THE UNIVERSITY OF CALGARY

SELF MEDICATION AND MEMORY IN AN ELDERLY POPULATION

BY

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE

DEGREE OF

MASTERS OF SCIENCE

DEPARTMENT OF PSYCHOLOGY

CALGARY, ALBERTA

DECEMBER, 1991

ISBN 0-315-75158-4

THE UNIVERSITY OF CALGARY

FACULTY OF GRADUATE STUDIES

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ABSTRACT

The ability of elderly people to comply with a medication regimen continues to be a major concern among health-care professionals. Several health-care facilities have adopted Self Medication Programs which teach the elderly, while in hospital, proper medication administration. While success/failure in a self medication program depends on several factors, memory has been found to be the most limiting factor (Thompson and Ellenberg, 1987). The current research investigated the predictive validity of various aspects of memory and cognitive functions that result in success/failure in the first stage of a four stage Self Medication Program. Three specific aspects of memory were tested among 49 elderly subjects involved stage one of a program: 1) prospective remembering, 2) retrospective memory and, 3) self assessment of memory. As well, two cognitive function measures were included to assess the subjects' general cognitive abilities and their relation to the tasks at hand. Results show that success/failure in stage one of the Self Medication Program can be predicted with a high accuracy rate (64% to 81%) using a combination of cognitive tests and procedures. Further results indicate that the combination of measures on the cognitive tests successfully discriminate between those subjects who

advanced to stage two of the program and those who did not. On the basis of the discriminant finding 100% of those subjects advanced to stage two of the program and 94.1% of those not advanced were correctly classified. The results of the present study provide information that will aid in improving the selection process for admission to similar Self Medication Programs.

ACKNOWLEDGEMENTS

It must first be acknowledged that the successful defense of a thesis is not possible without the kind contributions of several people. This thesis is no exception!

Most importantly, I must thank my supervisor, Dr. Keith S. Dobson. Without his valuable contributions, his encouragement and his positive attitude this thesis would not have been possible. Keith's kindness and sensitivity to the various dramas associated with being a graduate student not only provided me with the courage to succeed but renewed my faith and enthusiasm for psychology. For these things I am grateful.

I am also grateful to my committee members for creating a relaxing and friendly oral defense. Dr. Bruce Dunn was my statistical crutch and comic relief provider. Dr. Eva Pajurkovas' knowledge and understanding are clearly evident in both her role as a committee member and her lessons as a mentor. Dr. Phil Eatons' kind and courteous comments were comforting and appreciated. Thank you.

I thank Dr. D. Schoenfield and Dr. L. Weaver for their continuous support throughout my entire program. I have the utmost respect and fondness for both of these individuals.

Most certainly I thank my friends and family. All those who are close to me have watched me change and learn and grow. I apologize to my family and friends, especially Dad and Dalton, who have been forced to forego the niceties of a

normal daughter and girlfriend.

Finally, I acknowledge and thank not only those individuals who participated in the research, but all elderly people in general. Let it be known that we have much to learn from the elderly - if only we would allow them to teach!

DEDICATION

This thesis is dedicated to my mother, Mary Palmer. Although her physical presence was and continues to be greatly missed, her spiritual guidance provided the love, the support and the warmth that was needed.

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INTRODUCTION

The abilities to treat and control disease and disorders by medication stand as two of the greatest contributions of modern medicine. At the same time, the widespread use of medications is not without it's own perils. It has been suggested, in fact, that illness caused by medications may be the most significant treatable health problems in the elderly (Beers and Ouslander, 1989). Kendricke and Bayne (1982) found that the average elderly Canadian takes 3.8 prescription medications and 1.2 non-prescribed medications at any one time. It is known that the risk of having an adverse reaction to a medication increases with every drug added to the regimen (Beers and Ouslander, 1989). Normal aging changes an individuals ability to excrete and metabolize medication, and also alters the organs' sensitivity to medicines (Beers and Ouslander, 1989). The concurrent use of many medications, coupled with normal changes as a function of aging, result in problems arising more often in the elderly.

One concern that has been raised among health-care professionals is the ability of elderly people to comply with a medication regimen. Compliance refers to the adherence to verbal or written directions for self

administering medications. Compliance has been defined as having two components. The timing component requires that an individual take his/her medication at the correct time. The content component involves administering the appropriate medication, as well as the proper dosage.

In the United States 23% of nursing home admissions are due to an inability to manage medications at home and as many as 25% of all readmissions to hospital geriatric wards may be attributable to medication noncompliance (Backman,1987; Graham and Livesly, 1983). Noncompliance can lead to exacerbated health problems, complications, and can even become an indirect cause of death.

Self medication

The necessity to teach patients, while in hospital, how to take their medications properly is becoming a primary goal in most rehabilitation units. Hospitals are starting to move away from the more traditional practise of providing total care for the patient towards a more educational practise of teaching the patients how to care for themselves (Barofsky, 1978). Self medication is one aspect of care that patients should be able to take responsibility for prior to discharge.

Self medication programs refer to systems used within health care institutional settings that place patients in charge of their own medication administration

(Thompson and Ellenberg, 1987). Such programs acknowledge that patients function at many different levels as a result of the varying disabilities and aging processes. It is the objective of these programs to have each patient reach his/her individual maximum potential in self help living.

Self medication programs have been found to promote a sense of independence and personal control for the patient (Madaio and Clarke, 1977; Youngren, 1981) and have resulted in increased compliance after discharge back to the community (Cole, 1971; Hulka, Cassel, Kupper, Burnette, 1976; Aslam, Davis, Fletcher, 1979; Batey, Ledbetter, 1982; Deberry, Jeffries, Light, 1975). For example, in a pilot study conducted at the University Hospital in Saskatchewan, Matiko (1989) developed a three stage program that gradually increased the patients' responsibility for his/her own medications. A patient progressed to the next stage when both the nurse and patient felt comfortable with the advancement. Over a ten week period, the program obtained a 14.4% improvement in patient medication knowledge and an 89% (8 out of 9 patients) compliance rate (as assessed through direct questioning and random pill count) after completion of the self medication program.

In addition to improved compliance, self medication programs allow the patient the opportunity, while under supervision, to adapt his/her medication routine to his/her lifestyle and abilities. For example, requiring a patient who does not regularly eat breakfast to take his/her medications with breakfast will likely result in medication errors after discharge. Therefore, even in hospital the primary goals of medication programs should be to ensure compliance by accommodating the administration of the medications to the daily routine of the patient. Further, most self medication programs recognize the need to simplify the physical aspects of medication; to provide large print labels for those with vision problems and to rectify dexterity problems with easy access pill containers.

The most difficult aspect of self medication programs is for health care professionals to determine how capable patients are at performing the skills necessary to take medication (Meyer and Schuna, 1989). As it has been recognized that patients vary in their ability to learn the necessary strategies and information, interest has been shown recently in screening candidates to identify those most/least likely to succeed. Identification of limiting factors would also serve to suggest future modifications to training

programs so that a greater number of patients could achieve independence in this critical area.

Aspects of Memory and Performance

Previous investigations have suggested memory problems to be the most common limiting factor in self medication programs (Haynes, Taylor and Sackett, 1979; Harris, 1984; Youngren, 1981; Taylor and Hajek, 1984; Pelletier, 1983; Reibel, 1969; Thompson and Ellenberg, 1987; Newcomer and Anderson, 1974; Buchanan, Brooks and Greenwood, 1972). Despite the identified concern with memory, it is notable that not one of the previous studies has attempted to determine what aspects of memory are the limiting factors. The major purpose of the present research was to determine the predictive validity of various aspects of memory that result in success or failure in a self medication program.

Retrospective Memory

Traditionally, researchers interested in memory have accorded attention almost exclusively to performance on retrospective tasks; that is, the ability to recall information from the past. The process by which information is encoded and stored into memory has been referred to as the multistore model of memory (Atkinson and Shiffrin, 1971). This particular theory states that; firstly, the sensory register picks up information in the

form of literal sensory images. This information is retained in the sensory register for less than one second at which time, if the information is important and thus attended to, it is transferred to short term memory. If the information is not important it is discarded. Short term memory employs two forms of rehearsal to help to retain the information for a longer period of time. Maintenance rehearsal is a process that involves continuous repetition of the material to be remembered. Elaborate rehearsal is a process whereby associations are created between the new information and previously stored information. It is through these rehearsal strategies that information is stored into long term memory. Long term memory has the capacity to store millions of pieces of information that can be retrieved at any one point in time. The distinction between a good and a poor memory stems from an individual's ability to properly rehearse and store information as well as the effectiveness of the individual's retrieval methods.

Prospective Remembering

In addition to retrospective memory, another aspect of memory that has been proposed as important to daily life is prospective memory or remembering to attend to a future task (Meacham and Leiman, 1982; Meacham and Singer, 1977). One component of successful prospective

memory requires that a person cue him/herself to do something at a specific time or in a specific situation. This is often referred to as remembering to remember, or the timing aspect of a memory task. A second component of successful prospective memory is the recall of the specific task to be accomplished. This is often referred to as the content of the task (Cavanaugh, Grady and Perlmutter, 1983) and is primarily retrospective in nature.

Much of our daily lives require prospective remembering. Taking one's medication is a good example of prospective remembering. Remembering when an individual is to take the medication (e.g. with breakfast, one hour after eating, before bed etc.) represents the timing aspect of the remembering task, while remembering which medication and how much medication to take is the content aspect.

Craik (1986) has suggested that prospective memory should be particularly problematic for the elderly because it requires a great deal of self initiation and internal cueing (such as elaborative associations, strategies and categorization). Data have shown deficiences and inefficiencies in older adults' use of internal strategies (Craik, 1977, Reese, 1976 as cited in Schmitt, Murphy and Sanders, 1981). In a laboratory paradigm, for example, Sanders, Murphy, Schmitt and Walsh

(1980) showed that older adults' recall accuracy is substantially lower than younger subjects', and clustering of memories was less efficient. Not only were age differences found in rehearsal but older adults showed little use of categorization (putting items into memory by category) and displayed inadequate study strategies. Results showed that elderly adults have the ability, but, for some reason, fail to spontaneously produce an appropriate strategy in the context of a memory task.

Despite research results such as those by Sanders et al (1980), one must question whether the type of deficits that have been observed actually affect everyday memory. Outside of the laboratory, many elderly people do not have to rely on internal strategies because external cues (personal reminders such as lists or notes on calendars) are readily available. Indeed, research has shown that elderly subjects tend to outperform younger subjects in prospective memory tasks if external cues are permitted (Bennett-Levy and Powell, 1980; Cavanaugh, Grady and Perlmutter, 1983; Dobbs and Rule, 1987; Harris and Wilkins, 1982; Meacham and Singer, 1977; Moscovitch, 1982; Poon and Schaffer, 1982).

In Poon and Schaffer's study (1982) young and old subjects were asked to telephone the experimenter at

prearranged target times over a three week period. The elderly remembered more calls, were closer to the target times and were more consistent than the young subjects. Similar results were found by Moscovitch (1982) who also documented through subsequent interviews that the older subjects relied more on external memory aids.

Einstein and McDaniel (1990) acknowledged the influence that memory aids have on prospective memory and conducted research into the frequency of memory aid use and the use of internal or external cues among young and old subjects on both prospective and retrospective memory tasks. The subjects were presented with a set of words that they were to recall immediately after the set had been presented. At the start of the experiment, subjects were instructed to press a response key on the keyboard in front of them when a particular word was shown (the prospective aspect of the task). The subjects were put into either a memory aid condition, where objects (rubber bands, paper clips, tape, erasers, paper pads, scissors, a stapler, and pens) that were in front of the subject could be used as aids or the no memory aid condition, where the objects, although present, were not allowed to be used. Eighty three per cent of the elderly and 75% of the young subjects in the memory aid condition used some kind of external strategy - in every case a

manipulation of the external environment. The results show that when external reminders are allowed the majority of subjects will use them, although the elderly tend to rely on them somewhat more frequently.

In a study examining uncued prospective memory (Dobbs and Rule, 1987) two prospective memory tasks were given to subjects of five different age groups (30-39, 40-49, 50-59, 60-69, and over 70). At the beginning of the session the subjects were told they must ask for a red pen when instructed to draw a circle and a cube. They were told that no cues or reminders would be given. They were also asked to fill out a questionnaire when they returned home. They were instructed to write the date and time in the upper left corner of the questionnaire. They received these instructions only once. Nearly 100% of the person's in the age range 30-69 successfully completed the pen request. Successful performance of those in the 70+ range fell to 70%.

It can be suggested that successful prospective remembering in everyday activities depends primarily on the use of external cues. As shown by Einstein and McDaniel(1990) elderly people tend to rely on external cues more often than young people. In the absence of using external cues elderly individuals' performance on prospective remembering tasks decreases. It is important

to note, however, that internal cueing and self initiation do contribute to successful prospective memory in that one must remember to refer to the external cue. For example, if one were to make a grocery list prior to going shopping, one would need self initiation to remember to take the list and to refer to it later at the store.

Research on the relationship between prospective and retrospective memory has yielded mixed results. Einstein and McDaniel (1990) found that prospective memory was not related to performance on any of the retrospective memory tasks that they used. This result confirms earlier research by Meacham and Leiman (1982).

In contrast to the above results, Wilkins and Baddeley (1978) have reported an inverse relationship between their prospective and retrospective memory tasks with younger subjects. Wilkins and Baddeley selected two groups of subjects; one with a high score on verbal free recall (the retrospective measure) and one that was poor at the verbal free recall task. Both groups were required to perform a prospective memory task analogous to remembering to take pills. The task required the subject to press a button at regular intervals four times a day. Those with good verbal memory were significantly worse in prospective remembering performance than those with poor

verbal recall. The authors suggest that those subjects with high verbal recall tended to have higher levels of education. It was further inferred, in this study, that a higher level of education leads to a more varied lifestyle, which may be the moderating variable associated with worse prospective remembering.

The foregoing findings suggest that prospective remembering and retrospective memory are two distinguishable aspects of memory and that performance in one does not necessarily predict performance in the other (Pajurkova and Wilkins, 1983). The findings further suggest that tests of both types of memory should be employed in order to fully assess an individual's memory abilities. However, it is unclear at present whether or not a prospective memory test can accurately predict prospective memory in everyday life. Therefore, the predictive validity of prospective memory tests must first be established.

Self-Perception of Memory

One further aspect of memory to be investigated in the present study is an individual's self report of memory. As stated by Chaffin and Herrmann (1983): "Beliefs that people have about their memory abilities are of interest, not just because they may provide information about actual memory abilities, but

because their beliefs, regardless of accuracy, affect behaviour" (pg.18).

Moscovitch (1982) suggests that elderly people are likely to perceive their memory to be poor and therefore, when appropriate, adopt compensatory strategies such as external cues. However, the literature provides contradictory findings between perceived memory performance and actual memory performance. The relationship between the two has been found to be negatively correlated (Dobbs and Rule, 1987; Zelinski, Gilewski, and Thompson, 1980, as cited in Crook and Larrabee, 1990; Wilkins and Baddeley, 1978), positively correlated (Lachman, Steinberg and Trotter, 1987; Bennett-Levy and Powell, 1980; Hermann, 1982; Gilewski and Zelinski, 1986) and uncorrelated (Asch, 1977 as cited in Bennett-Levy and Powell, 1980)). Several suggestions can be made to account for these inconclusive results. The studies cited vary in the populations studied, the tests employed, and the type of analyses conducted. The variability in method and procedure from study to study can lead to remarkably different results, thereby confusing the relationship between perceived memory performance and actual memory performance.In addition, the inconclusive results may suggest that the validity of the self report assessments is questionable.

There are several concerns regarding self report measures of memory. As Rabbitt and Abson (1990) suggest, scores on self report measures may reflect individual differences in confidence and self regard as much as objective influences in cognitive competence. Bennett-Levy and Powell (1980) express concern that self report measures must rely on the layman's definition of memory, which possibly includes all kinds of processes under the label memory such as concentration and intelligence. Most self report measures of memory, however, ask specific questions which allow little room for the test taker to misinterpret the definition of memory. Nisbett and Wilson (1977) suggest that people may have limited access to their own cognitive processes, so that their judgements about their cognitive competence may reflect socially conditioned beliefs about memory and other cognitive functions as much as their personal ability. There is, for example, a widespread assumption in Western culture that cognitive ability, especially memory ability, markedly decrease with old age. Such beliefs may lead individuals to overestimate the amount of their actual decline in function. Finally, it is quite likely that those with poorer memories are more likely to 'forget that they forget' and thus underreport their true memory difficulties (Rabbitt and Abson, 1990).

Despite the reliability and validity problems associated with self report assessments, there have been several attempts to develop a measure that accurately predicts actual memory performance. A strong emphasis has been placed on the need for self report measures because of the potential advantages. Gilewski and Zelinski (1986) suggest three of these such advantages. Firstly, self report measures, as with other memory tests, may be important in detecting early signs of a dementing disorder. Secondly, memory reports may be useful in differentiating dementia and depression. They suggest that there may be minimal or no memory complaints in patients suffering significant memory deficits secondary to dementia, but that complaint of memory change may be magnified in depressive conditions. Finally, self report measures of memory are important because they provide general information on how people view their memory ability in conjunction with aging. The present researcher further suggests that: 1) self report measures can be concise and quickly administered and, 2) the questions generally deal with everyday matters which may provide a more accurate account of true performance.

Summary and Purpose

From the previous discussion it is clear that performance in self medication programs and memory are

likely related. Although studies have suggested memory to be a limiting factor in self medication (Haynes et al, 1979; Harris, 1984; Youngren, 1981; Taylor and Hajek, 1984; Pelletier, 1983; Reibel, 1969; Thompson and Ellenberg, 1987; Newcomer and Anderson, 1974; Buchanan et al, 1972), the relationship and degree of ability necessary for success are not clear.

One purpose of the present research was to determine the predictive validity of a prospective remembering test as compared with traditional retrospective memory tests and self report measures of memory, in the context of a self medication program. The research attempted to discover which aspect or combination of aspects of memory performance are important for a patient's ability to follow a self medication regimen.

An important aspect of the current study is that performance in the self medication program was assessed both with respect to the timing and content aspects of performance, therefore allowing the potential differentiation of factors predictive of both aspects of performance. Three memory tests were employed in the research. The California Verbal Learning Test was used to measure retrospective memory ability. This test involves the learning of a list of sixteen grocery items that can be divided into four categories. The subject is required

to say back as many items as he/she can remember. The Pajurkova-Wilkins Prospective Remembering Test was used to measure prospective remembering ability. This test involves two tasks that are to be performed at predetermined points during the testing session. The subject must ask for a red pencil when asked to draw a clock and later remind the experimenter to make a phone call when the blocks are brought out. The Memory Assessment Clinics Self Report Measure was used to measure an individuals' perception of his/her own memory ability. This test is a questionnaire that requires the subject to answer several questions relating to two main categories: 1) the ability to remember particular actions and, 2) the frequency of occurence of particular memory related actions. As well, two cognitive function measures were included to assess the subjects' general cognitive abilities and their relation to the tasks at hand.

The self cueing and reminding requirements of any self medication program are structurally and conceptually similar to formal prospective memory tasks. It was therefore predicted that the Pajurkova-Wilkins Prospective Remembering Test would be the most predictive measure of success/failure in the program.

It was further predicted that the timing aspect of the Pajurkova-Wilkins Prospective Remembering Test would correlate highly and be very predictive of the timing scores in the self medication program. Similarily, it was believed that the content aspect of the prospective remembering test and the content aspect of the self medication program would correlate strongly and show high predictability.

Identification of reliable predictors of successful self medication would have application in improving the selection process for admission to such a program. Furthermore, an understanding of the relative contribution of the various aspects of memory performance could ultimately lead to programs for intervention or remediation. Finally, the rationale for the inclusion of measures of various aspects of memory was to show how they differentiate from prospective remembering.

METHOD

Subjects

Fifty-two subjects were recruited from the Geriatric Assessment and Rehabilitation Unit (A2) of the Colonel Belcher Hospital, Calgary. This hospital unit was involved in an ongoing investigation of the effectiveness of a Self Medication Program (SMP) at the time of the study. The ongoing study required that subjects were randomly assigned to either an experimental group (these subjects were put on the SMP) or a control group (subjects not put on the SMP). The subjects in the the present study were all those from the experimental group. Two subjects had to be dropped from the study because they were discharged from the hospital in the first few days of the SMP. Another subject was not included because of the onset of new medication problems later in the SMP, and the physician chose to discontinue the patients' participation in the SMP. Thus, from an initial pool of 52 consecutive referrals to the SMP, the total number of subjects included in the final analyses was 49. Thirty-seven subjects were female and twelve were male. The subjects ranged in age from 57 to 97, with a mean age of 78.94 (SD 8.64). The medical diagnosis or reason for admission, as recorded on the admission form, were: cerebral vascular accident (12), fractured hip (7),

hypertension (3), diabetes (3), bowel obstruction (1), post operation rehabilitation (2), cognitive assessment (2), arthritis (4), senile dementia (1), cancer (2), alcohol abuse (1), vertigo (1), depression (2), Parkinson's Disease (1), abdominal pain (3), anxiety (2), chronic obstructive pulmonary disease (1) and dysphasia (1).

Measures

Self Medication Program

The self medication program currently in use by Unit A2 at the Colonel Belcher Hospital employs four stages. At the time of the study, stage one required that the patient ask a nurse, at the appropriate dosing time, for his/her medications by name and strength. The patient was given one hour before being reminded by the nurse. The patient remained in stage one for a period of seven days. At the end of the seven days, if the patient consistently asked for his/her medications correctly (as noted by the nurse at each dosing time), he/she proceeded to stage two.

In stage two the patient received a 24 hour supply of medications in easy access containers. The patient recorded (on a sheet provided by the pharmacist) the time and dosage of each medication taken and further noted any problems or side effects. The nurse checked, 30-45

minutes after the dose was due, whether or not the medications were taken appropriately. The patient progressed to stage three when the pharmacist, physician and nurse were satisfied with the patient's self administration of medication.

Stage three involved the patient being provided with a 3 day supply of medications. The nurse checked the medication quantity daily. The procedure remained the same as stage two. Promotion to stage four depended on successful completion of stage three as determined by the pharmacist, the physician and the nurse.

In stage four the patient received a seven day supply of medication. The procedure continued as in stage two and stage three.

Stage one of the self medication program was the only stage where control of medication distribution remained with the nurse. Due to the large range of functional and cognitive abilities among the patient group only stage one was assessed and scored in the current study.

Stage one of the SMP was scored once a day for seven consecutive days. The morning dosing time was chosen for assessment because most patients took the majority of their medications at that time. The stage one scoring was divided into two main components; timing and content. A

subject received two points for the timing component if they asked for their medication within one half hour of the appropriate dosing time. One point was awarded if the patient asked within one hour and anytime after one hour received zero points.

The content aspect of the program required the patient to request the proper name and the appropriate dosage of his/her medications. A correct response for name could be description by colour, size and/or purpose, either with or without provision of the pharmaceutical name. A correct reponse for dosage included either a description by number of pills or by the prescribed strength. If the subject properly gave both the name and dosage as defined above, they received two points. If the subject provided either the proper name or dosage as described above, they received one point. A failure to provide either the proper type or dosage lead to a score of 0. Therefore, scores for the content aspect of the program ranged from 0 to 2.

The timing and the content scores (both of which were equally possible) for each medication were added together to yield a total possible range of scores of 0 to 4 for each medication. The scores for each medication were summed and then divided by the number of medications the patient was required to take at the morning dosing hour. The average score

for each day was summed over the seven days resulting in a total timing score and a total content score, each having a theoretical range of 0 to 14. The timing and content scores were also added together to provide a total medication score for stage one of the SMP. If the patient was put on stage two of the program before the seven days were concluded, the patient was given full points for the completion of the seven days. Analyses were performed using the separate timing and content aspects of the SMP, as well as the total medication scores.

Prospective Remembering

The Pajurkova-Wilkins Prospective Remembering Test (Pajurkova and Wilkins, 1983) was employed to assess subjects' ability to remember to perform specific requests at a specified time in the future.

The Pajurkova-Wilkins Prospective Remembering Test takes approximately 20 minutes to complete. The initial instructions given to the subject are:

> I want to see how well you can remember to do something without being reminded. Later on I am going to ask you to draw a bicycle. When I ask you to draw a bicycle, I want you to ask for a red pencil to draw the bicycle with. I won't remind you: it is up to you to remember to ask me for the red pencil. Some time later I'll give you some colored blocks and ask you to arrange them to form a design. When we begin that test, in other words, when I bring out those colored blocks, I want you to remind me that I have to make a phone call. Now

> could you please tell me what it is that you have to remember to do?

The subject is then required to repeat the instructions. If the subject is unable to do so, the researcher may repeat them, but, not more than three times. It is important to ensure that the subject understands the instructions and what they have to do. The red pencil is to be kept out of sight of the subject until he/she requests it.

Both the red pencil request and the phone call reminding are scored. Points are allocated for the time and content for each item. For each item, if the subject makes the request at the correct time three points are awarded. If the subject makes a request at an inappropriate time as well as at the right time two points are awarded. If a request is made at an inappropriate time only, one point is awarded. Zero points are given if there is no request made at all.

The content is scored in the following manner. Two points are given for each item if the subject makes the correct request (i.e. asks for a red pencil and reminds the researcher to make a phone call). If the subject makes an error but knows that they need to do something (for example, if they ask for a blue pencil) then they

are given one point. If they do not know what to ask for at all, then zero points are awarded.

While the maximum score possible for each item is 5, separate scores are given for the time and the content elements of each item.

The face validity of the Pajurkova-Wilkins Prospective Remembering Test is strong. The test was developed to validate a frequent complaint by epilepsy patients regarding an inability to remember to do something in the future. As a result, 79 patients, (64 lobectomies and 14 who had surgical treatment of tumours), divided into groups based on the area of the lesion and the extent of hippocampal removal, were tested on the Pajurkova-Wilkins Prospective Remembering Test. A significant difference ($p<.01$) was found between the left temporal large hippocampal removal group and the other groups (Pajurkova and Wilkins, 1983)

The above finding suggests strong construct validity of the test for differentiating groups. A second study investigated prospective remembering impairment among 4 groups: 1) an asymptomatic group (HIV positive), 2) a progressive generalized lymphadonopathy group and AIDS related complex, 3) AIDS patients and, 4) a control group (a combination of HIV negative and Crohn's patients). A significant difference ($p<.05$) was found between the AIDS

patients and the other three groups (Pajurkova, Jason, and Read, 1991). Finally, an elderly memory impaired outpatient group was compared to an elderly control group across two age groups (60-69, 70-81). A significant difference ($p<.001$) was also found between these groups (Pajurkova, Jason, Chuang, and Gill, 1990). These results further support the construct validity of the test.

While the Pajurkova-Wilkins Prospective Remembering Test was not correlated with other memory tests in the original study (Pajurkova and Wilkins, 1983) the Pajurkova-Wilkins Prospective Remembering Test has not been validated with other measures of remembering to remember.

In summary, the Pajurkova-Wilkins Prospective Remembering Test is work in progress. The test evaluates a persons' ability to perform two tasks; 1) to ask the experimenter for a red pencil when instructed to draw a bicycle and, 2) to remind the experimenter to make a phone call when the colored blocks are brought out. Each task is scored on both the timing and content aspects of the task. The maximum score for each task is 5 (maximum of 2 for the content aspect and a maximum of 3 for the timing aspect). The individual aspects of the test as well as the total score are used in the analyses.

Retrospective Memory

The California Verbal Learning Test (CVLT; Delis, Kramer, Kaplan, and Ober, 1983) was used to assess strategies and processes involved in learning and remembering verbal material. The CVLT is an individually administered test that takes approximately 50 minutes to complete.

The CVLT measures recall of word lists (16 words) over a number of trials. The subject is read "Monday's shopping list" (consisting of 16 items that are divided into four categories: spices and herbs, tools, fruits, clothing)) and is asked to say back as many words as they can remember, in any order. The items said by the subject are recorded. The list of items is read to the subject five times. After each reading the subject is instructed to say back as many words as they can remember, including the ones they have already said. After the fifth trial the subject is informed that they are to pretend they are going shopping again on Tuesday. A new list of 16 items (Tuesday's shopping list) is read to the subject. The subject is asked to say back as many items from the Tuesday's shopping list that they can remember. The items are recorded. The subject is then asked to say all the items from the Monday shopping list that they remember. The experimenter then asks the subject to tell her all

the items from the Monday shopping list by the categories asked in the following order; spices and herbs, tools, fruits, and clothing. The test is then stopped for about twenty minutes during which time the experimenter continues with other tasks to prevent the subject from rehearsing the items from the shopping lists. The subject is not informed that after approximately twenty minutes they will be asked to repeat any items they can remember. After the delay, the experimenter asks the subject to tell her all the items they can remember from the Monday shopping list. The subject is reminded that the Monday shopping list was the list that was read to them five times. The subject is then asked by category to recall the items from the Monday shopping list. The experimenter provides the subject with the categories in the following order; clothing, fruits, tools, and spices and herbs. Finally, the experimenter reads to the subject a list of 44 shopping items. The subject is instructed to say "yes" if the item was from the Monday shopping list and "no" if it was not.

Reliability and validity studies (Delis et al, 1983) suggest that the CVLT is a reasonable reflection of ability to remember verbal material. Delis et al (1983) found internal consistency reliability coefficients of .92, .77, .85 for: 1) the trial scores, 2) semantic

categories and, 3) item totals across the 5 trials, respectively.

Test-retest reliability scores (see Table 1) , based on a one year time lapse, are significant for all but one of the items being assessed in the present study.

The validity of the CVLT has been assessed by factor analysis as well as through correlational analyses with scores from the Wechsler Memory Test (Wechsler, 1945). The results of the factor analyses indicate a theoretically meaningful five-factor solution. The results of the correlational analyses suggest that the majority of scores (64%) correlate significantly ($p<.05$) with the Wechsler Memory Test.

Seven scores from the CVLT were used in the analyses: 1) the sum of the correct recall of words across five trials which yielded a possible score range of 0-80, 2) the short delay free recall measure 3) the short delay cued recall measure, 4) the long delay free recall measure, 5) the long delay cued recall measure, all of which yielded a possible score range of 0-16, 6) semantic clustering measure (consecutive recall of words from the same category) yeilded a possible score range of 0-60 and, 7) serial clustering measure (recall of items in the same order as they are presented) yielded a possible score range of 0-75.

TABLE 1

Test-Retest Reliability Scores for the California Verbal Learning Test After a One Year Interval

Variable	r
List A Total Recall	.59**
Short Delay Free Recall	.49*
Short Delay Cued Recall	.66***
Long Delay Free Recall	.64***
Long Delay Cued Recall	.79***
Semantic Cluster	.49*
Serial Cluster	.12

*p<.05

**p<.01

***p<.001

Perceived Memory Ability

The Memory Assessment Clinics Revised Self Rating Scale (MAC-S; Crook and Larrabee, 1990) was employed to assess an individuals' perceived memory ability. The MAC-S is a 45 item self report of memory. The MAC-S is divided into two subscales. The ability subscale consists of 21 items and requires that the individual indicate his/her ability to remember specific types of information (for example, the ability to write letters you intend to write or make phone calls you intend to make). This subscale is reported on a five point Likert scale ranging from very poor (1) to very good (5). The ability subscale yields a possible score range of 0-105. The frequency of occurence subscale consists of 24 items and requires that the individual indicate how often specific memory problems occur (for example, the frequency with which one forgets an appointment that is very important). The scoring is recorded on a five point Likert scale ranging from very often (1) to very rarely (5). The frequency subscale yields a possible score range of 0-120. The two subscales were scored and assessed individually, as well as summed and scored as a total score.

Reliability and validity data (Crook and Larrabee, 1990; Larrabee, West and Crook, 1991; Crook and Larrabee,

in press) suggest that the MAC-S is a reasonable reflection of an individuals' perception of his/her memory. Three week test-retest reliabilities for the ability and the frequency subscales were both .92

The validity of the MAC-S has been assessed by factor analysis as well as through correlational analyses with scores from the Geriatric Depression Scale (Yesavage, Brink, Rose, Lum, Huang, Adey, Leirer, 1983), and actual performance on computer-simulated everyday memory tasks (Larrabee, West & Crook, in press). The results of the factor analyses indicate a theoretically meaningful five-factor solution for both the ability subscale and the frequency subscale (Crook and Larrabee, 1990). All five of the ability factors and all five of the frequency factors correlated significantly ($p<.001$) with the Geriatric Depression Scale (Crook and Larrabee, 1991). Canonical correlation analyses demonstrated that the MAC-S and the computer-simulated memory tasks shared from 27.9% to 29.4% of common variance (Larrabee et al, 1991).

In summary, three scores from the MAC-S are used in the analyses. The ability scores had a possible range of 0-105, the frequency scores had a possible range from 0-120 and the total score was the sum of the above mentioned two scores.

Cognitive Ability

The Mini Mental State Examination (MMSE; Folstein and McHugh, 1975) was employed to test cognitive aspects of mental function.

The test consists of eleven questions that require five to ten minutes to administer. The test is divided into two sections. The first requires verbal responses only and includes items such as orientation to date, place and time, memory and attention. The second section tests ability to name items, ability to follow verbal and written commands, requires the subject to write a sentence and draw a complex polygon. The test is not timed and is scored out of 30.

The test is considered to be a valid and reliable test of cognitive functions (Folstein, Folstein and McHugh, 1975). The test is temporally stable as test-retest analyses have been calculated on 24 hour and 28 day time dalays. The Pearson coefficient for the 24 hour retest was .89 while the Pearson coefficient for the 28 day retest was .98. The MMSE has been found to correlate with the Wechsler Adult Intelligence Scale ($r=.78$, $p<.001$). Finally, it has been shown to differentiate groups (clinical conditions, affective disorder and uncomplicated affective disorder) from one another and from the normal group.

Block Design

The Block Design Test is a nonverbal subtest of the Wechsler Adult Intelligence Scale-Revised (WAIS-R; Wechsler, 1981). The Block Design task measures an individuals' visuo-spatial and constructional ability.

The Block Design test uses four to nine identical red and white blocks. Two sides of each block are red, two sides are white and two sides are half red and half white. The subject is shown a picture of a red and white design and is asked to make the same design with the blocks as that in the picture. The subject is allowed one minute for the first five pictures and two minutes for the sixth. Each design is scored on a pass/fail basis.

The Block Design task used in the present research was a slightly modified version of the original form. The original form awards bonus points to those subjects capable of completing each design at a fast rate. The modified version of the Block Design was used to accomodate a research protocol going on at the hospital at the time of testing. The modified version has not been validated, however the reliability and validity coefficients of the original form are provided.

The Block Design test has been found to be reliable (Wechsler, 1981). The slit-half reliability coefficient for the Block Design task was .87. Test-retest

coefficients have been obtained for two age groups with a time delay of 2 to 7 weeks. The coefficient for the 25 to 34 age group was .91 while the coefficient for the 45 to 54 age group was .80.

The Block Design task elicited one total score with a range of 0 to 22.

Procedure

Subjects for the present study were selected from an ongoing study investigating the effectiveness of the SMP, which involved random assignment of subjects to either a control group or an experimental group. Those in the experimental group were started on stage one of the SMP. A sheet was posted to inform the researcher of those subjects that were continuously being selected for initiation into stage one.

Once the subject had been chosen to initiate stage one, the pharmacist explained the SMP to the subject. The pharmacist counseled the patient about his/her medications. This included each drug's name, purpose, dose, special administration instructions, storage requirements and common side effects. This information was reinforced with a medication schedule provided to each subject. Subjects were asked to request the medications from either a nurse or at the nursing station

at the appropriate dosing time. The subjects were instructed to ask by name and dose. The subject was given one hour before being reminded by the nurse. The nurse and/or researcher recorded if the subject correctly asked by name and dose for his/her medication and the time at which the request was made. This procedure was followed for a period of seven days.

Once the self medication program had been explained by the pharmacist and the pharmacist obtained permission from the patient to continue, the researcher contacted the subjects. The researcher explained the project further to the subject and provided each subject with a consent form for their signature. The subject was then given the instructions for the Pajurkova-Wilkins Prospective Remembering Test. The researcher continued with the first five trials and the short delay free recall of the California Verbal Learning Test. Following this, the subject was asked to draw a bicycle. The researcher marked down the time at which the subject was asked to draw a bicycle. If the subject asked for the red pencil the time was noted. The subject was then given the Memory Assessment Clinics' Self Assessment of Memory Questionnaire. Upon completion of the questionnaire, the researcher conducted a shortened version of the Block Design task. The time at which the blocks were brought

out and the time at which the patient mentioned the phone call were recorded. The long delay recall of the California Verbal Learning Test was then administered. Upon completion of this test the researcher asked the subject if he/she used any strategies in remembering the red pencil and the phone call tasks. Responses were noted. The testing session took approximately one hour. Subjects were thanked for their participation and excused.

RESULTS

Descriptive Statistics

The descriptive statistics for the sample are presented in Table 2. Years of education ranged from 1 to 16 with a mean of 9.99 (SD 3.45). The number of medications the patients were on during stage one of the program ranged from 1 to 7 with a mean of 3.86 (SD 1.73). All subjects had been on medication prior to admission to the unit.

Scores on the timing aspect of the program ranged from the lowest possible score (0) to the highest possible score (14) with a mean of 9.23 (SD 5.16). The scores on the content aspect of the program also ranged from 0 to 14 with a mean of 8.33 (SD 5.44). The total scores on the program ranged from 0 to 28 with a mean of

Table 2

Descriptive Statistics for the Sample

Variable	Mean	Standard Deviation	Range Minimum	Range Maximum
Age	78.94	8.64	57	97
Education	9.98	3.45	1	16
Number of Medications	3.86	1.73	1	7
Medication Total	17.56	10.20	0	28
Medication Content	8.33	5.44	0	14
Mini Mental State	24.98	3.59	9	29
Block Design	13.80	8.52	0	22
Total Trials	28.12	14.17	0	61
Long Delay Free Recall	5.63	3.14	0	13
Long Delay Cued Recall	6.92	3.53	0	14
Short Delay Free Recall	5.02	3.06	0	13
Short Delay Cued Recall	6.12	3.24	0	14
Semantic Cluster	6.08	7.25	0	22
Serial Cluster	5.47	5.67	0	24
Prospective Timing	2.27	2.62	0	6
Prospective Content	1.63	1.89	0	4
MAC-S Ability	77.96	12.10	43	102
MAC-S Frequency	86.02	12.41	58	114
MAC-S Total	173.22	24.21	109	214

17.56 (SD 10.2). Eleven subjects received a total score on the program of eight or less. Six of these subjects were stroke patients, and the others were in hospital for cognitive assessment, vertigo, bowel obstruction, diabetes and a hip fracture.

Correlations

Correlations among the variables are presented in Appendix A. Performance in the program correlated significantly with all the variables. The smallest correlation of total performance in the program was with total self assessment score ($r=0.44$, $p<.001$) and the highest correlation was with block design ($r=.80$, $p<.001$). Almost all of the variables were highly correlated with each other, as 146 out of 153 correlations were statistically significant. These results suggest an underlying common factor may have been be present in each test used in the research, a point which is discussed further.

Regression Analysis

The planned set of stepdown regression analysis was performed to assess the unique contributions of scores of prospective remembering, retrospective memory, self report measures of memory, cognitive ability and Block

Design to the timing and content aspects of self medication at stage one of the self medication program.

Table 3 contains the statistical information for the regression analysis when all the above mentioned variables were regressed on the total stage one self medication score. Seventy-seven per cent of the variance in the medication total scores was accounted for by three predictor variables: block design, short delay cued recall and cognitive ability.

The extremely high correlations between the timing and the content aspects of the self medication program ($r=.96$, $p<.001$) suggest that the same mental processes are involved in remembering not only when to perform an act, but also, what is to be performed. Despite these high correlations, a significant difference was found in terms of the scores obtained $t(48)=2.18$, $p<.05$. Therefore seperate regression analyses were performed to investigate if the dependent variables related differentially to the predictor variables. Tables 4 and 5 present the statistical information for these analyses. Using stepwise regression, 64.1 per cent of the variability in the timing aspect of the self medication program was accounted for by knowing subjects' scores on block design, short delay cued recall, and cognitive ability as measured by the Mini Mental State Exam.

Table 3

Stepwise Regression Analysis on Medication Total Score

Variable Entered	Multiple R	R Sq.	F
1. Block Design	.80	.64	82.79***
2. Short Delay Cued Recall	.86	.74	67.07***
3. Mini Mental State	.88	.77	50.55***

***p<.001

Table 4

Stepwise Regression Analysis on Medication Timing Score

Variables Entered	Multiple R	R Sq.	F
1. Block Design	.73	.53	52.84***
2. Short Delay Cued Recall	.78	.60	35.04***
3. Mini Mental State	.80	.64	26.79***

***p<.001

Table 5

Stepwise Regression Analysis on Medication Content Score

Variables Entered	Multiple R	R Sq.	F
1. Long Delay Cued Recall	.83	.68	100.38***
2. Block Design	.89	.79	86.18***
3. MAC-S Ability	.90	.81	65.17***

***p<.001

Eighty-one percent of the variability in the content aspect of the self medication program was accounted for by knowing subjects scores on long delay cued recall, block design and the ability aspect of the self assessment measure.

Factor Analysis

Due to the earlier mentioned high correlations between all the variables, factor analyses were performed to investigate the number of factors underlying subjects'memory. The resulting factors were then used in a second set of regression analyses.

Principal factors extraction with varimax rotation was performed with the scores of the 14 predictor variables. The rotated factor analysis, as shown in Table 6, clearly defined two major factors, both in terms of the criterion of an eigenvalue greater than 1.0 and a scree plot of the factors' eigenvalues (Cliff, 1987). Factor I accounted for 65.3% of the variance (eigenvalue 9.15) and included the variables from the Pajurkova-Wilkins Prospective Remembering Test, the California Verbal Learning Test, the Mini Mental Status Examination, and the Block Design. This factor was labelled Cognitive Disability and suggests some general cognitive impairment. Factor II accounted for 14.6% of the variance (eigenvalue 2.04) and was comprised of the

Table 6

Principle Factor Analysis with the Predictor Variables

Variables	Factor I	Factor II
Long Delay Cued Recall	.96	-.02
Total Trials	.94	-.09
Short Delay Cued Recall	.92	-.06
Long Delay Free Recall	.91	.03
Short Delay Free Recall	.89	-.21
Semantic Cluster	.88	-.07
Prospective Timing	.82	-.38
Serial Cluster	.81	-.27
Prospective Content	.81	-.45
Block Design	.80	.14
Mini Mental State	.72	-.09
MAC-S Total	.52	.78
MAC-S Frequency	.58	.71
MAC-S Ability	.62	.65
Percent of Variance	65.3	14.6

items from the self assessment of memory questionnaire. This factor was labelled Self Perception of Memory. Block Design was weighted relatively high on Factor II as well as Factor I.

The second set of stepdown regression analyses were performed to assess the contribution of the two factor scores on SMP scores. Table 7 contains the statistical information when the factor scores are regressed on the medication total score. Sixty nine per cent of the variance in the medication total score was accounted for by the first factor score, while the second did not contribute significantly to the prediction equation. Tables 8 and 9 show the statistical information when the factors are regressed on the timing and content aspects of the medication scores. The first factor was again the only significant variable, and accounted for 54.48 per cent of the variance in the timing aspect of the medication scores and 73.1 per cent of the variance in the content aspect of the medication scores.

Discriminators of Program Advancement

Two discriminant function analyses were performed to determine if the predictor variables could successfully discriminate between those subjects who advanced to Stage 2 of the self medication program and those subjects who did not. The first discriminant function analysis was

Table 7

Stepwise Regression Analysis of the Cognitive Disability Factor and the Self Perception of Memory Factor on Medication Total Score

Variable Entered	Multiple R	R Sq.	F
Cognitive Disability	.83	.69	50.61***

***p<.001

Table 8

Stepwise Regression Analysis of the Cognitive Disability Factor and the Self Perception of Memory Factor on Medication Timing Score

Variable Entered	Multiple R	R Sq.	F
Cognitive Disability	.74	.54	27.52***

***p<.001

Table 9

Stepwise Regression Analysis of the Cognitive Disability Factor and the Self Perception of Memory Factor on Medication Content Score

Variables Entered	Multiple R	R Sq.	F
Cognitive Disability	.86	.73	62.49***

***p<.001

performed using the self medication timing and content scores as predictors of membership in 2 groups; 1) advanced to stage 2 of the self medication program and, 2) not advance. As shown in Table 10, the mean scores of the self medication timing and content measures are significantly higher for those who were advanced to stage 2 than those who were not advanced. The discriminant function was significant x (1)=42.35, p<.001. The discriminant function coefficients for the self medication timing and the self medication content were able to clearly discriminate the two groups, as 84.4% of those advanced to stage 2 of the program and 88.2% of those not advanced were correctly classified.

The second discriminant function analysis was performed using the measures from the Pajurkova-Wilkins Prospective Remembering Test, the California Verbal Learning Test, the Memory Assessment Clinic's Self Assessment Measure of Memory, the Block Design and the Mini Mental State Examination as predictors. As shown in Table 11, the mean scores of the predictor variables are significantly higher for those in group 1 (those advanced to stage 2) than those in group 2 (those not advanced). The discriminant function was significant x(1)=69.61 (p<.001). The discriminant function coefficients (see Table 11) were able to clearly discriminate the two

Table 10

Discriminant Analysis of Program Advancement Using Medication Timing and Content Scores as Predictors

	Advanced		Not Advanced			Discriminant Function
	Mean	Standard	Mean	Standard	F	Coefficient
Medication Timing	11.84	3.23	4.31	4.49	45.66***	.24
Medication Content	11.35	3.27	2.64	3.90	68.83***	.82

***p<.001

Table 11

Discriminant Function Analysis Using the Memory Test Scores, Block Design and Mini Mental State as Predictors

	Advanced		Not Advanced			
	Mean	Standard Deviation	Mean	Standard Deviation	F	Discriminant Function Coefficient
Total Trials	35.44	11.38	14.35	6.59	49.27	.11
Long Delay Cued Recall	8.66	2.90	3.65	1.90	41.03	-.50
Long Delay Free Recall	7.13	2.66	2.82	1.59	37.14	.68
Short Delay Cued Recall	7.59	2.87	3.35	1.73	30.91	.27
Short Delay Free Recall	6.31	2.79	2.59	1.84	24.53	-.22
Semantic Cluster	8.91	7.52	.76	1.39	19.39	-.43
Serial Cluster	7.94	5.15	.82	1.59	26.88	.48
Prospective Timing	3.47	2.15	0.00	0.00	32.04	.37
Prospective Content	2.50	1.81	0.00	0.00	31.97	-.25
Block Design	19.19	3.00	3.65	5.71	157.37	.85
Mini Mental State	26.75	1.76	21.65	3.81	41.44	.10
MAC-S Abilitty	81.78	9.76	70.76	13.03	11.15	-.62
MAC-S Frequency	90.62	11.32	77.35	9.58	16.90	.11
MAC-S Total	181.50	21.86	157.65	20.92	13.61	.45

a. $p<.001$

groups. On the basis of the discriminant finding 100% of those in group 1 and 94.1% of those in group 2 were correctly classified. Of particular note is the performance on the Pajurkova-Wilkins Prospective Remembering Test. Every patient that was not advanced into stage two of the program received a score of zero on both the timing and content aspects of the self medication program

DISCUSSION

Summary of Results

The present study was designed to investigate the predictive validity of various aspects of memory and cognitive ability that result in success or failure in a self medication program. Three specific aspects of memory were tested among elderly subjects involved in a self medication program: prospective remembering, retrospective memory and self assessment of memory. The results of the investigation are reviewed followed by an overview of the limitations of the study and suggestions for future research.

It was hypothesized that, due to the structural and conceptual similarities between the self medication program and the Pajurkova-Wilkins Prospective Remembering Test, the Pajurkova-Wilkins Prospective Remembering Test

would be the most predictive test of performance in the program. The findings of the present research were that, while several of the variables contributed significantly as predictors of the total self medication score, the Block Design was the strongest.

There are several possible explanations for the finding that Block Design, rather than the prospective remembering test, best predicted program performance. Firstly, it should be noted that the Pajurkova-Wilkins Prospective Remembering Test was not designed as a psychometric test of memory ability in a general elderly population; rather, it was developed to validate a statement elicited by frequent complaints of forgetting to remember by young epileptic patients with focal cerebral lesions. The Block Design, on the other hand, is a more global impairment test designed and validated for assessment of a varied population. Secondly, the prospective remembering test is still in it's initial stages of development, whereas Block Design has already been revised and validated several times. Thirdly, the prospective remembering test is rather limited, in that it involves only two tasks while the Block Design has six tasks. The difference in the number of tasks for each test could allow for a larger range and more variability in scores.

Stepwise regression analysis is considered to be a controversial procedure because the order of entry of the variables is based solely on statistical criteria. "Minor differences in these statistics can have profound effect on the apparent importance of an independent variable" (Tabachnick and Fidell, 1989). In particular, both the Block Design and the Pajurkova-Wilkins Prospective Remembering scores correlated strongly with the self medication scores, although the latter correlated less strongly. Stepwise regression analyses makes the choice between the independent variables for the first entry based on which of the independent variables has the higher correlation with the dependent variable. Therefore, because Block Design had a slightly higher correlation than the other variables, it was entered in the equation first and contributed the largest amount of variance in the self medication scores. Once Block Design had been entered in the equation, it carried with it any overlap (which the high intercorrelations suggest to be large) with the other independent variables resulting in the other independent, variables not being allowed to contribute significantly to the equation.

Although the original hypothesis was not confirmed, it is suggested that the present findings are partly a result of the limitations of the regression procedure. No

other theoretical explanation is provided for the high predictability of the Block Design test. Furhter regression analyses were performed with all the variables except the Block Design. While some shrinkage in total variance accounted for was observed, the predictor variables for both the timing and content aspects of the program did not change.

The results of the regression analyses with the timing and content aspects of the SMP indicated that more of the variance was accounted for in the content aspect (81.0%) than in the timing aspect (64.1%). Such results are not surprising considering that the tests employed were predominately content oriented. Only the Pajurkova-Wilkins Prospective Remembering Test involves a calculable timing score. The California Verbal Learning Test, the Mini Mental Status Examination and the Memory Assessment Clinics Self Assessment Questionnaire do not have a timing component, and while the Block Design does require a time restriction a separate timing score is not computed on that measure.

As noted in the introduction Craik (1986) suggested that prospective remembering should be particularly problematic for the elderly due to the requirements for self-initiation and internal cueing. This would suggest that scores on a timing aspect of a task would be lower

than scores on the content aspect due to the self initiation and self cueing required to first remember when to take the medication. The timing aspect itself, should then act as a cue to the content aspect. The results of the current research, however, found subjects to perform better on the timing component than the content component.

Two suggestions are provided for the better performance on the timing component. Firstly, this result may be due to the fact that all the subjects included in the study were on medication prior to admission to the hospital. It is suggested that the patients already were accustomed to taking medications at particular hours during the day. This type of routine would change very little in hospital. However, while in hospital it is likely that the number, dose and type of medication would change, therefore requiring a patient to learn new information to successfully complete the content aspect of the SMP. According to Babbins (1988), older adults have difficulty in reasoning primarily when they must both store and manipulate new information, but that reasoning, in situations that permits inferences based on previous knowledge does not change with age. Secondly, according to Ribot's Law (1986), information is forgotten in the reverse order from which it was acquired.

Therefore, new information concerning the content aspect of medication taking (i.e. name, dose) is likely more easily forgotten.

The results of the literature review found the relationship between retrospective memory and prospective remembering to be inconclusive. While Einstein and McDaniel (1990) have found no relationship between the two aspects of memory, Wilkins and Baddeley (1978) have found an inverse relationship. The results of the present study have found retrospective memory and prospective remembering to be positively correlated ($p<.001$).

The results of the regression analyses support the notion that retrospective memory tasks aid in the prediction of performance in prospective remembering tasks. In each of the above cases (medication total, medication timing and medication content) the retrospective scores that were entered into the regression equations were the delayed recall scores. It must be pointed out that the ability to self administer medications at the proper time is similar to a delayed cued recall task. The delays are found from one dosing hour to the next. As well, several cues (such as the presence of a meal, the time of the day) are readily available to the individual.

The ability aspect of the self assessment measure of memory contributed significantly to the total variance

accounted for in the medication content score. It is suggested that one's ability to remember to perform an act is content oriented and therefore, if ones' perceptions about memory ability are accurate, then those perceptions should correlate with at least the content aspect of actual memory performance. The content aspect of actual memory performance and the ability measure of the self assessment questionnaire were significantly correlated ($p<.001$).

As noted in the introduction, the relationship between perceived memory ability and actual memory performance has been inconclusive. While the present study found a positive correlation, thereby confirming several studies (Lachman et al, 1987; Bennett-Levy and Powell, 1980; Hermann, 1982; Gilewski and Zelinski, 1986), other studies have found both a negative correlation (Dobbs and Rule, 1987; Zelinski et al, 1980 as cited in Crook and Larrabee, 1990; Wilkins and Baddeley, 1978) and no correlation (Asch, 1977 as cited in Bennett-Levy and Powell, 1980). The frequency of such varying results urges future research to focus on the various self assessment measures and their relationship to actual memory performance.

One of the purposes of the present study was to discriminate those patients capable of advancing to stage 2 of the program from those patients incapable of advancment. The results of the discriminant analyses indicate that the

combination of tests employed were successful at differentiating between advancement and no advancement with a high accuracy rate. The overall accuracy rate of the self medication timing and content scores from stage one of the program was 85.71%, while the overall accuracy rate of the combination of the testing battery employed was 97.96%. These results suggest that the subjective decisions made by the health care professionals regarding advancement into stage 2 of the SMP are accurate according to the clinical results obtained by the tests employed in the present study. It is suggested that the predictor variables alone would prove to be an accurate determinant of entry into the program. Logical followup research should involve a cross validation study of the above measures.

Limitations and Future Research Directions

Research conducted in any applied setting necessarily has limitations. In this section specific limitations of the current research, as well as methodological issues for this research area in general are discussed.

One possible limitation of the current research was the early developmental state of the Pajurkova-Wilkins Prospective Remembering Test. Although research utilizing the test is limited (Pajurkova-Wilkins, 1983; Pajurkova, personal communication, 1991) the results of these studies show the tests ability to discriminate groups of people

based on different diagnoses. The present research has confirmed the tests' ability to differentiate those patients capable of continuing into stage two of the program versus those functionally and/or cognitively incapable of continuation. Therefore, while the newness of the test is not a concern in the present study, future revisions and validations of the test are suggested. It should further be noted that the present research is the first predictive study using the Pajurkova-Wilkins Prospective Remembering Test and that future research directions should, therefore, incorporate the test in predictive studies of a similar nature.

For practical and ethical reasons, only stage one of the SMP was chosen for the study. The strong results regarding success/failure in stage one and the high predictability by the predictor variables of advancement to stage two of the SMP suggest the possibility of generalizing the results to the other stages of the program. However, it is acknowledged that the responsibilities associated with each stage of the program do differ and therefore, one must be careful in drawing conclusions based on such generalizations.

One potential limitation of the study was that the method of scoring the timing and content aspects of the program could have resulted in a disadvantage to those

subjects on a larger number of medications. Several factors suggest that this issue was not, however, problematic. In the first instance, the timing and content scores were computed based upon the average rather than total number of medications. Second, correlations among the number of medications and the performance tasks were not significant. Finally, the mean number of medications in the present study (3.86) is less than the average of 5 as described by Kendricke and Bayne (1982), implying less dysfunction. It is suggested that this lower amount of total medication is primarily due to an increasingly conscious effort of health professionals to reduce the daily medication intake by the elderly.

In addition to numbers of medications, the differences among subjects in medication types and dosages remain a potential confound. In the present study the variety of medication types and doses varied within the sample. Due to the relatively small numbers of subjects, coupled with the wide range of medication types used by the subjects, no appropriate statistical techniques existed to analyse the effect of drug types. Future research should, therefore, attempt to equate the medication type and dose across the sample used.

Attempts were made to make the study as naturalistic as possible, but issues of ecological validity remain. The SMP

and memory were assessed in the hospital. It is difficult to know how similar the thoughts and actions were to those that people have in their own homes. For example, a potential problem with studying memory in the laboratory is that demand characteristics could lead subjects to constantly think about the memory task, thereby producing an unrealistic memory situation.

When interpreting any study the generalizability of the research must always be considered. While the uneven ratio of men to women (12:37) must be noted, it is suggested that this ratio results from the lower life expectancy for males and mirrors somewhat the population ratio of men to women in this age group. In 1978 the ratio of men to women in the 65 to 74 age group was 3:4, the 75 to 84 age group was 3:5 and the 85 and over age group was 1:2 (Ward, 1984).

It is sometimes found that people remember a task but may refuse to act for their own good reasons (Wilkins and Baddeley, 1980). In the current research it is possible that subjects did not comply because they did not want to. For example, a hip fracture patient may prefer to avoid the pain and discomfort of getting out of bed to go to the nurses station to request medications. Instead, they may just wait until the nurse brings the medication to them. Sinnott (1985) has suggested that discriminating between remembering

and compliance is extremely difficult and may bias results. However, it should be noted that the strong results in the current study indicate that noncompliance for other reasons is not present and is not considered a serious issue in the present study.

One of the limitations of the current study was the fact that, due to the small number of patients with unique diagnoses, it was not possible to assess the effect of diagnostic conditions upon performance in the SMP. Future research should increase the number of subjects to allow grouping according to diagnoses. Pelletier (1983) found the most difficult group to teach a medication regimen to were those who had suffered a cerebral vascular accident. This suggests that certain medical disabilities may affect memory and ability to succeed/fail in a SMP. If this is found to be true a physician would be able to refer to the diagnosis of the patient to aid in the sometimes difficult decision as to whether a patient should be started on the SMP or not.

As discussed earlier, only the Pajurkova-Wilkins Prospective Remembering Test included a timing score that was analyzed. Timing is not only very important to prospective remembering (remembering to do something in the future) but it is also the primary distinguisher between retrospective and prospective remembering. In the present study the correlation between the timing and content aspects

of the Pajurkova-Wilkins Prospective Remembering Test was .96. It is suggested that further research not only incorporate more timing oriented tasks but also design new tests that better differentiate between timing and content.

It would be interesting to replicate the present study using different prospective and retrospective memory tests to confirm the results are a function of the type of memory process required to succeed/fail in the SMP and not the reliability and validity of the individual tests.

As mentioned in the limitations, compliance plays a large role in one's ability to self administer one's medication. There are several reasons for noncompliance as described by Fincham (1988): memory, social isolation, inadequate knowledge and understanding, impairment of vision, hearing and dexterity, greater susceptibility to adverse effects and complicated chronic therapy. Youngren (1981) further suggests that cost, physician-patient tension, and patient discouragement contribute to elderly people not complying to take their medication.

A future study should therefore, assess these causes of noncompliance by including them as additional independent variables. A compliance questionnaire might also be added to the testing battery. The compliance questionnaire should be given before the start of the SMP, after the SMP and sometime after the patient has been discharged home. These

questionnaires should be compared to subjects who were tested at the same times but were not enrolled in the SMP.

Concluding Remarks

Despite the undisputed advantage for improved health, medication administration among the elderly continues to be a grave concern. Many elderly people do not properly adhere to their medication regimen and, as a result, develop complications that may even result in hospitalization. It is, therefore, the goal of many health care facilities to teach the elderly proper administration of medications while in hospital allowing for safe return to independent living.

While several reasons for medication noncompliance have been discussed, the most frequently occuring reason for noncompliance is the individuals' ability to remember the medication. Hospitals are now, through self medication programs, putting a larger emphasis on teaching people about their medication regimen.

The present research has focused on different aspects of memory as predictors of success/failure in such a program. Success/ failure in stage one of the self medication program has been predicted with a high accuracy rate (64% to 81%) using a combination of cognitive tests and procedures. Future research is required to further advance this relatively new, yet increasingly important, area of health care research.

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Appendix A

Correlations of the Predictor Variables

	Medication Timing	Medication Content	Medication Total	Program Continuation	Mini Mental State	Block Designs
Medication Timing	-					
Medication Content	.85***	-				
Medication Total	.97***	.96***	-			
Program Continuation	-.70***	-.77***	-.77***	-		
Mini Mental State	.70***	.72***	.74***	-.68***	-	
Block Design	.73***	.81***	.80***	-.88***	.70***	-
Total Trials	.71***	.81***	.79***	-.71***	.70***	.74***
Long Delay Free Recall	.60***	.75***	.70***	-.66***	.63***	.64***
Long Delay Cued Recall	.64***	.83***	.77***	-.68***	.65***	.70***
Short Delay Free Recall	.61***	.70***	.68***	-.59***	.59***	.57***
Short Delay Cued Recall	.67***	.78***	.76***	-.63***	.61***	.63***
Semantic Cluster	.53***	.66***	.62***	-.54***	.49***	.57***
Serial Cluster	.55***	.68***	.64***	-.60***	.52***	.59***
Prospective Timing	.64***	.71***	.71***	-.64***	.59***	.65***
Prospective Content	.63***	.71***	.70***	-.64***	.62***	.66***
Prospective Total	.65***	.72***	.71***	-.64***	.61***	.66***
MAC-S Ability	.42**	.42***	.44***	-.44***	.33*	.55***
MAC-S Frequency	.45***	.51***	.50***	-.51***	.36*	.55***
MAC-S Total	.42**	.43***	.44***	-.47***	.30*	.52***

* $p < .05$
** $p < .01$
*** $p < .001$

Appendix A

Correlations of the Predictor Variables

	Total Trials	Long Delay Free Recall	Long Delay Cued Recall	Short Delay Free Recall	Short Delay Cued Recall	Semantic Cluster
Medication Timing						
Medication Content						
Medication Total						
Program Continuation						
Mini Mental State						
Block Design						
Total Trials	-					
Long Delay Free Recall	.87***	-				
Long Delay Cued Recall	.90***	.93***	-			
Short Delay Free Recall	.87***	.90***	.88***	-		
Short Delay Cued Recall	.87***	.85***	.93***	.90***	-	
Semantic Cluster	.81***	.76***	.82***	.79***	.81***	-
Serial Cluster	.75***	.69***	.78***	.72***	.70***	.80***
Prospective Timing	.75***	.62***	.73***	.71***	.74***	.72***
Prospective Content	.76***	.61***	.73***	.71***	.71***	.73***
Prospective Total	.77***	.62***	.74***	.72***	.73***	.73***
MAC-S Ability	.53***	.57***	.57***	.41**	.51***	.49***
MAC-S Frequency	.45*	.52***	.51***	.33**	.50***	.57***
MAC-S Total	.41**	.44***	.47***	.28*	.41***	.39**

* p <.05
** p <.01
*** p <.001

Appendix A

Correlations of the Predictor Variables

	Serial Cluster	Prospective Timing	Prospective Content	Prospective Total	MAC-S Ability	MAC-S Frequency
Medication Timing						
Medication Content						
Medication Total						
Program Continuation						
Mini Mental State						
Block Design						
Total Trials						
Long Delay Free Recall						
Long Delay Cued Recall						
Short Delay Free Recall						
Short Delay Cued Recall						
Semantic Cluster						
Serial Cluster	-					
Prospective Timing	.73***	-				
Prospective Content	.75***	.96***	-			
Prospective Total	.73***	.99***	.99***	-		
MAC-S Ability	.37**	.28*	n.s.	.25*	-	
MAC-S Frequency	.27*	.25*	n.s.	n.s.	.72***	-
MAC-S Total	n.s.	n.s.	n.s.	n.s.	.79***	.84***

* p <.05
** p <.01
*** p <.001