MENTAL STATUS IN THE HOSPITALIZED ELDERLY

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BY

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DEDICATION

This thesis is dedicated to my parents Olive Jean and Franklin Heath whose belief in me and in the value of this endeavor has been instrumental in helping me to see it through to completion.

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ABSTRACT

The purpose of this study was to assess the impact of hospitalization on mental status in the elderly. To this end subjects were given mental status exams in hospital and after discharge, with a retrospective assessment of functioning before illness obtained from an informant using the Informant's Interview section of the CAMDEX (Roth, Tyrne, Mountjoy, Huppert, Hendrie, Verma, & Goddard, 1986). Other measures that were taken include diagnosis, number of medications in hospital and at home, and the likelihood of those medications having an effect on mental status. A comparison was made of performance on the mental status exam (M.M.S.E., Folstein, ,Folstein, & McHugh, 1975) in hospital and at home. As well, multiple regression analyses were used to determine which factors more strongly predicted performance on the M.M.S.E. on both occasions.

The results reveal that 52% of the population interviewed scored below the accepted cutoff of 24/30 on the M.M.S.E.. This is an important finding given that those subjects who were delirious were eliminated from the study. Those subjects who scored in the impaired range on the M.M.S.E. in hospital

did significantly better at home ($p < .000$). There was no such difference for the unimpaired group suggesting that the finding is not the result of a practice effect. The regression analyses show that mental status in-hospital and post-discharge was most strongly predicted by the CAMDEX pre-hospitalization measures. The amount of variance explained post-discharge was greater than that explained in hospital. The CAMDEX Informant's Interview subscales which best predicted performance, both at home and in hospital, for the group scoring in the impaired range, were the Activities of Daily Living and Paranoia.

TABLE OF CONTENTS

LIST OF TABLES

Table 21. Pearson product moment correlations for subtests of informant's interview and follow-up mental status for non-confused group (n=7).

LIST OF FIGURES

I. INTRODUCTION

A. Background

It is widely recognized that elderly people are more prone to experience confusion than are younger groups (Lipowski, 1983). However, confusion is not a necessary concomitant of normal aging (Rowe, 1985). Prevalence studies of community dwelling older people find that for this population at least, cognitive impairment is the exception rather than the rule. Prevalence rates for the group over 65 years of age vary from 3% to 25% depending upon the sample, the assessment devices used to measure cognitive impairment and the definition of what constitutes impairment.

These figures do not hold true for the same group when they are hospitalized on medical or surgical wards. It is estimated that 30% to 80% of hospitalized elderly will experience some measurable form of confusion during their hospitalization (Cavanaugh, 1983; Gillick, Serrell, & Gillick, 1982; Kral, 1975; Liston, 1982). Studies have shown that this impairment goes undetected by medical personnel in 16% to 77% of cases (Cheah & Beard, 1980; Eaton, Stones & Rockwood, 1986; Gehi, Strain, Weltz & Jacobs, 1980; Knights & Folstein, 1977; McCartney & Palmateer, 1985). Cognitive impairment has been

identified as a factor in the use of restraints (Berland, Wachtel, Kiel, O'Sullivan & Phillips, 1990) and perhaps more importantly, is a major predictor of nursing home placement (Narain, Rubenstein, Wieland, Rosbrook, Strome, Pietruszka & Morley, 1988; Zarit & Zarit, 1983). A recent study completed in the St. John's Metro area hospitals identified two principle factors which precluded return home for elderly inpatients; 1. incontinence and 2. poor performance on a mental status exam (St. John's Hospital Council, 1991; unpublished manuscript).

It is critical to detect cognitive impairment and then evaluate its cause. Confusion may be a treatable disorder caused by drug toxicity or low grade infections amongst other factors. Irreversible or progressive cognitive impairment has enormous implications for both the patient and family members, who must begin to consider such issues as placement or home supports. Given the combination of high incidence of confusion and lack of recognition of the problem by health professionals, it has been suggested in the literature that routine mental status exams be given to patients over 65 admitted to medical wards (Blass, 1985; Gehi et al., 1980).

Before this practice is implemented, however, a closer examination of the problem is warranted. Several studies refer to the impact of illness and hospitalization on mental status (Gillick et al., 1982; Kennedy, 1959; Litin, 1956; Morency, 1990). Studies reporting on mental status in hospitalized adults find that some patients of any age score within the impaired range, although this percentage rises dramatically with age (Erkinjuntti, Wikstrom, Palo, & Autio, 1986; Fields, Mckenzie, Charlson, & Sax, 1986; Gehi et al., 1980). Given that these studies used short mental status exams noted for their high rate of false negatives(Zarit, Eiler, & Hassinger, 1985), one might speculate that the true incidence of confusion in these groups may be above that reported. Thus it appears that the combination of illness and hospitalization may impact negatively on cognitive functioning for both elderly and younger groups. An elderly individual would have the added handicaps of normal age related difficulties which are known to affect ability to perform on mental status exams (Anthony, LeResche, Niaz, Von Korff, & Folstein, 1982) and generally lower levels of education. Some research has shown that education levels are significantly correlated with performance on mental status exams (Brayne & Calloway, 1990; Murden, Mcrae, Kaner & Bucknam, 1991), while other

studies find no significant effect of education (Heeren, Lagaay, von Beek, Rooymans & Hijmans, 1990). Consequently, it is difficult to determine what is responsible for the high rate of cognitive impairment in hospitalized elderly individuals.

It has been suggested that the poor cognitive performance of the elderly in hospital may be at least partially due to the stressors, both physical and psychological, associated with such an experience (Kennedy, 1959). If this is in fact the case, then there should be, for at least a significant subgroup of the population, a distinct pattern to the development of cognitive impairment. Individuals who are functioning normally before admission should score in the impaired range on a mental status exam within a few days of admission to hospital and should score within normal limits again within a few weeks of discharge home. Thus the best predictor of mental status at follow-up would be the measures taken before hospitalization. There have been no studies published in which there have been pre-hospitalization measures, and in which the subjects have been followed up at home after discharge.

B. Purpose of the Study

The general purpose of this study was to examine the effects of hospitalization on the mental status of non delirious elderly medical inpatients. Specifically, the aims of this study were: 1. to examine which factors predict mental status scores in hospital and at home. 2. to determine the significance of any change in mental status score from hospital to home.

C. Significance of the Study

The elderly, as a group with significant health problems, are heavy utilizers of hospital beds. Once in hospital they are likely to develop confusion (Lipowski, 1983). The development of confusion has many implications for this group. Firstly, it has been demonstrated that confusion is one of most significant factors in determining nursing home placement. Secondly, a diagnosis of dementia may be made on the basis of poor performance on a mental status exam when there is no evidence of delirium. Finally, much patient teaching takes place on a medical floor (eg. diet changes for diabetics or cardiac patients, lifestyle changes, medications etc.) (Naylor & Shaid, 1991). If large numbers of patients are scoring in the confused range on a brief mental

status exam, it must be questioned whether much of the information being taught is being understood and remembered by the patient.

Decisions about placement and diagnosis of dementia presume that poor mental status scores, in the absence of delirium, will not change. The third implication assumes that if a patient is judged by medical or nursing staff not to be confused, then they are capable of understanding and remembering instructions. It is well known that medical and nursing staff fail to detect from 20% to 40% of cognitive impairment that is evident on a mental status exam (Roca, Klein, Kirby, McArthur, Vogelsang, Folstein, & Smith, 1984; McCartney & Palmateer, 1985). Consequently, it is questionable whether medical and nursing judgement alone is sufficient basis for making decisions about the patient's ability to participate in educational sessions.

This study will address the assumptions that mental status scores are stable in the absence of delirium and that patients who are neither dementing nor delirious are cognitively intact. The implications of these assumptions being incorrect are significant. Firstly, the mental status scores in hospital may be a poor predictor of how an individual performs cognitively at home. Secondly,if there is significant change in scores from hospital to home, any

diagnosis based on the in-hospital mental status score would be suspect. Finally, if large numbers of patients who are not delirious score in the impaired range in hospital but not at home, teaching may be more appropriately done in the patient's own home after discharge.

II. LITERATURE REVIEW

The major topic of this chapter is a review of the literature on confusion in the hospitalized elderly. The literature related to the general issue of cognitive impairment in the elderly will be discussed first, focusing on the definitional inconsistencies and poor operationalization of terms. A review of studies looking specifically at the mental status of hospitalized elderly will follow. This section will be broken down into three parts: 1. those studies in which mental status was measured on only one occasion during hospitalization. 2. studies in which there are multiple occasions on which mental status was measured during hospitalization. 3. the final section will examine the only study published in which pre, during and post hospitalization tests of mental status were conducted.

A. Literature Review

1. Cognitive Impairment in the Elderly

Two major forms of cognitive disorders, dementia and delirium, have been identified in the literature. Although they may co-exist, they are best differentiated on the basis of onset and/or course (DSM-III-R, 1987). Dementia is generally considered to be of slow onset with progressive deterioration while

delirium usually presents with rapid onset and reasonably quick resolution. Perhaps the most clinically significant difference between the two disorders is that delirium is generally reversible (Lipowski, 1983) while dementia is not (Clarfield, 1988).

a. Definitional Inconsistencies

Although the differentiation between dementia and delirium is theoretically clear, in practice it has been problematic to differentiate one from the other. The widespread cerebral dysfunction which characterizes both disorders results in difficulty in distinguishing between the two. The diagnostic features, onset and course of the dysfunction, can only be determined retrospectively. Furthermore, even when onset and course are known, in some cases dementia may have an acute onset and a delirium may be insidious in onset (Lipowski, 1987). A further complicating factor is that a delirium may be superimposed on a dementia making differentiation virtually impossible.

Dementia may be diagnosed when there is evidence of a slowly developing, long-lasting, global cognitive impairment without accompanying delirium. It is difficult to diagnose dementia particularly in the early stages, when signs and symptoms may overlap with and mimic other disorders (Rosen,

1983). It is also difficult, without a good corroborative history, to establish the course of the cognitive impairment. This makes it clinically problematic to determine, on the basis of mental status testing alone, whether cognitive impairment is due to a dementia or a delirium.

Delirium in the elderly is even less clearly understood and researched. One of the major challenges facing researchers in the area is the ambiguity in the definition of terms (Lipowski, 1990). Terms such as reversible dementia, delirium, confusion, acute confusional state, transient confusional state, acute brain syndrome or failure, pseudodementia, clouded states, toxic psychosis and others are often used interchangeably. The terms are usually poorly defined in the literature and operational definitions are virtually non-existent.

This situation is further complicated by the fact that there appears to be yet another kind of confusion present in the elderly which does not fit the diagnostic criteria for either dementia or delirium. This form of cognitive impairment is not characterized by any clear physiological etiology nor by obvious clouding of consciousness. However, those suffering from it perform poorly on formal mental status exams.

Historically the existence of this form of cognitive impairment in the elderly, which appears to be neither classic delirium nor dementia in terms of etiology and/or symptomatology, has been acknowledged. Very early papers, which reviewed what was known about confusion in the elderly, allowed that environmental and psychological factors may affect mental status. Lipowski (1983) points out that as early as 1904, Pickett distinguished between delirium and "confusion" in the elderly. From an etiological perspective, delirium was believed to stem from organic causes, while confusion could be the result of some psychosocial stressor such as bereavement. Pickett did not address differences in symptomatology.

Litin (1956) highlighted the aspects of the hospitalization experience which may contribute to the development of cognitive impairment. He suggested that the combined stress of physiological trauma and hospitalization may overtax an elderly person's capacities for adjustment. A case presentation illustrates the development of an acute confusional state in a previously mentally intact elderly individual. The patient was treated successfully simply by attempting to recreate, as closely as possible, a home environment in the hospital setting. In a similar vein, Kennedy (1959) examines the possible

psychological etiologies of confusional states in the elderly. He proposes that factors such as change from a familiar to an unfamiliar environment and the sensory deprivation experienced in hospital, in combination with a nervous system already compromised by the aging process, can produce confusion. Kral (1962) hypothesized that confusion is a reaction to acute physical or psychological stress which may be physiologically mediated by cortisol levels.

Foreman (1987) published a study which may illustrate clinically the development of cognitive impairment which is neither dementia nor classic delirium. He followed 71 hospitalized elderly patients who had scored within the normal range on an admission Mini-Mental Status Exam (M.M.S.E.) (Folstein, Folstein, & McHugh, 1975) for several days into their hospitalization to document the development of confusion. Foreman (1987) attempted to explain the development of confusion by using Levine's (1967) four Conservation Principles of Nursing. The four principles are: 1. the conservation of energy which involved measures of energy intake and output and was operationalized in variables such as those related to nutritional status and vital signs. 2. the conservation of structural integrity which included measures of factors which would affect neurophysiology and neuroanatomy

such as oxygenation of the blood, electrolytes, renal function and dementia. 3. the conservation of personal integrity which included a. presence of objects in the environment which provide familiar cues and aid in orientation (eg. radio, clock, newspapers), b. ability to function independently and current level of physical activity, c. sensory impairment, d. nurse's perception of whether or not the patient was confused e. patient's educational level and f. patient's subjective level of depression. 4. the conservation of social integrity which includes measures related to the social existence of the individual such as contact with others and demographic information thought to be related to the development of confusion.

The psychologically based principle referred to as the conservation of personal integrity was related to the development of confusion. On the basis of the six variables listed above, 93% of the subjects were accurately classified as confused or non-confused after admission. This finding reflects a higher "hit rate" than either of the physical principles alone. Variables such as the abnormalities in serum sodium and potassium, blood urea nitrogen, mean arterial pressure, serum albumin and body temperature increased the "hit rate" just 7%, from 93% to 100% correct classification. Clearly the abnormalities in

mental status in this sample are not completely physiologically based. These findings would corroborate the hypothesis that psychological factors are important in producing confusion.

The mental status scores which Foreman reports for the sub-group which developed confusion ($\underline{M}$ = 18.11, $\underline{s.d.}$ = 3.24, Cut-off for confusion = 24/30) do not appear to be representative of subjects who meet the diagnostic criteria for delirium (see Appendix D). Given the content of the M.M.S.E.(see Appendix B), lower scores would be anticipated for subjects who have difficulty maintaining and shifting attention appropriately and are unable to maintain coherent conversation. This impression cannot be substantiated on the basis of what is reported in the study because the issue is not addressed by the author. The normal mental status score on admission would suggest that these subjects are not demented and they do not appear to fit into the diagnostic criteria for delirium. They do show evidence of significant cognitive impairment which is difficult to explain. Foreman's (1987) findings related to the Conservation Principles referred to above, suggest that the confusion which develops over the hospitalization period is not only organically based, but is associated with environmental factors as well.

Most research has not specifically addressed the psychosocial factors involved in the development of cognitive impairment (e.g. Beresin, 1988; Levkoff, Besdine, Wetle, 1986; Liston, 1982). The focus has been largely on predisposing physiological factors such as age-related changes in the brain, dehydration, infections, medication related issues and other physical parameters (Lipowski, 1987). However it is probable that a percentage of hospitalized elderly patients become confused not only as a result of physical insults, but also due to the psychological and environmental stressors of the hospitalization experience. These papers have focused exclusively on etiology with no attempt to address the various symptomatologies which characterize cognitive impairment in the elderly. It is likely, in studies which do not operationalize their subject selection process except to include those who score below a cutoff score on a mental status exam, that a certain percentage of subjects will be characterized by the cognitive impairment which is neither dementia nor classic delirium.

b. Operationalization of Terms

In reviewing the literature, the majority of studies operationalize the concept of cognitive impairment on the basis of scores on some kind of

measure of mental status. The fact that an individual scores poorly on a mental status exam, or is judged to be confused by a nurse or physician, does not shed any light on what is causing the cognitive impairment.

It is difficult to ascertain who would be included in a subject group characterized by cognitive impairment. It is likely that they would be a mixed group of patients who are demented, delirious, and those suffering from confusion of undetermined etiology. It was suggested by Lipowski (1983) that the term delirium be used to denote transient global cognitive disorders that are judged to be of organic etiology. They would be characterized by abrupt onset, relatively brief duration, disturbances of attention, sleep-wake cycle and psychomotor behaviour. Those disorders which mimic delirium in symptomatology but are of functional etiology, Lipowski (1983) felt ought to be referred to as pseudodelirium.

Although there is inconsistency in the literature about how to clinically ascertain the diagnostic grouping into which a patient fits, there is general agreement that there are at least two categories of global cognitive impairment: dementia and delirium. Both diagnostic groupings would perform poorly on mental status exams but delirium would also be characterized by disorganized

thinking and altered attentional capacity (DSM-III-R, 1987; see Appendix D). These characteristics ought to be reasonably easily identified by an investigator in an interview situation and would allow for at least a tentative diagnosis of delirium. However, there are few studies which operationalize global impairment, except to report on mental status scores which, as mentioned above, may be the result of long standing or transient cognitive impairment or a combination of both. Without clearly operationalized diagnostic categories, it is difficult to interpret results. It is possible that from one study to another the sample may vary quite markedly in composition.

In summary, the research on cognitive impairment in the elderly is plagued by definitional inconsistencies and poor operationalization of terms. The distinction between dementia and delirium, while theoretically clear, has remained clinically problematic. There is recognition, at least historically, that there is a third form of cognitive impairment which is neither delirium nor dementia. However, this form of confusion in the elderly has not been operationally defined nor studied in any systematic way. This represents a gap in the literature in this area which has yet to be addressed.

2. Mental Status in Hospitalized Elderly

The past fifteen years have seen an increase in interest and corresponding research in the area of the cognitive functioning of the elderly in hospital. This is no doubt reflective of the fact that a growing percentage of hospital beds are being utilized by this group and that they are frequently presenting clinically with cognitive impairment. Although some cognitive impairment or confusion would be expected for surgical patients post-operatively, the incidence of cognitive impairment on medical wards have been anecdotally reported to be surprisingly high (eg. Kennedy, 1959).

A number of studies have been published examining the phenomenon of poor cognitive performance in the elderly hospitalized on medical wards. However, the research is characterized by methodological problems. The instruments used to detect cognitive impairment vary and objective measures are not always used. The way in which the instruments are administered and interpreted are not uniform. There are few studies which make any effort to differentiate between cognitive impairment due to a dementia and that due to a more self-limiting process such as delirium.

Even with the methodological limitations of the existing literature, it is clear that there is a clinically significant problem in the area of cognitive functioning for hospitalized elderly patients. There is a consistent finding that the likelihood of exhibiting cognitive impairment in hospital increases with age (Foreman, 1987; Jacobs, Bernhard, Delgado & Strain, 1977) although some studies have found cognitive impairment in younger populations as well (eg. Cheah & Beard, 1980; Jacobs et al., 1977; Knights & Folstein, 1977; Roca, Klein, Kirby, McArthur, Vogelsang, Folstein, & Smith, 1984). It has been suggested that the relatively larger proportion of elderly patients experiencing cognitive impairment is probably due to a combination of pre-existing cognitive impairment and a reduced capacity for handling the physical and psychological stressors of hospitalization (eg. Morency, 1990). The fact that the younger populations also experience some cognitive impairment in hospital may reflect the magnitude of the impact of hospitalization and illness even on an intact cognitive structure.

a. Studies Measuring Mental Status on a Single Occasion

There have been sixteen studies published over the last fifteen years examining cognitive impairment in the elderly on medical wards

utilizing one assessment point. All assessments were done in the hospital at various times during hospital stay. These studies show a wide variation in rates of cognitive impairment reported. Some studies report low rates ranging from 9.1% (Erkinjuntti, Wikstrom, Palo, & Autio, 1985) to 12.1% (Erkinjuntti, Autio, & Wikstrom, 1988), while others are reporting extremely high rates in the order of 65% (Cheah & Beard, 1980; Narain, Rubenstein, Weiland, Rosbrook, Strome, Pietruszka, & Morely, 1988) to 70% (Barclay, Weiss, Mattis, Bond, & Blass, 1988). Most studies report figures in between these extremes with rates falling between 30 and 40 percent (Anthony et al., 1982; Eaton, Stones, & Rockwood, 1986; Gehi et al., 1980; Jacobs et al., 1977; Knights & Folstein, 1977; McCartney & Palmateer, 1985;. Pinholt, Kroenke, Hanley, Kussman, Twyman, & Carpenter, 1987; Seymour, Henschke, Cape & Campbell, 1980).

The differences in these figures are a result of several factors. One of the most critical factors is the assessment tool used to ascertain whether or not cognitive impairment is present. In two of the studies which reported the highest figures, the assessment tool used was either extremely rigorous (Barclay et al., 1988) or highly subjective (Cheah & Beard, 1980). Barclay et al.'s

(1988) comprehensive evaluation consisted of a combination of neuropsychological assessment devices. These included the Purdue Pegboard, the Boston Naming Test and the Initiation and Perseveration subtests of the Mattis Dementia Rating Scale as well as two mental status exams and 4 subtests on the WAIS-R. Cheah and Beard (1980) used the DSM II criteria for Organic Brain Syndrome (O.B.S.) which they graded as mild, moderate, or severe. It is unclear how O.B.S. was operationalized or how the diagnosis was made. In the third publication reporting a high rate of impairment (Narain et al., 1988), the cutoff used on the mental status exam was unusually high (a patient scoring less than 10/10 was considered impaired), probably resulting in a high number of false positives.

The low figures come from studies in which the assessment instruments included a dementia scale and in which patients with obvious delirium were excluded (Erkinjuntti et al., 1988; Erkinjuntti et al.,1985). These procedures would result in only those patients with a dementia or a long standing cognitive impairment being included. In addition, Erkinjuntti et al. (1985 & 1988) reported only moderate and severe impairment. It is the mild cases which make up the bulk of the figures reported in other studies and in which there is

the most uncertainty in diagnosis. For example Cheah & Beard (1980) report that 40% of their figure of 65.3% cognitively impaired elderly is made up of mildly affected subjects.

Bergman & Eastham (1974) report their figures broken down into categories of dementia and delirium. It is unclear how the differentiation was made except that it reflected a diagnostic decision made on the part of one of the authors in consultation with the second author. The figures showed that of 100 consecutive admissions over 65 years of age to a medical unit, 42% exhibited some form of psychiatric morbidity. Of this figure, 7% were diagnosed as demented, 16% were diagnosed as suffering from delirium and 19% fell into the category of a moderately severe functional psychosyndrome (including such diagnoses as depression, anxiety states, personality disorders). The Cheah & Beard (1980) and Bergman & Eastham (1974) studies illustrate that the percentages of patients with cognitive impairment of different levels of severity and varying etiologies fluctuate rather markedly.

The studies reporting the moderate figures generally used the better known and more widely used measures of mental status such as the M.M.S.E. (Folstein et al., 1975) the Cognitive Capacity Screening Examination or

C.C.S.E., (Jacobs, Bernard, Delgado, & Strain, 1977) and the Mental Status Questionnaire or M.S.Q., (Robertson, Rockwood, & Stollee, 1982). These studies also used the recommended cutoff points for the instrument utilized.

The varying figures quoted in the literature on mental status of elderly medical inpatients appear to be due to: (1). the psychometric properties of the instrument used to assess mental status (2). the kinds of cognitive impairment being detected by the measurement device being used, and (3). the degree of impairment that the author specifies must be present in order to define the subject as being impaired.

In summary, studies which have measured mental status in elderly medical inpatients have consistently documented a significant percentage of patients exhibiting cognitive impairment. Because these studies reported on single assessments, it is unknown what percentage of cognitive impairment is a result of the hospitalization and illness and what percentage pre-dated the admission.

b. Studies Measuring Mental Status on More Than One Occasion

There have been seven studies published in which mental status in elderly medical inpatients has been assessed on two or more occasions through-out the subject's hospitalization. The focus of these studies varies considerably.

Rockwood (1989) studied acute confusional states or delirium in 80 consecutively admitted elderly medical inpatients. Rockwood measured mental status using the Mental Status Questionnaire (M.S.Q.; Robertson et al., 1982), both on admission and again if the patient developed confusion. However, the results of the mental status questionnaire are not reported. Using clinical diagnosis, the investigator reports that 25% (n=20) of his sample exhibited confusion at least once throughout hospitalization. Thirty percent of this group (n=6) had dementia. Rockwood (1989) also examined the causes for confusion in those who exhibited it. For the majority of patients who presented with confusion, underlying physiological factors appear to account for the impairment. Of the nine patients who developed confusion in hospital, at least two had no obvious physiological cause. It is also interesting to note that

although recovery from the confusional state seemed to parallel treatment for the underlying medical condition, according to the author "improvement was often [noted] before clinical or laboratory evidence for improvement could be demonstrated" (p. 153).

Hodkinson (1973) was interested in differentiating subjects with dementia from those with "confusion" due to other factors and those who were normal. This study also sought to evaluate precipitating factors for cognitive impairment in the hospitalized elderly. Hodkinson (1973) assessed the mental status of 588 consecutive medical admissions, using a device modeled on the Blessed Dementia Scale (Blessed, Tomlinson & Roth, 1968), at admission, at 2 weeks and at 4 weeks. The mental status test devised by Hodkinson had a total possible score of 34. He found on admission that 50% were normal, 33% fit the criteria for dementia, 10% were "confused" and 10% were depressed. The criteria for including subjects in the depressed group were not addressed in the article and in most of his analyses Hodkinson combines the "confused" and depressed groups and calls them "confused". Hodkinson (1973) examined the changes in mental status which occurred over the hospitalization period for the three groups. He found that when significant change is defined as a change of

5 or more points in either direction, that the "confused" group showed significantly greater ($p < .10$) improvement than either the demented or the normal groups over the hospitalization period, with 61% of the group showing an improvement of 5 points or more. Unfortunately, Hodkinson did not include enough information to allow for adequate assessment of what this information may mean. There is no data to indicate what magnitude the changes were, except that they were 5 points or greater. Also Hodkinson's decision to alter the measurement device, while clinically defensible, makes it more difficult to interpret the findings as there is nothing in the literature with which to compare the results. It is probable that the confused group improved as a result of treatment of whatever caused the impairment evident on admission. There are no figures presented for the number of "normal" subjects whose mental status scores declined over the study period.

One of the interesting findings coming out of the Hodkinson (1973) study was that hearing and visual impairment are strongly correlated with "confusion" but not dementia. One possible interpretation of this finding is that visual and hearing impairments interfere with the ability of subjects whose cognitive abilities may not be impaired, to perform on mental status exams, particularly

in a hospital environment where there is competing noise and distracting visual input.

Francis, Martin & Kapoor (1990) published a prospective study of mental status in 229 elderly (70 years +) medical in-patients. They assessed subjects using the M.M.S.E. (Folstein, Folstein & McHugh, 1975) with-in 48 hours of admission, and at 48 hour intervals there-after until discharge. Francis et al. (1990) found that 22% of subjects met the criteria for delirium (D.S.M. III-R, 1987) and that between admission and discharge this group improved their mental status scores by an average of 1.9 points. The significance of this change was not tested. The importance of practice effects in this study resulting from repeated testing with the same instrument over a short period of time must be kept in mind. It appears that the diagnosis of delirium was made retrospectively based on the information gathered through out the hospital stay from chart notes and unstructured staff interviews. The validity and reliability of unstructured staff interviews are particularly suspect because of factors such as experimenter expectation effect, selective memory and response bias (tendency to maintain consistency in reporting regardless of situation). Given

the procedure used to diagnose delirium in this study, it is questionable whether these cases would represent a valid diagnosis of delirium.

Francis et al. (1990) report that 42/50 or 84% of patients who met the study criteria for delirium were not diagnosed by the physicians as being delirious. The average percentage of missed diagnoses of cognitive impairment by physicians reported in the literature varies from 20% (Roca et al. 1984) to 38% (McCartney & Palmateer, (1985) with some figures falling in the middle ground (Eaton et al., 1986; DePaulo & Folstein, 1978). The combination of the diagnostic procedures and the surprisingly large percentage of missed diagnoses suggests that at least a percentage of the cases of delirium may not be accurately diagnosed.

Roslaniec & Fitzpatrick (1979) completed a study in which a sample of 25 elderly inpatients were assessed on two occasions using a mental status exam designed by the authors. The first assessment was done on the day of admission and the second on the fourth hospital day. The authors hypothesized significant changes over the four day period in; a. orientation, b. level of consciousness, c. attention and concentration, d. memory and e. performance on measures of higher cognitive functioning. The direction of the predicted

change is not identified, so presumably the authors were looking for either improvement or decline in cognitive functioning. A copy of the assessment device was not included in the article and consequently it is difficult to be certain how the concepts listed in the hypotheses were operationalized.

Roslaniec and Fitzpatrick (1979) found support for the hypotheses related to orientation, level of consciousness and memory. The hypotheses related to attention and concentration and higher cognitive functioning were not supported, although one of the two sub-components of higher cognitive functioning (abstract reasoning) did reach significance. Overall the findings are in the direction of increasing cognitive impairment over the hospitalization period. Orientation and level of consciousness declined as did the abstract reasoning sub-component of the higher cognitive functioning measure. Performance on the memory measure actually improved significantly over the assessment period. When this result is more closely examined it becomes evident that this finding was accounted for by a strong improvement effect on one sub-component of the memory measure, a story recall test. The same story recall test was used on both occasions, most likely resulting in a practice effect which could explain the finding of improvement over time. The other

sub-components of the memory measure approach significance in the direction of poorer performance ($t(24) = 1.96$ $p < .07$). The small N in this study ($N = 25$) is a limitation, as is the decision to restrict subjects to those admitted between certain hours which may have biased the sample.

Cronin (1989) studied the relationship between loneliness, social support and cognitive function in elderly hospitalized subjects. She assessed subjects within 24 hours of admission and again five days later using the M.M.S.E. (Folstein et al., 1975) on both occasions. Cronin's original sample was made up of 145 subjects who were interviewed on the first occasion and scored 24 or above on the M.M.S.E.. She was able to re-test 86 subjects from the original sample . This sub-group did not differ from the original sample on any of the demographic variables. Cronin found that 31% of her sample showed decline in mental status score, 44% increased their score on the M.M.S.E. and 24% showed no change. It is unknown what percentage of the subjects met the criteria for diagnosis of delirium. The surprisingly high percentage of subjects who improved their performance despite being in hospital may be explained by resolution of delirium in some cases as well as the practice effect of doing the same mental status exam within less than one week. This artifact of repeated

assessments is a common problem facing studies with repeated measures designs using the same instrument over a short period of time.

Foreman (1987) in a study examining the development of confusion in elderly inpatients, reported 38% of 71 subjects without cognitive impairment on admission, developed confusion within 6 days. Confusion was defined as scoring below 24/30 which is the accepted cut-off on the M.M.S.E. (Folstein et al., 1975). Neither the number of subjects who improved nor the number who met the criteria for the diagnosis of delirium were reported. Subjects were assessed daily with the same instruments making it highly likely that practice effects resulted in an underestimate of the true figures.

In summary, four of the studies which measured mental status on two or more occasions in hospital show a significant decline in cognitive functioning over the hospitalization period. For those studies in which there is an improvement in cognitive functioning of elderly inpatients, it was most likely due to delirium which resolves with time or treatment, or practice effects resulting from repeated assessments with the same instrument over a short period of time. It is particularly noteworthy that some studies did find a decline in mental status given the high likelihood that practice effects reduced

the percentages of subjects scoring in the impaired range on the second assessment.

c. Studies using a Pre-, During and Post Hospitalization Design

Currently, there are no published studies which have tracked elderly patient's cognitive status using a formal mental status measure from before admission, through hospitalization and back to the home environment. Hirsch, Sommers, Olsen, Mullen & Winograd (1990), published a study designed to document the natural history of functional morbidity during hospitalization. There was a cursory assessment of mental status administered to 71 consecutive medical unit admissions over the age of 74. The authors endeavoured to obtain a pre-admission measure of functional status from the caregiver, an in-hospital measure from the nursing staff and a one week post discharge measure from either the caregiver or the patient. Unfortunately, the mental status measure consisted of a single, simple rating of level of cognitive functioning, ranging from a rating of 2 for normal, 1 for mild cognitive impairment and 0 for severe cognitive impairment. The ratings are generally poorly defined. For example, mild cognitive impairment is defined as follows:

"Confused or disoriented one shift (eight hour period over which a nurse would work) at a time; mild memory impairment; no agitation or wandering. Appears very depressed (p. 1303)." The validity and reliability of the instrument used were not addressed in the study, but it is clearly low quality. The lack of operationalization of the rating scale, the confounding of depression with mild cognitive impairment, and the exclusive use of observer impressions are three of the more significant problems with this study. Hirsch et al. (1990) found no significant change from pre-admission, through hospitalization to post-discharge on their measure of mental status.

Consequently, the only study which has a pre-post design with respect to mental status was poorly designed for its intended purpose. Given the importance of the problem, it is worthwhile to design a study specifically aimed at measuring mental status before, during and after hospitalization for this target group. This was the primary goal of the present study.

B. Summary

It is evident that little is known about the phenomenon of cognitive impairment in hospitalized elderly people except that it is common. There is considerable disagreement in the literature concerning the magnitude of the

problem. The current research base is fraught with definitional inconsistencies and lack of operationalization of concepts. The majority of studies measured mental status at only one point in time which gives comparatively little information. The studies in which mental status was assessed on more than one occasion are plagued by a well-known threat to internal validity common in repeated measures designs - practice effects. Nonetheless most of these studies document a significant number of subjects developing cognitive impairment following admission. There are no studies currently published measuring mental status before, during and post hospitalization. This represents a major gap in the literature which this current research will begin to fill.

III. METHOD

The focus of this study is the cognitive functioning of medically ill elderly inpatients before, during and post hospitalization. In this chapter the methods are presented. Included are sections on the sample, the instruments, the data collection procedure, and methods of data analysis.

A. Design and criteria for subject selection

The study was conducted on the medical units of two of the three general hospitals in the St. John's area over two six week periods separated by the Christmas season. Data were not gathered over the Christmas season because of admission patterns which are not representative of the remainder of the year, such as bed closures and reduced staffing resulting in fewer admissions. Only two of the three general hospitals were involved because there were not sufficient admissions to the third hospital (General Hospital) meeting the inclusion criteria. During the two six week periods, consecutive admissions to the designated units meeting inclusion criteria were contacted and asked to participate in the study.

Criteria for inclusion in the study included:

1. Age 65 years or older;

2. admission to a medical ward;

3. living in the St. John's Metro area;

4. willingness to participate in the study;

5. able to conduct a coherent conversation;

1. Age

In this study, the chronological age of 65 was used as the lower limit of the elderly age group. As the usual age of retirement from paid employment, 65 years is a commonly accepted transition point to old age. While it is recognized that chronological age is not an ideal indicator of aging, a practical alternative has yet to be developed.

2. Medical wards

Medical wards were chosen because there are fewer potentially confounding factors to affect mental status than would be present on other units, such as surgery or psychiatry. Subjects were not accessed from the critical care units because the severity of the illness alone would affect the subject's ability to perform on the mental status tests. By restricting data collection to medical wards and to patients who were not delirious and were

able to participate normally in a conversation, I hoped to reduce variability in illness severity.

3. Region

Subjects had to be living in the St. John's Metro area to make follow-up feasible.

4. Competence and exclusion criteria

Exclusion from the study was based on:

a. unconsciousness or inability to communicate.

b. clouding of consciousness present.

c. unwillingness to permit a follow-up assessment in the home.

d. admission from anywhere other than own residence.

e. expectation that the subject would not be returning home.

Any subject unable to communicate, or unconscious, would be unable to complete the mental status exam or to give informed consent and would be inappropriate for inclusion in this study. As suggested by Rabins and Folstein (1982), consciousness was considered to be clouded if the subject appeared to be drowsy, stated that he/she was drowsy, was difficult to arouse or did not

respond unless questions were shouted. Clouding of consciousness is a hallmark of delirium as is the inability to conduct a coherent conversation.

Patients suffering from delirium would predictably perform poorly on the M.M.S.E. and would equally predictably have improved mental status scores over time. It was felt that including patients who meet the DSM-III-R (1987) diagnostic criteria for delirium (see Appendix D) in the study would bias the results.

Refusal of a follow-up assessment would result in data critical to the study being lost and thus such subjects were eliminated from the subject pool. Subjects admitted from a chronic care facility of any kind were felt to be inappropriate for inclusion, as the focus of the study was the difference in performance on mental status tests between hospital and home. The effect of returning to an institutional home was considered a contaminating factor. For the same reason subjects not expected to return home were not included in the study.

B. Subjects

One hundred and thirty six patients were initially contacted to be included in the pool. Six patients were eliminated due to clouded consciousness

or inability to conduct a coherent conversation. Eleven of 130 remaining subjects who were contacted refused to participate, leaving 119 subjects in the study. No subjects were eliminated for initial refusal of follow-up assessment.

Of the 119 subjects, 57 scored in the Non-confused range and 62 scored in the impaired range on the Mini Mental Status Exam. Of the 57 in the Non-confused group, 10 subjects were contacted for follow-up, and 7 of these were followed up. The three subjects in this group who were approached to be included in the follow-up but refused, did so due to unavailability. In the Confused group, 43 of 62 subjects were followed up. Deaths accounted for 5 of those not followed up. The remaining 14 refused, for various reasons, to allow a re-assessment (See Study Flow Chart ; Figure 1).

C. Measures

1. The Mini-Mental State Examination

The Mini-Mental State Examination (M.M.S.E.) was developed by Folstein, Folstein and McHugh (1975) to simplify assessment of cognitive functioning in both institutional and community dwelling populations. The test includes: measures of orientation, verbal memory, attention, object naming, the ability to follow verbal and written commands, the ability to generate and write

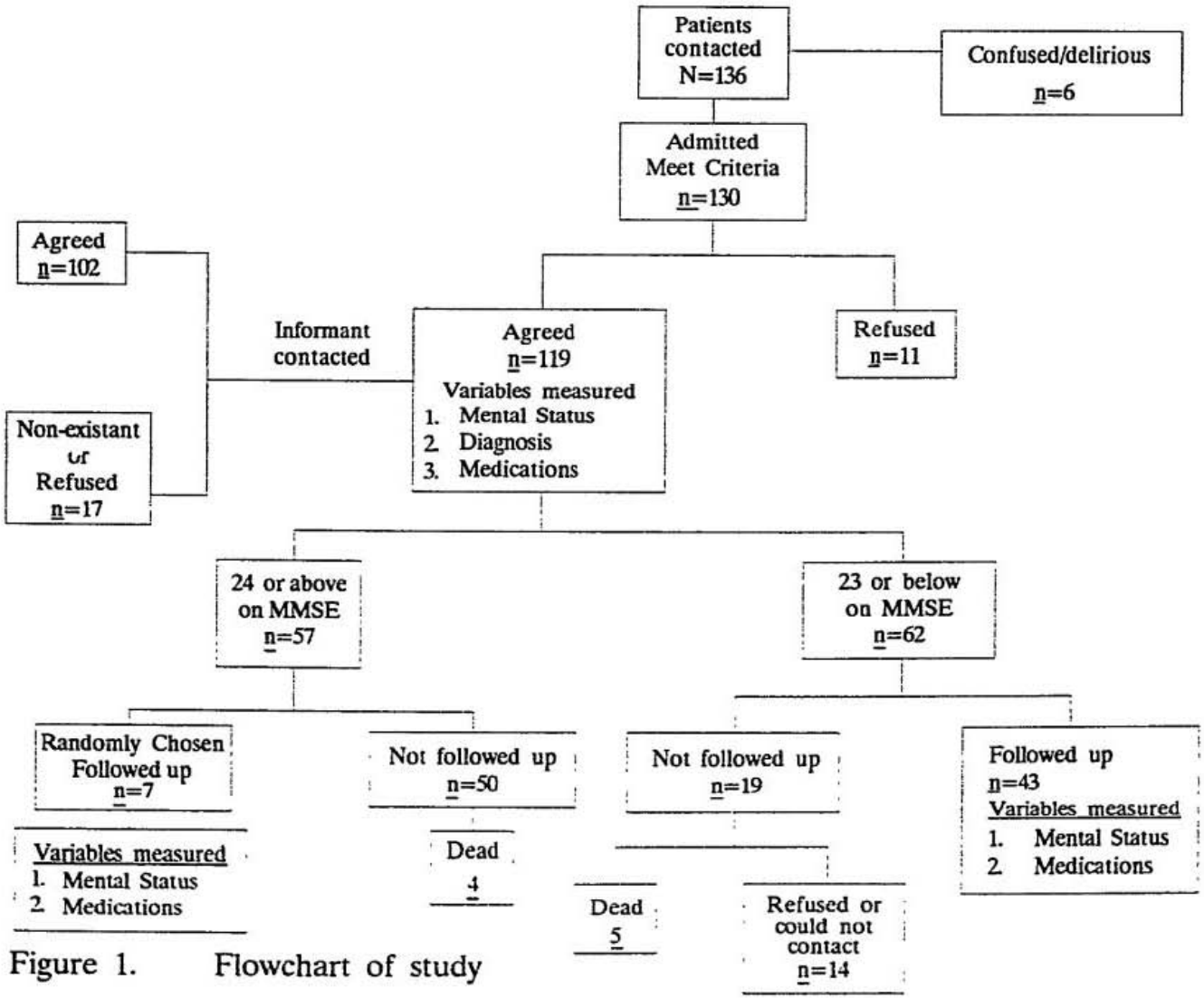

Figure 1. Flowchart of study

a sentence and constructional ability. Administering the test takes 5-10 minutes. There are 11 questions each of which is assigned a point value (see Appendix B). The total possible points is 30, and a score of below 24 is considered to be indicative of confusion (Anthony et. al., 1982; Folstein et. al., 1975). This was the score used in this study for categorizing subjects into the Confused or Non-confused groups.

The M.M.S.E. (Folstein et al., 1975) is a reliable and valid measure of mental status. Although there are other mental status exams which are equally valid and reliable, there is a trade-off in terms of the length and subject acceptance with the M.M.S.E. being short and well tolerated by subjects. The issues of length and acceptability are of particular concern for this age group because of fatigue and increased sensitivity to concerns regarding cognitive functioning. The M.M.S.E. is also the mental status examination used most frequently in the literature. Reliability and validity were initially tested with 206 hospitalized psychiatric patients; 38 were demented and the remainder had various functional psychiatric disorders (Folstein, et al., 1975). The investigators also assessed a normal community dwelling sample of 63 elderly people.

Reliability. Test-retest reliability for the entire sample over 24 hours was r = .887 and for a 28 day retest on clinically stable patients the Pearson r was .82. A combination of test-retest and inter-rater reliability was assessed by having two testers administer the M.M.S.E. to the same, clinically stable patients, 24 hours apart. The Pearson r remained high at .827 suggesting that the effect of different examiners even over a 24 hour time period is minimal. Other research has also supported the reliability of the M.M.S.E.. Test-retest reliabilities range from .56 to .90 (Anthony et al., 1982; Dick et al., 1984) and interrater reliablilty has not been reported lower than .82 (Anthony et al., 1982). The test-retest reliability of .56 refers to a small (n = 7) group of patients judged to have delirium and to be clinically unstable. This group would be expected to have fluctuating cognitive status.

Validity. The validity of the instrument has been supported by high sensitivity (.87) and specificity (.82) (Anthony et al., 1982), and correlation with psychiatric diagnosis between r = .82 to r = .87 (Anthony et al., 1982). Foreman (1989), using a sample of 66 elderly medical-surgical patients, reported the internal consistency of the M.M.S.E. as .96. Criterion validity was evaluated in the same study using clinical diagnosis of global impairment as

the criterion against which the M.M.S.E. was judged; Spearman's rho was reported as .76 ($p < .001$).

2. Informant's Interview

The Informant's Interview is a subsection of the CAMDEX Schedule (The Cambridge Examination for Mental Disorders of the Elderly). The CAMDEX was developed with two major aims. The first aim was to assemble into a single standardized instrument all the components recognized to contribute to the diagnosis of the most common forms of cognitive impairment. The second aim was to develop an instrument capable of detecting dementia in its early stages. The Informant's Interview is seen as offering a baseline measure of cognitive functioning against which to judge current level of functioning (Roth et al., 1986).

The Informant's Interview was chosen for use in this study to give as accurate as possible a picture of the subject's pre-hospitalization functional level. It is recognized that a retrospective assessment has inherent flaws given the limitations of human memory. However, it was not feasible to have subjects tested prior to hospitalization because virtually all admissions were unplanned. Given the limitations of the situation, it was felt that an interview

with a significant other would provide the most accurate assessment of how the subject was functioning before the current illness. It is intuitively believable that a person who knows the subject well could offer the best retrospective estimate of actual functional level. A significant advantage associated with this approach is that the data represent an averaging of impressions over a period of time, as compared to an assessment at any one point in time. The latter may not reflect the usual functional level.

The Informant's Interview is broken down into three parts: 1. items related to level of functioning over the preceding year: 2. questions pertaining to the subject's past history and 3. questions pertaining to the family's past history. The past history and family history were irrelevant to this study and thus were not included in the interview. The first part of the Informant's Interview contains nine subscales which include: personality changes, memory problems, general mental functioning, activities of daily living, clouding or delirium, depression, sleep problems, paranoid features and cerebrovascular problems (see Appendix C).

Roth et al. (1986) conducted a reliability study using a sample of 40 outpatients and inpatients of the Department of Geriatric Medicine. Inter-rater

reliability for the Informant's Interview is high $r = .90$ ($p < .000$). The validity of the Informant's Interview was not examined extensively at that time, but Roth et al. (1986) report that responses to questions about memory, concentration and muddled thinking all correlated highly ($p < .001$) with the total score on the cognitive assessment section of the CAMDEX.

Surprisingly, there are few studies published looking specifically at using an informant interview to gather information concerning cognitive decline. Jorm and Korten (1984), using a standardised informant's interview, found a correlation of $r = .74$ with the M.M.S.E. (Folstein et al., 1975). The sample comprised 64 elderly subjects, 33 of whom lived independently, 13 living in a hostel and 18 residing in a nursing home.

O'Connor and his associates (1989) provide evidence on the validity of informant histories in a community study of cognitive decline. In this study, 406 informants were interviewed using the same portions of the CAMDEX Informant's Interview used in the present study. Scores were calculated by summing across all subscales to give a 'total informant score'. It should be pointed out that a high score on this assessment means a low functional level (i.e., in contrast to the M.M.S.E. on which a high score indicates good

cognitive functioning). Comparisons were made between the 'total informant score' and the results of the CAMDEX cognitive testing section. As well, the ratings of abnormalities made by psychiatrists in the areas measured by the Informant's Interview were compared with the informant's score. The results show high correlation coefficients between the informant's score and the objective cognitive assessment (r = -.731, p < .000), and the informant's score and the psychiatrist's assessment (r = .741, p < .000). These findings indicate that an informant interview is a cost-effective, valid method of assessing cognitive functioning.

Although there have been several published studies using the CAMDEX over the past four years, few have specifically examined the Informant's Interview separately from the rest of the Schedule. Most make anecdotal reference to the usefulness of the informant's information. For example, O'Connor et al. (1990) in discussing cases which required a review of diagnosis, make reference to the consistency between the results on the mental status exam and the Informant's Interview. Brayne and Calloway (1989), in referring to cases which were "unusual", make a point of mentioning the informant's perspective and comparing it to the rest of the test results.

O'Connor (1990) perhaps best represents the state of the literature on the Informant's Interview; "The histories provided by the informants proved enormously helpful in making sense of complex clinical presentations of a loss of function in everyday life. ... the number of questions informants answered positively correlated to a highly significant degree with subject's scores on cognitive tests and the psychiatrists' observations"(p.219).

3. Medication measures

It has been recognized that certain medications can affect cognitive functioning (e.g. Task Force of the N.I.A., 1980). The elderly are particularly at risk for side-effects in general, and mental status side effects in particular, as a result of the large numbers of medications they are prescribed, and their altered metabolism of the drugs.

At the time of assessment, the names, dosages and frequency of administration of medication for each subject in hospital were recorded. The same information was gathered at the time of follow-up assessment at home. We attempted to obtain the pre-admission medication profile from the informant, but the information given was incomplete and in many cases

missing. No attempt was made to analyze the small amount of information that was gathered.

The medications for both assessment periods were reviewed by a geriatric psychiatrist. In consultation with the Canadian Pharmaceutical Association's Compendium of Pharmaceuticals and Specialties (1991), he rated each drug's likelihood of having an effect on mental status given the dosage and frequency of administration of the drug. The scale used in the rating was as follows: highly improbable, improbable, possible and probable. The ratings were summed across medications to get a total likelihood of effect on mental status.

C. Procedure

Once approval had been granted from the Human Investigations Committees of the Medical School and the three hospitals, letters were sent out to the medical directors, nursing directors and chiefs of medical services in each hospital, requesting co-operation with data collection. Following approval from these levels within the hospital, nursing supervisors from the floors involved were contacted. Meetings were held to discuss the purpose and nature of the study and to ask for assistance in introductions to patients.

Subjects were identified by the Admissions Department in each hospital and those patients meeting the criteria for inclusion were contacted within four days of admission. Most patients were contacted between day 2 and day 4. Foreman (1987) reported that 70% of the subjects who developed confusion in his study, were confused by the second day of hospitalization. By the fourth day an additional 15% of the group which developed confusion were confused. Consequently, it was considered that assessment between days 2 and 4 would be optimal for the purpose of detecting confusion.

At that time, the state of consciousness of the subject was assessed as was his/her ability to carry on a coherent conversation. The conversation which took place between the subject and the investigator in this study included a detailed description of the study and the subject's role in it, as well as a request for questions before the signing of the consent form. The subject was given guarantees of anonymity, confidentiality, and the opportunity to withdraw from the study at any time without jeopardizing treatment. Subjects were then asked to sign a written consent form. There were typically at least some questions about the reason behind the research, the role of the investigator, confidentiality, and many about the signing of the consent form (see

Appendix A). There was also usually some social chitchat about our respective places of origin, families, and the subject's reason for hospitalization. After the mental status test there was on average a 15-20 minute discussion about what the test was and what it was supposed to measure. Permission was also sought to contact a significant other who knew the subject well so as to ascertain the patient's condition prior to illness and entering hospital. It is my opinion that any patient able to participate reasonably well in such a discussion would be unlikely to be diagnosed as delirious.

If consent was given, the interview was conducted in the patient's own room or, when this was not feasible, in an interview room on the unit. Although the M.M.S.E. only takes about 10 minutes to complete, the amount time taken with each subject averaged 45-50 minutes. This reflects the amount of time needed to put the subject at ease and to reassure him/her about performance on the M.M.S.E..

Within a few days of the subject having been assessed in hospital, a research assistant contacted the informant by telephone to request the Informant's Interview. The research assistant had been trained in the use of the Informant's Interview, and had several years experience working with the

elderly and their families. The research assistant was unacquainted with the subjects and was unaware of their performance on the M.M.S.E.. It was considered that this procedure would reduce the potential for experimenter-expectation-effects on the informant's responses. Each informant was told that the subject had given his/her name and had consented to the researcher contacting him/her for information about the subject's condition prior to admission to hospital. The informants were asked to answer the questions as they applied to the preceding year, prior to the current episode of illness.

Subjects were contacted again two to three months following discharge. They were asked to set a time convenient for the researcher to visit for purposes of the follow-up assessment. It was thought that this length of time between assessments would reduce the probability of practice effects, always a concern in a repeated measures design. In fact, most subjects spontaneously mentioned that they did not remember doing the test in hospital, nor did they remember the experimenter. During the home visit the M.M.S.E. was administered and the medication measures were recorded. As was the case when data gathering in hospital, I found the amount of time required to get the information was longer than would be expected given the measures used. It

took on average, more than an hour per subject to complete the follow-up assessment.

D. Analysis

Descriptive statistics using SPSS-X were used to appropriately summarize all pertinent data. The following hypotheses were tested:

Hypothesis 1: There are a greater proportion of medical inpatients over the age of 65 scoring in the confused range on the M.M.S.E. than would be expected, given the prevalence rates in a community dwelling population. This hypothesis was to be tested by comparing the percentage of this sample scoring in the confused range with the figures reported in the literature.

Hypothesis 2: Those who score in the confused range on the M.M.S.E. (below 24/30) perform at a higher level when tested at home two to three months after discharge. This hypothesis was tested by comparing means on the M.M.S.E. during hospitalization and post-discharge for the

group scoring in the impaired range. The statistic used was a two-tailed *t*-test for paired samples.

Hypothesis 3: The M.M.S.E. score in hospital for both the Confused and Non-confused groups can be predicted by a combination of the Informant's Interview, the number of medications, and the likelihood of a mental status effect of those medications. A stepwise multiple regression analysis was computed listing these variables as predictors and M.M.S.E. as the dependent variable.

Hypothesis 4: For both the Confused and the Non-confused groups, the follow-up mental status score is most strongly predicted by the Informant's Interview. This hypothesis was tested by a step-wise multiple regression analysis with the Informant's Interview, the number of medications being taken at the time of testing, the likelihood of a medication effect and the mental status score in hospital as predictor variables. The dependent variable was the follow-up M.M.S.E. score.

Hypothesis 5: The variance explained by the Informant's Interview in the follow-up M.M.S.E. is greater than that explained in the M.M.S.E. in hospital. This hypothesis was tested by examining the percentage of variance accounted for in each case by the predictor variable.

IV. RESULTS

All patients who met the inclusion criteria and who gave their consent, were assessed using Folstein's Mini-Mental Status Exam (M.M.S.E.) within four days after admission. Information on the patient's admission diagnosis and the number, dosage and type of medications prescribed at the time of testing was recorded.

In addition, where permission was granted, a retrospective measure of the patient's functional level prior to admission was obtained by contacting an informant and administering the Informant's Interview section of the CAMDEX Schedule (for copies of all assessment instruments see Appendices).

For those patients who scored below the accepted cutoff of 24/30 while in hospital, the Mini-Mental Status Exam was readministered in the patient's own home two to three months after discharge. A random sample of approximately 10 percent of those who scored above the cutoff (n = 7) were also followed up with a second administration of the M.M.S.E.. For both groups the same medication measures that were obtained in hospital were recorded at the follow-up assessment point.

The results are divided into two major sections. The first section includes demographic information on the sample as a whole along with, where appropriate, reference to comparison figures from provincial databases to establish representativeness of the study sample. As well, the individuals who scored below the cutoff on the M.M.S.E. are compared with those who scored above to determine similarities and differences on demographic variables in order to rule out sample biases that may affect the study findings.

The second section includes analyses of the change in mental status from hospital to home and the variables predicting performance on the M.M.S.E. on both occasions.

A. Subjects

There were 11 subjects of 130 contacted who refused to participate in the study. This represents a little over eight percent (8.46%) of the sample. Demographic information on this group was unavailable due to inaccessibility of charts. Therefore they are not included in any of the analyses. Eight of the eleven who refused, did so when asked to sign the consent form. It was my impression, after talking with these people, that verbal consent would have been given in most of these cases. The difficulties associated with obtaining written

consent with this population have been documented elsewhere (Brod & Feinbloom, 1990). The refusal rate of approximately 8% in this project is consistent with other studies (e.g. Singer, 1978; 7% refusal rate) in which the population is elderly and the protocol requires a negligible intrusion on the subject's time (questionnaires only).

In 17 or 14% (N = 119) of cases a significant other was not contacted to carry out the Informant's Interview. The reasons for this included no-one to contact (n = 8), subject doesn't want the informant bothered (n = 5) and informant refused to answer questions (n = 4). Slightly more than one-half, 52.1% (n = 62) of the 119 subjects who agreed to participate in the study scored below the cutoff of 24/30 on the M.M.S.E. while in hospital. Those scoring below the cutoff will be referred as the Confused group while those scoring above the cutoff make up the Non-confused group.

1. Description of the subjects

In the following section, a description of the sample as a whole will be followed by a comparison of the Confused group and the Non-confused group on demographic variables. This comparison should rule out the possibility of a sample selection bias which might influence the subject's mental

status and consequently, the results of the study. Specifically, the two groups were compared with respect to age, sex, marital status, diagnosis on admission, hospital to which they were admitted and factors related to the Informant's Interview. It was decided to convert the mental status score to a dichotomous variable (Confused and Non-confused) based on the accepted cutoff figure of 24/30 in order to facilitate comparison with other studies.

a. Demographic characteristics

The demographic characteristics of the sample as a whole as well as those for each of the subgroups is shown in Table 1. Ages of the subjects ranged from 65 to 92 years ($\underline{M}$ = 75.11; *s.d.* = 6.19). Due to small cell numbers, particularly in the older age group, the age categories were collapsed into two categories to simplify analysis. The sample was divided at age 75 resulting in a young old (65-74) group and an old (75+) group. The numbers in these two groups are almost identical with 58 in the young-old group and 60 in the old group. A chi-square test of independence was calculated for age using the two categories described above. No association was found between groups and age, x^2 (df=1) = .295 $p > .05$.

Table 1.

Demographic Characteristics of Complete Sample, Confused, and Non-Confused Groups.

Characteristic	Group					
	Non-confused (n=57)		Confused (n=62)		All Subjects (n=119)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
SEX						
Female	35	61.4	40	64.5	75	63
Male	22	38.6	22	35.5	44	37
HOSPITAL						
Grace	23	40.3	29	46.8	52	43.7
St. Clare's	34	59.7	33	53.2	67	56.3
MARITAL STATUS						
Single	3	5.2	3	4.8	6	5.0
Married	27	47.3	28	45.1	55	46.2
Divorced	0	0	1	1.5	1	1.0
Widowed	26	45.6	29	46.8	55	46.2
AGE						
Young-Old (65-74)	29	50.9	29	46.8	58	48.7
Old (75+)	27	47.3	33	53.2	60	50.4

Consequently, age is not associated with poor performance on the M.M.S.E. in this sample.

Sixty three percent of this sample was female and the remaining thirty seven percent male. This is consistent with provincial ratios of hospitalized people over the age of sixty five (personal communication, St. John's Hospital Council, 1991.). The Confused group was comprised of 64.5% females and the Non-confused group was 61.4% female. A chi-square test of independence was calculated for sex with no association found between sex and group membership, x^2 (df=1) = .123 $p > .05$. Consequently, sex is not associated with confusion in this sample.

Subjects were assessed at two general hospitals. It is possible that one hospital had significantly more confused subjects than did the other, thereby biasing the sample. Just over fifty-six percent of the sample was admitted to St. Clare's Mercy Hospital compared to 43.7% admitted to the Grace General Hospital. This is consistent with typical admission patterns of the two hospitals for the age group over 65 years (personal communication, St. John's Hospital Council, 1991.). A chi-square test of independence was calculated for hospital and no association between hospital and group membership was found, x^2

(df=1) = .751, $p > .05$. Therefore the hospital to which the subject was admitted is not associated with performance on the M.M.S.E..

Approximately 46% of the sample was widowed and another 46% married, leaving about 6% either single or divorced. A chi-square test of independence was carried out for marital status and no association was found between marital status and group membership x^2 (df=3) = .970, $p > .05$. These results indicate that marital status is not associated with confusion for this sample.

b. Health related characteristics

The subject's admission diagnoses are listed in order of prevalence in Table 2. The most common diagnosis was cardiovascular disease which accounted for 49.6% of all diagnoses. The next most common ailment was respiratory disease including such diagnoses as pneumonia, pulmonary embolism and shortness of breath. This group accounted for only 11.8% of the diagnoses. The only other group for which the percent accounted for was above 10% was neurological disease (10.1%). Because of the small numbers in

Table 2.

Admission Diagnosis for all Subjects

Diagnosis	Frequency	Percent
Cardiovascular Disease	59	49.6
Respiratory Disease	14	11.8
Neurological Disease	12	10.1
Metabolic Disease	10	8.4
G.I. Disease	9	7.6
Urinary Tract disease	6	5.0
Cancer	5	4.2
Skin Disease	2	1.7
Joint Disease	2	1.7

Table 3.

Collapsed Diagnostic Categories for Non-Confused and Confused Groups.

Diagnostic Category	Group					
	Non-Confused		Confused		All	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Cardiovascular Disease	30	50.8	29	49.1	59	49.5
Other	27	45	33	55	60	50.5

the diagnostic groupings other than cardiovascular the decision was made to collapse the categories into two large approximately equal groups; cardiovascular disease (n = 59) and other (n = 60). The breakdown of diagnostic category by group (Confused; Non-confused) is presented in Table 3. A chi-square test of independence was computed for admission diagnosis and no association found between group membership and diagnosis, x^2 (df=1) = .544 p > .05. Consequently, admission diagnosis is not associated with confusion in this sample.

The number of medications prescribed and the likelihood of a mental status effect of those medications was examined for the two groups while in hospital. A chi-square test of independence was calculated for both variables and no association was found between group membership and the two medication variables, x^2 (df=1) = .574 p > .05. Consequently medication is not associated with cognitive impairment in hospital.

c. Significant other characteristics

The two groups were examined with respect to the relationship of the subject to the significant other contacted for information. The individuals contacted for this sample fell into one of eight categories.

Table 4.

Informant Contacted for Informant's Interview for all Groups.

Informant	Frequency	Percent
Spouse	38	37.3
Son/Daughter	35	34.3
Other	9	8.8
Son/Daughter-in-law	7	6.9
Sibling	4	3.9
Sister/Brother-in-law	3	2.9
Friend	3	2.9
Caretaker	3	2.9

Note: There are 17 subjects for whom an informant was not contacted.

Table 5.

Collapsed Categories of Informant Contacted for Confused and Non-confused Groups.

	Group			
	Non-confused		Confused	
Informant Contacted	Frequency	Percent	Frequency	Percent
Spouse	16	42.1	22	57.9
Child or Child-in-law	20	47.6	22	52.4
Other	6	27.3	16	72.7

Note: There are 17 subjects for whom an informant was not contacted.

These groupings are listed in order of prevalence in Table 4. To increase cell number to an acceptable level, these categories were collapsed into 3 groups as follows: 1. spouse; 2. child or child-in-law; and 3. other. The most common contact person was the spouse (37.3%) with a son or daughter coming a close second (34.3%). It was decided to combine son and daughter-in-law with son and daughter. This was decided based on the supposition that information acquired from the two groups would be comparable given that the child and the in-law would be in close contact on a daily basis. Together the first two categories comprise almost 80% of the sample. Table 5 shows the frequencies and percentages which fell into the collapsed categories broken down for the Confused and Non-confused groups. A chi-square test for independence was calculated for type of significant other contacted, with no significant association found, x^2 (df=2) = 2.49, $p > .05$. This result suggests that type of relative contacted did not differ between the confused and non-confused groups.

Another factor which might be of significance in biasing the results of the Informant's Interview is the frequency of contact between the subject and the significant other. As would be expected given the types of informants contacted, the most common frequency of contact is "lives with" (62.5%).

Ninety-three percent of the informants have contact with the subject more often than once per week and 80% have daily contact. This increases the likelihood of getting a valid and reliable assessment of the subject's functioning prior to hospitalization. Table 6 lists the frequency of contact categories for the sample as a whole in order of prevalence. Due to small numbers in several of the categories it was decided to collapse them into four categories: lives with; daily contact but not living with; once per week or more but less than daily; and less than once per week. The frequencies of these categories of contact and the breakdown by group can be seen in Table 7. A chi-square test for independence was computed for these categories, with no significant association found, x^2 (df=3) = 1.30 $p > .05$.

In summary, the Confused and Non-confused groups did not differ with respect to age, sex, hospital to which they were admitted, marital status or admitting diagnosis. There were also no significant differences between the Confused and Non-confused groups with respect to the type of significant other interviewed or the amount of contact the significant other had with the subject.

Table 6.

Frequency of Contact Between Subject and Informant.

Frequency of Contact	Frequency	Percent
Lives With	65	62.5
Daily	19	18.3
Once Per Week +	13	12.5
Weekly	3	2.9
Yearly	2	1.9
Monthly	2	1.9

Note: There are 17 subjects for whom an informant was not contacted

Table 7.

Collapsed Frequency of Contact Categories for Confused and Non-confused Groups.

	Group			
	Non-confused		Confused	
Frequency of Contact	Frequency	Percent	Frequency	Percent
Lives With	25	38.4	40	61.5
Daily	9	47.3	10	52.6
Once Per Week+	7	53.8	6	46.2
LT Once Per Week	3	42.8	4	57.1

Note: There are 17 subjects for whom an informant was not contacted.

B. Change in mental status

The subject's mental status was assessed using the M.M.S.E. on two occasions. The first assessment was within four days of admission to hospital and the second was conducted at home, at least four weeks and in most cases, two to three months after discharge. Virtually all of these admissions were emergency, unplanned admissions making it impossible to get a pre-admission assessment of mental status. In an effort to get a measure of how the subject was functioning prior to admission, the CAMDEX Informant's Interview was conducted with a person identified by the subject as knowing the him/her well.

Factors thought to affect performance on the M.M.S.E. in hospital included pre-admission functioning, the illness, the number, and likelihood of a mental status effect of medications, and the hospitalization experience itself.

The pre-admission functional level was calculated by summing the subscales of the CAMDEX Informant's Interview to form a composite figure representing the level of the subject's functioning in the year prior to the current illness. A high score on the Informant's Interview was indicative of poor (or low) functional level.

It is generally recognized that it is difficult to quantify severity of illness, particularly in reference to its potential impact on mental status. Gillick et al. (1982) examined the relationship between the development of confusion in elderly medical inpatients and the severity of illness and found no significant association except for patients suffering from infection. A practical complication in obtaining illness acuity measures in this study was that for each patient there were a number of doctors at varying levels of training and different nurses involved, making consistency, validity and reliability of any measure across patients highly questionable. Thus the only measure of illness that was recorded was the admission diagnosis.

The likelihood of a confusion effect from medication was calculated for each medication by developing a rating scale (1. highly improbable; 2. improbable; 3. possible; 4. probable) which was applied by a geriatric psychiatrist taking into consideration the patient's age, the type of medication and the dosage. This figure was summed across medications to get a measure of the likelihood of a medication effect on the subject's mental status. An alternate weighted method of calculating the medication effect was used in order to control for the differential effects of drugs. All analyses were

calculated using both methods; however, the results did not differ appreciably. Therefore, the analyses using the summed figures (a variable hereafter referred to as medeffect) will be reported. The calculation of medeffect does not take into account, in any sophisticated way, the interaction effect between medications which may well be significant in this population. However, it is widely recognized in pharmacy that interaction effects are highly complex, particularly when the number of medications increases beyond two or three. It is especially problematic to assess interaction effects for the elderly for whom the physiology of drug interactions is poorly understood.

There were 62 subjects scoring at or below the cutoff on the M.M.S.E. in hospital. Of that group 43 were contacted for follow-up. Five of the nineteen subjects lost died between the first assessment and the follow-up. The remaining 14 subjects, representing a drop-out rate of 22.5%, refused to allow a reassessment. Analyses show no significant differences between the group which was followed up and those who were not followed up on any of the demographic variables.

A randomly chosen subsample of approximately 10% (n = 7) of those who scored above the cutoff on the M.M.S.E. in hospital were followed up at

home. In this group 10 people were contacted with seven agreeing to re-assessment.

A two-tailed t-test for paired samples was computed to assess the significance of the differences between the in-hospital and at-home scores on the M.M.S.E. for those followed up. For those who scored below the cutoff, a significant difference between the two administrations of the M.M.S.E. was found, t (df=42) = -6.73 $p < .000$ (see Table 8). More than 75% of subjects who had scored in the impaired range in hospital on the first assessment, scored in the normal range on the follow-up assessment. For the subjects who scored above the cutoff, a two-tailed t-test for paired samples was also computed and no significant differences were found between the two assessments (t (df=6) = -.31 p = .766 ns.). These findings indicate that the Confused group of subjects did significantly better when tested at home. The Non-confused group did not perform any differently at home, despite there being room for improvement in their scores (see Table 9).

Table 8.

T-test for Paired Samples Comparing the M.M.S.E. in Hospital and at Follow-up for the Confused Group.

Variable	*n* of Cases	Mean	S.D.	*t*-Value	df	2 Tail Prob.
M.M.S.E. in Hospital		19.488	4.75			
	43			-6.73	42	.000
M.M.S.E. at Home (Follow-up)		24.651	4.55			

Table 9.

T-test for Paired Samples Comparing the M.M.S.E. in Hospital and at Follow-up for the Non-confused Group.

Variable	n of Cases	Mean	S.D.	t -Value	df	2 Tail Prob.
M.M.S.E. in Hospital		26.71	1.70			
	7			-.31	6	.776
M.M.S.E. at Home (Follow-up)		27.00	3.46			

When the pattern of results is examined for the Confused group it is evident that responses to some of the questions on the M.M.S.E. are more likely to change from in-hospital to at-home assessment than are others. The questions which showed little or no change included orientation to year, season, month and date; orientation to country, province, town, and hospital/street; and, naming a pencil and a watch. For a more detailed description of the pattern of responses on both assessments see Appendix E.

1. Factors Predicting Mental Status In Hospital

Multiple regression analyses were computed using M.M.S.E. scores in hospital as a dependent variable. A step-wise regression analysis was performed using the Informant's Interview score, the total number of medications and the likelihood of a medication effect as independent variables. The results for this section will be examined first for the group as a whole, then for the Confused group and finally for the Non-confused group.

On the step-wise multiple regression for the sample as a whole, the only variable to reach criterion in the equation was the Informant's Interview (see Table 10). This variable alone accounted for 21% of the variance

Table 10.

Results of Step-wise Multiple Regression Analysis of Informant's Interview and Medication Variables on Mental Status While in Hospital for Complete Sample (n=119).

Step Variable	R	R^2	F	p
Informant's Interview	.458	.210	27.17	.000

Table 11.

Results of Step-wise Multiple Regression Analysis of Informant's Interview and Medication Variables on Mental Status While in Hospital for the Confused Group (n=62).

Step Variable	R	R^2	F	p
Informant's Interview	.527	.278	22.32	.000

($R = .458$, $R^2 = .210$, $p < .000$). The step-wise regression analysis for the Confused group produced similar findings. The Informant's Interview was again the only variable to reach criterion in the equation (see Table 11). For this subsample the percentage of variance accounted for was 27.8% ($R = .527$, $R^2 = .278$, $p < .000$). A step-wise regression analysis using the same independent variables failed to identify any significant predictors for the Non-confused group. These results suggest that the Informant's Interview predicts M.M.S.E. performance in hospital more powerfully for the Confused group than either the number of medications or the likelihood of a mental status effect (medeffect) of those medications.

2. Factors Predicting Follow-up Mental Status Scores

The number of medications taken was one factor hypothesized to be important in predicting mental status scores. A two-tailed t-test for paired samples shows that the difference between the number of medications prescribed in hospital and the number of medications being taken at home, is significant at the .05 level (t (df=49) = 2.61, $p < .05$). However when the means and standard deviations are examined, the differences are not clinically strong (see Table 12).

Table 12.

T-test for Paired Samples Comparing Number of Medications in Hospital and at Follow-up for Confused and Non-confused Groups.

Variable	n of Cases	Mean	S.D.	*t*-Value	df	2 Tail Prob.
Number of Medications in Hospital		4.62	2.94			
	50			2.61	49	.05
Number of Medications at Home (Follow-up)		4.04	2.62			

Using the score on the follow-up administration of the M.M.S.E. as a dependent variable, stepwise multiple regressions were computed for the entire subsample of subjects who were followed up (n = 50) and for the Confused (n = 43) subsample alone. Correlation coefficients were calculated for the Non-confused follow-up group because of the small n (n = 7). The regression analyses included the following variables as predictors: score on Informant's Interview, number of medications being taken at the time of testing, medeffect and score on the M.M.S.E. in hospital.

For the complete subsample (n = 50), the only variable to meet criterion for inclusion in the equation was the Informant's Interview, (R =.695, R^2 = .483, p < .000) (see Table 13). This variable alone accounted for 48.3% of the variance, a notable increase over the variance accounted for by the same variable in the mental status score in hospital. For the Confused group, the results are much the same. The Informant's Interview, the only variable to be included in the equation, explains 46.8% of the variance, (R = .684, R^2 = .468, p < .000) (see Table 14). The correlation between the Informant's Interview and the follow-up M.M.S.E. for the small Non-confused subsample (n = 7) is very high at -.9696 (p < .01). The correlations for the other

Table 13.

Results of Step-wise Multiple Regression Analysis of Informant's Interview, Medication Variables and Mental Status in Hospital on Follow-up Mental Status Scores for all Subjects Followed Up (n=50).

Step Variable	R	R^2	F	p
Informant's Interview	.695	.483	42.95	.000

Table 14.

Results of Step-wise Multiple Regression Analysis of Informant's Interview, Medication Variables and Mental Status in Hospital on Follow-up Mental Status Scores for the Confused Group (n=43).

Step Variable	R	R^2	F	p
Informant's Interview	.684	.468	34.33	.000

variables are not as high with only the mental status score in hospital reaching significance (see Table 15).

3. Breakdown of Informant's Interview

Given the significance of the Informant's Interview in predicting performance on the M.M.S.E. on both occasions, it was decided to break the interview down into its subcomponents. The schedule is divided into nine sections. These sections are as follows: personality change, memory, general mental functioning, activities of daily living, clouding/delirium, depression, sleep difficulties, paranoia and cerebrovascular problems. Regression analyses were computed for the M.M.S.E. scores in hospital and at follow-up using the subsections of the Informant's Interview as independent variables.

Step-wise multiple regressions were computed for the sample as a whole (n = 119), the Confused group (n = 62) and the Non-confused group (n = 57) to determine the relationship between the subsections of the Informant's Interview and the mental status score in hospital. For the sample as a whole, the variable which reaches criterion on step 1 is the memory problems section, which accounts for 16% of the variance, ($\underline{R}$ = .401, $\underline{R}^2$ =.161,

Table 15.

Correlations for Mental Status in Hospital, Informant's Interivew, Medication Variables and Follow-up Mental Status for Non-confused Group (n=7).

Variable	Correlation Coefficient
Mental Status in Hospital	.7622 *
Informant's Interview	-.9696 **
Total Number of Medications	.5594
Medication Effect	.4893

* $p < .05$ ** $p < .01$ (2-tailed)

$p < .000$). On step 2 the sleep problems section reaches criterion and raises the variance accounted for to 20.4%, ($R = .452$, $R^2 = .204$, $p < .021$). The paranoia section is the final variable to reach criterion and it adds 3.3% to the variance accounted for ($R = .487$, $R^2 = .237$, $p < .042$) (see Table 16).

The step-wise regression analysis for the Confused group alone ($n = 62$) found two variables accounting for a total of 32.6% of the variance (see Table 17). The first variable to reach criterion in the equation was the Paranoia subtest ($R = .496$, $R^2 = .246$, $p < .000$). The second variable included in the equation was the Activities of Daily Living subtest ($R = .571$, $R^2 = .326$, $p < .013$).

The results of the step-wise regression analysis for the Non-confused group ($n = 57$) revealed the Memory Problems subtest accounting for 9.6% of the variance ($R = .309$, $R^2 = .096$, $p < .041$) (see Table 18).

For the follow-up mental status score, the same subtests were listed as independent variables and a step-wise regression analysis was performed for all subjects who were followed up. The variable to reach criterion on the first step was the subtest which measured activities of daily living. This variable accounts for 46.6% of the variance ($R = .683$, $R^2 = .466$, $p < .000$). The

Table 16.

Results of Step-wise Multiple Regression Analysis of Subtests of the Informant's Interview on Mental Status in Hospital for Entire Sample (n=119).

Step Variable	R	R^2	F	p
Memory Problems	.401	.161	19.357	.000
Sleep Problems	.452	.204	12.867	.021
Paranoia	.487	.237	10.27	.042

Table 17.

Results of Step-wise Multiple Regression Analysis of Subtests of Informant's Interview of Mental Status in Hospital for the Confused Group (n=62).

Step Variable	R	R^2	F	p
Paranoia	.496	.246	18.606	.000
Activities of Daily Living	.571	.326	13.531	.013

Table 18.

Results of Step-wise Multiple Regression Analysis of Subtests of Informant's Interview of Mental Status in Hospital for Non-confused Group (n=57).

Step Variable	R	R^2	F	p
Memory Problems	.309	.096	4.448	.041

section measuring paranoia was reached criterion in the equation on the second step, and it raised the variance accounted for to 63.6% ($\underline{R}$ = .797, $\underline{R}^2$ = .636, $\underline{p}$ < .000) (see Table 19).

A step-wise regression was also calculated for the confused group alone and the findings are similar (see Table 20). The variables to reach criterion were the activities of daily living and the paranoia subtests, which together explained 64.3% of the variance ($\underline{R}$ = .801, $\underline{R}^2$ = .643, $\underline{p}$ < .001).

Only correlations between the subtests of the Informant's Interview and the follow-up M.M.S.E. were calculated for the Non-confused group because of the small number of subjects (n = 7). The highest correlation coefficient was for the memory subtest ($\underline{r}$ = -.969, $\underline{p}$ < .01). The activities of daily living and the cerebrovascular problems subtests both had correlation coefficients of $\underline{r}$ = -.891 ($\underline{p}$ < .01). The other subtest correlations to reach significance at the .05 level were the depression ($\underline{r}$ = -.789) and the general mental functioning ($\underline{r}$ = -.870) subtests (see Table 21).

Table 19.

Results of Step-wise Multiple Regression Analysis of Subtests of Informant's Interview of Follow-up Mental Status for all Subject's Followed up (n=50).

Step Variable	R	R^2	F	p
Activities of Daily Living	.683	.466	39.308	.000
Paranoia	.797	.636	38.458	.000

Table 20.

Results of Step-wise Multiple Regression Analysis of Subtests of Informant's Interivew on Follow-up Mental Status for the Confused Group (n=43).

Step Variable	R	R^2	F	p
Activities of Daily Living	.683	.466	33.245	.000
Paranoia	.801	.643	33.277	.000

Table 21.

Correlations for Subtests of Informant's Interview and Follow-up Mental Status for Non-confused Group (n=7).

Variable	Correlation Coefficient
Memory Problems	-.9669 **
General Mental Functioning	-.8701 **
Activities of Daily Living	-.8911 **
Depression	-.7888 *
Sleep Problems	.2376
Cerebrovascular Problems	-.8911 **

* $p < .05$ **$p < .01$ (2-tailed)

V. DISCUSSION

The purpose of this study was to assess the impact of hospitalization on mental status in the elderly. To this end subjects were given mental status exams in hospital and after discharge, with a retrospective assessment of functioning before illness obtained from an informant. Other measures that were taken include diagnosis, number of medications in hospital and at home, and the likelihood of those medications having an effect on mental status. A comparison was made of performance on the mental status exam (M.M.S.E., Folstein et al., 1975) in hospital and at home. As well, multiple regression analyses were used to determine which factors more strongly predicted performance on the M.M.S.E. on both occasions.

In this section, methodological considerations associated with the study will be addressed. Following the discussion of the methodological issues, the results as they relate to each hypothesis will be presented. Finally, the major findings of the study will be examined along with the implications of these findings.

A. Methodological considerations

There are several methodological considerations to be examined in relation to this study. They include; the possibility of selection bias in the sample, subject attrition, and practice effects.

1. Selection bias

It could be questioned whether the sample obtained is representative of the population of hospitalized elderly. The data were obtained at two of the three city hospitals in St. John's, Newfoundland. The third general hospital was not involved because it was established by doing an admissions study over a two week period that there were insufficient numbers of patients meeting the inclusion criteria. It appears that the two general hospitals studied admitted the vast majority of the elderly patients from the St. John's area while the third hospital tended to admit patients from other areas of the island. There is no reason to believe that people from St. John's would differ in any systematic way on the variables of interest to this study. In fact a number of the subjects had lived most of their lives in rural Newfoundland and had recently moved into St. John's to live with or near a son or daughter.

The representativeness of the time periods over which the study was conducted must also be considered. In conversation with a spokesperson for the St. John's Hospital Council which oversees the collection and collating of data on the admissions to all the hospitals, I was assured that for elderly admissions from the St. John's area, the numbers of admissions and their ages were not atypical. We did not collect data over a holiday period during which admission patterns are known to be atypical.

The refusal rate, always a concern in applied research has been documented to be an even greater problem with studies involving the elderly (Brod & Feinbloom, 1990). The refusal rate in the present study was not exceptionally high; 8.46% of those approached were unwilling to participate. However, it required an inordinate amount of time to reassure potential subjects that the consent form did not commit them to anything, but rather simply acknowledged their understanding of the research and their role in it. The need for written consent from the elderly, particularly in research which is non-invasive needs to be considered seriously. Several subjects were clearly distressed by the necessity of signing the form. They wanted to participate in

the study but were uneasy, even with considerable reassurance, about the advisability of signing anything.

Brod & Feinbloom (1990) studied the effect of requiring written consent on participation in a study of group therapy in a nursing home. They found that of 114 patients approached, 100 gave verbal consent. When written consent was requested only 60 of the 100 who had verbally agreed would sign a consent form. With what the authors refer to as "substantial coaxing" an additional 35 patients agreed to sign the form. It is questionably ethical to use such coercion to ensure signing of the consent form and one might argue that it defeats the reason for having it. Nonetheless the authors make the point that verbal consent was freely given and that the addition of the written consent was unnecessary. It was my experience that those who did refuse would have almost universally agreed had there only been verbal consent required. The anxiety provoked in some of those who did sign was in my opinion further reason to raise questions about the advisability of written consent when other procedures could serve the same purpose. Witnessed verbal consent sought by an individual uninvolved in the patients care could circumvent many of the ethical issues for which written consent required.

2. Subject attrition

The problem of attrition from follow-up studies is well known. The present study did suffer significant subject attrition from in-hospital measure to after discharge. Of the 30.5% attrition rate (19/62), five died and fourteen refused to be seen at home. T-tests show that there were no significant differences between the group that was followed up and the group that was unable to be followed up on age, mental status score in hospital or the pre-admission Informant's Interview. This suggests that on these variables at least the groups are comparable. Whether they would have differed on the second measure of mental status is of course unknown. The reasons given for refusing follow-up included being too busy, not wanting to be bothered and some subjects refused abruptly with no reason given. The subject attrition does represent a limitation for the study as does the comparatively small sample size.

The question of how to ethically ensure follow-up participation is a thorny one. In an effort to increase participation, I scheduled the meeting in the subject's home at a time which was convenient for the subject. At the time of telephone contact I reiterated my appreciation and the importance of their co-

operation. Apart from these measures there was not much that could have been done to decrease drop-out.

3. Practice effects

Practice effects, or "the effects of taking a test upon the scores of a second testing" (Campbell & Stanley, 1963, p. 175), are a common threat to internal validity in any study using repeated measures. There are two reasons to believe that the finding of significant improvement in this study is not a practice effect as a result of giving the same test on two occasions. The first is that the time period of two to three months between assessments decreases the likelihood of a subject remembering any significant amount of material. In fact few subjects remembered the testing experience or the investigator at all. The second is that although the impaired group did improve significantly, the normal group did not have a statistically significant difference between testings, despite there being room for improvement. If a practice effect were to be operating, one might expect it to be evident in the cognitively intact, rather than the impaired group.

B. Hypotheses and results

1. Hypothesis 1

Hypothesis 1 predicted a greater proportion of medical inpatients over the age of 65 scoring in the confused range on a mental status exam than would be expected from the prevalence rates in a community dwelling population. This hypothesis has been supported. Community dwelling samples have been found to have a range of 3% (Kay, 1972) to 25% (Pfeiffer, 1975) of the population scoring in the confused range on cognitive assessment instruments similar the M.M.S.E.. The hospitalized sample in this study had double the highest estimate, with 52% scoring below the cutoff on the M.M.S.E..

2. Hypothesis 2

The second hypothesis stated that those who score in the impaired range (below 24/30 on the M.M.S.E.) will perform at a higher level when tested at home after discharge. This hypothesis was supported by the findings. There was a significant difference on a *t*-test for paired samples between scores on the two occasions for those who had scored below the cutoff on the

M.M.S.E. ($p < .000$), while there was no such difference for the subjects who did not score in the impaired range.

3. Hypothesis 3

Hypothesis 3 stated that the M.M.S.E. score in hospital can be predicted by a combination of the Informant's Interview, the number of medications and the likelihood of a mental status effect of those medications. This hypothesis was not completely supported by the results of the study. The Informant's Interview did explain 21% of the variance. The medication factors did not reach criterion for inclusion in the step-wise regression equation.

4. Hypothesis 4

The fourth hypothesis stated that for both the Confused and the Non-confused groups, the follow-up mental status score would be best predicted by the Informant's Interview. This hypothesis was supported by the findings. Step-wise multiple regression analysis revealed that this variable accounted for 48.3% of the variance. No other predictor variables reached criterion for inclusion in the regression equation.

5. Hypothesis 5

The fifth hypothesis stated that because of the effect of illness and hospitalization on the first M.M.S.E. score, the variance explained by the Informant's Interview in the follow-up M.M.S.E. will be greater than that explained by the M.M.S.E. in hospital. This hypothesis was supported by the results. When the Informant's Interview total score is used, the step-wise multiple regression results show 21% of the variance explained in M.M.S.E. in hospital, and 48.3% explained in follow-up M.M.S.E. This finding is highlighted when the Informant's Interview is broken down into its subcomponents. When a step-wise regression analysis is computed using the subcomponents, the variance accounted for the sample as a whole is 23.7% for the in-hospital M.M.S.E.. For the follow-up mental status scores, the variance accounted for by the subcomponents is 63.6% using step-wise multiple regression.

C. Major findings

This study produced three major positive findings, each with important implications: 1. a large proportion of elderly medical inpatients performed at a low level on a mental status exam in hospital, and this low

performance was not solely due to dementias or delirium; 2. for those who scored as cognitively impaired in hospital, there was significant improvement in mental status after discharge; and 3. the mental status during hospitalization and after discharge was most strongly predicted by pre-hospitalization measures, with the amount of variance explained being greater at post-discharge assessment. The study failed to find evidence of impact of medications on mental status.

1. Cognitive impairment in hospital

Fifty-two percent of the sample scored in the cognitively impaired range on a mental status exam, lending support to figures previously published. Due to a lack of clarity in the literature in defining the causes of poor performance on mental status exams, it is difficult to interpret what the previous statistics mean. It has been generally assumed that the cognitive impairment assessed on mental status tests is due to either dementia or delirium. The findings of the present study present a challenge to this assumption.

In this study, those patients who met the criteria for a diagnosis of delirium (D.S.M. III-R, 1987) at the time they were assessed, were excluded. Those who suffer from dementia should stand out as measuring consistently low

on all three measures of functioning. Of the group who scored in the cognitively impaired range and who were followed up, 75% improved their score to within normal limits. Of the 11 who failed to change their performance sufficiently to score in the normal range, only 5 had scores which would have been compatible with a dementia. The definition for compatibility with dementia was either that the score did not improve to close to within a normal range (above 20/30), or the subject did worse on re-assessment. It is a conservative estimate therefore, that the percentage of the Confused group with dementia lies below 25% and possibly as low as 11.6%. This leaves at least 75% of the cognitively impaired subjects with no obvious diagnosis to explain their poor performance on the mental status test.

The kind of low mental status found in this study suggests that the assumption that there are only two forms of cognitive impairment in the elderly may need to be rethought. Delirium and dementia may make up only a portion of the cognitive impairment picked up on formal mental status testing in the hospitalized elderly. Although there is no reference to it in the literature, geriatric psychiatrists clinically recognize a type of cognitive impairment which is acknowledged to be common in the elderly population. It is referred to as

"sub-acute delirium" (Dr. H.R. Strong, personal communication, 1991). This entity fits the description of the cognitive impairment found in this study and is presumed to have a physical basis.

It would be interesting to assess the physical parameters of these subjects who appear to be functioning normally but who score poorly on the mental status exam. Foreman's (1987) study, in which at least a percentage of the sample would appear to be similar to this one, found that physiological factors added little to the correct classification of subjects as confused or not confused. However, Foreman did not look at electroencephalograms (E.E.G.) which might have proven informative. Generally patients who meet the criteria for diagnosis of delirium show diffuse slowing on an E.E.G. (Rabins & Folstein, 1982). A positive finding on the E.E.G. for these subjects who have "sub-acute" delirium would substantiate that the causal mechanisms are the same as for typical delirium and that the presentation simply differs in degree. There have been no studies published to date which have examined the correlation between mental status exams and E.E.G. findings.

Given the present state of knowledge in the area, it is difficult to predict what mechanism is responsible for the cognitive impairment which has been

identified. It has been suggested that the stress of hospitalization, when added to the physical insults of illness may overwhelm the organism's ability to adapt - while neither independently would have such an effect (Litin, 1956). In the present study, the most logical explanation for the high rate of cognitive impairment in hospital, is a combination of illness and hospitalization effects.

In an effort to separate out the effects of illness and hospitalization, we attempted to control the impact of illness severity on performance. To this end, data were gathered on a medical unit, rather than a critical care unit; delirious subjects were also eliminated. The results showed no effects on scores on the M.M.S.E. due to diagnosis. The number of medications prescribed might be indirectly related to severity of illness. The total number of medications being taken is not significantly different in the Confused and Non-confused groups. A more specific assessment was conducted on the likelihood of medications affecting mental status. However, there was no significant difference on this measure between the Confused group and within the Non- confused group. In addition, medication did not reach criterion in any of the regression analyses.

Some studies have shown an illness acuity effect on mental status (eg. Cronin, 1989; Francis, et al., 1990) however, these studies have included

delirious patients which would predictably inflate the relationship. In addition, the global measures of illness severity used in the literature have questionable reliability and validity. They typically involve a simple rating scale ranging from mild through moderate to severe. Because the various ratings are not clearly defined nor operationalized, there is likely to be significant variation in use of the rating scale amongst health care professionals even within studies. Charlson, Sax, MacKenzie, Fields, Braham, & Douglas (1986) studied the accuracy of physician's assessments of illness severity in predicting mortality. They found that the physician's ratings of severity were significantly associated with mortality ($p < .001$). The authors did not conduct any inter-rater reliability checks to assess whether different physicians would ascribe the same rating of severity to the same patient. They also did not attempt to assess the methods by which the physicians made their admittedly subjective ratings. Although these results are interesting, without operationalization of the assessment process, it is impossible to train physicians in the use of the scale. It would however, be beneficial to have a valid and reliable instrument which could then be studied in relation to mental status in hospitalized elderly patients. Some studies (e.g. Hirsch et al., 1990) attempted to measure illness acuity by

tabulating time units of nursing care provided. They found this measure to be negatively correlated with performance on a mental status exam. It was assumed that the amount of nursing care required was an indicator of severity of illness, and that a relationship existed between the illness severity and mental status. However, an alternative interpretation is that poor mental status was at least partially responsible for the higher nursing care.

Consequently, although a measure of illness severity or acuity would have been appropriate in this study, the lack of a well standardized, valid and reliable instrument coupled with the practical problems associated with obtaining such a measurement from each subject precluded the its inclusion.

It was the clinical impression of the investigator that none of the patients were sufficiently ill that it interfered in any important way with their performance on the mental status exam. All were able to sit up in bed, conduct a lucid conversation, and pick up a pencil to write or draw. Unfortunately, hospitalization effects independent of severity of illness cannot be quantified, and thus cannot be statistically analyzed using the data in this study. Nonetheless, given the controls for illness severity that were in place, it would

be appropriate to conclude that for the elderly, hospitalization adversely affects cognitive functioning, even for those who are not severely ill.

Implications

The high number of patients functioning in the cognitively impaired range has practical implications for nursing staffing on the medical floors. Those cognitively impaired patients who are vocal and disruptive are known to require extra nursing time but the quiet disoriented and confused patient may also require some extra practical aid with activities of daily living. He or she may also benefit from some contact time simply aimed at re-orientation. One study has shown a significant reduction of confusion as a result of nursing interactions with a consistent individual in which orientation, clarification and correction of sensory deficit took place (Williams, Campbell, Raynor, Mlynarczyk, & Ward, 1985). The patients identified by mental status exam as confused often may miss being targeted for extra care by virtue of their "silent" presentation. Assuming that the sample in the present study is representative, more than half of the elderly admitted to medical units who are not delirious are scoring in the cognitively impaired range on a mental status exam. It would be worthwhile to assess whether usual staffing ratios are

adequate to meet the needs of this group. There are studies which have shown a significant negative correlation between nursing care units and mental status scores (eg. Hirsch et al., 1990) These studies lend support to an increased need for nursing time for those who score cognitively impaired on a formal measure of mental status.

Another clinically relevant implication of the high prevalence of impaired mental status in hospitalized elderly is effect of cognitive impairment on the ability to process and learn new information. There have been initiatives set up on medical nursing units over the past several years to increase the amount of patient education in order to enhance compliance in medication regimes and altering lifestyle. It is unlikely, given the percentage of patients who perform poorly on a simple mental status exam, that hospital would be the appropriate setting for introducing new information which would involve complex new learning and consolidation. It would be valuable to test the ability of the patient who scores cognitively impaired but appears to be functioning normally, to retain the information taught in hospital. At the present time there has been no research published documenting the relationship between poor performance on a

mental status exam and new learning. This is an important area for further clinical nursing research.

It has been suggested by several authors that given the high percentage of hospitalized elderly performing at a low level, routine mental status exams ought to be administered (e.g. Blass, 1985; Gehi et al., 1980). The present study might support such a recommendation with the following goals; 1. to ascertain which patients have difficulty absorbing and remembering information given to them in the hospital setting and 2. to target patients who might benefit from extra nursing care.

2. Change in mental status from hospital to home

The hypothesis that subjects scoring impaired on a mental status exam in hospital would score significantly higher at home after discharge, was supported by the findings ($p < .000$). There are currently no published data on hospitalized elderly subjects who are not delirious in which there is a substantive follow-up measure of mental status after discharge. Thus the present study represents the first documentation of the significance of improvement in cognitive functioning from hospital to home.

Appendix E documents the sub-sections of the mental status exam on which there was significant change from in hospital to at home. The cognitive processes which seem to be the most affected are those involving attention and cocentration. This finding is not unexpected given that the hospital setting has many distracting stimuli which are not present at home. If the cognitive structures are already compromised then the additional stresses in the hospital setting may overwhelm the person's ability to cope resulting in poor performance.

Implications

The most striking implication of this finding is the limitations that it implies for the use of the in-hospital mental status score. If 75% of subjects scoring in the impaired range improve to within normal limits once they are back at home, then the predictive validity of the in-hospital score is very limited indeed. However, it has been recommended that in-hospital mental status tests be used routinely as a screening device, and the results are being used as if they had good predictive power. Poor scores on a mental status exam are a common factor in decisions concerning nursing home placement. Relatives may be reluctant to take home family members who are

identified as impaired. The mental status score may be incorporated into the diagnosis, assuming that in absence of delirium mental status scores are stable. This study has clearly shown that this is not the case.

Although it has not been documented, it is probable that the knowledge that a person has scored cognitively impaired, particularly in the absence of delirium, changes the way in which doctors and nurses interact with a patient. It would be interesting to study the effects of knowledge of cognitive impairment on the behaviour of medical and nursing staff. One might speculate that the outcome would parallel the findings of the classic "self-fulfilling prophecy" studies of the effects of knowledge of children's I.Q. on teacher's behaviour. In these studies teacher expectations had a significant effect on children's performance even when actual ability was controlled (Rosenthal & Jacobson, 1968). Although this study has been called into question in regards to children in the classroom, it is intuitively a plausible factor in staff patient interactions with the elderly in a hospital situation. It would be intriguing to test the effects of physician and nurse expectation on patient mental status.

3. Factors predicting mental status score

The hypothesis that mental status scores in hospital would be predicted by a combination of pre-admission measures and medication measures was not supported. The only factor that achieved entry into the equation was the pre-admission measure which explained 21% of the variance for the group as a whole and 27.8% for the Confused group. For the Non-confused group alone no variable reached criterion. When the pre-admission measure is broken down into its subcomponents, a combination of the memory problems, sleep problems and paranoia subtests explain 23.7% of the variance for the group as a whole. For the impaired group, the paranoia and activities of daily living subtests explain 32.6% of the variance. For the non-impaired group, the memory problems subtest explained 9.6% of the variance. Overall, the total amount of variance accounted for is small suggesting other factors were affecting mental status, most likely hospitalization and illness.

The hypothesis that mental status scores after discharge would be strongly predicted by pre-admission measures was supported. Using regression analysis to predict scores at home, the only independent variable to reach criterion was the pre-admission assessment which accounted for 48.3 % of the

variance for the combined groups. For the group which scored impaired in hospital the amount of variance accounted for by the pre-admission assessment is slightly lower at 46.8%.

When the pre-admission assessment is broken down into its subcomponents, the variance accounted for in the follow-up mental status score increases to 63.6% for the two groups combined and to 64.3% for the impaired group alone. The two subtests explaining the variance in both cases are activities of daily living and paranoia with activities of daily living explaining the majority (46.6% for both groups) of the variance. This finding reflects the importance of the relative's perception of how the patient is coping in day to day life for prediction of mental status at home following discharge. The significance of the paranoia subscale is most likely due to a small number of subjects for whom paranoia is a significant predictor of poor mental status. This supposition is supported by the finding that in the in-hospital analyses the paranoia subscale reaches criterion and accounts for 24.6% out of 32.6% of total variance explained only for the impaired group. In addition, when the very small non-impaired group (n=7) is removed from the follow-up analysis, the percentage of variance accounted for by the paranoia subscale increases.

It is interesting to note that the relative importance of the activities of daily living and the paranoia subscales for the impaired group were reversed from in hospital to after discharge. In hospital the paranoia subscale explained the greater proportion of the variance accounted for (24.6% out of 32.6%), with activities of daily living accounting for the remainder. After discharge the activities of daily living subscale explained 46.6% out of a possible 64.3% of variance with the paranoia subscale accounting for the remainder. The possible explanation for this finding is the effects of illness and hospitalization. The paranoia subscale consists of two questions, one related to persecutory thoughts and the second related to the presence of hallucinations. There are three likely explanations for a positive response to either or both of these questions. One is the presence of a paranoid psychotic state. The second is the presence of paranoid personality traits. The third is that the subject suffers from a sensory impairment which is known to increase likelihood of hallucinations and delusions. Any of these problems could be exacerbated in the unfamiliar and potentially threatening hospital environment, affecting the mental status score. However once back in a familiar environment, the process responsible for the positive paranoia score may have less of an effect on mental status.

Implications

These findings have implications for the use of mental status scores when performed in hospital. If mental status scores are significantly different in hospital and at home and performance at home is best predicted by pre-admission measures, then the in hospital measure is limited in its usefulness. These results suggest that a pre-admission measure, easily obtained from an informant, will predict with much greater accuracy how a person will do at home after discharge than will a measure of cognitive functioning obtained in hospital. Furthermore, a complete Informant Interview appears unnecessary based on the findings of the present study. The subscales of activities of daily living and paranoia together account for a significant portion of the variance in mental status scores at home after discharge for those who scored impaired while in hospital. Consequently, one could devise a simple measure incorporating activities of daily living and paranoia measures, ask a significant other to rate the patient on these measures, and use this information to make judgements about how the patient is likely to function after discharge. It would be worth-while to accumulate more data on the Informant's Interview examining such factors as the effect of which informant is contacted.

It would also be useful to devise a cutoff score for determining cognitive impairment.

D. Summary

The purpose of the present study was to study mental status in elderly medical inpatients before they are hospitalized, while in hospital and once they are discharged. A measure of general functioning was obtained from a significant other for the time period prior to hospitalization and a formal mental status exam was given during the hospital stay and again following discharge. Measures were taken of medication related factors on both occasions.

Slightly more than half (52%) of the study sample scored below the cutoff on the mental status exam while in the hospital. Of this group 75% improved their scores to within normal limits by the time they were tested at home following discharge. Regression analyses revealed that the best predictor of mental status both in hospital and after discharge was the pre-admission Informant's Interview. The percentage of variance accounted for by the Informant's Interview in the in-hospital measure was low (21% - complete sample; 27.8% - Confused group) compared to the variance accounted for in the follow-up measure (48.3% - complete sample; 46.8% - Confused group).

When the Informant's Interview was broken down into its subscales, the variance accounted for increased both for the in-hospital measure (23.7% - complete sample; 32.6% - Confused group) and the follow-up measure (63.6% - complete sample; 64.3% - Confused group). Thus a major finding for this study is the importance of obtaining a relative's measure of functioning in order to predict future functioning. Interestingly the study failed to find any support for the role of medication in determining mental status either at home or in hospital. This may be due to relative lack of change in medications from in-hospital to post-discharge.

The study also found a statistically significant improvement in mental status score from in hospital to after discharge ($p < .000$) for the cognitively impaired group. This is the first follow-up study in which delirious patients were excluded, in which the measure of mental status has established validity and reliability, and in which the subjects are followed up two to three months after discharge.

The study has raised several important research questions. Firstly, if the subjects in this study are not delirious and for the most part are not demented, why are such a large percentage of them scoring in the impaired range on a

mental status exam ? Secondly, are there physical parameters (such as E.E.G. or illness severity) not measured in this study which may account for the high number of cognitively impaired ? Thirdly, what are the implications of this cognitive impairment for teaching the patient and for the level of nursing care needed ? Fourthly, is it feasible to develop a cutoff on the Informant's Interview for determining cognitive impairment ? Finally can a shortened version of the Informant's Interview accurately predict how the patient will do after discharge and would it be practical for use in hospitals to aid in discharge planning?

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APPENDICES

CONSENT TO PARTICIPATE IN BIO-MEDICAL RESEARCH

TITLE: Cognitive Impairment in Hospitalized Elderly Patients: A Follow-up Study.

INVESTIGATOR(S): Olga Heath

You have been asked to participate in a research study. Participation in this study is entirely voluntary. You may decide not to participate or may withdraw from the study at any time without affecting your normal treatment.

Confidentiality of information concerning participants will be maintained by the investigator. The investigator will be available during the study at all times should you have any problems or questions about the study.

Information About The Study:

We are trying to find out how illness and hospitalization affects older patients. Other studies have found that many older people as well as some younger people, become confused when sick and in hospital. We would like to ask you a few questions in order to check your memory and thinking. These questions will only take about 5-10 minutes. We would also like to speak with a relative who either lives with you or spends a lot of time with you. This way we can get an idea of how you were before you went into the hospital.

In order to see how you are doing after you have recovered we would like to come to your home about 6 to 8 weeks after you have been discharged and ask you and your relative the same questions.

APPENDIX A (Continued)

CONSENT FORM

I, _____, the undersigned, agree to (my relative's,

_____) participation in the research study described above.

Any questions have been answered and I understand what is involved in the study. I realize that participation is voluntary and that there is no guarantee that I will benefit from my involvement. I acknowledge that a copy of this form has been offered to me.

_____ _____

(Signature of Participant) (Date)

_____

(Signature of Witness, optional)

To be signed by investigator:

To the best of my ability I have fully explained to the subject the nature of this research study. I have invited questions and provided answers. I believe that the subject fully understands the implications and voluntary nature of the study.

_____ _____

(Signature of Investigator) (Date)

APPENDIX B

NAME:_____ STUDY NUMBER:_____

"MINI-MENTAL STATE: TEST FORM"

ORIENTATION	MAX SCORE
What is the (year/season/date/day/month)?	5
Where are we: (country/province/town/hospital/floor)?	5
REGISTRATION	
Name 3 objects at 1/second. Then ask for all three Give 1 point for each correct answer. Repeat until the subject learns all 3. Score # of trials:	3
ATTENTION AND CALCULATION	
Serial 7s. 1 point for each correct, stopping after 5 answers: OR spell "WORLD" backwards.	5
RECALL	
Ask for the 3 objects repeated above. Give 1 point for each correct.	3
LANGUAGE	
Name a pencil, and watch	2
Repeat: "NO IFS, ANDS OR BUTS".	1
Follow a 3-stage command: "TAKE A PAPER IN YOUR RIGHT HAND, FOLD IN HALF, AND PUT IT ON THE FLOOR".	3
Read and obey the following: CLOSE YOUR EYES	1
WRITE A SENTENCE	1
COPY DESIGN	1

APPENDIX B (Continued)

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, country, etc.). One point for each correct.

REGISTRATION

Ask the patient if you may test his memory. Then say, e.g. Apple: Table: Penny, clearly and slowly, about one second for each. After you have said all 3, ask him to repeat them. The 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, 79, 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, dlorw = 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.

APPENDIX B (Continued)

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 inch 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.

APPENDIX C

The CAMDEX schedule

SECTION H. Interview with patient's relative or other informant

Interview to be conducted with a relative, friend or carer concerned with subject who may or may not be living with them.

Questions are organised into headed sections. It may be necessary at your discretion to introduce each section: for example, "Sometimes people develop difficulty with everyday life" could introduce the section on Daily Activities.

Introduction to informant:

I'm going to ask some questions relating to changes in behaviour and character of...These changes do not always appear in late life and may not be relevant to him/her. But we ask these of everybody because the replies might prove valuable in helping people who do have difficulties.

Record on the score sheet:

Informant's name
Address
Date of interview

235	How was the interview conducted?	Face to Face . . . . . 1 Telephone 2	9
236	Relationship of informant to subject. Specify "other".	Spouse . . . . . 1 Sibling . . . . . 2 Sister-/brother-in-law . . . . . 3 Son-daughter . . . . . 4 Son-/daughter-in-law . . . . . 5 Friend . . . . . 6 Caretaker/warden . . . . . 7 Other 8	9

APPENDIX C (continued)

237	Roughly how often do you see him/her?	Lives with	1	
		Daily	2	
		More than once a week	3	
		Weekly	4	
		Monthly	5	
		Yearly	6	9

PART I. Items concerned with history of present difficulty

Personality

238	Have you noticed any changes in his/her personality, such as the way he/she behaves socially? Specify type of change.	No	0	8
		Yes	1	9
239	Has there been any noticeable exaggeration in his/her normal character?	No	0	8
		Yes	1	9
240	Has he/she become more (or less) changeable in mood?	No	0	8
		Yes	1	9
241	Has he/she become more (or less) irritable or angry?	No	0	
		Less	1	8
		More	2	9
242	Does he/she show less concern for others? Or more?	No	0	
		Less	1	8
		More	2	9
243	Does he/she get involved in difficult or embarrassing situations in public because of his/her behaviour?	No	0	8
		Yes	1	9
244	Has he/she become more stubborn or perhaps a little awkward? Or less?	No	0	
		Less	1	8
		More	2	9

APPENDIX C (continued)

If no personality changes omit questions 245 and 246 and code 999 or 9 below.

245	How long have these changes been present?	Duration in months	888 999	
246	Have these changes developed gradually or did they come on suddenly	Gradual . . . . . 0 Sudden 1		8 9

Memory

247	Does he/she have more difficulty remembering short lists of items, e.g. shopping?	No difficulty . . . . . 0 Slight difficulty . . . . . 1 Great difficulty 2		8 9
248	Does he/she have difficulty remembering recent events, e.g. when he/she last saw you or what happened the day before?	No difficulty . . . . . 0 Slight difficulty . . . . . 1 Great difficulty 2		8 9
249	Does he/she have difficulty interpreting surroundings, e.g., knowing where he/she is, or discriminating between different types of people, such as doctors, visitors, relatives?	No difficulty . . . . . 0 Slight difficulty . . . . . 1 Great difficulty 2		8 9
250	Does he/she have difficulty finding the way about home (or ward), e.g. finding the toilet?	No difficulty . . . . . 0 Slight difficulty . . . . . 1 Great difficulty 2		8 9
251	Does he/she have difficulty finding the way around the neighbourhood, e.g. to the shops or Post Office near home?	No difficulty . . . . . 0 Slight difficulty . . . . . 1 Great difficulty 2		8 9

APPENDIX C (continued)

If no memory problems omit questions 252 and 253 and code 999 or 9 below.

252	How long have these changes been present?	Duration in months	888 999	
253	Have these changes developed gradually or did they come on suddenly?	Gradual	0	8
		Sudden	1	9

General Mental Functioning

254	Has there been a more general decline in his/her mental functioning? For example is it less clear or sharp?	Yes	0	8
		No	1	9
255	Does he/she tend to talk about what happened long ago rather than in the present?	No	0	
		Sometimes	1	8
		Often	2	9
256	When speaking, does he/she have difficulty finding the right word or use wrong words?	No	0	8
		Yes	1	9
257	Does he/she seem to find it more difficult to make decisions lately?	No	0	8
		Yes	1	9
258	Is there a loss of any special skill or hobby he/she could manage before?	No	0	8
		Yes	1	9
259	Does his/her thinking seem muddled?	No	0	8
		Yes	1	9

If no mental deterioration omit questions 260 - 262 and code 999 or 9 below.

APPENDIX C (continued)

260	How long have these changes been present?	Duration in months ____	888 999
261	Has this difficulty developed in a gradual manner or did it come on suddenly?	Gradual . . . . . 0 Sudden 1	8 9
262	Has this difficulty developed in steps and stages?	No . . . . . 0 Yes 1	8 9

Everyday Activities

For questions 263 - 267 score only if difficulties are not due to physical illness and are judged to be due to cognitive impairment.

263	Does he/she have any difficulty performing common household chores, e.g. can he/she make a cup of tea?	No difficulty . . . . . 0 Slight difficulty . . . . . 1 Great difficulty 2	 8 9
264	Does he/she have more difficulty managing small amounts of money?	No more difficulty . . . . . 0 Slight difficulty . . . . . 1 Great difficulty 2	 8 9
265	Does he/she have difficulty feeding him/herself?	No difficulty . . . . . 0 Messily with a spoon only . . . . . 2 Simple solids, eg.g biscuits . . . . . 4 Has to be fed 6	 8 9
266	Does he/she have difficulty dressing?	No difficulty . . . . . 0 Occasionally misaligned buttons, etc. 2 Wrong sequence, often forgets items 4 Unable to dress self 6	 8 9
267	Does he/she wet or soil him/herself?	No . . . . . 0 Wets occasionally . . . . . 2 Wets often . . . . . 4 Doubly incontinent 6	 8 9

APPENDIX C (continued)

If none of the above present, omit questions 268 and 269 and code 999 or 9 below.

268	How long has this difficulty been present?	Duration in months ____	888 999
269	Have these difficulties developed gradually or did they come on suddenly?	Gradual . . . . . 0 Sudden 1	8 9

Clouding/delirium

270	Has there been a sudden deterioration towards mental confusion in recent weeks or months which has continued to the present time? If "yes" or uncertain ask questions 271 - 274. If "no" code 999 or 9 below.	No . . . . . 0 Yes 1	8 9
271	Are there periods lasting days or weeks when his/her thinking seems quite clear and then muddled?	No . . . . . 0 Yes 1	8 9
272	Are there brief episodes during 24 hours when he/she seems much worse and then times when quite clear?	No . . . . . 0 Yes 1	8 9
273	Is the confusion worse towards dusk or the evening?	No . . . . . 0 Yes 1	8 9
274	How long has this difficulty been present?	Duration in months _____	888 999

APPENDIX C (continued)

Depressed Mood

275	Is there a loss of interest or enjoyment in things in general?	No	0	8
		Yes	1	9
276	Has/he/she been inclined to blame herself or feel unreasonably guilty?	No	0	8
		Yes	1	9
277	Do you think he/she is depressed?	No	0	8
		Yes	1	9

If no depression, omit questions 278 and 279 and code 999 or 9 below.

278	How long has this been present?	Duration in months _____	888 999
279	Did this develop gradually or come on suddenly?	Gradual 0	8
		Sudden 1	9

Sleep

280	Does he/she have difficulty in getting to sleep?	No	0	8
		Yes	1	9
281	Is he/she restless or wakeful during the night?	No	0	8
		Yes	1	9
282	Does he/she wake early in the morning, and fail to fall asleep again?	No	0	8
		Yes	1	9
283	Does he/she tend to get up and wander at night, or any other time?	No	0	8
		Yes	1	9

If no difficulties omit questions 284 and 285 and code 999 or 9 below.

APPENDIX C (continued)

284	How long has this difficulty been present?	Duration in months ____	888 999
285	Did this come on gradually or develop suddenly?	Gradual . . . . . 0 Sudden 1	8 9

Paranoid Features

286	Has he/she complained unjustifiably of being persecuted or spied on by others?	No . . . . . 0 Yes . . . . . 1 Duration in months ____	8 9 888 999
287	Has he/she been troubled by voices or visions not experienced by others?	No . . . . . 0 Yes . . . . . 1 Duration in months ____	8 9 888 999

Cerebrovascular Problems

If "yes" to any of the following questions establish how long since first occurrence (in months).

288	Has he/she ever "passed out" and then had a brief weakness or difficulty with speech, memory or vision?	No . . . . . 0 Yes 1	8 9
289	Does he/she have a tendency to fall?	No . . . . . 0 Yes 1	8 9
290	Has he/she ever had a stroke?	No . . . . . 0 Yes 1	8 9

APPENDIX C (continued)

If any answer is positive, record time (in months) since onset of first symptom. If all answers are "no", code 999.

291	How long ago did this first occur?	Duration in months ____	888 999

General Summary

If no problem has been established anywhere in this section (questions 238 - 291, code 9 or 999 below.

Question 292 is aimed at identifying immobility associated with moderately advanced Alzheimer's disease, clouded states or severe depression or changes in gait not due to definable neurological illness.

292	Does he/she have trouble getting about since the onset of the above difficulties?	No . . . . . 0 Some difficulty . . . . . 1 Great difficulty 2	8 8 9
293	You have indicated some changes in (the subject). Can you tell me what was the first change you noticed in his/her behaviour? Record answer in full.		
	How long ago was that?	Duration in months ____	888 999

APPENDIX C (Continued)

294	When in your judgement was his/her mental ability last quite normal?	Duration in months ____	888 999

APPENDIX D

CRITERIA FOR DELIRIUM

A. Reduced ability to maintain attention to external stimuli (eg., questions must be repeated because attention wanders) and to appropriately shift attention to new external stimuli (e.g., perseverates answer to a previous question).

B. Disorganized thinking, as indicated by rambling, irrelevant, or incoherent speech.

C. At least two of the following:

1. Reduced level of consciousness (e.g., difficulty keeping awake during examination).
2. Perceptual disturbances: misinterpretations, illusions, or hallucinations.
3. Disturbance of sleep-wake cycle with insomnia or daytime sleepiness.
4. Increased or decreased psychomotor activity.
5. Disorientation to time, place, or person.
6. Memory impairment (e.g., inability to learn new material, such as the names of several unrelated objects after five minutes, or to remember past events, such as history of current episode of illness).

D. Clinical features develop over a short period of time (usually hours to days) and tend to fluctuate over the course of a day.

E. Either (1) or (2):

1. Evidence from the history, physical examination, or laboratory tests of a specific organic factor (or factors_ judged to be etiologically related to the disturbance.
2. In the absence of such evidence, an etiologic organic factor can be presumed if the disturbance cannot be accounted for by any nonorganic mental disorder (e.g., manic episode accounting for agitation and sleep disturbance).

Table from DSM-III-R, *Diagnostic and Statistical Manual of Mental Disorders*, ed 3, revised.

APPENDIX E

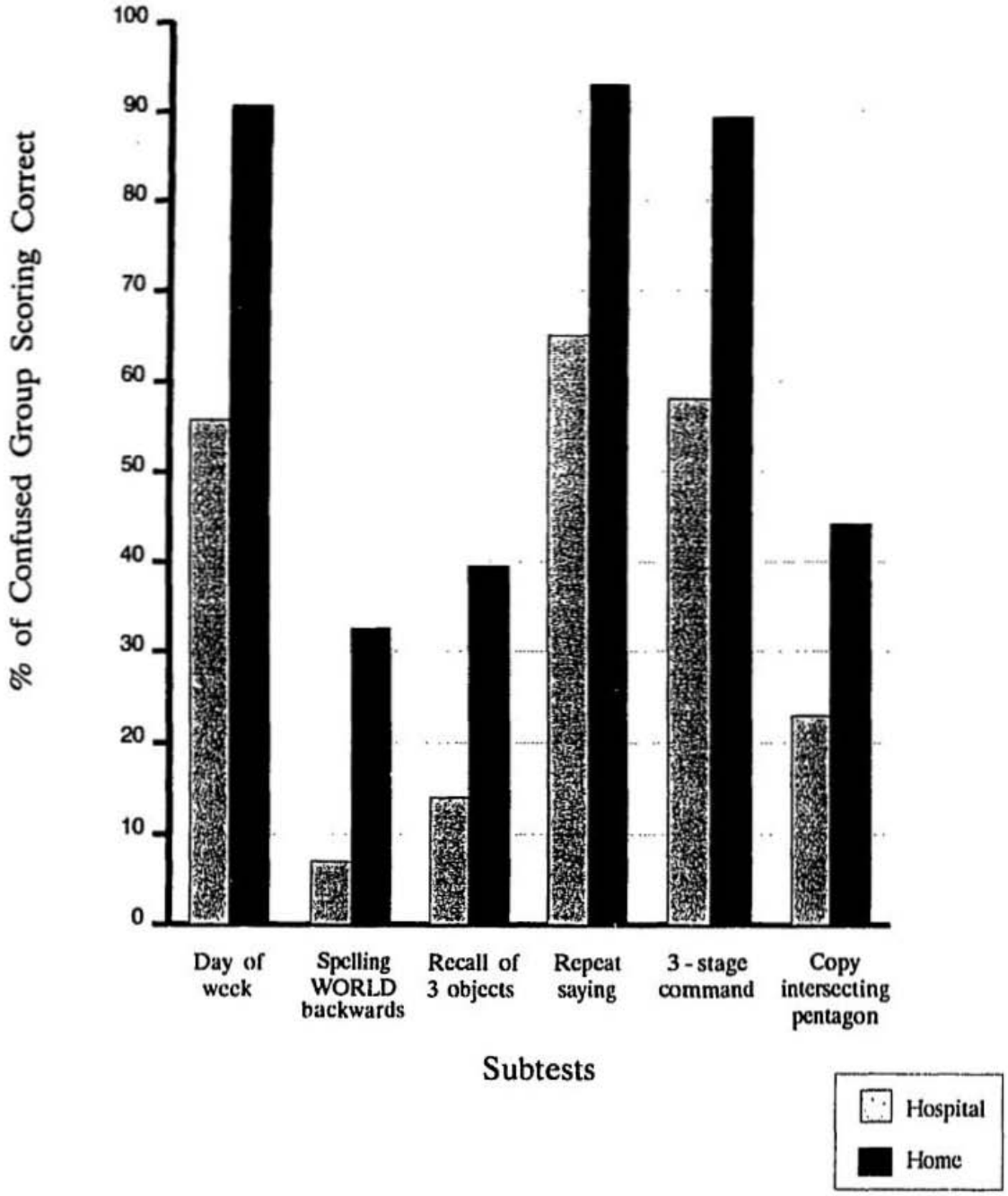

FIGURE 2. Subtests of M.M.S.E. With Twenty Percent or Greater Difference Between In-hospital and Follow-up Score.