second issue that has implications for nursing practice is that nurses are able to educate team members to understand, and to intervene with elderly clients who are cognitively impaired.

Those who care for these elderly clients must be particularly vigilant, not only to the decline in cognitive abilities but to affirm the elderly clients of their strengths and to enhance their quality of life. A third equally important issue is the assessment of the client's level of functional performance and the ability to determine with confidence whether or not this performance is influenced by the decline in cognitive status. Finally, due to current health care reform initiatives, the attention of nurses should be directed toward factors related to early discharge and home care of elderly clients who are cognitively impaired. These individuals may require continuous supervision and a hazard free environment in which they can safely reside.

Recommendations for Further Research

Several directions for further research are generated by this study. First, the study needs to be replicated using larger samples of cognitively impaired elderly clients. Larger samples will yield greater statistical confidence in the results obtained. Second, empirical studies are required to determine the extent to which, in the administration of both the MMSE and SMMSE scales to elderly clients, the reliability and the validity remain consistent with the use of multiple raters. Another suggested direction is that further testing of the psychometric properties of the SMMSE scale should be conducted to establish the utility of the instrument in a variety of settings. Further

evidence of the effectiveness of the SMMSE is needed. Fourth, an examination of individual items using various techniques of item analysis should be conducted to assess the ability of each item to discriminate between cognitive impairment and non cognitive impairment. Fifth, the curricula used in nursing education programs should be explored to identify content areas of study which might benefit by the use of screening tools and methods for their implemention. Finally, correlational studies are required to determine the relationships which might exist between various degrees of cognitive impairment in older adults and the quality of the daily performance tasks conducted by them.

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Appendix A
Gender, Age, and Education Levels of Clients by Group

I. Gender

Group A	**n**	**%**
male	5	36
female	9	64
Group B		
male	4	29
female	10	71

II. Ages

	N	**Mean**	**Range**
Group A	14	80 yrs.	64-98 yrs.
Group B	14	78 yrs.	60-89 yrs.

III. Education Level Achieved

	Gr 8 or higher (%)		**Less than Gr 8 (%)**	
Group A	86	n=12	14	n=2
Group B	93	n=13	7	n=1

Note: Of the 14 participants assigned to Group A, 5 were male and 9 were female. Their mean age was 80 years, (range 64-98). The majority (86%) had education of grade eight or more while the minority (14%) had less than grade eight education. Group B, which was somewhat similar to Group A, was comprised of 14 participants (4 male, 10 female). Their mean age was 78 years, and ranged from 60-89 years. The majority (93%) had education of grade eight and above and the minority (7%) had less than grade eight education.

Appendix B
Ethnic Status and Pre-retirement Occupation by Group

I Ethnic Status

Group	Ethnicity	n	%
Group A	British	6	43
	Slavic	2	14
	French	2	14
	German	1	7
	Icelandic	1	7
	Swedish	1	7
	Aboriginal	1	7
Group B	British	6	43
	Slavic	4	29
	Scottish	2	14
	French	1	7
	Icelandic	1	7

Note: Percentages have been rounded so they may not total to 100 %.

II. Pre-retirement Occupation

Group	Occupation	n	%
Group A	Homemaker	5	36
	Brewer	1	7
	Factory Worker	1	7
	Labourer	1	7
	Purchasing Agt	1	7
	Religious Bro.	1	7
	Restauranteur	1	7
	Salesperson	1	7
	Telegrapher	1	7
	Welder	1	7
Group B	Homemaker	4	29
	Salesperson	3	21
	Teacher	2	14
	Counsellor	1	7
	Mailman	1	7
	Pilot	1	7
	Seamstress	1	7
	Waitress	1	7

Note: Percentages have been rounded so they may not total to 100 %.

Appendix C1
The Traditional Mini-Mental State Examination (MMSE)

Patient Code_____

Examiner_____

Date_____

TRADITIONAL "MINI-MENTAL STATE EXAMINATION

Maximum Score	Score	
		ORIENTATION
5	( )	What is the (year) (season) (date) (day) (month)?
5	( )	Where are we: (state) (county) (town) (hospital) (floor).
		REGISTRATION
3	( )	Name 3 objects: 1 second to say each. Then ask the patient all 3 after you have said them. Give 1 point for each correct answer. Then repeat them until he learns all 3. Count trials and record.
		ATTENTION AND CALCULATION
5	( )	Serial 7's. 1 point for each correct. Stop after 5 answers. Alternatively spell "world" backwards.
		RECALL

3 ( ) Ask for the 3 objects repeated above. Give 1 point for each correct.

LANGUAGE

9 ( ) Name a pencil, and watch (2 points)
Repeat the following "No ifs, ands or buts." (1 point)
Follow a 3-stage command:
"Take a paper in your right hand, fold it in half, and put it on the floor" (3 points)

Read and obey the following:
CLOSE YOUR EYES (1 point)

Write a sentence (1 point)

Copy design (1 point)

_____ Total Score

ASSESS level of consciousness along a continuum

Alert Drowsy Stupor Coma

Source:
Folstein, M., Folstein, S. & McHugh, P. (1975). "Mini-Mental State" A practical method for grading the cognitive state for the clinician. Journal of Psychiatric Research, 12, 189-198.

INSTRUCTIONS FOR ADMINISTRATION OF MINI-MENTAL STATE EXAMINATION

ORIENTATION

(1) Ask for the date. Then ask specifically for parts omitted, e.g., "Can you also tell me what season it is?" One point for each correct.
(2) Ask in turn "Can you tell me the name of this hospital?" (town, county, etc.). One point for each correct.

REGISTRATION

Ask the patient if you may test his memory. Then say the names of 3 unrelated objects, clearly and slowly, about one second for each. After you have said all 3, ask him to repeat them. This first repetition determines his score (0-3) but keep saying them until he can repeat all 3, up to 6 trials. If he does not eventually learn all 3, recall cannot be meaningfully tested.

ATTENTION AND CALCULATION

Ask the patient to begin with 100 and count backwards by 7. Stop after 5 subtractions (93, 86, 72, 65). Score the total number of correct answers.

If the patient cannot or will not perform this task, ask him to spell the word "world" backwards. The score is the number of letters in correct order. E.G. dlrow = 5, dlrow = 3.

RECALL

Ask the patient if he can recall the 3 words you previously asked him to remember. Score 0-3.

LANGUAGE

Naming: Show the patient a wrist watch and ask him what it is. Repeat for pencil. Score 0-2.

Repetition: Ask the patient to repeat the sentence after you. Allow only one trial. Score 0 or 1.

3-Stage command: Give the patient a piece of plain blank paper and repeat the command. Score 1 point for each part correctly executed.

Reading: On a blank piece of paper print the sentence "close your eyes", in letters large enough for the patient to see clearly. Ask him to read it and do what it says. Score 1 point only if he actually closes his eyes.

Writing: Give the patient a blank piece of paper and ask him to write a sentence for you. Do not dictate a sentence, it is to be written spontaneously. It must contain a subject and verb and be sensible. Correct grammar and punctuation are not necessary.

Copying: On a clean piece of paper, draw intersecting pentagons, each side about 1 in., and ask him to copy it exactly as it is. All 10 angles must be present and 2 must intersect to score 1 point. Tremor and rotation are ignored.

Estimate the patient's level of sensorium along a continuum, from alert on the left to coma on the right.

Source:
Folstein, M., Folstein, S. & McHugh, P. (1975). "Mini-Mental State" A practical method for grading the cognitive state for the clinician. Journal of Psychiatric Research, 12, 189-198.

Appendix C2
Standardized Mini-Mental State Examination (SMMSE)

Research Participant Code_____

Investigator_____

Date_____

STANDARDIZED MINI-MENTAL STATE EXAMINATION (SMMSE)

I am going to ask you some questions and give you some problems to solve. Please try to answer as best as you can.

		MAX SCORE
1.	(Allow 10 seconds for each reply)	
	a) *What year is this?* (accept exact answer only)	1
	b) *What season is this?* (during last week of the old season or first week of a new season, accept either season)	1
	c) *What month of the year is this?* (on the first day of new month, or last day of the previous months accept either)	1
	d) *What is today's date?* (accept previous or next date, e.g. on the 7th accept 6th or 8th)	1
	e) *What day of the week is this?* (accept exact answer only)	1
2.	**(Allow 10 seconds for each reply)**	
	a) *What country are we in?* (accept exact answer only)	1
	b) *What province/state/county are we in?* (accept exact answer only)	1
	c) *What city/town are we in?* (accept exact answer only)	1
	d) *What is the name of this hospital/building?* (accept exact name of hospital or institution only)	1
	e) *What floor of the building are we on?* (accept exact answer only)	1

3. *I am going to name 3 objects. After I have said all three objects, I want you to repeat them. Remember what they are because I am going to ask you to name them again in a few minutes.* (say them slowly at approximately 1 second intervals)

BALL	CAR	MAN
For repeated use:		
BELL	JAR	FAN
BILL	TAR	CAN
BULL	WAR	PAN

Please repeat the 3 items for me. (score 1 point for each correct reply on the first attempt. Allow 20 seconds for reply. If subject did not repeat all three, repeat until they are learned or up to a maximum of 5 times) 3

4. *Spell the word "WORLD"* (you may help subject to spell **world** correctly)

Say "*now spell it backwards please*". (allow 30 seconds to spell backwards. If the subject cannot spell "world" even with assistance - score 0) 5

5. *Now what were the three objects that I asked you to remember?*

BALL CAR MAN

(score 1 point for each correct response regardless of order)(allow 10 seconds) 3

6. Show wristwatch. Ask "*What is this called?*" (score 1 point for correct response. Accept "wristwatch" or "watch". Do not accept "clock", "time", etc. Allow 10 seconds) 1

7. Show pencil. Ask "*What is this called*" (score 1 point for correct response, accept pencil only, - score 0 for pen) 1

8. *I'd like you to repeat a phrase after me: "No if's, and's or but's"* (allow 10 seconds for response. Score 1 point for a correct repetition. Must be exact, e.g. No if's or but's - score 0) 1

9.	*Read the words on this page and then do what it say:* (hand subject the laminated sheet with "CLOSE YOUR EYES" on it) *Close Your Eyes* (if subject just reads and does not then close eyes - may repeat "read the words on this page and then do what it says" to a maximum of 3 times. Allow 10 seconds, score 1 point <u>only</u> if subject closes eyes. Subject does not have to read aloud)	1
10.	Ask if the subject is right - or left-handed. Alternate right/left hand in statement, e.g. if the subject is right-handed say "Take this paper in your left hand..." Take a piece of paper - hold it up in front of subject and say the following: "*Take this paper in your right/left hand, fold the paper in half once with both hands, and put the paper down on the floor.*" Takes paper in correct hand _____ Folds it in half _____ Puts in on the floor _____ (allow 30 seconds. Score 1 point for each instruction correctly executed)	3
11.	Hand subject a pencil and paper. *"Write any complete sentence on that piece of paper."* (allow 30 seconds. Score 1 point. The sentence should make sense. Ignore spelling errors.	1
12.	Place design, pencil, eraser and paper in front of subject. *"Copy this design please."* (allow multiple tries until patient is finished and hands it back. Score 1 point for correctly copied diagram. the subject must have drawn a 4-sided figure between the two 5-sided figures) (Maximum time - 1 minute)	1
	TOTAL TEST SCORE	**30**

Source: Dr. D.W. Molloy

DIRECTIONS FOR ADMINISTRATION OF SMMSE

1. Before the Questionnaire is administered try to get the subject to sit down facing you. Assess the subjects ability to hear and understand very simple conversation, e.g. What is your name? If the subject uses hearing or visual aids provide these before starting.

2. Introduce yourself and try to get the subject's confidence. Before you commence get the subject's permission to ask questions, e.g. "would it be alright to ask you some questions about your memory?". This helps to avoid catastrophic reactions.

3. Ask each question a maximum of three times. If the subject does not respond - score 0.

4. If the subject answers incorrectly - score 0. Do not hint, prompt or ask the question again, e.g. What year is this - 1952. Accept that answer - do not ask the question again, hint or provide any physical clues such as head shaking, etc.

5. The following equipment is required to administer the instrument: a watch, a pencil, and some blank paper. A piece of paper with "CLOSE YOUR EYES" written in large letters and two 5-sided figures intersecting to make a 4-sided figure is also required. We have laminated this paper and enclosed it for your convenience.

6. If the subject answers "What did you say" - do not explain or engage in conversation - merely repeat the same directions (e.g. What year is this? to a maximum of 3 times.

7. If the subject interrupts e.g. "What's this for?" just reply: "I will explain in a few minutes when we are finished. Now if we could just proceed please..we are almost finished..."

Source: Dr. D.W. Molloy

Appendix D1
Letter of Invitation to Participate:
To Person Legally Responsible for Participant in Question

Manitoba
R
June 20, 1994

Name
Address
City/Town
Postal Code.

Dear (Name).
I am a graduate student enrolled at the University of Manitoba in the Master of Nursing degree program. Part of the requirement for the Master's degree, is to complete a research study. My project is being supervised by a committee of three professors at the University of Manitoba.

Dr. Lorna Guse	Faculty of Nursing
Dr. Jeff Sloane	Faculty of Nursing
Dr. John Bond	Faculty of Human Ecology

I obtained your name and address from the Associate Director, Quality/Research/Programs, Deer Lodge Centre. As you are designated the legally responsible person for (Name of Resident), you are invited to provide consent for (NAME of resident) to participate in the research study. The Associate Director has suggested that I contact you personally to seek the necessary consent from you.
The general purpose of the research project is;
(1) to assess thinking skills of elderly clients by allowing them to respond to a series of questions;
(2) to communicate that information to nurses so they can help the older adult enjoy a better quality of life.

There is no cost or risks involved. The study has been approved by the Ethical Review Committee of the University of Manitoba and by the Administration at Deer Lodge Centre. I will telephone you within one week of date of mailing. At that time I will provide further information and I will request your participation in the study..

I look forward to speaking with you in the near future.
Thank-you.

Sincerely,

Verna Pangman RN BA MEd

Appendix D2

Telephone Message to Person Legally Responsible for Participant

Hello Mr. /Mrs._____, my name is Verna Pangman. I am a graduate student in nursing from the University of Manitoba. Last week, I sent to you a letter about a study that I will conduct at Deer Lodge Centre. I certainly would appreciate greatly your help in this project.

I mentioned in the letter that I would be calling you to provide further information about the study and to request your participation. May I provide that information now?

The general purpose of the study is to assess older adult's thinking ability. Participation in this study requires your relative/client to answer a series of questions and to follow a few instructions (name objects, follow some simple requests, and copy a figure). It is anticipated that these activities will take about fifteen minutes of time on four different occasions one week apart.

The participation of your relative/ client in this study will help us to know more about older adults and their thinking skills. What we learn hopefully will help to improve the quality of nursing care provided to elderly clients. Whether or not your relative/client participates will NOT, in any way, affect his/her care here on the unit, or in the Centre. Participation in this study is voluntary. There are no risks involved. Your relative/client may withdraw from the study at any time.

All information collected during the study will remain confidential. The data collected will be grouped. Your relative/client will not be identified by name. I would be pleased to provided a brief copy of the results if you wish. Do you have any questions so far?

I would like to request your agreement to have (Name of resident) participate in the study. I would like to make an appointment for around ten minutes at Deer Lodge Centre. At that time I will need to obtain your signature on the consent form to keep.

If you have any questions at any time, or if you need to change the date of the appointment please feel free to contact me at . Thank-you for your time. I will be looking forward to meeting you (date, time, place).

Appendix E
Consent Form

Your relative/client is invited to participate in a study, which is part of a Master of Nursing degree program, to determine how older people think. About 30 elderly residents at Deer Lodge Centre will participate. The general purpose of the study is to assess, through a series of questions and a few instructions, the thinking ability of older adults.

Participation in this study requires your relative/client to answer a series of questions and to follow a few instructions (name objects, follow some simple requests, and copy a figure). These activities will take about fifteen minutes of time on four different occasions, one week apart. The participation of your relative/client in this study will help us to know more about the thinking skills of older adults. Hopefully, what we learn will help to improve the quality of nursing care provided to elderly clients. Participation in this study is voluntary, no risks are involved, and the research participant may withdraw from the study at any time. Should your relative/client decide not to participate, or to end participation after commencement, their decision will, in no way, influence the quality of the care they receive.

All information collected during the study will remain confidential. The data will be held in storage by the investigator, and retained for 7 - 10 years. Information will be grouped and the elderly research participants will not be identified by name. The results of the study may be published; but the research site and the names of participants will remain confidential. If you wish to receive a summary of the results please check the appropriate space on the following page. No financial cost is involved.

Your signature on the following page will indicate your agreement to permit your relative/client to participate in this study. You will receive a copy of the consent form. If you have questions please feel free to contact me. Your participation in this matter is most appreciated. Thank you.

Please see next page

(Original was double spaced and on two pages)

I agree to participate in this project.
Date:_____ Trustee/Next of kin signature:_____
Date:_____ Investigator's signature:_____
Please send me a copy of the results of this research study.
yes___ no____

Verna Pangman RN MEd. from the Misericordia General Hospital School of Nursing is the research investigator. Ph.
Lorna Guse, PhD, is thesis committee Chairperson. Ph.

Appendix F1
Letter of Invitation to Participate: To Next of Kin

, Manitoba
R
June 20, 1994

Name
Address
City/Town
Postal Code.

Dear (Name).
I am a graduate student enrolled at the University of Manitoba in the Master of Nursing degree program. Part of the requirement for the Master's degree, is to complete a research study. My project is being supervised by a committee of three professors at the University of Manitoba.

Dr. Lorna Guse	Faculty of Nursing
Dr. Jeff Sloane	Faculty of Nursing
Dr. John Bond	Faculty of Human Ecology

I obtained your name and address from the Associate Director, Quality/Research/Programs, Deer Lodge Centre. As you are designated the next of kin for (Name of Resident), you are asked to assist in the participation of your relative in the research study. The Associate Director has suggested that I contact you personally to seek the necessary information from you.
The general purpose of the research project is;
(1) to assess thinking skills of elderly clients by allowing them to respond to a series of questions;
(2) to communicate that information to nurses so they can help the older adult enjoy a better quality of life.

There is no cost or risks involved. The study has been approved by the Ethical Review Committee of the University of Manitoba and by the Administration at Deer Lodge Centre. I will telephone you within one week of date of mailing. At that time I will provide further information and I will request your participation in the study.

I look forward to speaking with you in the near future.
Thank-you,

Sincerely,

Verna Pangman RN BA MEd

Appendix F2
Telephone Message to Next of Kin

Hello Mr./Mrs._____, my name is Verna Pangman. I am a graduate student in nursing from the University of Manitoba. Last week, I sent to you a letter about a study that I will conduct at Deer Lodge Centre. I certainly would appreciate greatly your help in this project.

I mentioned in the letter that I would be calling you to provide further information about the study and to request your participation. May I provide that information now?

The general purpose of the study is to assess older adult's thinking ability. Participation in this study requires your relative/client to answer a series of questions and to follow a few instructions (name objects, follow some simple requests, and copy a figure). It is anticipated that these activities will take about fifteen minutes of time on four different occasions one week apart.

The participation of your relative/ client in this study will help us to know more about older adults and their thinking skills. What we learn will hopefully help to improve the quality of nursing care provided to elderly clients. Whether or not your relative/client participates will NOT, in any way, affect his/her care here on the unit, or in the Centre. Participation in this study is voluntary. There are no risks involved. Your relative/client may withdraw from the study at any time.

All information collected during the study will remain confidential. The data collected will be grouped. Your relative/client will not be identified by name. I would be pleased to provided a brief copy of the results if you wish. Do you have any questions so far?

I am interested in how you perceive your relatives decision-making capabilities. Have you solely been making decisions regarding the care for your relative or do you and your relative (Name of resident) share decision- making?

SITUATION 1: Kin member solely making decisions for relative.

1. Thank-you for this information. I now need your agreement that (Name of resident) participate in the study. I would like to meet with you for around ten minutes at Deer Lodge Centre. At that time you can provide your signature on the consent form. You will be given a copy of the consent form to keep.

SITUATION 2: Kin member sharing decision-making capabilities with relative

2. Thank-you for this information. I look forward to having (Name of resident) participate in this project. I would like to meet with you, for about ten minutes at Deer Lodge Centre so that you can be present when I ask (Name of resident) to participate in the study. At that time, if your relative freely consents to participate in the study the consent form may be signed either by the client or by yourself.

SITUATION 1&2:

If you have any questions at any time, or if you need to change the date of the appointment please feel free to contact me at . Thank-you for your time. I will be looking forward to meeting you (date, time, place)

Appendix G
Raw Scores of MMSE and SMMSE at Each Assessment Time Period

	MMSE		SMMSE	
Particip't No.	TIME 1	TIME 2	TIME 1	TIME 2
1.	26	25	28	22
2.	20	19	18	19
3.	19	20	18	15
4.	26	22	29	27
5.	15	15	15	14
6.	13	13	10	12
7.	16	16	15	20
8.	19	20	25	24
9.	21	21	26	22
10.	26	24	28	23
11.	4	6	5	1
12.	1	0	4	2
13.	20	23	17	21
14.	11	10	14	9
15.	20	18	20	19
16.	15	15	17	15
17.	29	30	27	28
18.	12	16	15	13
19.	15	16	14	13
20.	22	21	18	24
21.	26	25	25	25
22.	17	15	15	16
23.	21	25	24	24
24.	29	30	28	27
25.	14	14	12	14
26.	8	7	6	4
27.	23	24	22	24
28.	12	11	14	9

Appendix H
Levels of Cognitive Impairment for MMSE and SMMSE at Times 1 and 2

A. MMSE

Extent of Impairment	Range of Scores	Time 1 n	Time 2 n
mild	18-23	9	6
severe	0-17	13	15

B. SMMSE

Extent of Impairment	Range of Scores	Time 1 n	Time 2 n
mild	20-23	2	5
moderate	10-19	14	11
severe	0-9	3	4

Appendix I
Item Scale Correlations

MMSE Time 1			MMSE Time 2		
Deleted Variable	Correlation with Total	Alpha	Deleted Variable	Correlation with Total	Alpha
1	.69	.80	1	.40	.84
2	.46	.81	2	.57	.83
3	.40	.81	3	.60	.83
4	.59	.80	4	.63	.83
5	.61	.80	5	.66	.83
6	.37	.81	6	.43	.84
7	.26	.82	7	.32	.84
8	.61	.81	8	.46	.84
9	.73	.80	9	.75	.83
10	.58	.81	10	.63	.83
11	.61	.80	11	.53	.83
12	.56	.84	12	.55	.86
13	.54	.81	13	.58	.83
14	.38	.82	14	.51	.84
15	.11	.82	15	.34	.84
16	.55	.81	16	.56	.83
20	.38	.81	20	.44	.84
21	.34	.81	21	.23	.84
22	-.11	.83	22	.18	.84

Examination of item-total correlations revealed that item 22 (copy a figure) had a low negative correlation in the MMSE and SMMSE scale Time 1 (-.11 & -.10). Item 19 (fold paper) had a low negative correlation for the SMMSE scale Time 2 (-.04). All other item-total correlations were positive for both scales at Time 1 and at Time 2 ranging from .06 to .75. Low positive correlation were found as follows: in MMSE scale Time 1 item 15 (name object watch) (.11); in MMSE scale Time 2 item 22 (copy a figure) (.18); in SMMSE scale Time 1 item 18 (takes paper) (.11); in SMMSE scale Time 2 item 20 (put paper on floor) (.10) and item 21 (write a sentence) (.07). Only one item, item 21 (write a sentence) had a low positive correlation in the SMMSE scale at Time 1 and Time 2 (.06 & .07). Furthermore, the SMMSE scale Time 1 and Time 2 had lower item - total correlations compared to the MMSE scale Time 1 and Time 2.

Appendix I

Item Scale Correlations (continued)

SMMSE Time 1			SMMSE Time 2		
Deleted Variable	Correlation with Total	Alpha	Deleted Variable	Correlation with Total	Alpha
1	.75	.79	1	.65	.83
2	.46	.80	2	.60	.83
3	.44	.80	3	.55	.83
4	.57	.80	4	.60	.83
5	.58	.79	5	.66	.82
6	.31	.80	6	.26	.84
7	.51	.80	7	.57	.83
8	.42	.80	8	.74	.82
9	.58	.79	9	.75	.82
10	.61	.79	10	.59	.83
11	.54	.79	11	.54	.83
12	.54	.84	12	.51	.89
13	.64	.78	13	.65	.82
14	.46	.80	14	.61	.83
15	.33	.81	15	.61	.83
16	.66	.79	16	.57	.83
17	.52	.80	17	.57	.83
18	.11	.81	18	.23	.84
19	.07	.81	19	-.04	.84
20	.07	.81	20	.10	.84
21	.19	.81	21	.07	.84
22	-.10	.81			

Appendix J
The Calculation of Sensitivity, Specificity, and Predictive Value of SMMSE Using MMSE as the Gold Standard

A. Time 1

	Gold Standard MMSE Time 1. Yes	**No**	**Totals**
Yes Results of SMMSE Time 1	19 (a) True Positive	0 (b) False Positive	19
No Results of SMMSE Time 1	3 (c) False Negative	6 (d) True Negative	9
Totals	22	6	28

Terms, Definitions, and Calculations

Term	**Definition**	**Formula & Result**
Sensitivity	Percentage of those who have a **positive** test	$\frac{a}{a + c}$ x 100%= **86.3%**
Specificity	Percentage of those who have a **negative** test	$\frac{d}{b + d}$ x 100%= **100%**
Predictive Value of Positive Test	Percentage of those with **positive** test results and who **have** the attribute	$\frac{a}{a + b}$ x 100%= **100%**
Predictive Value of Negative Test	Percentage of those with **negative** test results but who do **not** have the attribute	$\frac{d}{c + d}$ x 100%= **66.7%**

Continued on next page with Time 2.

B. Time 2

	Gold Standard MMSE Time 2.		
	Yes	**No**	**Totals**
Yes Results of SMMSE Time 2	18 (a) True Positive	2 (b) False Positive	20
No Results of SMMSE Time 2	3 (c) False Negative	5 (d) True Negative	8
Totals	21	7	28

Terms, Definitions, and Calculations

Term	Definition	Formula & Result
Sensitivity	Percentage of those who have a **positive** test	$\frac{a}{a+c}$ x 100%= **85.7%**
Specificity	Percentage of those who have a **negative** test	$\frac{d}{b+d}$ x 100%= **71.4%**
Predictive Value of Positive Test	Percentage of those with **positive** test results and who **have** the attribute	$\frac{a}{a+b}$ x 100%= **90%**
Predictive Value of Negative Test	Percentage of those with **negative** test results but who do **not** have the attribute	$\frac{d}{c+d}$ x 100%= **62.5%**

Appendix K
Tests for Order Effects

Part A

Typical Square in a Two-time Period Crossover Study

Participant	Time 1	Time 2	Sums	Differences
1	$A(X_1)$	$B(X_2)$	$T = X_1 + X_2$	$D_1 = X_1 - X_2$
2	$B(Y_1)$	$A(Y_2)$	$T = Y_1 + Y_2$	$D_2 = Y_1 - Y_2$

Note: A particular square is exemplified by Participant 1. who, for example, is administered the scales in the order (MMSE & SMMSE); that is, A then B. Meanwhile Participant 2 receives the scales in the reverse order (SMMSE & MMSE), or B, then A. In the present study 28 participants were paired randomly to form 14 2X2 Latin Squares. Sums and differences of each participant's response were used in the analysis. The summary means and standard deviations of the sums and differences appear in Part B below.

Part B

Summary Results for Crossover Designs

		Sums		Differences	
Order	**n**	**Mean**	**sd**	**Mean**	**sd**
A - B MMSE - SMMSE	14	35.17	13.64	- 0.75	2.26
A - B SMMSE - MMSE	14	36.11	15.14	- 0.96	1.23

Note: The differences and sums are analyzed by simple t tests.

t diff = [t(26) = .31 p > .05]

t sum = [t(26) = -.17 p > .05]

[t critical, 26 df, p < .05] = 2.06

The findings are not significant. Therefore, no order effects are considered to be present.