UNIVERSITY OF ALBERTA

AGE DIFFERENCES IN PRESCRIPTION SCHEDULING AND RECALL AS INFLUENCED BY SCHEMA DEVELOPMENT

BY

MARJORIE C. ANDERSON

A Thesis

Submitted to the Faculty of Graduate Studies and Research in

partial fulfillment of the requirement for the degree of

DOCTOR OF PHILOSOPHY

DEPARTMENT OF PSYCHOLOGY

Edmonton, Alberta

FALL, 1993

ISBN 0-315-88407-X

UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR Marjorie C. Anderson

TITLE OF THESIS Age Differences in Prescription Scheduling and Recall as Influenced by Schema Development.

DEGREE FOR WHICH THESIS WAS PRESENTED Doctor of Philosophy

YEAR THIS DEGREE GRANTED Fall, 1993

(SIGNED) Marjorie C. Anderson

PERMANENT ADDRESS:
10964 - 109 Street
Edmonton, AB, T6H 2G6

DATED : August 25, 1993

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommended to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled AGE DIFFERENCES IN PRESCRIPTION SCHEDULING AND RECALL AS INFLUENCED BY SCHEMA DEVELOPMENT submitted by MARJORIE C. ANDERSON in partial fulfilment of the requirements for the degree of DOCTOR OF PHILOSOPHY in PSYCHOLOGY.

Allen R. Dobbs

Dr. Allen R. Dobbs (Supervisor)

Jeffrey Bisanz

Dr. Jeffrey Bisanz (Chairman)

Gay L. Bisanz

Dr. Gay L. Bisanz

Peter Dixon

Dr. Peter Dixon

Anne Neufeld

Dr. Anne Neufeld

Jeffrey Bisanz

Dr. Roger A. Dixon (External)

Date: 2 June 1993

ABSTRACT

The study's primary objective was improving memory for, and interpretation of, prescription information through schema development. In Experiment 1, 62 undergraduate students (M age = 19.5 years) were given a questionnaire to demonstrate their competence in interpreting common medication prescriptions. There was no correlation between medication experience and response accuracy on the questionnaire. Questionnaire data showed that these young adults held a poorly developed schematic structure for managing prescription medications.

In Experiment 2, a learning module of concepts generic to managing medications was presented to 54 young (M age = 20.3 years) and 54 older (M age = 71.7 years) adults before or after (or not at all) listening to prescription information for three medicines. Given the overall quality of responding to module verification questions, the assumption was made that in the module first condition, an instantiated schema for managing medication had been acquired, which would increase the efficiency of prescription information processing. It was anticipated both groups, but especially the older adults, with possible age-related deficits in working memory capacity, would significantly improve recall of prescription information when the medication management schema was available to aid processing.

There was no effect of the manipulation on delayed recall of prescription information or accuracy in forming 24 hour schedules for the three medicines. The young adults recalled more prescription information and made more accurate schedules than did the older adults. Working memory capacity, as measured by listening span and auditory working memory tasks, showed age-related differences favouring the young adults. Listening span was the better predictor of performance, on medication recall and prescription scheduling, suggesting that the storage component of working memory, rather than processing agility, was of greater importance to both tasks.

Schema theory suggests that participants had formed mental models of the learning module enabling immediate recall of module concepts. Learning conditions appeared insufficient to support schema instantiation and substantive global schema development for managing medications. Trends in the data showed instances in which

young adults seemed to benefit from medication module acquisition and provided encouragement for future exploration. Discussion for future research suggests learning conditions under which schematic structure development for medication management would be more lasting.

ACKNOWLEDGEMENTS

To begin, I would like to sincerely thank my supervisor Allen Dobbs for his unfailing support while I was a graduate student within the Department of Psychology. His creative thinking was a consistent source of intellectual stimulation and his constructive criticism was insightful and served to motivate the search for deeper understanding.

Peter Dixon and Gay Bisanz are to be particularly thanked for their thoughtful comments on the dissertation at critical points in its conception and production. Their comments frequently suggested reconceptualization and a deeper search into the data for explanation. The final product is better for their motivating forces.

I should also like to thank Jeff Bisanz for acting as both chair and as a member of the examining committee. Both roles were performed admirably and were supportive of the candidate. Anne Neufeld and Roger Dixon are also to be thanked for their instructive comments on the dissertation and their stimulating questions.

Without the understanding support of my family; father, sisters, brothers and their families, the long process of obtaining this degree would have been even more arduous. For similar reasons, my fellow graduate students in psychology and my colleagues in nursing are to be extended heartfelt thanks. In particular, Robert Heller is to be thanked for his understandable instructions on statistical programming as is Barbara Reeves for her faith that I would complete this work. The nursing "All But Dissertation" group deserves a special thank you for their ever supportive consultation.

Officially, I must thank the Medical Research Council of Canada for granting me a Studentship award. The monies made available to me over the two year period of the award were invaluable to the rate of my progress through the course of study and to my financial peace of mind.

Finally, I would like thank Brendon Gail Rule for her support in the initial phases of my course of study within the Department of Psychology. Her untimely death in February, 1991, was deeply felt by myself and many other students, colleagues, family, and friends.

TABLE OF CONTENTS

INTRODUCTION 1
Aging and Schematic Knowledge Processing 3
Schema Theory 4
Study Paradigm 9

INTRODUCTION TO EXPERIMENT 1 12
Method 13
Participants 13
Materials 13
Procedure 15
Results 16
Medication Experience and General Understanding (Section A) 16
Importance Ratings (Sections B & C) 18
Responding to Medication Management Questions (Section C) 18
Item Analysis of Multiple Choice and Short Answer Questions 18
Interpreting typical prescription orders 21
Following additional instructions 22
Rationale for special instructions or therapeutic effects 23
Delayed dose 23
Missed dose 24
Several missed doses 24
Side effects 24
Correlations 24
Discussion 25

INTRODUCTION TO EXPERIMENT 2 28
Medication Module 29
Medication Module Preparation 30
Contributions of Working Memory 33
Study Goals 35
Method 37
Participants 37
Experimental Design 38
Materials and Tasks 38
1. Demographic screening 38
2. Vision and hearing screen 39
3. Medication management learning module 40
3.1. Verification 41
3.2. Scoring 41
4. Control learning module 42
4.1. Verification 42
4.2. Scoring 42

5. Medication prescription information 42
6. Medication recall 43
6.1. Scoring 44
7. Prescription scheduling 44
7.1. Scoring 45
8. Dobbs and Rule auditory working memory task 45
8.1. Scoring 46
9. Listening span task 46
9.1. Scoring 46
10. Advanced vocabulary task 47
10.1. Scoring 47
Procedure 47
1. Medication management learning module 47
2. Medication prescription information 48
3. Working memory tasks 48
4. Medication recall 49
5. Prescription scheduling 49
6. Advanced vocabulary task 49
7. Debriefing 50
Results 50
Participants 50
Medication Management Learning Module 54
1. Presentation time 54
2. Verification time 55
3. Verification accuracy 55
Medication Recall 57
Prescription Scheduling 63
1. Planning accuracy 63
2. Planning errors 66
3. Checking labels (frequency) 70
4. Checking labels (time) 75
Retention Interval. 75
Working Memory Tasks 77
1. Auditory working memory 77
2. Listening span task 77
Correlations and Regression Analyses 79
Discussion 85
Schema Acquisition 85
Medication Recall 87
Prescription Scheduling 92
1. Planning accuracy 92
2. Checking labels 95
Retention Interval 96
Working Memory Capacity 96

GENERAL DISCUSSION 99

IMPLICATIONS AND DIRECTIONS FOR FURTHER RESEARCH 110

REFERENCES 114

Appendix A 125

Appendix B 134

Appendix C 149

Appendix D 160

Appendix E 161

Appendix F 166

Appendix G 170

Appendix H 185

LIST OF TABLES

1. Means or Frequencies for Medication Experience, Drug Classification and Knowledge of Prescription Content. 17

2. Best Responses in Percent (and Frequency) for Question Categories in the Prescription Knowledge Questionnaire. 21

3. Task Sequence for Experiment 2 39

4. Mean Scores (Standard Deviations) on Participant Characteristics of Group Size, Age, Sex, Education, Vocabulary and Health Related Variables by Group and Condition 51

5. Correlations among Age, Verbal and Health Related Variables, Working Memory Tasks, Medication Recall and Planning Accuracy. 80

6. Regression Analysis for Medication Recall on Age, Education, Vocabulary, and Working Memory 82

7. Regression Analysis for Planning Accuracy on Age, Education, Vocabulary, and Working Memory 84

LIST OF FIGURES

1. Schema Theory Hierarchy 5
2. Importance Ratings.. 19
3. Percent Accuracy on Medication Management Questions 20
4. Mean Ratings of Self-Rated Health on Activities of Daily Living 53
5. Accuracy of Responding to Module Verification Questions 56
6A. Application Recall for Cloxapen by Age and Condition 62
6B. Trade Name Recall for Benemid by Age and Condition 62
7. Accuracy in Medication Planning by Age, Condition, and Medication 65
8. Planning Accuracy for Benemid by Age and Condition 67
9. Percent Errors in Following Special Instructions for Cloxapen and Benemid 69
10. Percent Errors Combined by Age and Medication 71
11. Frequency of Checking Labels More than Once for Cloxapen by Age and Condition 73
12. Frequency of Checking Labels More than Once by Age, Condition, and Medication 74
13. Time in Seconds Spent Checking Prescription Labels by Age and Medication 76
14. Mean Digits to First Error on the Auditory Working Memory Task 78

INTRODUCTION

Typically, older adults recall less information after listening to a prose passages than do young adults and both recall less after listening than after reading (see Hultsch & Dixon, 1984; Zelinski & Gilewski, 1988 for reviews). This age related difference in recall, favouring the young, is apparent after listening to story narratives (Petros, Tabor, Cooney, & Chabot, 1983), to expository prose (Byrd, 1985; R. Dixon, Simon, Nøwak, & Hultsch, 1982; Stine & Wingfield, 1990), to television dramas (Cavanaugh, 1983), to television newscasts (Cole & Houston, 1987), and for topics of conversation following an interview (Kausler & Hakami, 1983). Although older adults may not recall as much overall information as do young adults, both age groups recalled more information when they had pre-experimental knowledge within the same domain as the to be remembered material (Hultsch & Dixon, 1983). Furthermore, there is ample evidence to suggest that use of schematic knowledge structures during cognitive processing is age invariant (Arbuckle, Vanderleck, Harsany, & Lapidus, 1990; Hess, 1990).

The primary goal of this research was to determine if understanding a schema for managing medications would improve memory for, and subsequent implementation of, medication prescription information. The design of the study was guided by schema theory and the positive effect that activation of the appropriate schema can have on on-line comprehension and recall of discourse (Arbuckle et al., 1990; Hess, 1990; Zelinski & Miura, 1988). As well, the understanding that older adults can activate and use schematic knowledge structures as effectively as young adults to aid memory for domain related information was important (Hess, Donley, & Vandermaas, 1989; Hess, 1990). In this study, participants were guided in their acquisition of a schema for managing medications. In the two treatment conditions, participants learned the schema either before or after listening to prescription information for three medications. It was expected that those who had received the medication management schema first would remember more prescription information than those who received the schema second. Furthermore, it was conjectured, that older adults who possibly have decreased processing resources, would find the availability of the schema first particularly useful in integrating prescription information for later recall.

Everyday memory situations offer many opportunities for people of all ages to demonstrate competence in on-line discourse comprehension and in immediate or delayed recall of the information. One such situation is the on-line comprehending of a treatment regimen provided during a medical appointment. Most older adults have at least one chronic illness that requires medical therapy and it is often medication related. In fact, those over age 65 are prescribed 25% of all prescription drugs and are often on three or more medications at one time (Burns, Austin, & Bax, 1990; Canada Health Survey, 1981; Kendrick & Bayne, 1982). When the patient receives medication related information, the information is usually understood as the doctor talks about it, but at the time of implementation recall may be incomplete or inaccurate (D. Morrow, Leirer, & Sheikh, 1988). Thus compliance is jeopardized from the start.

Health care providers consider compliance, taking medications or following a therapeutic plan as prescribed, to be a common problem. There is, however, no evidence to suggest that older adults are less compliant in taking their medicines than are young adults (McKim & Mishara, 1987; Richardson, 1986). Not uncommonly, patients simply forget to take a dose of medicine (Cramer, Mattson, Privey, Scheyer, & Ouellette, 1989). In this case noncompliance was never intended. A more disturbing form of unintentional noncompliance was that reported by Kendrick and Bayne (1982) and Lundin, Eros, Melloh, and Sands (1980). In this type of noncompliance, patients misinterpreted the instructions provided and were not taking the medicine as prescribed. Because of the physiological changes that normally occur with age, older adults are at greater risk for drug related health problems should instructions be misinterpreted or forgotten (McKim & Mishara, Report of the Royal College of Physicians, 1984). Perhaps if adults learned a general schema for managing medications, it could be activated acting as a framework to increase processing efficiency during on-line comprehension of prescription information. If understanding and memory for the drug information were improved, then perhaps unintentional noncompliance secondary to these problems could be decreased (Ley, 1986).

Aging and Schematic Knowledge Processing

Although, in many situations older adults have been shown not to recall as much content overall as do young adults, there are some conditions under which this age effect of memory for discourse seems to be attenuated. For example, older adults with high verbal ability often perform as well as young adults on measures of comprehension (Cavanaugh, 1983; Meyer & Rice, 1983; Taub, 1979; Zelinski & Gilewski, 1988). As well, and important to this research, high levels of relevant domain specific knowledge have been shown to counteract the negative change in cognitive performance found to be associated with age. Hultsch and Dixon (1983) reported that when older adults had pre-experimental familiarity with the subject matter of the expository text (well known celebrities in their era), their recall of content equalled that of the younger adults.

Another recognized example of the effect that pre-experimental knowledge has on cognitive performance is the work done by Charness (1985) with elderly master chess players. His studies show that the ability to correctly and efficiently evaluate end-game positions was invariant with age, but skill dependent. Accuracy in recall of chess board positions, however, did decline with age in similarly skilled players but was significantly better than unskilled young adults. Similarly, Arbuckle et al. (1990) reported that patterns of recall by old and young adults with formal training in music, were similar within that domain of knowledge. These findings indicate that there is age invariance with respect to the use of underlying schematic knowledge structures or schemas during cognitive processing. However, this age related facilitation effect of schematic knowledge is domain specific.

The positive influence of schematic knowledge structures on memory is well accepted for young adults (Alba & Hasher, 1983; Bartlett, 1932; Bransford & Johnson, 1972; Rumelhart, 1984). In the classic study by Bransford and Johnson, prior knowledge of even the title for an ambiguously written prose passage, greatly enhances content recall. Zelinski and Miura (1988) have found that old and young adults recalled more information when provided with the theme for the to-be-remembered passage then when no theme was provided. Older adults, however, did recall less information in both conditions.

Zelinski and Miura (1988) and others (Light & Anderson; 1983; Hess et al., 1989; Hess, 1990) strongly support the notion that common knowledge structures such as schemas, remain relatively stable across the adult life span. Furthermore, older adults are just as effective as young adults in their activation of schemas and the integration of generic schematic knowledge with new information. Hess (1990), along with Fincher-Kiefer, Post, Greene, and Voss (1988) and Spilich, Vesonder, Chiesi, and Voss (1979) proposed that high levels of domain specific knowledge can decrease demands on cognitive resources in that schemas provide an organizing structure that guides discourse processing, enabling processing to proceed with greater efficiency. For example, Fincher-Kiefer et al. reported that participants with high knowledge in a particular domain read domain related discourse faster than those with limited knowledge.

As discourse processing is generally considered to take place within working memory (Daneman & Carpenter, 1980; Kintsch & van Dijk, 1978), the presence of a domain related schema could be of considerable importance to elderly participants who are often considered to have diminished processing resources (Rabinowitz, Craik, & Ackerman, 1982; Stine, 1990; Zacks & Hasher, 1988).

Schema Theory

As indicated above, schema theory was used extensively in this research project to guide development of the procedure and will be used in interpretation of the findings. Unfortunately, as several researchers have pointed out (Alba & Hasher, 1983; Garnham, 1987; Hess, 1990; Mandler, 1984; Rumelhart, 1984), schema theory is still not clearly defined. For example, little is known about schema development, nor how the correct schema is activated. Regardless, Garnham and others (e.g. Brewer, 1987) suggest that schemas could be one way in which knowledge is represented and organized in memory and Rumelhart (1984), stated that schemas "are truly building blocks of cognition" (p. 33).

Brewer (1987) defined schemas as "unconscious generic mental structures that underlie the molar aspects of human knowledge and skill" (p. 188). As early as 1932, Bartlett wrote about schemas, describing them as unconscious organizations of past experiences constantly developing in response to present experiences. Rumelhart (1984) stated that schemas are generic representations of those concepts that underly situations, events, actions and objects at all levels of abstraction. In summary, then, schemas may be thought of as unconscious generic mental structures, constantly under revision, that represent the knowledge and skills acquired through life experiences.

Brewer (1987) as well as Hess (1990), Garnham (1987) and Mandler (1984), consider scripts (Schank & Abelson, 1977) and frames (Minsky, 1975) to be similar to, or perhaps subsumed under the umbrella of, schemas. These proposed forms of mental representational knowledge structures share similar characteristics; they have variables or slots with associated default values and with specified interrelations among them (Rumelhart, 1984), they have imaginal properties and are modular in the sense that "different cognitive domains have schemas with different structural properties" (Brewer, 1987, p. 188). Brewer refers to generic pre-existing knowledge structures as "global" schemas. A schema theory hierarchy is proposed and shown in Figure 1 in which the global schema occupies the top level.

Level 1.	GLOBAL SCHEMA
Level 2.	INSTANTIATED SCHEMA (Episodic Information Acted on by Global Schema)
Level 3.	EPISODIC MENTAL MODEL (Episodic Information Acted on by Local Schema)

Figure 1. Schema Theory Hierarchy

Global schemas are thought to aid comprehension and memory for new information in several ways. Once activated, the appropriate global schema selectively guides the interpretation and integration of new domain related information (Alba & Hasher, 1983; Brewer & Nakamura, 1984). As well, activation of schematic knowledge tends to prepare the comprehender for what to expect and for inferencing, should default values be needed to achieve a more coherent structure. When domain relevant schemas are available, processing is thought to be conceptually driven (Rumelhart, 1984) and more efficient in that less attention need be directed towards typical schema related information (Brewer & Nakamura; Mandler, 1984). Attention and processing effort can, instead, be directed toward the acquisition of information relevant to but not necessarily generic to the activated global schema (Friedman, 1979).

Level 2 of the schema theory hierarchy is conceptualized as an instantiated schematic structure (Figure 1). These are defined by Brewer (1987) as more specific knowledge structures formed from the integration of incoming episodic information with the activated global schema-based information. Episodic information includes the incoming verbal, spatial, or other sensory information selected for processing. Although it is not entirely clear how the appropriate global schema is activated (Brewer & Nakamura, 1984; Rumelhart, 1984), it is likely that some concept in the incoming episodic information provides the activation. The activated global schema guides interpretation of the incoming episodic information and its integration into the developing instantiated schema. Instantiated schemas would, therefore, be a combination of values from the processed episodic information and inferred values from the activated global schemas needed to ensure coherence of the representation. The instantiated representation would, however, be more specific to the incoming episodic information and may significantly alter the original generic schematic structure.

Given the integrating and organizing quality of schema instantiation processing, it most likely takes place within working memory (Glenberg & Langston, 1992; Mayer, 1989), where capacity is considered to be limited. The presence in working memory of a relevant and well developed schematic structure should increase the efficiency with which processing takes place and could result in less episodic information being lost during processing (Fincher-Kiefer et al., 1988; Hess, 1990; Spilich et al., 1979).

As time between schema instantiation and recall increases, the detail surface structure of the episodic information is lost, but concepts in the instantiated schema remain. In time, these concepts may well modify, in whole or in part, the original global schema making it increasingly more difficult to recall the latter (Alba & Hasher, 1983; Mandler, 1984; Rumelhart, 1984). It is not clear when in time or what conditions must prevail for an instantiated schema to alter global schematic structures.

Occupying the bottom place or Level 3 of the schema theory hierarchy, as conceptualized here, are episodic mental models. Brewer (1987) defines mental models (or episodic models) as specific nongeneric knowledge structures "constructed to represent new situations out of more specific generic knowledge represented in 'local schemas'" (p. 193). Because no other term was available, Brewer coined the term 'local schemas' for the generic knowledge structures activated in the process of constructing episodic mental models. For the purposes of this research project, I will suggest that local schemas could be specialized portions of an instantiated schema or alternately, of a global schema. Regardless from which level of generic knowledge a local schema becomes activated, Johnson-Laird (1983) suggests that the formation of mental models is shaped by generic schematic information structures.

Episodic mental models are creations of the moment and are constructed to represent the state of affairs of the episodic information currently in review and as modified by activated local schematic knowledge (Brewer, 1987; Garnham, 1987; Vosniadou, 1991). Mental models represent the situation described in the text rather than the exact semantic or syntactic structure of the text itself (Garnham, 1987; Glenberg & Langston, 1992; Johnson-Laird, 1983). They share certain characteristics with instantiated schemas in that both have imaginal and domain specific properties and both integrate conceptual world knowledge and episodic information. Episodic mental models differ from instantiated schemas in that models are nongeneric relating specifically to the episodic information they represent.

For clarification, and as Brewer (1987) points out, the knowledge structures described here as episodic mental models have been variously named and variously applied in empirical studies. Radvansky and colleagues (Gerard, Zacks, & Hasher, 1990; Radvansky, Spieler, & Zacks, 1993; Radvansky & Zacks, 1991), use the term mental model in a way similar to that of Brewer (1987) and Johnson-Laird (1983). They showed that mental representations formed by their participants reflected functional relations, such as location and person, among the concepts presented within a text. Similarly, Garnham (1987) and Glenberg, Meyer, and Linden (1987) reported that participants appeared to form mental models that represented the situation described in a text rather than the surface syntactic structure of the text. Although Kintsch (1988) uses the term situation model, he too was describing the mental representation of what the text was about, not exact text structure. Bower and Morrow (1990) would concur with this interpretation and also report, that over time, it is likely that the mental model would be recalled, rather than the text itself.

Causal episodic model is the term Brewer (1987) uses in order to differentiate mental models as conceptualized by human factor researchers such as Gentner and Gentner (1983) and Wilson and Rutherford (1989) from mental models as described by Johnson-Laird (1983). Causal episodic mental models represent physical systems such as those demonstrated in practice by participants who are learning computer programming. They are domain specific, usually have imaginal components, and do explain a physical system.

The schema theory hierarchy model depicted in Figure 1 suggests a progression in increased generality in the knowledge structures formed from the episodic mental model upward through the instantiated schema to the global schema. It seems likely that this progression would be most applicable to the evolution of a global schema for a domain of knowledge novel to the individual. In learning a new domain, mental models of the text would be formed, as aided by general syntactic and semantic knowledge and modified as further discourse was comprehended. Concepts acquired through this processing would be committed to long term memory as part of a developing global schema for the knowledge domain being learned.

Further experiences with information related to the knowledge domain being learned would activate the existing global schema, which would in turn guide processing of the incoming episodic information. As noted earlier, the instantiated schema would be a modified form of global schematic concepts as influenced by the incoming episodic information. As domain related information is presented for processing, it is probable that schema instantiation and mental modelling would occur in parallel. The episodic mental models would most closely represent the concepts described by the text. Aspects of these mental models could modify the instantiated schema and both structures could modify the developing global schema committed to long term memory.

In summary, then, and important to this project, it appears that the activation of an appropriate global or local schema within working memory increases the efficiency with which expected and related episodic information can be comprehended and integrated into a coherent instantiated schema or episodic mental model. Knowing as little as the title or theme for a vaguely written prose passage can activate the appropriate schema thereby facilitating understanding of the passage and its subsequent recall (Bransford & Johnson, 1972). Similarly, activation of a specialized schema has the potential to assure more efficient processing and better recall of domain related discourse (Spilich et al., 1979; Fincher-Kiefer et al., 1988). As well, older adults respond to the presence of schematic knowledge in the same manner as do young adults (Arbuckle, et. al., 1991; Hess, 1990; Light & Anderson, 1983). Hence, schemas have the potential to attenuate the effects of age related change in discourse processing.

Study Paradigm

Schema theory supports the position that activated prior knowledge in the same domain as the to-be-remembered information facilitates comprehension and memory for that information. Also, as information processing takes place within capacity limited working memory, it is possible that the older participants, who are often thought to have diminished working memory resources, may well benefit from schema-based processing (Hess, 1990). In the schema first condition, participants were presented with a learning module for managing prescription medications. The intent in this condition was that participants would acquire an instantiated schema for managing medications, parts of which could then function as a local schema to aid in the comprehension and formation of episodic mental models for the three medication prescriptions that were to follow. In the schema second condition, participants listened to the medication prescription information before they were presented with the medication management learning module. Therefore, these participants would not have a readily available instantiated schema for managing medications to function as a framework for information processing.

The underlying paradigm of schema activation used in this study is not new and it has been used satisfactorily with older adults. P. Dixon (1987a) used it with college students in a simple instruction following task which also demonstrated the impact that schema activation has on processing efficiency. Participants who read concept first sentences such as "To make a house..." followed by the component phrases "...draw a square..." and "...put a triangle on top." read the component sentences faster than when the order was reversed. P. Dixon hypothesized that mental plans of the task are organized hierarchically, and when the concept was presented first, the prototypical schema for a house was activated complete with its typical default values. Hence typical components values would be expected. In the concept first condition, comprehension and planning could overlap and little information would have to be stored in working memory. Processing efficiency was reflected in faster reading times and drawings were more accurate in the concept first condition (P. Dixon, 1987b). As noted earlier, Fincher-Kiefer et al. (1988) also equated more efficient processing with faster reading times.

Using the same research paradigm as P. Dixon (1987a), Priebe (1991) reported on reading times and the quality of drawings made by a sample of over 550 adults ranging in age from 30 to 70 years. Overall reading times increased reliably with age and the quality of the drawings declined with age. In the concept first condition, however, reading times were faster and instructions were followed more reliably by all age groups. This finding suggests that regardless of age, activation of the schema positively affected processing efficiency which was reflected in the reading times and the quality of the drawings.

In a similar paradigm, but with more complex stimuli, Arbuckle et al. (1990) reported that both young and old adults recalled more little-known information about famous people if they were first presented with information that permitted identification of the person. Learning the identity of the famous person after reading and listening to the biographical sketches did not have a facilitative effect on recall. Although the older adults did recall less information in both conditions, their schema-based processing appeared similar to that of the young adults.

In the protocol to be used in the research described here, a slightly different use of schema theory is proposed in that participants will be coached to form an instantiated schema. It was recognized that all participants would have at least some generic schematic knowledge about taking medicines, acquired through life experiences. This would function as the global schema referred to in Figure 1. It was proposed that the medication management learning module, specifically developed for this study, would function as the episodic information and would activate and interact with the global medicine schema resulting in the formation of an instantiated medication management schema. It was anticipated, given the manner in which the module would be presented, that it would be remembered quite well, at least in the short term. Furthermore, it was thought that the general concepts learned would serve to modify and be incorporated into the developing global schema for managing medications. Verification of instantiated schema acquisition was evaluated by response accuracy to a series of short answer questions that tested recall of concepts described in the learning module.

Either before or after instantiated schema acquisition, participants listened to medication prescription information. In the schema first condition, this information would be the episodic information needed at Level 3 (Figure 1) to activate the local schema (part of the instantiated medication management schema or modified global schema) to form an episodic mental model of the prescription information of each medicine. It was proposed that those who were presented with the medication management learning module first, and presumed to form the instantiated schema, would recall more of the medication prescription information at a later time. Activation of local aspects of the instantiated schema would serve to guide the processing of and memory for the three medicine prescriptions. Furthermore, its availability could increase the efficiency with which episodic information was processed and integrated resulting in a more complete mental model being formed (Fincher-Kiefer et al., (1988); Hess, 1990; Spilich et al., 1979). Recall would possibly be more complete as less information would be lost during processing.

In the schema second condition, the local schema would have to be derived from the unmodified global schema (Level 1) and processing of prescription information would not be aided by an available instantiated schematic structure. Thus discourse processing would presumably be less efficient, resulting in greater loss of prescription information which would be reflected in poorer performance at recall.

INTRODUCTION TO EXPERIMENT 1

In P. Dixon's (1987a) early research, the concepts instantiated were of well learned schematic structures, i.e. concrete objects. Thus, in reading the concept statement, a mental plan for drawing the object would have been readily formed. In the present study the medication learning module was believed to be novel and, as will become evident following the discussion for Experiment 1, of greater complexity and abstraction than concrete objects such as houses and suitcases. From the literature on medication self-administration it was learned which concepts were considered important for safe medication administration in the home (Lundin, et al., 1980; Pagliaro & Pagliaro, 1986). It was not clear, however, what young lay persons would consider important concepts to understand when self-administering medications nor how knowledgable they were in interpreting medication prescriptions and monitoring outcomes.

To try to answer these questions, in Experiment 1, a questionnaire was developed that sought to assess the importance young adults attributed to certain concepts related to medication self-administration. In addition, the ability of these young adults to interpret prescription information and monitor responses to medications, was assessed. It was anticipated that there would be a significant correlation between participant medication taking experience and accuracy in responding to question items. This positive correlation was expected because those with more medication experience would most likely have a better developed global schema for managing medications. Furthermore, it was anticipated that the strengths and weakness observed in questionnaire response patterns would guide development of the medication management learning module to be used in Experiment 2. In Experiment 2, the medication management module was presented to both young and old participants either before or after they listened to prescription information for three medicines. The goals of this second experiment were threefold. First, it was important to validate that both young and old participants had learned the medication management module. Second, it was expected that those participants who learned the medication management module before they heard the prescription information would be more efficient at integrating the new episodic information and would therefore be able to recall it more completely later in the interview. Third, it was anticipated that the older adult, while not recalling as much information as the young adult, would recall more in the schema first condition than the schema second condition (provided medication experience was not facilitative.

Method

Participants

The sixty-two (26 male and 36 female) undergraduate students in psychology participated in the study for course credit. The mean age of the sample was 19.5 years (range 17-28) and all but six spoke English as their first language.

Materials

The questionnaire developed for the study was divided into three sections (See Appendix A: Prescription Knowledge Questionnaire). Section A requested basic demographic data as well as a profile of each participant's medication experience; the prescription drugs and over the counter medications taken in the past two years. The number of medicines taken in these two categories was summed to form the medication experience variable which was used in analyses. Participants were asked to list as many classes of drugs as they could and were awarded one point for each correct response. For example, one point was awarded for antibiotics or penicillin but not both (AMA Drug Evaluation, 1986).

In addition, participants were asked to list the information they expected to receive when given a prescription. Participants were awarded one point for each category of information they were able to list out of a possible ten. These categories included a) the name of the drug, b) the route of administration, c) the number of pills and when to take them, d) the action or purpose of the drug, e) special instructions such as whether to administer with or without food or on an empty stomach, f) when to stop taking the medicine, g) side effects and how to handle them, h) pharmacy information such as doctor's name and prescription number, i) how to handle late and missed doses, and j) expected therapeutic effects (D. Morrow et al., 1988; Pagliaro & Pagliaro, 1986).

In Section B, participants were asked to rate, using a five point Likert scale (one being not very important to five being very important), the importance to them of certain categories of medicine related information. Included were the a) name of the medicine, b) purpose of the medication, c) expected therapeutic response, and d) commonly experienced side effects of the medicine. Mean ratings were entered into analyses.

In Section C, participants were asked to respond to eight questions on each of four classes of medications: antibiotics (drugs that inhibit growth or destroy microorganisms), anxiolytics (drugs used to treat anxiety), analgesics (drugs that relieve pain), and thyroid supplements (drugs that replace endogenous thyroxin). Each question addressed a possible concern in interpreting a medication prescription or monitoring the response to the medication in relation to its drug classification. There were eight question categories, with a representative question from each category within each of the four classes of medication. The eight question categories included a) the importance of sustaining a therapeutic serum level, b) interpretation of a typical prescription order for the medication class (e.g. take every six hours or take three times a day), c) adjusting the schedule to follow additional instructions (e.g. taking the medicine with food), d) explanation for special instructions or expected therapeutic response, e) monitoring for side effects, and f) how to handle a late dose, g) one missed dose or h) several missed doses (Ascione, Kirscht, Shimp, 1986; D. Morrow et al., 1988).

Questions were chosen to test, as comprehensively as possible, understanding of prescription knowledge within the eight question categories. For example, in interpreting typical prescription orders, the significance of the word "every" in an order as opposed to the word "times" had to be understood. The word "every" infers that the medicine must be taken around the clock spaced as ordered, e.g. six hours apart; whereas there is more flexibility in scheduling when the order reads "times". In the monitoring side effects category, understanding of an allergic reaction (antibiotic), drug tolerance (anxiolytic), drug addiction (analgesic), and possible under medication (thyroid supplement) was tested.

Question format included multiple choice and short answer questions and in case of importance ratings for maintaining a therapeutic serum level, the five-point Likert scale introduced in Section B was used. The eight questions for each medication class were grouped together. The order of the four medication classes was counterbalanced, creating four participant subgroups each starting with a different class of medication. Except for the items using the Likert scale, participants were awarded one point for each best response. A total of seven correct responses was therefore possible for each class of medication. For each item, frequencies and percents of both correct and incorrect responses were examined to provide insight into the patterns of responding made by the participants. (See Appendix A: Scoring Guide for Prescription Knowledge Questionnaire.)

<u>Procedure</u>

Participants were tested in small groups of 10-15. Following a brief introduction to the study, participants were given the questionnaire and asked to complete each question before going on to the next one. They were also told they could proceed at their own rate. All subjects completed the questionnaire within 40 minutes.

Results

Medication Experience and General Understanding (Section A)

As can be observed from Table 1, on average, over the past two years, participants had taken 2.11 prescription medications and 0.97 over the counter medications. Combining the two types of medications into the medication experience variable, participants had taken, on average, 3.08 medications in the past two years. Twenty-one percent reported that they had not taken any prescription medications during the past two years. Participants could name 1.9 classes of medication with 29% being unable to name any medication classification. The three most commonly named classes were antibiotics (53.2%), analgesics (35.5%) and cold remedies (22.6%).

Out of the possible ten categories of prescription information, participants could provide an average of 3.3 items. One participant was unable to cite any item of information. In Table 1, it can be seen that how often and/or how many pills to take (98.4%) was the most frequently given response. Two other frequently cited items of information were special instructions such as taking the drug with or without food (72.6%) and side effects and/or other warning (46.8%). Although important to medication self-administration, no participant wanted to know how to monitor the expected therapeutic effects of the medications, nor what to do if a dose of medication was delayed or missed.

Table 1

Means or Frequencies for Medication Experience, Drug Classification and Knowledge of Prescription Content.

Medication History

Prescription	2.11 (0-6)*
Over the Counter	0.97 (0-5)
Medication Experience	3.08 (0-7)

Drug Classification

Total Listed	1.9 (0-7)*
Antibiotics	53.2% (33)**
Analgesics	35.2% (22)
Cold Remedies	22.6% (14)

Knowledge of Prescription Content

When and How Many	98.4% (61)**
Additional Instructions	72.6% (45)
Side Effects/Warnings	46.8% (29)
When to Stop Taking	21.0% (13)
Pharmacy Related	14.5% (9)
Action of the Drug	8.1% (5)
Medication Name	1.6% (1)
Route for Administration	1.6% (1)
Monitoring Therapeutic Effects	.0% (0)
Handling Delayed/Missed Doses	.0% (0)

(*) Means (and Range); (**) Percent (and Frequency)

Importance Ratings (Sections B & C)

On the Likert scale of one to five, with five being most important, participants rated knowing (a) the names of their medications at 3.34, (b) the purpose of the medication at 4.57, (c) if the expected therapeutic response was achieved at 4.66 and (d) the usual side effects at 4.69. Using the same scale, participants rated the importance to them of maintaining therapeutic serum levels at 3.82 for the antibiotic, 3.89 for the anxiolytic, 3.42 for a analgesic, and 4.07 for a thyroid supplement. As can be observed in Figure 2, participants generally rated that it was somewhat more important for them to understand the expected therapeutic response and side effects of their medications than it was to know the name of the drug.

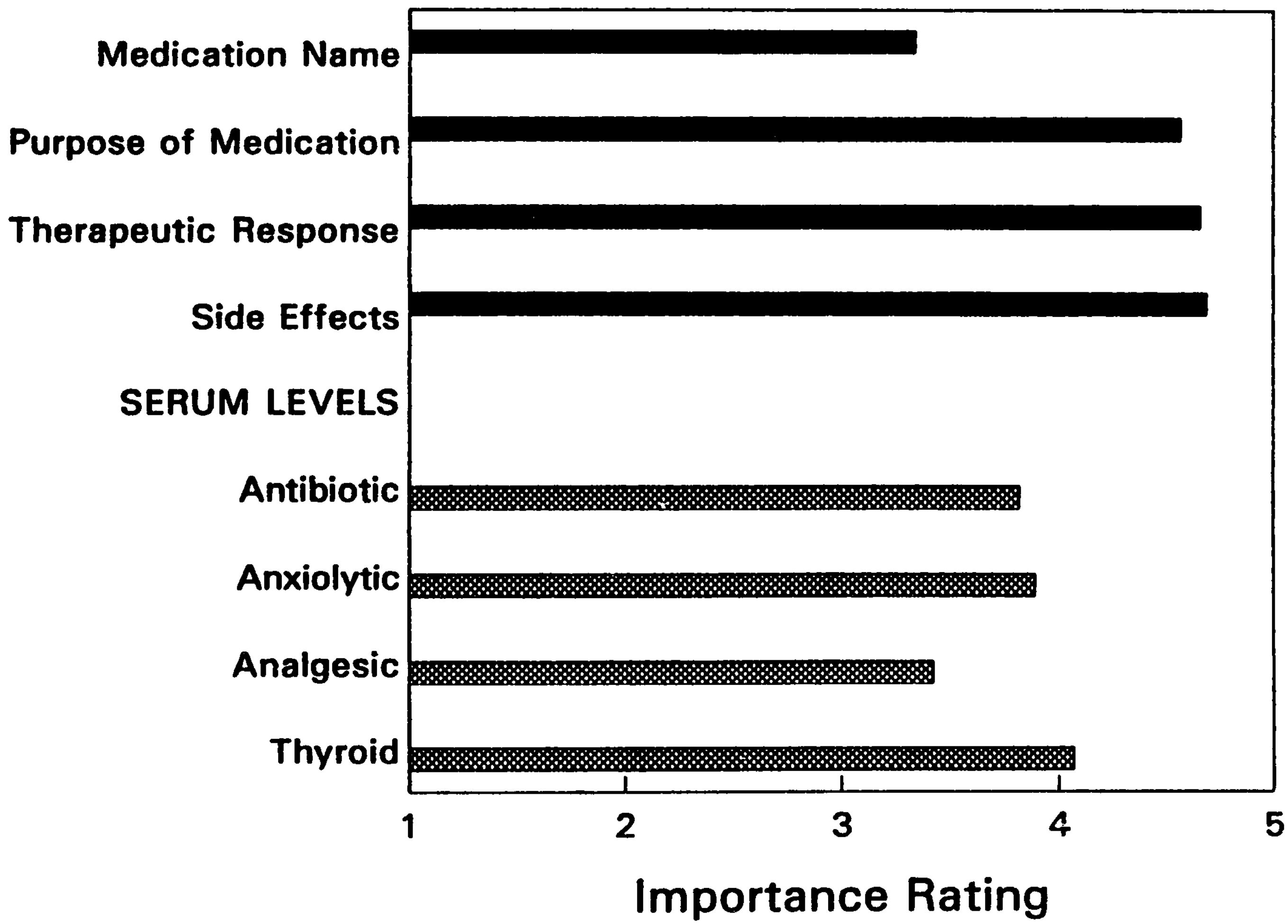
Responding to Medication Management Questions (Section C)

To determine if the order in which the questions on medication class in Section C were presented affected responding, a 4(Medication Class) x 4(Participant Subgroup) analysis of variance was carried out. The difference in scores among the four Participant Subgroups was not significant, $F < 1.00$). Thus, there appeared to be no learning effect across the four classes of medications regardless of which medication was presented first. There was a significant main effect for Medication Class, $F(3,174) = 15.33$, $p < .001$ and the interaction approached significance, $F(9,174) = 1.76$, $p = .08$. Figure 3 shows that participants, regardless of subgroup, generally responded most poorly to questions on antibiotics (48.6%), most accurately to those on analgesics (66.6%), and about the same to questions on anxiolytics (60.7%) and thyroid supplements (58.5%).

Item Analysis of Multiple Choice and Short Answer Questions

In the following subsections, responses for participants in each of the seven remaining question categories across the four drug groups will be presented. To provide a visual display of the patterns in responding that emerged in the data, percentages and frequencies of the best response in each question category are displayed in Table 2.

Figure 2. Importance Ratings



<u>Figure 3</u>. Percent Accuracy on Medication Management Questions

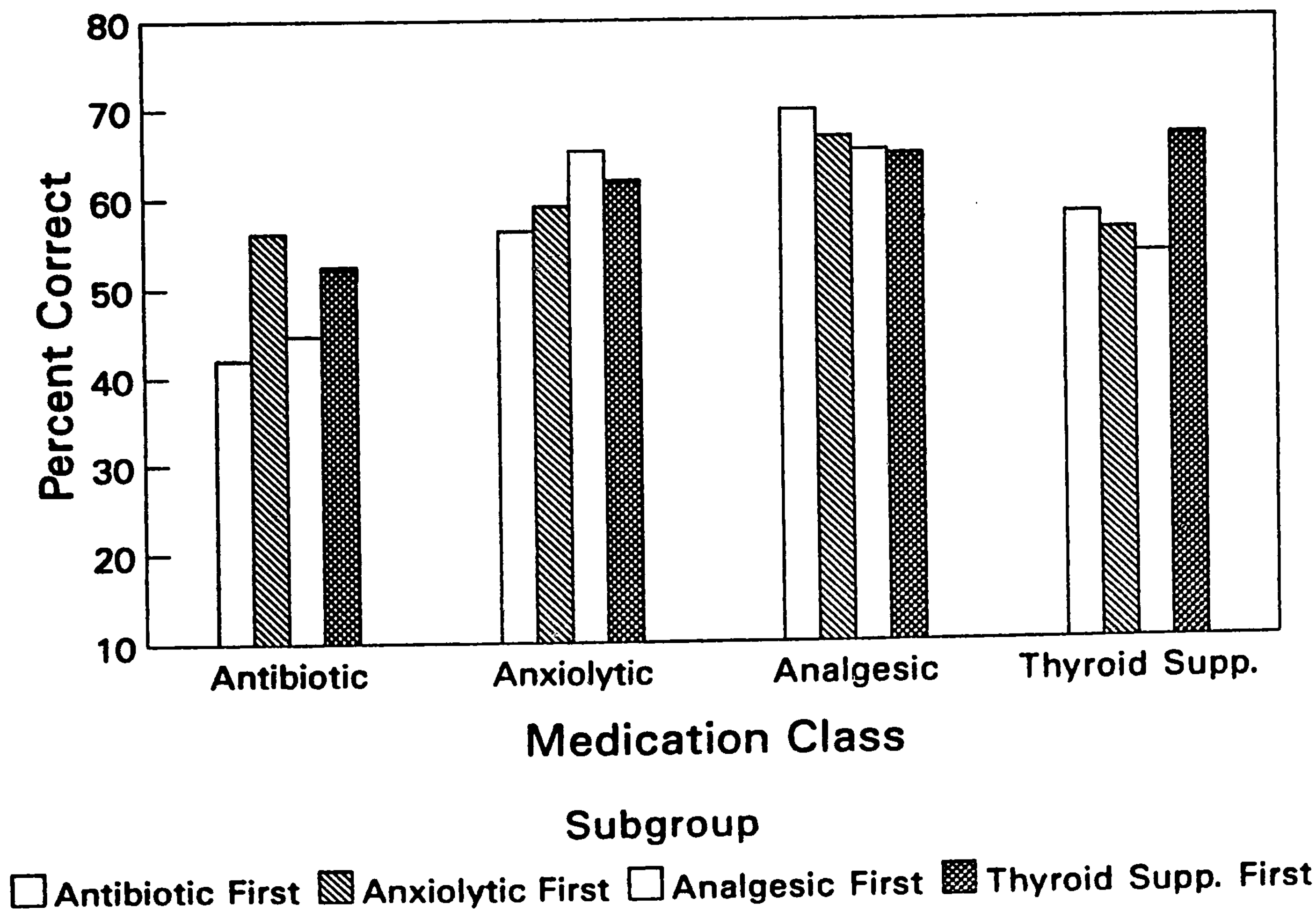


Table 2

Best Responses in Percent (and Frequency) for Question Categories in the Prescription Knowledge Questionnaire.

	Drug Classification			
Question	Antibiotic	Anxiolytic	Analgesic	Thyroid
Prescription Order	35.5 (22)	91.9 (57)	66.1 (41)	88.7 (55)
Additional Instructions	3.2 (2)	72.6 (45)	82.3 (51)	14.5 (9)
Special Effects	40.3 (25)	30.6 (19)	98.4 (61)	72.6 (45)
Delayed Dose	40.3 (27)	43.5 (27)	67.7 (42)	41.9 (26)
Missed Dose	69.4 (43)	67.7 (42)	64.5 (40)	58.1 (36)
Several Misses	67.7 (42)	21.0 (13)	58.1 (36)	35.5 (22)
Side Effects	83.9 (52)	96.8 (60)	29.0 (18)	98.4 (61)

Interpreting typical prescription orders. When asked to interpret the prescription order, participants experienced the most difficulty scheduling the "take every six hours" antibiotic prescription. Only 35.5% of respondents interpreted this prescription order correctly, that is four times a day, about six hours apart. Many (45.2%) either failed to schedule the medication four times a day (the usual alternative was three times a day) or the timing of a scheduled dose, though correct, was unlikely to result in compliance (e.g. scheduled between 1:00 a.m. and 5:00 a.m.). A similar finding has been reported elsewhere (Kendrick & Bayne, 1982; McBean-Cochrane, 1989a; 1989b). The prescription order for the anxiolytic read "take three times a day". Almost 92% of participants correctly interpreted this order when they planned to take the medication three times a day with at least four hours between each dose.

Participants were asked to state the maximum number of analgesic tablets they could take when the prescription order read "take one-two tablets every four to six hours as needed". The correct response of 12 tablets was given by 66.1% of the participants. Others gave responses of eight tablets (19.4%), six tablets (9.7%) or four tablets (4.8%). McBean-Cochrane (1989a, 1989b) reported a similar accuracy rate for this type of question. When asked at what time during the day the thyroid supplement should be taken, 88.7% correctly indicated that any time would be satisfactory as long as it was consistent across days.

Following additional instructions. Not uncommonly, a medication must be taken either in conjunction with a meal or on an empty stomach. Participants were asked to adjust the "every six hour" schedule for the antibiotic to allow for taking it on an empty stomach. Only 3.2% interpreted this request correctly. The responses from 40% of respondents showed that they did not understand that the medication should be taken either one hour before or two hours after a meal and that it was advisable not to awaken during the night to take the medicine. An additional 50% would have taken too few doses per day, usually three. Experience with taking antibiotics failed to positively affect responses to this question as more than 50% of participants had taken an antibiotic and the two who responded correctly, did not report taking an antibiotic. When the prescription order for the anxiolytic was amended to read "take every eight hours", it was interpreted correctly by 72.6% of participants. However, 12.9% either took too few doses (the usual alternative being two doses a day instead of three) or chose to take the medication some time during the middle of the night. The pattern of these responses was similar to that for the antibiotic in the first question category.

Participants were asked why they should take the thyroid supplement at the same time each day. Although an overall 67.7% recognized this would have some beneficial effect on body function, just 14.5% knew that a regular dosing schedule would ensure a consistent diurnal rhythm in blood level (the most correct response). Just over 82% of respondents correctly understood that the "... as needed for pain." portion of the order for the analgesic meant that self administration could be flexible, dictated by pain level.

Rationale for special instructions or therapeutic effects. When asked why some medications should be taken with or without food, 40.3% of participants correctly understood that stomach acids will destroy some antibiotics and 30.6% recognized that some anxiolytics cause sensations of nausea and should be taken with food. Although incorrect for anxiolytics, the alternative most frequently selected (50.6%) was that the medicine irritated the stomach lining. These respondents appreciated that fact that some medicines do cause stomach irritation.

For the thyroid supplement and analgesic, understanding the therapeutic effect was tested. Participants were asked if they would alter their prescription for the thyroid supplement if they now felt in good health. While 72.6% understood that they should continue taking the medication as prescribed, 25.8% chose to alter the dose in some way. These participants were not aware that for this medication, feeling well indicates that the medication is working properly and the dose should not be altered. A full 98% of participants were aware that when the maximum dose of analgesic provided ineffective pain control, that the doctor should be contacted for consultation.

Delayed dose. Forty to forty-four percent of participants knew that when a dose of antibiotic, anxiolytic or thyroid supplement had to be delayed that they should "Take the dose now and resume the established regimen". Others, 27-37% of participants, thought it appropriate to consider the dose missed and resume the established regimen or take the dose now and permanently alter the schedule. These choices meant that a dose of medication would have been entirely omitted or a dosing schedule created that may have contributed to poor compliance. For the analgesic, 67.7% of respondents understood that this type of medication should be taken as needed to control pain and therefore, a regular dosing schedule need not be followed.

Missed dose. Overall, 58-69% of participants knew that if one dose of antibiotic, anxiolytic, or thyroid supplement was missed that the original schedule should be resumed with the next scheduled dose and in the amount prescribed. The next most frequent response (18-27%) was to phone the doctor to ask for directions even though only one dose had been missed. Nearly 68% of participants understood that it did not matter if a dose of analgesia was missed, rather it was important to medicate for pain relief as needed.

Several missed doses. If at least three consecutive doses of medication were missed when taking an anxiolytic or thyroid supplement, 72.6% and 62.9% of participants respectively sought to consult their physicians for instructions. Although this response was not incorrect, it was not the best choice as it reflected inadequate understanding of basic pharmacokinetics for these medications. The best response was to resume the prescribed dosing schedule, chosen by 21.0% for the anxiolytic and 35.5% for the thyroid supplement. Slightly more than 58% of participants recognized that an analgesic would retain its effectiveness even though three doses were missed. Sixteen percent of participants, however, were needlessly concerned that resuming the medication after three missed doses would increase the risk of addiction. In the case of the antibiotic, 67.7% of the participants recognized that in missing three consecutive doses, the effectiveness of the antibiotic against the bacteria may have been altered.

Side effects. Should a common side effect occur while taking an antibiotic or thyroid supplement, 83.9% and 98.4% of respondents, respectively, knew to contact their physician. As well, 96.8% of participants understood drug tolerance can result when taking an anxiolytic. Unfortunately, only 29.0% knew that there was little risk of addiction when taking an analgesic as prescribed for acute pain.

Correlations

A Pearson's product moment correlation between medication experience over the past two years and response accuracy on the medication management questions for each drug class revealed no signification correlations (largest r < .170). Therefore, experience in taking medications failed to predict accuracy in responding to questions related to interpretation of common medication prescription orders or to monitoring therapeutic responses.

A further correlation among the importance ratings (medication name, purpose, therapeutic effects, and side effects) and the seven question categories, was performed. To form the seven question category variables, responses across the four medication classes were summed in each category. It was thought that participants who recognized the importance of, for example, knowing about side effects, would score highly on the questions relating to this concern. Only three correlations were significant; between knowing the name of the medication and when to schedule a medicine (r = 0.26), between the purpose of a medication and the rationale for certain special instructions (r = 0.37), and between knowing the side effects and how to handle a missed dose of medication (r = -0.32). Thus no pattern of correlations between importance ratings and question categories emerged.

Discussion

The goal of the questionnaire was an exploration of the knowledge structure held by young adults for interpreting medication prescription information and handling problems that commonly occur when taking four common prescription medicines. Insofar as the responses to the questions reflected the current schematic knowledge structure held by participants in the domain of managing prescription medicines, the extent of their global schema in this domain could be inferred. In making this inference, however, caution must be exercised because the scope of the questionnaire was restricted in that knowledge about only four classes of medicines was explored and the question format was primarily multiple choice. The medication classes selected, however, were chosen on the basis of their relatively common use by the public. Indeed, the majority of participants indicated that they had taken an antibiotic and/or a mild analgesic in the past two years. Anxiolytics are also commonly prescribed and the physiological basis for use of the thyroid supplement was thought to create a reference point for question interpretation.

Although over 75% of participants reported taking at least one prescription medication, most commonly an antibiotic, the predicted correlation between participant medication experience and response accuracy on the medication management questions over the four common drug classes was not confirmed. Thus, medication experience had no bearing on accuracy of responding to the medication management questions. As well, even though most participants recognized that certain types of drug related information was important by assigning them high importance ratings, correlation with correct responding to questions in a similar knowledge domain were low.

If development of a global medication management schema by these undergraduate students can be inferred from their responding on this questionnaire, then schema development in this domain must be rated as sketchy and inadequate in application. The development of a schema for managing medication would be beneficial to young and older adults because it would contribute to making them more intelligent about the safe self-administration of medication. As well, the availability of schematic knowledge within this domain could contribute to more effective comprehension and memory for prescription information.

Exploration of the questionnaire data revealed knowledge deficits in several question categories that would be of concern for safe self-medication practice. These deficient areas will be discussed below as they will form a considerable part of the content in the learning module for managing medication used in Experiment 2.

Most participants failed to appreciated the significance of the word "every versus the word "times" as used in a prescription order. A considerable number of participants did not realize that the word "every" meant "around the clock" and furthermore, that it meant four times a day in the case of the "every six hours" prescription and three times a day for the "every eight hours" prescription. Many participants simply omitted a dose so as to conveniently take the medicines six or eight hours apart during waking hours. This solution, though not uncommon (McBean-Cochrane, 1989a, 1989b), is not therapeutically acceptable. In contrast, most participants were able to correctly interpret prescription orders using the word "times" as schedules may be made with considerably more flexibility. In recognition of this scheduling problem, the medication management learning module sought to include information that would improve understanding in this area.

A related concern was the difficulty the majority of participants experienced in adjusting the "every six hour" antibiotic regimen to a schedule that would include "on an empty stomach". This request was particularly difficult for participant to interpret because they had to know that "on an empty stomach" meant one hour before eating or two hours after. As well, four doses of the medicine had to be scheduled, approximately six hours apart and during waking hours. Because special instructions such as taking a medicine with or without food can be important to the amount of medication that is absorbed, and because this information does not appear to be generally known, it was included in the learning module.

Another major concern was the manner in which delayed and one or more missed doses were handled by the participants. Respondent uncertainty within this area perhaps reflected the failure of health care workers who dispense medicines to address this issue in patient teaching. It seems likely that health care workers chose to just ignore the possibility that patients can forget, perhaps thinking that if the issue were addressed, it might indicate that the practice was sanctioned. In reality, single or multiple doses of a medication may be unintentionally delayed or completely forgotten. In light of the uncertainty these young adults experienced in correctly answering these questions, patients taking prescription medicines need to be provided with guidelines on how to manage late and missed doses of medication.

Responses to questions related to taking analgesics showed that most participants were appreciative of the flexibility inherent in a "take as needed for pain" order. Responses to some questions, however, did reflect commonly held misconceptions about addiction to analgesics. For example, few understood that it is rare for addiction to develop when an analgesic is taken for acute pain. Although the questionnaire did reveal that schema development for analgesics was incomplete, information specifically related to this drug classification was not be included in the learning module developed for Experiment 2. The rationale in this instance was that information such as addiction was specific rather than generic to medication management.

In conclusion, Experiment 1 did answer some questions about the global schema held by these young adults in the domain of prescription medicine interpretation and management of common problems associated with self-medication practice. Global schema development, as assessed by the questionnaire, was judged as less than acceptable for safe self-medication practice. As well, medication experience, as quantified by the number of prescription and over the counter medicines taken in the past two years, did not appear to positively affect performance on the questionnaire. These findings suggest that the guided acquisition of a schema for managing prescriptions could be useful regardless of the extent of participant medication experience. Furthermore, the schema induced should provide insight into how to correctly interpret prescription orders when making a prescription schedule.

INTRODUCTION TO EXPERIMENT 2

If performance on the medication questionnaire in Experiment 1 accurately reflects the generic knowledge structure held by these young adults for interpreting and managing prescription medicines, then their global schema in this domain must be considered incomplete. Deficits were apparent in their ability to correctly interpret a medication prescription, to handle disruptions in day to day scheduling, and to describe what prescription information was needed to aid safe self-medication practice. These deficits raised concerns for safe self-medication practice and suggested that learning a schema for managing medications could potentially promote improved health behaviours in this group of young people. The presence of schematic knowledge for managing prescription medications would act as a framework for guiding comprehension of and memory for prescription information. Recall of the information by adults of all ages, but especially by older adults, could be improved.

In Experiment 2 young and older adults listened to a learning module for managing prescription medicines either before or after (or not at all) they heard prescription information for three medicines. Learning the module was to induce a schema for medication management. The question that arose from this manipulation was whether acquisition of the medication management schema before hearing the prescription information would enhance comprehension of and subsequently, memory for this information over schema acquisition after hearing the prescription information. The underlying theoretical constructs that guided the research questions and data analyses were schema theory and working memory. It is generally accepted that there are age-related changes in discourse processing in which older adults function with a decreased working memory capacity (Rabinowitz et al., 1982; Zacks & Hasher, 1988) and possibly slowing in efficiency of processing (Hartley, 1988; Salthouse, 1990; Stine & Wingfield, 1987). The presence of domain related schematic knowledge, may attenuate these age-related changes by increasing comprehension efficiency and accuracy of the created mental representation (Hess, 1990).

<u>Medication Module</u>

In conceptualizing the learning module for managing medications, it was recognized that it must function within certain limitations. Not only would it need to be modest in length but also in complexity as the participants were to be lay persons, not familiar with pharmacology. Based on the data from Experiment 1 and related information on self-medication administration (Cramer & Russell, 1988; Kendrick & Bayne, 1982; Lundin et al., 1980; D. Morrow, et al., 1988; Improving Patient Compliance, 1991), certain concepts for inclusion in the module were identified. Content, however, was designed to be generally applicable to most drug classifications. For example, specific therapeutic effects were not included; rather, the more abstract concept that the desired treatment effect was achieved through maintaining therapeutic serum levels of the medicine was used. Also, the concepts of medication name and purpose were not specifically included as this information was considered medication specific. In final form, the learning module contained three content areas that will be described below. (See Appendix B: Script for Medication

Management Learning Module.)

The Medication Management Learning Module commenced with the underlying theme; maintaining therapeutic serum levels in accord with the rate at which a drug is metabolized by the body and the relation these factors have on scheduling. The importance of this concept was recognized by the questionnaire respondents and is reflected in pharmacokinetic theory, the study of drug metabolism (Griffith, 1990; Pagliaro & Pagliaro, 1986). As noted in Experiment 1, participants recognized that they should know if the medicine was to be taken with or without food. In the learning module, participants were provided with the rationale for prescribing certain medicines with or without food and the effect this action would have on therapeutic serum levels and prescription scheduling.

The second content area included interpretation of the prescription order. Most participants in Experiment 1 recognized the need to know the actual content of the prescription order; the number of pills to take and how often to schedule them. Participants did, however, experience difficulty in accurately interpreting prescription orders. Understanding how to interpret prescription orders and to plan practical personalized schedules is vital to safe self-medication practice (Lundin et al, 1980; D. Morrow et al., 1988; Pagliaro & Pagliaro, 1986). Therefore, the medication management module provided guidelines and examples on how to interpret prescription orders and plan medicine schedules around routine eating and sleeping patterns.

The final content area in the learning module included information on ways to manage late and missed doses of medicine. This information was considered important to include because participants in Experiment 1 had experienced considerable difficulty in responding accurately to these questions on the questionnaire. Furthermore, forgetting to take a dose of medicine at the scheduled time does happen, even though health professionals may not wish to acknowledge this fact.

<u>Medication Module Preparation</u>

In drafting the actual text of the Medication Module, several factors were taken into consideration. Foremost was the understanding that the text was to be presented by the experimenter as the young and old participants listened. That is, participants were being asked to comprehend, on-line, a fairly complex message of more or less novel information, to remember much of the content for immediate recall, to integrate the content into their developing global schema for managing medication and to apply the concepts later in the interview. Within schema theory, the learning module would function as the episodic information that would activate the existing global schema and become integrated into it, forming an instantiated schema for managing medications (Figure 1; Brewer, 1987).

An important factor taken into consideration in drafting the text was that sentence structure had to be kept simple. This was important for two reasons. First, comprehension and learning was to take place during listening and second, half the participants were older adults in whom processing capacity may be diminished (Rabinowitz et al., 1982; Stine, 1990; Zacks & Hasher, 1988). Thus, clauses were chained together avoiding left branching sentences (Chafe & Danielewicz, 1987; Kemper, 1987, 1988; Stine et al., 1986; Stine, Wingfield, & Poon, 1986, 1989) and vocabulary, including medical terminology, was kept as simple as possible (D. Morrow, et al., 1988). Using simple syntax should minimally tax working memory and aid on-line comprehension, integration and memory for content. As well, every effort was made to organize text content in a logical manner as both young and old adults recall more information from a logically organized discourse (Dixon, Hultsch, Simon, & von Eye, 1984; Hultsch & Dixon, 1984).

Another factor that could significantly affect module comprehension was the manner in which the text was presented to the participants. In delivering the prepared text, every effort was made to facilitate on-line comprehension. The text was to be delivered at a rate of between 130 and 145 words per minute. This speech rate was slower than the normal conversational rate of 175 words per minute (Schmitt & Carroll, 1985) and only slightly faster than 120 words per minute where inferencing by older adults still shows little deterioration (Cohen, 1979). At the slower pace of approximately 100 words per minute, Kim and Grier (1981) reported that a group of older adults retained more drug related information than those who heard the same information presented at 160 words per minute. However, even at a delivery rate of 120 words per minute, Burke and Harrold (1988) showed that older adults took slightly longer to comprehend semantic targets than did younger adults. This study suggests that for some older adults, even at the slow speech rates to be used in the study reported here, on-line processing may not keep pace with input and thus the overall quantity and quality of the retained information may be different from that of younger adults.

Older adults have been shown to rely more heavily on normal prosody during discourse processing than do young adults especially as speech rate increases (Stine & Wingfield, 1987; Wingfield, Lahar, & Stine, 1989). As well, Cohen and Faulkner (1986a) reported that comprehension and recall by older adults was aided when semantically important words within the discourse received focal stress. Thus, to ensure that the older adults were advantaged as much as possible, the text was delivered using normal prosody and with slight emphasis placed on key words.

Several studies have reported that illustrated text aids the formation of accurate representations of the text. Illustrations have been used to represent spatial relations (Hayes & Henk, 1986; Mayer, 1989; D. G. Morrow, Bower, & Greenspan, 1989) or diagram temporal relations occurring within the text (Glenberg & Langston, 1992). In both situations, study groups that read the illustrated text recalled more information than groups that read text alone. Levin, Anglin, and Carney (1987), Peeck (1987) and Schallert (1980) concluded in their reviews that when text-embedded illustrations accurately represent the text, comprehension was facilitated in both reading and listening modalities, abstract content made more concrete, and the representation held in memory standardized. Schallert suggested that perhaps the illustrations encouraged elaboration of the text which increased its integration.

For these reasons, in the present research, simple coloured line drawings were created to accurately represent the text. The drawings were consistently labelled throughout using wording from the text. Although the bimodal effect of pictures and text benefits young adults it is not as clear that old adults always benefit under all conditions. For example, Stine, Wingfield, and Myers (1990), showed that young adults benefited significantly more from television-like presentations of newscast material than did old adults. Cole and Houston (1987) reported similar findings. These two studies used television with its moving pictures and verbal dialogue as the bimodal medium. Morrell and Park (1992) showed that errors on procedural tasks were reduced by both young and old adults when they followed instructions composed of both written text and illustrations. Thus, older adults did benefit from a learning module that used illustrations to accurately represent the text. It was anticipated that because the illustrations in the present research would be pictures, they would aid both age groups equally in text comprehension, in the integration of global and episodic information into an instantiated schema, and in immediate recall of the Medication Module (Glenberg & Langston; Levine et al.; Peeck). It was conjectured that by using the slower speaking rate noted above, that the additional time shown to be needed by the older adults to foster spontaneous integration of pictures and text would be available (Pezdek & Miceli, 1982).

<u>Contributions of Working Memory</u>

Although schema theory provided the guiding structure for the design and interpretation of the results in this study, an underlying theoretical explanation for the anticipated results lies in the relationships among schema theory, working memory, and age-related change in processing resources. Discourse processing, considered to take place within working memory, becomes more efficient when a related schema can be activated to provide a framework for interpretation and integration of relevant information (Hess, 1990). Deficits in two aspects of processing resource are thought to occur with age; age-related deficits in working memory capacity (Cohen, 1988; Dobbs & Rule, 1989; Light & Anderson, 1985; Light & Burke, 1988; Spilich, 1983; Stine & Wingfield, 1987; but see Hartley, 1986, 1988) and age-related slowing in processing speed (Cohen, 1988; Burke & Harrold, 1988; Hartley, 1988; Salthouse, 1990).

Working memory has been conceptualized as a capacity limited resource where information is simultaneously processed and temporarily stored (Daneman & Carpenter, 1980). Baddeley (1986) conceives working memory to be a processing resource with central executive functions that select and control information, moving it within and among at least two temporary slave systems and long term store. Although an age-related decline in tasks thought to measure working memory capacity has been demonstrated, findings are not conclusive. It is possible that the slowing of mental processing observed in many studies (e.g. Burke & Harrold, 1988) could be fundamental to age-related deficits in working memory capacity and could aid in explaining them (Hasher & Zacks, 1988; Gick, Craik, & Morris, 1988; Salthouse, 1990). Regardless of which explanation may be accurate, language processing and especially on-line comprehension is thought to rely heavily on working memory capacity and the rate at which information can be processed (Hartley, 1988; Hasher & Zacks, 1988; Kintsch & van Dijk, 1978; Spilich, 1983).

Several tasks, including the reading and listening span task reported by Daneman and Carpenter (1980) and the auditory working memory task conceived by Dobbs and Rule (1989), have been used as measures of working memory capacity. Performance on these tasks is thought to reflect the storage and manipulation functions of working memory with auditory working memory placing greater emphasis on manipulation. Dobbs and Rule reported that the older adults in their sample performed significantly more poorly on auditory working memory than did the young adults. They attributed this decline in performance to the task demands on agility in processing.

While some researchers have reported age-related decline in performance on the Daneman and Carpenter span tasks (Baddeley, Logie, Nimmo-Smith, & Brereton, 1985; Light & Anderson, 1985; Stine & Wingfield, 1987; Tun, Wingfield, & Stine, 1991), others do not (Hartley, 1986, 1988). Hartley (1988) reported that even though there was no age related change in working memory, reading span (Daneman & Carpenter, 1980) did predict performance on prose recall. As well, she showed that reading span was part of both a general speed component and a verbal component. Thus reading span seems to use both the storage and agility processing components of working memory capacity. On the other hand, Light and Anderson (1985) reported that reading span did not correlate with verbatim recall but did with response on paragraph memory. In addition, even though Light and Anderson reported age-related differences in reading span, they could not conclude that this age-related difference in working memory capacity explained the performance differences they found on responding to paragraph memory.

Because of these differences, two working memory tasks were used in this research, the listening span task modelled after the task by Daneman and Carpenter (1980) and the Dobbs and Rule (1989) auditory working memory task. Age-related differences in these span tasks were expected. As well, their inclusion was anticipated to provide insight into age-related differences in working memory capacity and processing agility demanded by the recall and planning dependent measures used in the study.

<u>Study Goals</u>

The objective of presenting the Medication Module text as described above was the facilitation of content comprehension. Comprehension was to be accompanied by integration of this episodic information with global schema information to form an instantiated schema for managing medications. Schema instantiation was assessed through a questionnaire consisting of a series of short answer questions that evaluated understanding and memory of the concepts presented in the learning module. By inference, accuracy of at least 80% was meant to indicate that an accurate instantiated schema of the Medication Module had been acquired.

In the schema first condition, participants listened to the prescription information after understanding of the Medication Module had been verified. It was thought that in this condition participants would be able to make use of aspects of the newly instantiated medication management schema to guide their integration of the episodic prescription information into an episodic mental model of that information. Processing would therefore be accomplished with increased efficiency and should result in a more complete episodic mental model of the prescription information. After an activity filled delay of approximately 20 minutes, Medication Recall (short answer questionnaire testing memory for prescription information) and Prescription Scheduling (participant created 24 hour plan for scheduling the three medicines), ability were tested to determine the effectiveness of the manipulation.

In the schema second condition, participants heard the prescription information before they learned the Medication Module. Without the organizing framework offered by the instantiated medication management schema, processing would be less efficient and more information would be lost. Older adults would be expected to lose more information than younger adults because the pace of the incoming oral message could possibly exceed the capacity of their working memories to process and store the information as completely. The episodic mental models held by the older adults in the schema second condition would not be as complete a representation of the prescription information content as would be present in the schema first condition.

A control condition was introduced into the experimental design because it was quite possible that medication prescription information could be remembered and interpreted equally well with or without learning the Medication Module. In the control condition, participants listened to a learning module on different medication preparation before listening to the prescription information. Learning the control condition module information should have had no effect on processing the prescription information. Thus the episodic mental models representing the prescription information in the control and schema second conditions should be similar. An unknown factor, however, was the effect that learning the Medication Module after hearing the prescription information (schema second condition) might have at Medication Recall and Prescription Scheduling.

Because the episodic mental models held by participants in the schema first condition would possibly have been more complete, it was anticipated that they would achieve higher accuracy scores on the Medication Recall questionnaire and on the Prescription Scheduling activity than would those in the schema second. It was further anticipated that the older adults would recall significantly less information than young adults on the Medication Recall questionnaire, and that this effect would be greater in the schema second condition. The rationale behind this hypothesis was that the availability of a domain related schema in the schema first condition would increase processing efficiency for the prescription information, thus somewhat compensating for the age-related decline in processing capacity.

The older adults were most likely to have more extensive medication experience than the young adults. It was not entirely clear, therefore, whether older adults would create Prescription Schedules that were similar to or possibly of greater accuracy than those generated by young adults. From Experiment 1, however, medication experience did not appear to affect performance on the Prescription Questionnaire. Should medication experience fail to be a factor in Experiment 2, then it was anticipated that Prescription Scheduling by older adults would be less accurate than by young adults, and the effect might be greater in the schema second condition because the instantiated schema was not available during initial processing of the prescription information.

Method

Participants

The young adults, 56 in total, were undergraduate students from the University of Alberta who volunteered for participation as an option for course credit. Data from two students were dropped from the study; one because English was not the native tongue spoken and another because instructions for the Prescription Scheduling task were misinterpreted. The remaining 54 young adults, 22 males and 32 females ranged in age from 18 to 31 years with a mean age of 20.26 years (SD = 2.96).

The older adults were community dwelling volunteers who responded to a series of advertisements in community newspapers, and at three senior citizen centres. Fifty eight seniors participated. Data from four participants had to be discarded because one suffered from poor vision, one from poor hearing, one was taking antidepressant medication, and another misunderstood instructions relative to the Medication Recall task. The remaining 54 old adults, 15 males and 39 females ranged in age from 65 to 81 years with a mean age of 71.69 years (SD = 4.83).

All participants entered into the study were native speakers of English and were not currently taking any psychotropic medications. As well, with the exception of one older adult, all participants completed the vision and hearing screening procedures without an error. This one participant received a score of nine out of ten on the hearing screen. The volume on the audiotape was adjusted slightly upwards and performance on subsequent tasks, such as listening span, indicated adequate compensation.

Experimental Design

The study was a 2 Age (young and old) by 3 Condition (schema first, schema second, control) design. Both Age and Condition were between subjects. The control condition was introduced on the assumption that it could be possible to remember and interpret medication prescription information equally well with or without acquiring the instantiated schema. The within subject variables included performance on Prescription Scheduling and Medication Recall, two working memory tasks and a vocabulary task. The sequencing of tasks implemented during the data collection interviews for Experiment 2 is displayed in Table 3.

The sequence of tasks in the three conditions was planned with the intent that the time interval between the presentation of the Medication Prescription Information and administration of the Medication Recall questionnaire would be approximately the same.

Materials and Tasks

1. Demographic screening. The participants' age at the time of testing and the number of years of education were recorded. A set of four health related variables were documented during screening: self-rated health, effect of health state on activities of daily living, current prescription medications, and medication experience. To assess self-rated health, participants were asked to rate their state of general health on a four point scale: Excellent [1], Good [2], Fair [3] or Poor [4]. Also on a four point scale, participants were asked to rate the extent to which their health state interfered with activities of daily living: Not at all [1], A little [2], Some [2], or Quite a bit [4]. The number and type of medication prescriptions were

documented. Medication experience was the sum of the number of prescription medicines currently taken, the number of additional prescriptions taken in the past two years and the incidence of assisting a close relative with medications in the past two years. (See Appendix G: Interview Protocol.)

Table 3

Task Sequence for Experiment 2

	CONDITION		
	Schema lst	Schema 2nd	Control
GROUP	Young/Old	Young/Old	Young/Old
PROTOCOL			
	Briefing	Briefing	Briefing
	Screening	Screening	Screening
	Med. Module	**Auditory WM**	**Control Module**
	Prescription	**Prescription**	**Prescription**
	Auditory WM	**Med. Module**	**Auditory WM**
	LSPAN	LSPAN	LSPAN
	Recall	Recall	Recall
	Scheduling	Scheduling	Scheduling
	Vocabulary	Vocabulary	Vocabulary
	Debriefing	Debriefing	Debriefing

Note: Auditory WM = auditory working memory, LSPAN = listening span, Med. Module = Medication Management Learning Module, Prescription = Medication Prescription Information, Recall = Medication Recall, Scheduling = Prescription Scheduling

2. Vision and hearing screen. Vision was screened by asking participants to read out loud a series of ten words printed on individual 5x7 inch index cards. Two sizes of type were used, in keeping with those used in the stimulus materials.

Hearing was screened by asking participants to follow a series of brief instructions that had been audiotaped by a male speaker of English. The same male speaker taped the other auditory stimuli. In the instructions participants were asked to carry out simple manipulations of ten coloured tokens (e.g. Touch the red circle). (See Appendix G: Interview Protocol)

3. Medication management learning module. As was outlined in the introduction to Experiment 2, the Medication Management Learning Module (Medication Module) presented to participants included three major content areas. The first content area introduced the underlying theme of the learning module: that sustaining a therapeutic serum level of a medication throughout treatment was desirable and achieved through taking medicines as prescribed. In the script (See Appendix B: Medication Management Learning Module), the concept that some medicines are used relatively rapidly by the body and must be taken EVERY so many hours, while others are used relatively more slowly and so may be taken at certain TIMES during the day, was emphasized. The presentation then described why some medicines must be taken with food or milk while others must be taken on an empty stomach. The implication these actions had on sustaining the necessary serum medication level was described.

In the second content area, the usual information contained in a prescription order was outlined and interpreted. Examples of how to interpret two prescription orders, one that emphasized EVERY four hours and the other four TIMES a day were included. The session concluded with the third content area, which addressed the problem of how to handle late and forgotten doses of medicine and how you know when to stop taking a medicine. Wording and phrasing in the text was kept simple to meet the Fog Formula criteria for a grade 6.5 level (Gunning, 1952).

To augment the prepared text read to participants in the schema first and second conditions, a series of illustrations were prepared that depicted, in pictorial form, what the text was describing in words. The illustrations were sequentially arranged in a booklet and were shown in time with the relevant text. The drawings diagrammed changes in medication concentration within the blood stream under the various conditions discussed in the text. Changes in serum level concentration were depicted both by shades of green from dark to light and by the number of ovals in the blood stream within each man-shaped outline. Each man-shaped outline was appropriately and consistently labelled in large type using words from the text. The one page in the booklet without illustrations presented, in point form and using a large type, key factors to consider when formulating a plan for scheduling medicines. At the bottom of this page was the slide rule used to interpret the EVERY and TIMES concept in prescription orders. The experimenter pointed to salient aspects of the illustrations as they were described in the text. (See Appendix B: Medication Management Learning Module)

The learning module was read from the prepared text at a deliberate pace, between 130-145 words per minute. Care was taken to articulate words clearly and to use normal prosody. Certain key words, for example EVERY, were consistently emphasized during the presentation and appeared in upper case type within the script.

3.1. Verification. Participants responded to a series of eight questions designed to assess understanding of and immediate memory for concepts in the Medication Module. Responses to these questions also provided insight into instantiated schema development in the domain of managing prescription medications. To answer three of the questions, participants were given seven 5x7 inch index cards. Each card depicted an exact replica, including labelling, of one of the man-shaped outlines used in the Medication Module. Participants were asked to arrange in a sequence as many cards as needed to depict, for example, changes in the concentration of medication in the blood for a medicine used slowly by the body. Participants responded verbally to the remaining five questions which asked about information explicitly described in the learning module, e.g. Can you tell me why some medicines must be taken on an empty stomach? As it was important to ensure that participants understood module content, there was no time limit for responding. If an incorrect response was given, the correct response was provided by the experimenter.

3.2. Scoring. A fully correct response for each question required knowledge of items of information described in the Medication Module. Participants were, therefore, awarded a possible two points for each of the eight questions. The score in percent correct was entered into analysis. (See Appendix B: Verification Questions and Scoring Guide.)

4. Control learning module. In lieu of the Medication Module, control group participants were instructed on routes for self-administration of medications. This topic was chosen because it was medication related but was not directly related to planning a medication schedule. Various forms of oral medicines, such as enteric coated and sublinquals, were presented. As well, eye (ophthalmic), nasal sprays, and topical medicines were covered. As the text was read, in the same manner as for the Medication Module, participants were shown illustrations that depicted the type of medicine and route of administration being described in the script. The experimenter pointed to salient aspects of the illustrations as they were described in the text. Wording and phrasing in the text was kept simple to met the Fog Formula criteria for a grade 6.5 level (Gunning, 1952). (See Appendix C: Control Learning Module.)

4.1. Verification. At the conclusion of the reading, participants were asked to respond verbally and by gesture to six questions. Questions were explicit but did require interpretation by participants. For example, they were asked to demonstrate how to give themselves a nasal spray. Any item that could not be recalled or demonstrated was explained by the experimenter to ensure that content was understood.

4.2. Scoring. The six questions asked participants to recall or demonstrate ten items of information. Each item of information was awarded one point. The percent correct was entered into the analysis. (See Appendix C: Verification Questions and Scoring Guide.)

5. Medication prescription information. Participants were asked to listen to information about three prescription medicines chosen to fit into the common illness scenario of pneumonia with productive cough and insomnia secondary to anxiety. Two of the medicines came from familiar classifications, antibiotics and anxiolytics but their trade names were intentionally unfamiliar; Cloxapen and Lorax respectively. The third medicine, Benemid, potentiated the action of the antibiotic but should have been unfamiliar (Olin, 1991; Pagliaro & Pagliaro, 1986; Canadian Pharmaceutical

Association, 1991). The same categories of information were provided for each medicine; a) trade name and colour, b) action, c) number of pills and how often to take them, d) special instructions to follow when taking the medicine, e) expected benefits from taking the medicine, f) possible side effects and action to take should these occur, and g) how long the medicine was to be taken. Wording and phrasing within the text was kept simple and met the Fog Formula for a grade 6.5 level (Gunning, 1952). (See Appendix D: Medication Prescription Information)

Information in each category was unique to the prescription medicine being described except that both Cloxapen and Benemid were to be taken for ten days. Content was designed to be integrated with much of the information presented in the Medication Module. For example, Cloxapen was to be taken EVERY six hours on an empty stomach, and Benemid, two TIMES a day with food or milk. The categories of information were ordered differently within each prescription. Identification of each medicine was especially emphasized in that each was identified three times during the discourse, twice by trade name and once by colour. In addition, participants were shown the trade name in large print on a 5x7 inch index card. The text was audiotaped by a male speaker of English who spoke in a deliberate manner, using normal prosody at a rate of approximately 120 words per minute. The end of each prescription was signalled by a three second pause.

6. Medication recall. A short answer, ten item, questionnaire was developed to assess the long term recall of Prescription Information and by inference, the episodic mental model formed of the three prescriptions. Three groupings of questions were used. Answering one group, explicit recall items, relied primarily on memory for information explicitly stated and only given in the Prescription Information. Questions in this group included the name of the medicine (item one), its purpose, expected therapeutic effect and side effects (items two, nine and ten). In the second group, application recall questions (items seven and eight), participants were to apply information on how to handle late and forgotten doses of medicine learned in the Medication Module or as drawn from their instantiated schema in the context of the questionnaire. In responding to the third group, integration recall questions (items three through six), participants needed to integrate instantiated schema and Prescription Information to answer the questions correctly. For example, participants were questioned about how they would schedule the medication, about special instructions, and when they could stop taking the medicine. There was no time limit imposed for completing the task.

6.1. Scoring. The scoring procedure was guided by content in the Medication Module and the Prescription Information and by the integration expected from the participants. Scores ranged from 0.5 to 2 points per question for a total of 17 points for each medication. The questionnaires were scored once and the guide amended to include acceptable variations generated by participants. Using the amended guide, the questionnaires were rescored. As well, a random selection of one third of the questionnaires in each group (Age by Condition) was scored by a second scorer who was unaware of the Age and Condition assignment of the respondent. The inter-rater reliability was 95%. Percent scores on each question and total scores were entered into the analyses. (See Appendix E: Medication Recall questionnaire and scoring guide.)

7. **Prescription scheduling**. Participants were asked to create a written 24 hour plan for taking the three prescribed medicines. They were given an 8 x 11 inch sheet of paper prepared with 24 blank rows each labelled on the left hand side with the time in hours beginning at 6:00 a.m. and ending 24 hours later with 5:00 a.m. Columns were labelled from Monday through Thursday. Participants were asked to record both the name (or first letter) of medicine and how many pills they would take at each time slot where they planned to take the medicine over the four day period.

Three medicine bottles labelled in accord with Prescription Information heard earlier on the audiotape were always available for reference. Labelling of the bottles was consistent and in accord with the method taught by the Department of Pharmacology in their dispensing laboratory. Special instruction labels were attached to the Cloxapen bottle (Take on Empty Stomach) and the Benemid bottle (Take With Food or Milk) immediately above the main label. The bottles were held in a small narrow box with only the tops showing above the lip of the box. Each bottle could be identified from the top by a coloured oval and black letter placed on the bottle cap: red and "C" for Cloxapen, yellow and "B" for Benemid, and green and "L" for Lorax. The coloured oval corresponded to the colour of the candy pills inside and the pill colour mentioned in the Medicine Prescription script. In order to read the label, the bottle had to be removed from the box. This action provided the cue for recording, in the score booklet, the identity of the bottle removed and the time it was removed and returned to the box by the participant.

7.1. Scoring. In scoring for accuracy of the plan, each correctly timed entry on the Prescription Schedule could be awarded a maximum of two points, one for the correct medication and one for the correct number of pills. Some flexibility in scheduling was permitted within the parameters of the prescription order and the participant's usual sleeping and eating pattern. The number of possible correct entries was different for each medicine; Cloxapen was scored out of 28 points, Benemid out of 14, and Lorax out of a possible of 22 points. The score in percent correct (Planning Accuracy) for each medicine was entered into the analyses.

As well, the plans were scored for three types of errors: a) timing errors - failure to schedule doses of medicine the required number of hours apart within the plan, b) quantity errors - failure to record the correct dosage in the appropriate time slot, and c) special instruction errors - failure to take into account the special instructions that accompanied the prescriptions for Cloxapen and Benemid. Cloxapen was to be taken on an empty stomach while Benemid was to be taken with food or milk. It was possible to schedule doses of Cloxapen 5-7 hours apart but fail to schedule them one hour before or two hours after a meal. Thus a participant could be error free for timing on Cloxapen but incur errors in following special instructions. The total number of errors possible for Cloxapen was seven, for Benemid, five, and for Lorax, four. (See Appendix F: 24 Hour Prescription Schedule and Scoring Guides.)

8. **Dobbs and Rule auditory working memory task**. Participants listened to strings of randomly ordered single digits presented auditorily at a rate of one digit every 1.8 seconds (Dobbs & Rule, 1989). The digit strings were audiotaped by a

male speaker of English. There were four response conditions presented in ascending order: report the digit just heard (Lag 0), report the digit one back (Lag 1), report the digit 2 back (Lag 2) and report the digit 3 back (Lag 3). Two trials were administered at each lag with ten correct responses being possible on each trial.

8.1. Scoring. A score of ten was possible on each of the four conditions. The performance score was the number correct to first error and the better of the two trials at each level was entered into analyses. (See Appendix G: Auditory Working Memory.)

9. Listening span task. This task was modelled after the one designed by Daneman and Carpenter (1980) and later modified by Baddeley et al. (1985). Participants listened to sets of two, three, four and five short sentences (7-12 words). There were three sets of sentences at each of four levels beginning with three sets of two sentences as Level Two. Half the sentences made sense semantically and half did not. These two sentence types were distributed equally and randomly within each level. The sentences were audiotaped at approximately 120 word per minute by a male English speaker. Participants were asked to listen carefully to each sentence and then to immediately say out loud, "yes" if the sentence made sense or "no" if it did not. There was a pause of approximately two and a half seconds between each sentence for this response to be made.

As well as deciding if the sentences made sense or not, participants were asked to remember the last word in each sentence and to recall them, in any order, after all the sentences in the set had been presented. The tape was stopped during the recall periods. Recall in any order was permitted because Daneman and Carpenter (1980) reported that recall in the listening modality was more difficult than after reading. After completing the three sets of sentences at one level, the task progressed to the next level. All four levels, two through five were completed.

9.1. Scoring. Two different scoring methods were used and both were entered into analyses. Using the Baddeley et al. (1985) method, the total number of correctly recalled responses at each level was totalled and summed over all the levels giving a perfect score of 42 points. Using the Daneman and Carpenter (1980) method, an overall listening span level was awarded. A full level was awarded if all the sentence last words in two of three sets at the level were recalled. An additional half level was awarded if all the sentence last words in one of the three sets of the next level were successfully recalled. Thus if a participant recalled all the sentence last words in two sets at Level Two and one at Level Three, the Listening Span was 2.5. (See Appendix G: Listening Span Task.)

10. Advanced vocabulary task. Part one (18 items) of the vocabulary test from the Kit of Factor-Referenced Cognitive Tests (Ekstrom, French, Harman, & Kermen, 1976) were printed on a single sheet of paper. Each item consisted of an underlined target word with four words or short phrases immediately beneath it. The task was to identify, and circle, the word or short phrase that was closest in meaning to the underlined word. The target words ranged in difficulty from relatively familiar to relatively unfamiliar. There was a four minute time limit on this task.

10.1. Scoring. Performance was scored by awarding one mark for each correct choice made within the four minute time limit. (See Appendix G: Advanced Vocabulary Task.)

Procedure

After a brief orientation to the purpose of the study, and securing consent from each participant, demographic questions were completed and vision and hearing screened. As can be seen in Table 3, the order in which the Medication Module and Prescription Information as well as other tasks were administered varied with the assigned condition. Although the order differed, tasks were administered in the same manner across groups.

1. Medication management learning module. Participants were asked to imagine that they were at an early afternoon doctor's appointment seeking treatment for a persistent chest cold with productive cough and anxiety induced insomnia. The diagnosis of pneumonia was given and several prescriptions promised. In both experimental conditions, the Medication Module was introduced as "some information about taking medicines."

Participants were asked to listen carefully as the information could only be given once and that they would be asked some questions about the information immediately after the presentation was completed. The Medication Module was read from the prepared script as described under Materials. As the experimenter read the text, she turned the pages of the illustration booklet pointing to salient features as they were described in the text. The same procedure was followed when presenting the Control Learning Module (Control Module).

After presentation of the learning module was completed, verification questioning commenced. Each question was read from the prepared script. Participants responded either verbally and by displaying a sequence of illustrated cards (Medication Module), or by word and gesture (Control Module). Participant responses were noted in the interview booklet. The total time for task completion was noted by the experimenter who also recorded a split time after Module presentation was completed.

2. Medication prescription information. Participants in all conditions were instructed that the doctor would now give them prescriptions for the three medicines they were to take at home. They were also told that the information had been audiotaped, to listen carefully as it would only be given once and that they would be asked to recall the information sometime later in the interview. Finally, participants were informed that the name of each medicine would be presented on a card when it was referred to during the taped message. The tape was then played.

3. Working memory tasks. In the auditory working memory task participants listened to a tape with some recorded numbers on it. With the exception of the Lag 0 condition, one or more practice trials was given before the actual test trials to ensure the participant understood the task. The experimenter recorded the numbers given by the participant and the time it took to complete the task.

Before commencing the listening span task, participants were guided through a practice trial at Level two to ensure they understood the task. The task proceeded as described previously. The experimenter recorded whether the participant made the right decision about the sense of the sentence, which word(s) were recalled and the time it took to complete the task.

4. Medication recall. Participants were given the three page medication recall questionnaire and asked to record their responses in the spaces provided in accord with the information about the three prescription medicines they had heard on the audiotape earlier in the interview. They were also informed that the same questions were asked of each medicine, that they could fill out the questionnaire in any order and that there was no time limit. The experimenter went out of the room for approximately fifteen minutes but if the questionnaire was completed sooner, participants could signal by opening the testing room door. The time to complete the task was recorded by the experimenter.

5. Prescription scheduling. Participants were supplied with the medication planning form described under Materials and instructed on its use. They were asked to create a 24 hour plan for the three medicines that had been prescribed, commencing the plan Monday afternoon when they returned from the pharmacy and ending at bedtime Thursday. They were then shown the box with the three prescription bottles. The bottle of Cloxapen was taken out and the label displayed while saying that the plan should be made in accord with the prescription label information on the bottle including any special instructions, and with their usual sleeping and eating patterns. Also, more than one medicine could be scheduled at a given time interval. Participants were asked to record the first letter of the medicine and the number of pills they would take at each entry. Participants were assured that there was no time limit and that they could look at the bottles as long and often as they wished but only one at a time.

The experimenter recorded, in the interview booklet, the time each bottle was taken out and returned to the box as well as the time it took to complete the task. When the plan had been completed to the satisfaction of the participant, the plan was reviewed. In doing this, the usual eating and sleeping patterns were recorded on the planning form, errors in the plan were noted, and improvements in the plan solicited. The improvements were recorded in interview booklet as prompts.

6. Advanced vocabulary task. Participants were introduced to this task and guided through three practice trials. They were assured that the task contained some

words that they may not recognize but to make a best guess on each word. The time limit of four minutes was also stated. Participants were given the prepared form and their performance was timed.

7. **Debriefing**. All participants were asked a series of questions designed to ensure that no participant left the testing situation unduly concerned that they were perhaps taking medicines inappropriately. Participants were asked what they thought about the medication instructions they had listened to during the interview, if these instructions might affect how they took medicines in the future and lastly if they had any concerns about their current medicine taking practices. Should a concern have been raised, the participant would have been referred to their doctor or pharmacist for clarification. No concerns were raised.

Results

Participants

A series of analyses of variance (ANOVA) were conducted on the participant variables as a function of 2(Age, young and old) and 3(Condition, schema first, schema second or control). The purpose of these analyses was to determine if the groups differed unpredictably on any of these individual difference variables. The participant variables of, education, and vocabulary will be reported first followed by the health related variables of self-rated health, effect of health state on activities of daily living, current prescription medicines, and medication experience. Mean scores for these data appear in Table 4.

There was a reliable effect for education with the young adults (13.95 years; SD = 1.16) somewhat better educated than the older adults (12.44 years; SD = 3.09), $F(1,102) = 11.67$, $p < .002$. The Condition main effect was also significant, $F(1,102) = 3.22$, $p < .05$ as both groups in the schema first condition were slightly better educated than in the other two conditions. The mean years of education were 13.98, 12.70 and 12.92 years for the schema first, schema second and control conditions respectively. The interaction was not significant ($F < 1.50$).

Analysis of vocabulary scores showed that the older adults (11.85 words; SD = 4.03) scored significantly higher than the young adults (8.83 words; SD = 2.96)

Table 4

Mean Scores (Standard Deviations) on Participant Characteristics of Group Size, Age, Sex, Education, Vocabulary and Health Related Variables by Group and Condition

	CONDITION					
	Schema 1st		Schema 2nd		Control	
Age	Young	Old	Young	Old	Young	Old
Group Size						
Male	7	5	8	5	7	5
Female	11	13	10	13	11	13
Total	18	18	18	18	18	18
Age in Years	21.06 (3.24)	72.00 (4.98)	19.72 (1.78)	72.33 (4.79)	20.00 (2.61)	70.72 (4.85)
Education in Years	14.39 (1.54)	13.56 (3.28)	13.89 (1.02)	11.50 (2.50)	13.56 (0.62)	12.28 (3.23)
Vocabulary	9.07 (2.56)	12.83 (4.40)	8.29 (2.99)	12.00 (3.48)	9.17 (3.37)	10.22 (4.08)
Self-Rated Health	1.50 (0.62)	1.61 (0.50)	1.61 (0.50)	1.89 (0.76)	1.56 (0.62)	2.00 (0.59)
Activities of Daily Living	1.17 (0.51)	1.50 (0.71)	1.33 (0.77)	1.61 (0.78)	1.56 (0.62)	2.17 (1.04)
Current Prescriptions	0.22 (0.43)	1.06 (1.31)	0.39 (0.50)	1.17 (1.54)	0.33 (0.46)	1.67 (1.91)
Medication Experience	1.39 (1.38)	1.78 (1.87)	1.56 (1.76)	2.22 (2.02)	1.50 (1.43)	2.65 (2.40)

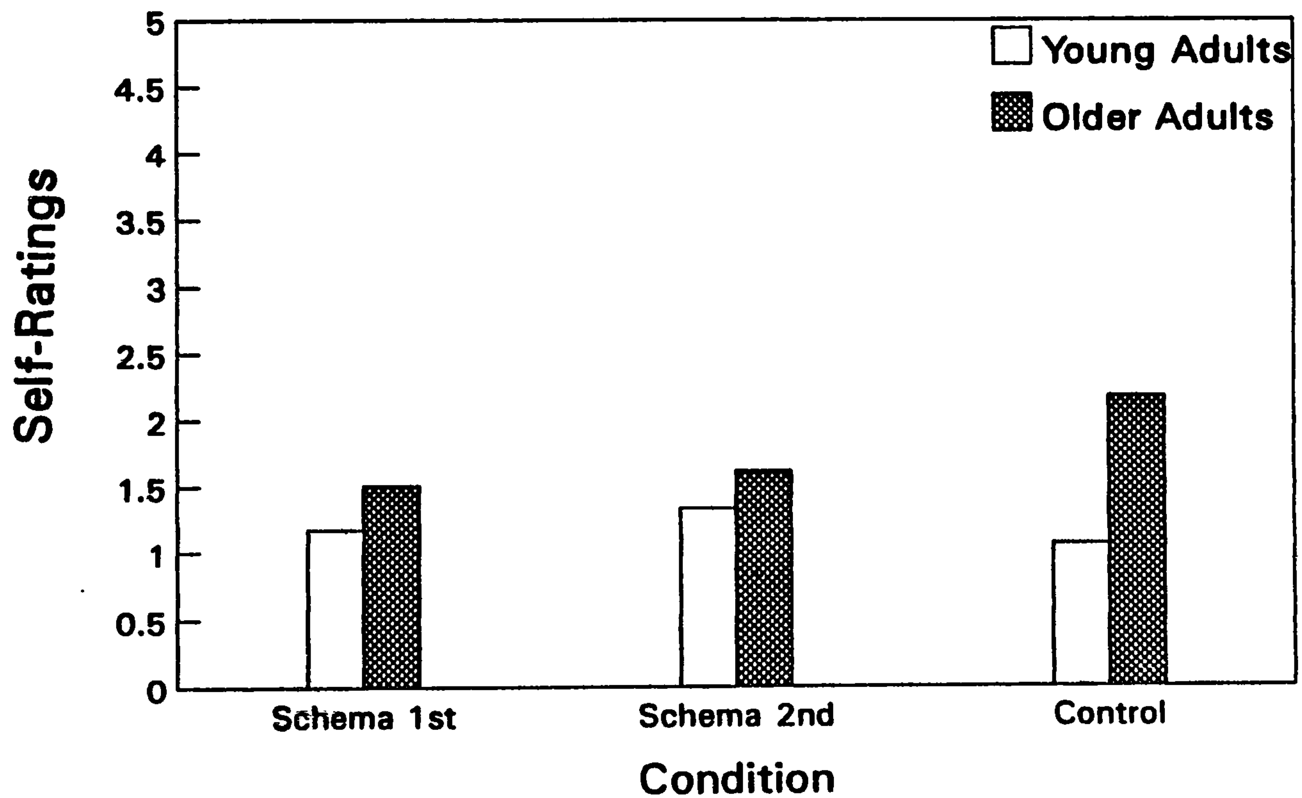
on this task, $F(1,102) = 19.71$, $p < .001$. Neither the Condition main effect nor the interaction were significant ($F < 1.50$).

Similar analyses were carried out on the health related variables. The young adults (1.56; SD = 0.57) rated their state of health as reliably better than did the older adults (1.83; SD = 0.64), $F(1,102) = 5.70$, $p < .019$. On the rating scale used, one was excellent and two good. Thus, on average, both age groups rated theirhealth in the good to excellent range. Almost all the young adults indicated that they had no illness that interfered with their activities of daily living (M = 1.19; SD = 0.55) while the older adults stated that chronic illness interfered with their activities of daily living "a little" (M = 1.76; SD = 0.89). Although the main effect for Age on this variable was statistically significant, $F(1,102) = 17.22$, $p < .001$, the difference between the two age groups on the degree to which illness interfered with activities of daily living was functionally very small, somewhere between none and "a little".

Older adults (1.30; SD = 1.60) reported that they were currently taking, on average, almost one prescription medicine more per person than were young adults (0.32; SD = 0.50). This Age group difference was reliable, $F(1,102) = 18.57$ $p < .001$. The medication experience index was the sum of the number of prescription medicines taken currently and over the past two years as well as the incidence of assistance given to others in the past two years. The older adults had a mean medication experience score of 2.01 (SD = 2.09) while the score for young adults was 1.48 (SD = 1.50). Even though the difference between the two age groups was small, it proved to be reliable, $F(1,102) = 4.29$; $p < .05$. Although medication experience failed to correlate significantly with accuracy of performance in Experiment 1, it could have affect performance in Experiment 2. Therefore, medication experience was entered as a covariate on selected analyses.

With one exception, there were no Condition main effects or Age by Condition interactions on the health related variables ($F < 1.50$). The one exception was a significant Age by Condition interaction on the self-rated effects of health state on activities of daily living , $F(1,102) = 3.78$, $p < .030$. As shown in Figure 4, the

Figure 4. Mean Ratings of Self-Rated Health on Activities of Daily Living



pattern of the interaction was for the older adults to give higher ratings in all conditions, with the young versus older adult differences exaggerated in the control condition. As the actual difference in rating between one ("Not at all.") and two ("A little.") was functionally small, it was considered that this finding would have a minimal effect on performance.

Medication Management Learning Module

One of the desired outcomes of Medication Module presentation was that participants would be able demonstrate accurate comprehension and recall of the information it contained. Accuracy on the verification questionnaire evaluated this level of understanding. It was also believed that schema instantiation could be inferred from this performance. As well, the time it took the experimenter to present the learning module and for the participants to respond to the verification questions were subjected to analyses. In these analyses, the Age and Condition variables were between subjects. (Appendix H provides complete tables for most of the data sets referred to in the Results section.)

1. Presentation time. In presenting the Medication Module, it was the intention of the experimenter to maintain a constant presentation time across the four experimental groups. Comprehension of the Medication Module, however, was the main goal. Presentation time, in seconds, was analyzed in a 2(Age; young and old) x 2(Condition; schema first or second) ANOVA. The control condition was analyzed separately because the content of the Control Module was completely different. (Appendix H: Table H-1.)

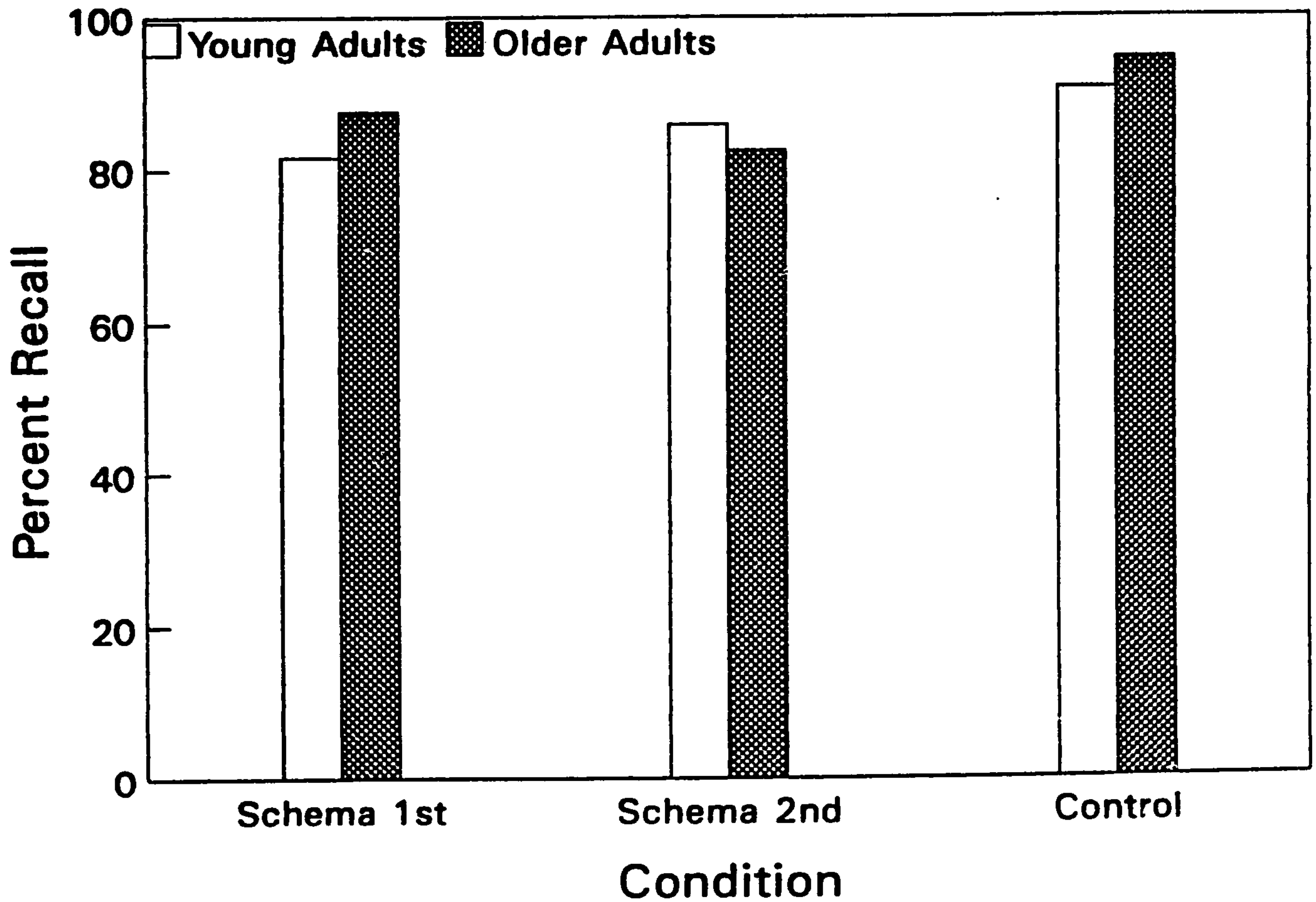
The ANOVA for the experimental conditions showed that presentation time for the older adults (M = 498.78 s) was significantly longer than for young adults (M = 455.48 s), $F(1,67) = 44.55$, $p < .001$. (One data point was missed due to experimental error.) The Condition main effect and interaction were not significant (largest $F < 1.00$). Similarly, there was a significant Age effect for the control condition, $t(32) = 2.84$, $p < .009$. (Two data points missed due to experimental error.) The means for this comparison were 434.94 s for the young adults and 463.06 s for the older adults. The primary reason for this difference in timing was the sensitivity of the experimenter to the nonverbal cues given by the older adults. These cues indicated that more time was needed by the older adults to process the information.

2. Verification time. Differences in time to complete Module verification in the experimental conditions were analyzed in a 2(Age) x 2(Condition) ANOVA. The older adults (M = 450.50 s) were shown to take significantly longer than young adults (M = 366.72 s) to complete and receive constructive feedback on the questionnaire items $F(1,67) = 7.78$, $p < .008$). The Condition main effect and interaction were not significant (largest $F < 1.00$). Similarly, in the control condition, older adults (M = 181.31 s) were shown to take significantly longer than young adults (M = 133.06 s) to respond to the verification items, $t(32) = 2.74$, $p < .02$. (Missing data points were the same as in the previous analysis.) As participants were under no pressure to respond quickly, this age difference in completion times was not a major concern. (Appendix H: Table H-2)

3. Verification accuracy. The percent accuracy in responding to Module verification questions in the experimental and control conditions were analyzed separately because the two question sets were necessarily different. In the experimental conditions, the 2(Age) x 2(Condition) ANOVA resulted in a significant Age by Condition interaction $F(1,68) = 5.61$, $p < .03$. Main effects for Age and Condition were not significant (largest $F < 1.00$). Figure 5 shows that in the schema first condition, older adults achieved higher average scores than did young adults while in the schema second condition, the reverse was found. For the control condition, there was no significant difference between the young and old groups, $t < 1.50$. Scores in the control condition were somewhat higher than those in the experimental condition because content in the control module was simpler. Means for these analyses for schema first, schema second and control conditions for young adults were 81.60%, 85.78% and 90.56% respectively and for old adults were 87.50%, 82.29% and 94.44% respectively. (Appendix H: Table H-3)

Accuracy of responding to the items on the Medication Module verification questionnaire was fairly uniform between groups and across most of the eight

Figure 5. Accuracy of Responding to Module Verification Questions



questions. Three of the questions directed participants to arrange illustrated index cards to depict the rise and fall of serum levels of medication within the blood under different conditions, e.g. after a dose of medication had been missed. Across both experimental conditions, the accuracy of responding to these items was 94.03% for the young adults and 94.33% for the older adults. Accuracy of the verbal responses to most of the other items (for exceptions see below) was also very high. Thus, there was evidence that participants had understood the concepts presented in the Medication Module and that the illustrations had also been understood.

Two questions (items six and eight) were poorly answered by both age groups. In each question participants were able to give one correct response but were unable to provide a second response. For example, in question eight, participants knew that the doctor would usually tell them when to stop taking a medicine but did not remember that in the Medication Module a second way of knowing had been suggested--knowing why you were taking the medicine. Question six may have been poorly answered because of how the question was worded. Almost all the participants responded that the desired outcome of taking the medicine as planned was to "get better". Very few gave the sought after response of "maintaining a therapeutic blood level". If this item was excluded, the overall accuracy of responding on the Medication Module verification questionnaire would have been 88.21% for the young adults and 88.40% for the older adults.

<u>Medication Recall</u>

Memory for the audiotaped Medication Prescription Information was assessed by asking participants to complete the Medication Recall questionnaire. Responses on this questionnaire would, on the basis of schema theory (Figure 1), reflect the nature of the episodic mental model formed by the listeners of the audiotaped information. The same questions were asked for each of the three medicines prescribed (Cloxapen, Benemid, and Lorax) and each was scored separately. It was anticipated that both age groups would remember more Prescription Information in the schema first than schema second condition.

The percent correct for each of the three medicines in the Medication Recall questionnaire was entered into a 2(Age) x 3(Condition) x 3(Medication) ANOVA with repeated measures across Age and Conditions. Age and Condition were between group variables while Medication was within subject and referred to the three medicines: Cloxapen, Benemid, and Lorax. Means score for the young adults (62.64%) were significantly higher than were the scores of the older adults (40.69%), $F(1,102) = 55.62$, $p<.001$. The main effect for Medication was also significant, $F(2,204) = 4.67$, $p<.020$. Participants recalled the least amount of information about Benemid (48.88%) and about the same amount for Cloxapen (53.70%) and Lorax (52.40%). The Condition main effect and interactions were not significant (largest $F<1.50$). As the Condition main effect was not significant, there was no overall support for the hypothesis that presenting the Medication Module first would aid memory for the Prescription Information that followed. (Appendix H: Table H-4)

Even though, in Experiment 1, medication experience failed to correlate significantly with questionnaire performance, there remained a concern that medication experience could affect formation of the instantiated schema in the experimental conditions and subsequently, memory for prescription information. Therefore medication experience was entered as a covariate in the analysis just described. The pattern of results did not change. Because the data were proportional an arcsine transformation was performed on the data and the 2(Age) x 3(Condition) x 3(Medication) ANOVA repeated. The pattern of results remained unchanged.

As there was no Condition effect in the above analyses, the two experimental conditions were combined and the data analyzed in a 2(Age) x 2(Condition, treatment and control) x 3(Medication) ANOVA with repeated measure. The same pattern of results prevailed. That is, main effects for Age and Medication were the only significant findings.

Items within the questionnaire were analyzed individually or in small groups dependent on the degree to which recall relied primarily on a) explicit memory for Prescription Information (explicit recall), b) application of Medication Module information within the context of responding to the Medication Recall questions (application recall), or c) integration of Prescription Information with the Medication Module (integration recall). (See Appendix E: Medication Recall Questionnaire.)

Item one asked participants to identify the medicine by name, first letter or pill colour. This item was analyzed separately because older adults have been shown to be disadvantaged when asked to remember proper names (Cohen & Faulkner, 1986b). A 2(Age) x 3(Condition) x 3(Medication) ANOVA with repeated measures across Age and Condition was performed on item one. With a mean score of 50.03%, old adults were significantly less likely than young adults, mean score of 83.03%, to correctly identify the medicines by name, letter or colour, $F(1,102) = 28.88$, $p < .001$. No other main effect or interaction was significant (largest $F < 2.00$). (Appendix H: Table H-5)

The remaining explicit recall items, 2, 9, and 10, asked participants to recall the purpose of the medicine, the expected therapeutic effect, and possible side effects. The three items were grouped within each medication and the percent correct score over the three items was entered into a 2(Age) x 3(Condition) x 3(Medication) ANOVA with repeated measures across Age and Condition. The older adults (M = 39.46%) recalled significantly less information in these three items than did young adults (M = 64.56%), $F(1,102) = 40.78$, $p < .001$). The Medication main effect was also significant $F(2,204) = 14.81$, $p < .001$). On the explicit recall items, participants recalled more information for Lorax (60.49%) then they did for either Cloxapen (48.23%) or Benemid (47.30%) which were similar. The Condition main effect and interactions failed to reach significance (largest $F < 2.00$, $p > .125$). (Appendix H: Table H-6)

Integration recall items 3, 4, 5, and 6 asked participants to describe when during the day they would take the medicine, how many pills they were to take each time, any special instructions they were to follow, and when the medicine could be stopped. The 2(Age) x 3(Condition) x 3(Medication) ANOVA with repeated measures across Age and Condition was carried out on the percent correct scores for these four items. It revealed a significant main effect for Age $F(1,102) = 40.096$, $p < .001$) The young adults recalled an average of 57.49% of the information and the older adults 37.40%. The main effect for Medication was also significant $F(2,204) = 24.12, p < .001$). For the integration recall items both age groups recalled significantly more information about Cloxapen (57.41%), than they did for either Benemid (42.90%) or Lorax (41.98%) which were about the same. The Condition main effect and interactions were not significant (largest $F < 1.50$). (Appendix H: Table H-7)

Correctly answering the two application recall questions, items 7 and 8, required participants to apply the concept of how to handle late and missed doses of medication learned in the Medication Module. A 2(Age) x 3(Condition) x 3(Medication) ANOVA with repeated measures across Age and Condition was carried out on the percent correct scores on these two items. The analysis showed that young adults recalled significantly more information than did older adults, $F(1,102) = 13.48, p < .001$. Mean scores were 62.42% and 45.06% respectively. The Medication and Condition main effects and interactions were not significant (largest $F < 2.50$). (Appendix H: Table H-8)

In summary, the pattern of results for the questions grouped by type was the same as for the questionnaire as a whole. That is, there were significant Age effects but no apparent support for the hypothesis that learning the Medication Module first significantly improved memory for prescription information over learning the Medication Module afterwards or not at all.

In two of the question groupings, name alone and application recall, there appeared to be a trend for a condition effect in one or more of the medications. To examine this possibility more closely, a 2(Age) x 3(Condition) ANOVA for each of the three medicines in each of the question groupings (name alone, explicit, integration and application recall) was carried out. The Age main effect persisted across all these analyses and there were no significant Condition main effects. In the explicit recall question for the name Benemid there was a significant Age by Condition interaction, $F(2,102) = 3.50$, $p < .04$. The means for the young adults were 86.1%, 100%, and 69.4% for the schema first, schema second, and conditions respectively, and for the older adults, 30.6%, 47.2% and 55.6%. (Appendix H:

Table H-5)

Because the Condition effects were not significant in the 2(Age) x 3(Condition) analyses, the two experimental conditions were combined and 2(Age) x 2(Condition) x 3(Medication) ANVOAs with repeated measures were carried out on the question groupings. The pattern for the main effects for Age, Condition, and Medication remained essentially unchanged. There was one Condition main effect that approached significance; application recall, $F(1,104) = 3.70$, $p < .06$. The mean for the experimental conditions was 58.18% and for the control condition, 47.92%. There were no significant interactions in the application recall data. The Age by Condition interaction for explicit recall of medication names also approached significance, $F(1,104) = 3.90$, $p < .06$. The means for the young adults were 86.57% and 75.87% for experimental and control conditions respectively and for the older adults, 45.38% and 60.2% respectively.

Trends observed in data suggested that 2(Age) x 2(Condition) ANOVAs on each of the three medicines within each of the question groupings should be explored. Several apparent trends approached or were significant. The Age main effects remained and one Condition main effect approached significance; for Cloxapen in application recall, $F(1,104) = 3.94$, $p < .06$. As well, within this same analysis, the Age by Condition interaction was significant, $F(1,104) = 5.67$, $p < .02$. The means for this interaction for the young adults were 72.92% and 50.00% for experimental and control conditions respectively and for the older adults, 43.75% and 45.83% respectively. Figure 6A shows the form of this interaction. The young adults appear to benefit from learning the Medication Module regardless of when. Finally, the Age by Condition interaction for explicit recall of the medication name, Benemid, was significant, $F(1,104) = 6.91$, $p < .010$. The means for the young adults were 93.05% and 69.40% for experimental and control condition respectively and for the older adults, 38.90% and 55.60% respectively. Figure 6B shows the excellent recall the young adults had for this trade name especially in the experimental conditions, in comparison to the older adults.

In summary, then, inspection of the data suggested possible Condition effects

Figure 6A. Application Recall for Cloxapen by Age and Condition

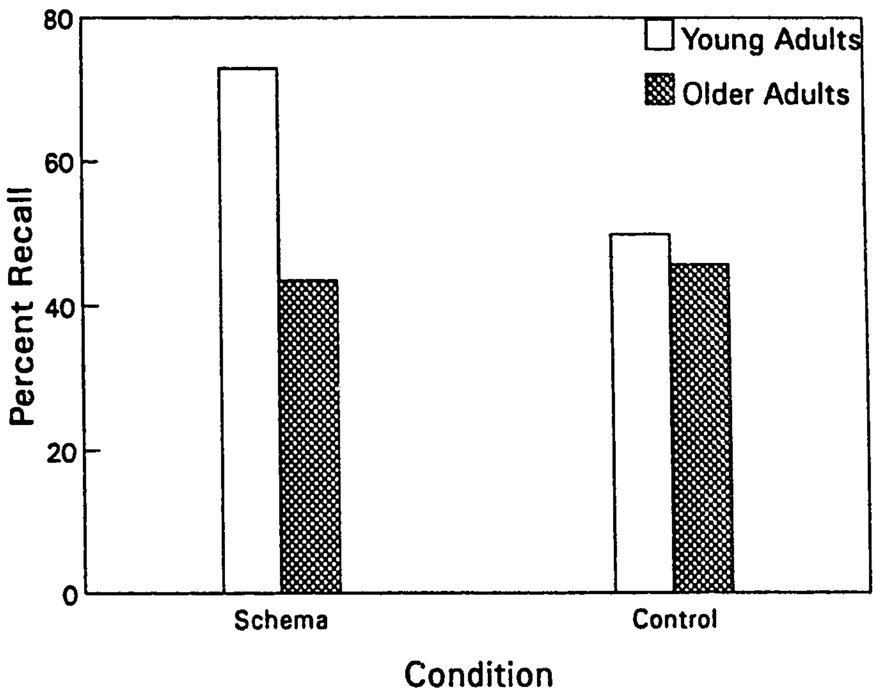
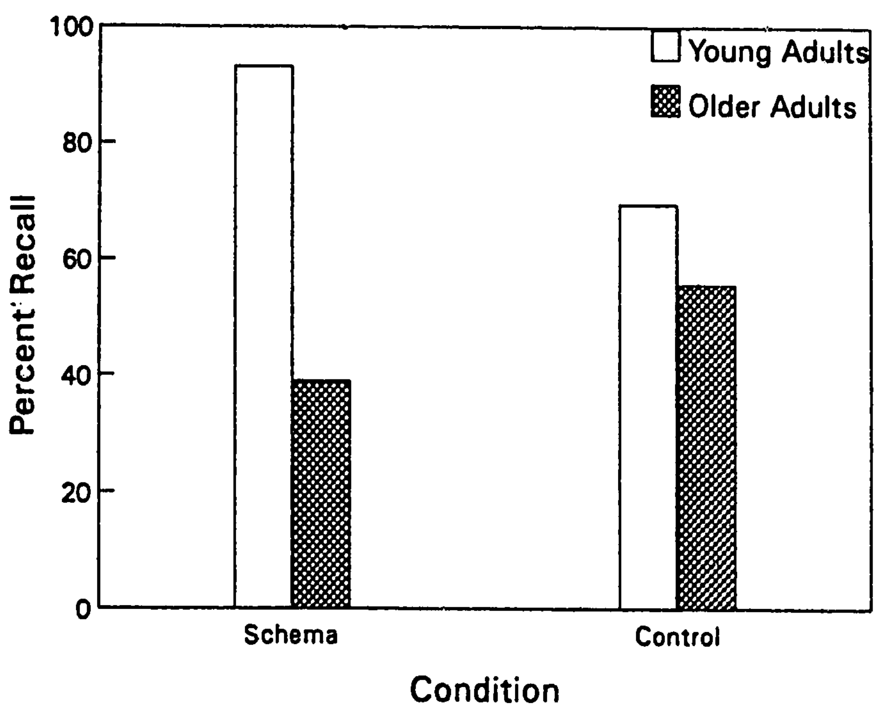


Figure 6B. Trade Name Recall for Benemid by Age and Condition



in the name and application recall question groups within selected medications. Condition effects were most promising when the two treatment conditions were combined. In these analyses there was a nearly significant Condition effect for application recall and for the Age by Condition interaction for explicit recall of trade names. When the medication were explored separately, there were reliable Age by Condition interactions for application recall for Cloxapen and for name recall of Benemid. These analyses suggested that the young adults benefited more from acquisition of the Medication Module, regardless of whether it was heard before or after the Prescription Information was presented, whereas the older adults did not.

Caution must be used in drawing the above conclusions because of the risk of Type I errors from repeated, though slightly different, analyses on the same data. As, however, the manipulation used in this study had not been tried before, exploration of the data in the manner described above seemed justified. Even slight indications of a treatment effect could be considered encouraging suggesting that replication of the study would have merit.

Prescription Scheduling

In prescription scheduling participants were asked to generate a 24 hour schedule for the three prescription medicines. They were provided with correctly labelled medicines bottles to aid them in this task. The frequency and amount of time spent checking the medication labels as well as the overall accuracy of the 24 hour plans and the types of errors were compared among groups. It was anticipated that participants who had heard the schema first would generate more accurate plans and do so with greater efficiency than those who had heard the schema second or not at all.

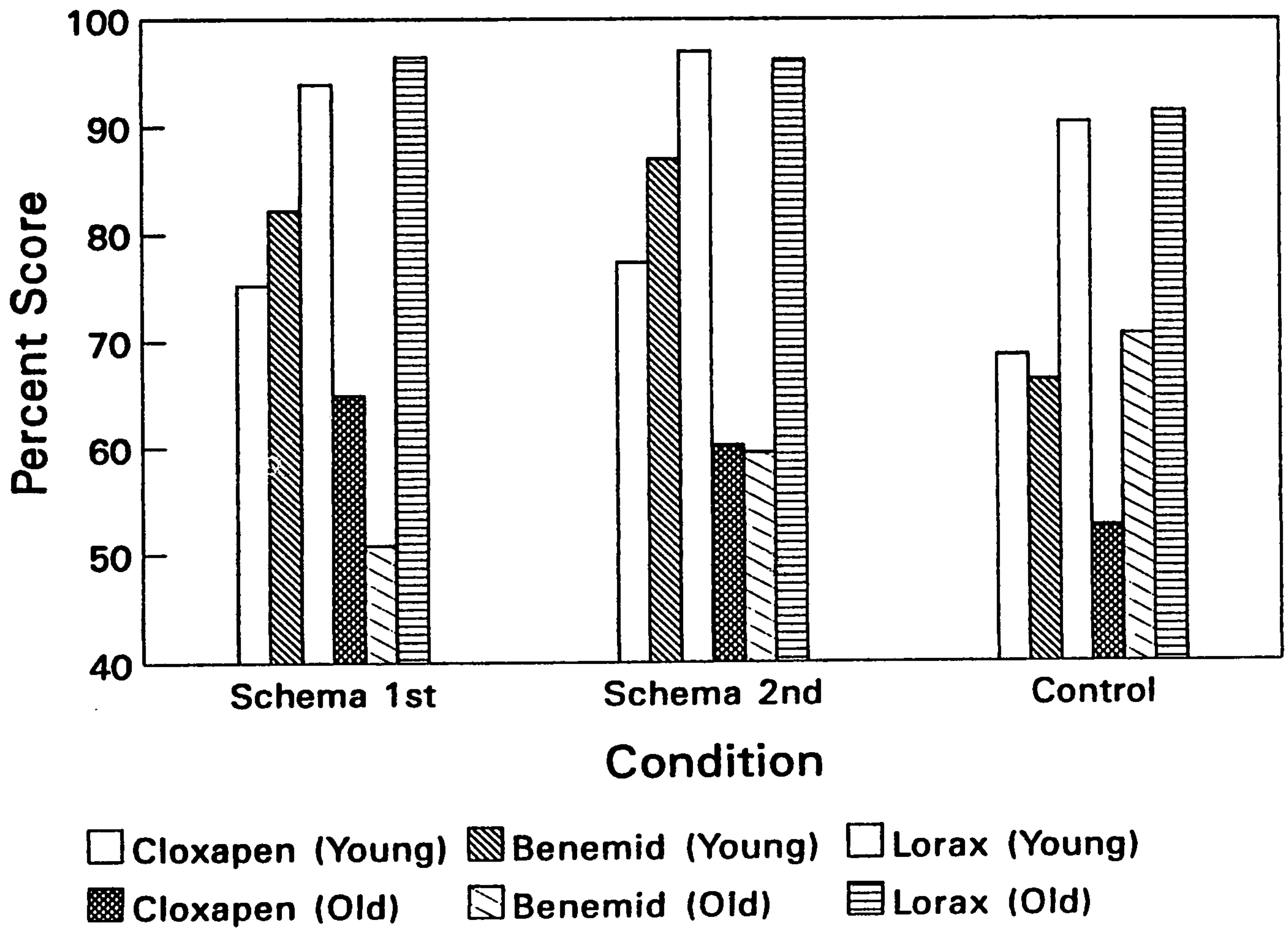
1. Planning accuracy. The percent accuracy in planning the administration schedule for the three prescription medications was submitted to a 2(Age) x 3(Condition) x 3(Medication) ANOVA with repeated measures across Age and Condition. This analysis revealed that young adults made significantly more accurate plans than did the older adults, $F(1,102) = 10.43$, $p < .003$. The group means for this analysis were 81.98% and 71.40% respectively. There was also a main effect for

Medication, $F(2,204) = 47.76$, $p < .001$. The plans for Lorax ($M = 94.23\%$) were considerably more accurate than were plans for Benemid ($M = 69.38\%$) and Cloxapen ($M = 66.47\%$), which about equal in accuracy. These main effects were qualified by a significant Age by Medication interaction, $F(2,204) = 5.25$, $p < .007$ and an Age by Condition by Medication interaction, $F(4,204) = 2.44$ $p < .05$. Figure 7 shows the form of this triple interaction. Both age groups made the most accurate plans for Lorax and for this medication there was little difference in scores across Age group and Condition. Also from Figure 7 it can be observed that young adults created more accurate plans for both Cloxapen and Benemid in the schema first and second conditions and for Cloxapen in control condition than did older adults. In the control condition, both groups were similarly accurate in their plans for Benemid. (Appendix H: Table H-9) The Condition main effect and remaining interactions did not reach significance (largest $F < 1.50$). Thus there appeared to be little support for an effect of learning the Medication Module on creating 24 hour medication plans.

As there was a reliable Age effect for medication experience in favour of the older adults there was a concern that this experience could have affected performance in this planning task. Therefore, medication experience was entered as a covariate in the above analysis. The pattern of results remained the same. Because the data were proportional in nature, they were subjected to an arcsine transformation and the same analysis repeated. The pattern of results remained unchanged. Given that the Condition main effect was not significant, the two experimental conditions were combined and a 2(Age) x 2(Condition, experimental and control) x 3(Medication) ANOVA with repeated measure was carried out. The pattern of results remained unchanged. The Age and Medication main effects and Age by Medication interactions were significant in these analyses. The Condition main effect and remaining interactions were not significant.

Trends for a Condition effect, especially for the younger adults, was apparent in the data for Cloxapen and Benemid. To explore this possibility, a 2(Age) x 3(Condition) ANOVA was carried out on each of the three medicines. No Condition main effect was found. The Age main effect was significant for Cloxapen ($F(1,102)$

Figure 7. Accuracy in Medication Planning by Age, Condition, and Medication



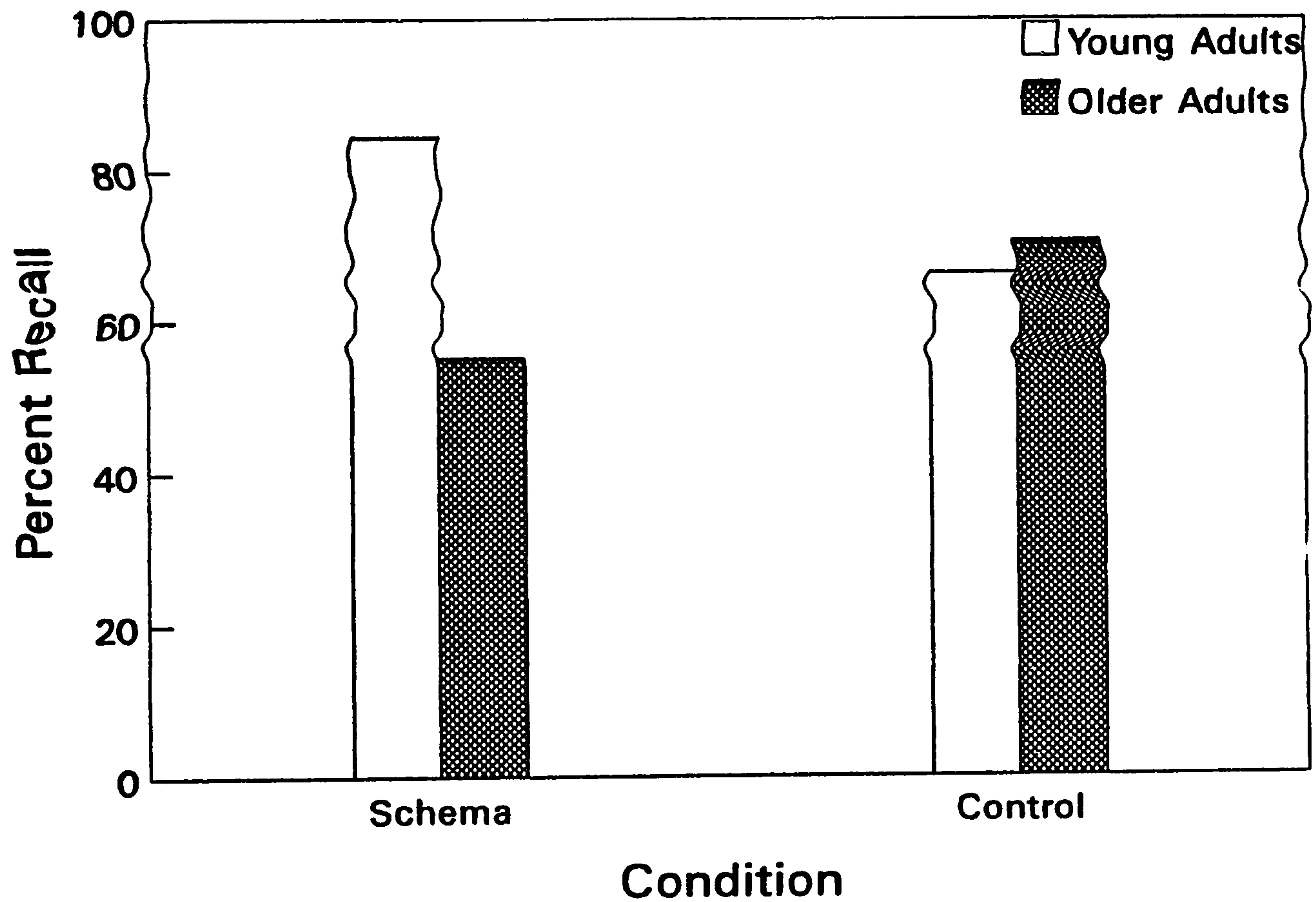
= 7.76, $p < .007$) and for Benemid ($F(1,102) = 9.36$, $p < .004$) but not for Lorax ($F < 1.50$). These Age effects suggest that prescription that require little inferencing, as did Lorax, are interpreted readily by both age groups (See Figure 7). The Age by Condition interaction for Benemid was significant, $F(2,102) = 3.64$, $p < .04$. The remaining interaction were not significant (largest $F < 1.50$). (See Appendix H: Table H-9 for means.)

As the Condition main effect was not significant, the two experimental conditions were combined and a 2(Age) x 2(Condition, experimental and control) ANOVA was carried out on each of the three medicines. The same pattern of results prevailed with the Age by Condition interaction effect for Benemid increased in size, $F(1,104) = 7.28$, $p < .010$. The means for the young adults were 84.53% and 66.27% for experimental and control conditions respectively and for the older adults, 55.16% and 70.64% respectively. Figure 8 shows the shape of this interaction. The young adults appeared to benefit more from the treatment than did the older adults.

In summary, even though trends in the data for a Condition effect in Cloxapen and Benemid were apparent, only the Age by Condition interactions for Benemid were significant. The young adults seemed to respond to learning the Medication Module, regardless of order, whereas the older adults did not. This response was more evident for Benemid than Cloxapen. In the control condition for Benemid, however, the older adults were very accurate in their planning, a finding that was not readily explained and which likely contributed to the interaction. As noted earlier, planning accuracy for Lorax was invariant to age. Again, caution must be exercised in drawing the above conclusions from the data for the same reasons as discussed following similar analyses for Medication Recall.

2. Planning errors. The 24 Hour plans were reviewed for the types of errors made by participants. This review was guided by the work done by Morrell et al. (1990) and resulted in the identification of three types of errors: timing errors, quantity errors, and errors in carrying out special instructions. Definitions for these error types appear under Materials. The three types of errors plus the errors combined were entered separately into 2(Age) x 3(Condition) x 3(Medication)

Figure 8. Planning Accuracy for Benemid by Age and Condition



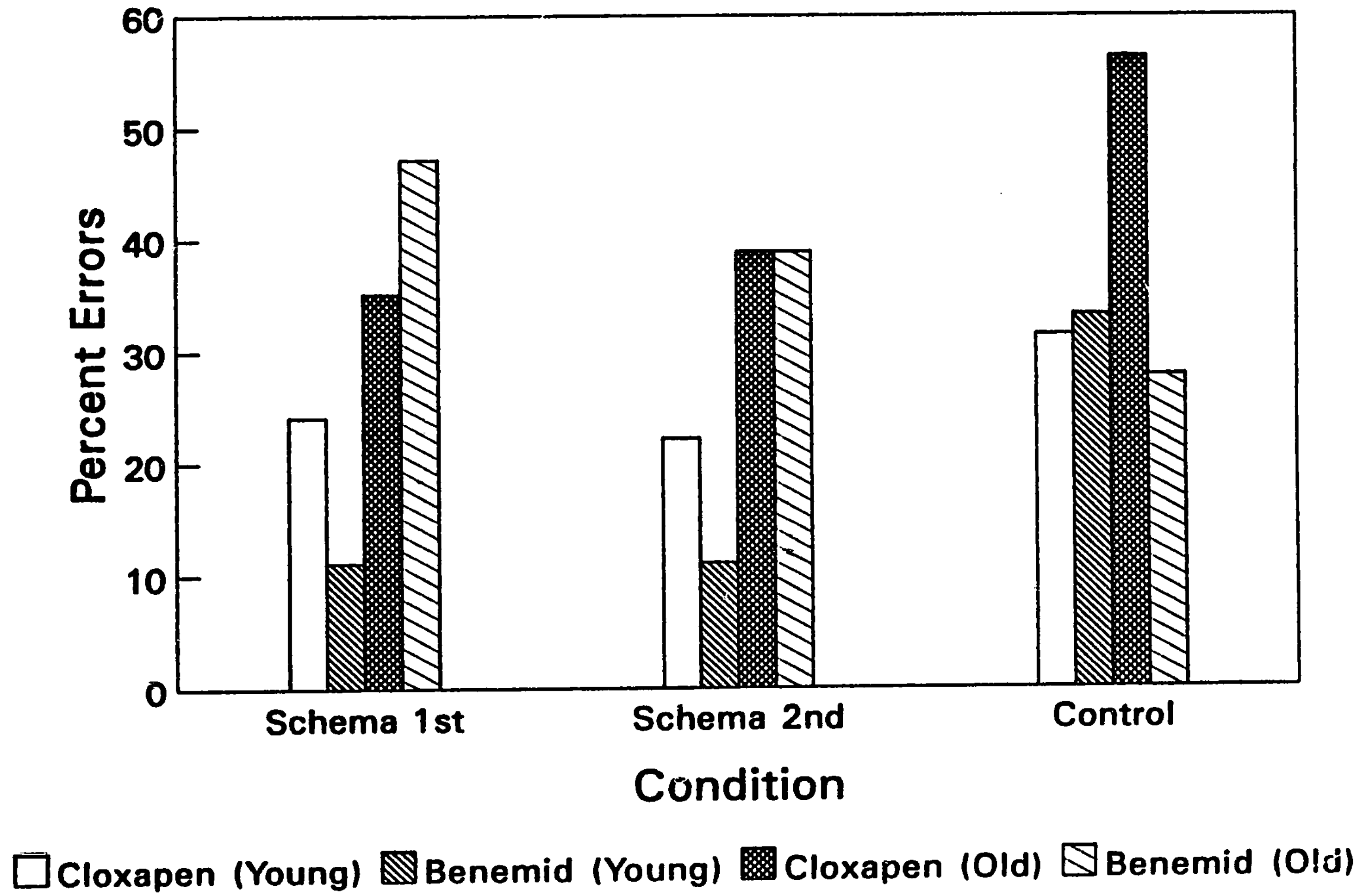
ANOVAs with repeated measures across Age and Condition.

In the analysis of the timing errors, only the Medication main effect was significant, $F(2,204) = 19.30$, $p<.001$. Participants made the most errors when scheduling Cloxapen ($M = 19.76\%$), followed by Benemid ($M = 9.26\%$) and Lorax ($M = 2.46\%$). The remaining main effects and interactions were not significant (largest $F<2.50$). Participants often experienced difficulty in scheduling a fourth dose of Cloxapen in an acceptable time period. In fact four, three, and seven participants in the schema first, schema second and control conditions respectively, only scheduled three doses of medication rather than four. Thus, as had been observed in Experiment 1, the notion that medications need only be scheduled during convenient waking hours is pervasive and resistant to change. (Appendix H: Table H-10)

The analysis for errors in recording the correct dosage (quantity errors) showed only a main effect for Medication $F(2,204) = 43.53$, $p<.001$. The majority of quantity errors were made in scheduling Benemid ($M = 23.15\%$). Few errors were made when scheduling Lorax ($M = 3.24\%$) and Cloxapen ($M = 1.85\%$). Participants had difficulty in deciding when the dosage for Benemid was to be increased (after the fourth dose) or they forgot to increase it at all. The remaining main effects and interactions were not significant (largest $F<1.50$). (Appendix H: Table H-11)

Special instructions were only provided for Cloxapen and Benemid. Therefore, a 2(Age) x 3(Condition) x 2(Medication, Cloxapen and Benemid) ANOVA with repeated measure on Age and Condition was carried out on the errors made in initiating special instructions. The Age main effect was significant, $F(1,102) = 14.35$, $p<.001$. Means were 22.22% for the young adults and 41.21% for the older adults. The Medication main effect approached significance, $F(1,102) = 3.26$, $p<.08$. The mean error rate for Cloxapen was 35.19% and for Benemid, 28.24%. The Age by Condition by Medication interaction was significant, $F(2,102) = 5.23$, $p<.01$. Figure 9 shows that the both groups made more errors when implementing special instructions for Cloxapen than they did for Benemid. This is not surprising as

Figure 9. Percent Errors in Following Special Instructions for Cloxapen and Benemid



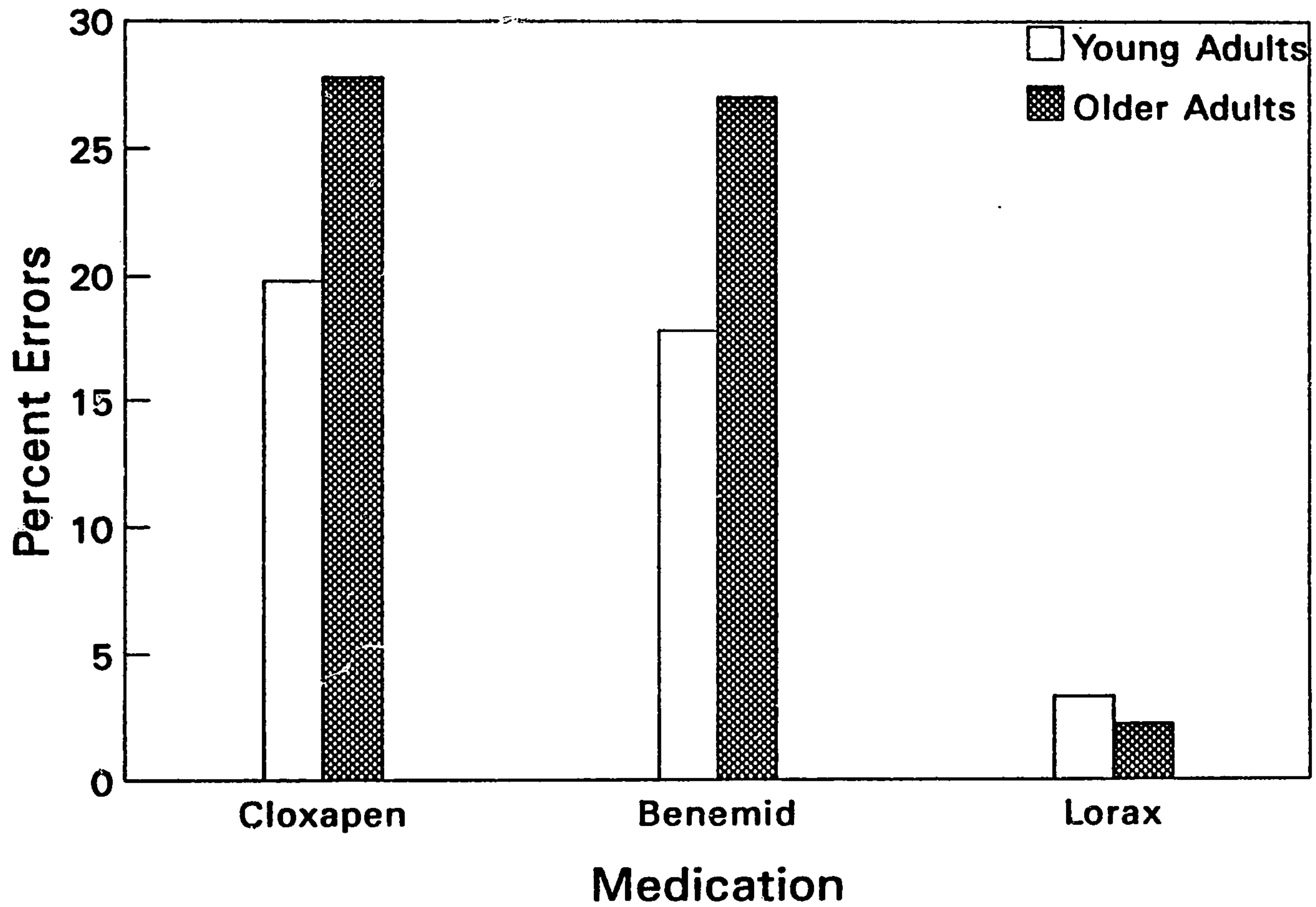
it is more difficult to schedule a medicine four times a day on an empty stomach than it is to take one twice a day with food. As well, the older adults made more of these errors than did young adults and errors tended to be more common in the control condition. (Appendix H: Table H-13)

The errors were combined and a 2(Age) x 3(Condition) x 3(Medication) ANOVA with repeated measure on Age and Condition was carried out on the data. All the main effects were significant. The young adults made significantly fewer errors (M = 13.65%) than did the older adults (M = 19.01%), $F(1,102) = 5.50$, $p < .03$. Participants in the control condition (M = 20.56%) made considerably more errors than did those in the schema first condition (M = 14.47%) and schema second condition (M = 13.97%), $F(2,102) = 3.53$, $p < .04$. Although there was a Condition effect, there was no evidence that receiving the Medication Module first positively affected scheduling as the means in the two experimental conditions were almost the same. For the Medication main effect ($F(2,204) = 73.63$, $p < .001$), the fewest number of errors were made in scheduling Lorax (M = 2.76%) while the errors made in scheduling Cloxapen (M = 23.81%) and Benemid (M = 22.41%) were about equal. (Appendix H: Table H-12)

The Age by Medication interaction for the errors combined was also significant, $F(2,204) = 4.24$, $p < .02$. From Figure 10, it can be observed that the older adults made more combined errors when scheduling Cloxapen and Benemid than did the younger adults and both made the fewest errors when scheduling Lorax. The remaining interactions were not significant (largest $F < 1.500$).

3. Checking labels (frequency). Each participant was monitored for the number of times a medicine bottle was removed from the box and the label examined during planning. Data were scored either as zero when the label on the bottle was examined once or as one when the label was examined more than once. As each prescription bottle was checked by each participant at least once, interest lies in the frequency with which the bottles were examined more than once by the two age groups. Overall there was very little difference between the two age groups. (Appendix H: Table H-14)

Figure 10. Percent Errors Combined by Age and Medication



A 2(Age) by 3(Condition) chi square for multiple independent samples was carried out to test how the groups differed with respect to the frequency with which each medicine bottle was examined more than once. The chi square was significant for Cloxapen ($\chi^2(2, N = 35) = 7.04$, $p < .05$). The remaining two chi square tests were not significant (Largest $\chi^2 = 4.50$). Figure 11 shows the frequencies for Cloxapen in graph form and reveals that the young adults in the control condition checked the bottles most often followed by the older adults in the schema first condition. Trends in the data for Cloxapen and Benemid suggested that the young adults may have benefited from learning the Medication Module, regardless of order, whereas the performance by the older adults was more erratic for these two medications.

As can be seen in Table H-14, several of the cells contain small observed frequencies. If the expected frequencies are also small, less than five, the assumption of normality for the chi square distribution is considered violated (Howell, 1987). In his review, Howell states that the risk of a Type I error is small and "rarely exceeds 0.06 even for total sample sizes as small as 20" (p. 137). The power to reject a false hypothesis, however, is low for small sample sizes. Remington and Schank (1970) recommend that where more than 20% of the expected cell frequencies are less than five, cells should be combined to increase expected frequencies to an adequate size. By combining the two experimental groups, expected cell frequencies were all greater than five and the assumption of normality was no longer in possible in violation. Combining these cells was considered appropriate given the trends in the data for Cloxapen and Benemid noted above.

The data were explored further by combining the two experimental conditions and comparing them to the control condition for each medication. This 2(Age) x 2(Condition, experimental and control) chi square revealed a significant group difference for Cloxapen ($\chi^2(1, N = 35) = 6.65$, $p < .01$) and Benemid ($\chi^2(1, N = 38) = 3.91$, $p < .05$). The chi square for Lorax failed to reach significance ($\chi^2(1, N = 30) = .35$). Figure 12 shows the frequencies for these data. The young adults performed similarly in both experimental and control conditions for Benemid, but

Figure 11. Frequency of Checking Labels More than Once for Cloxapen by Age and Condition

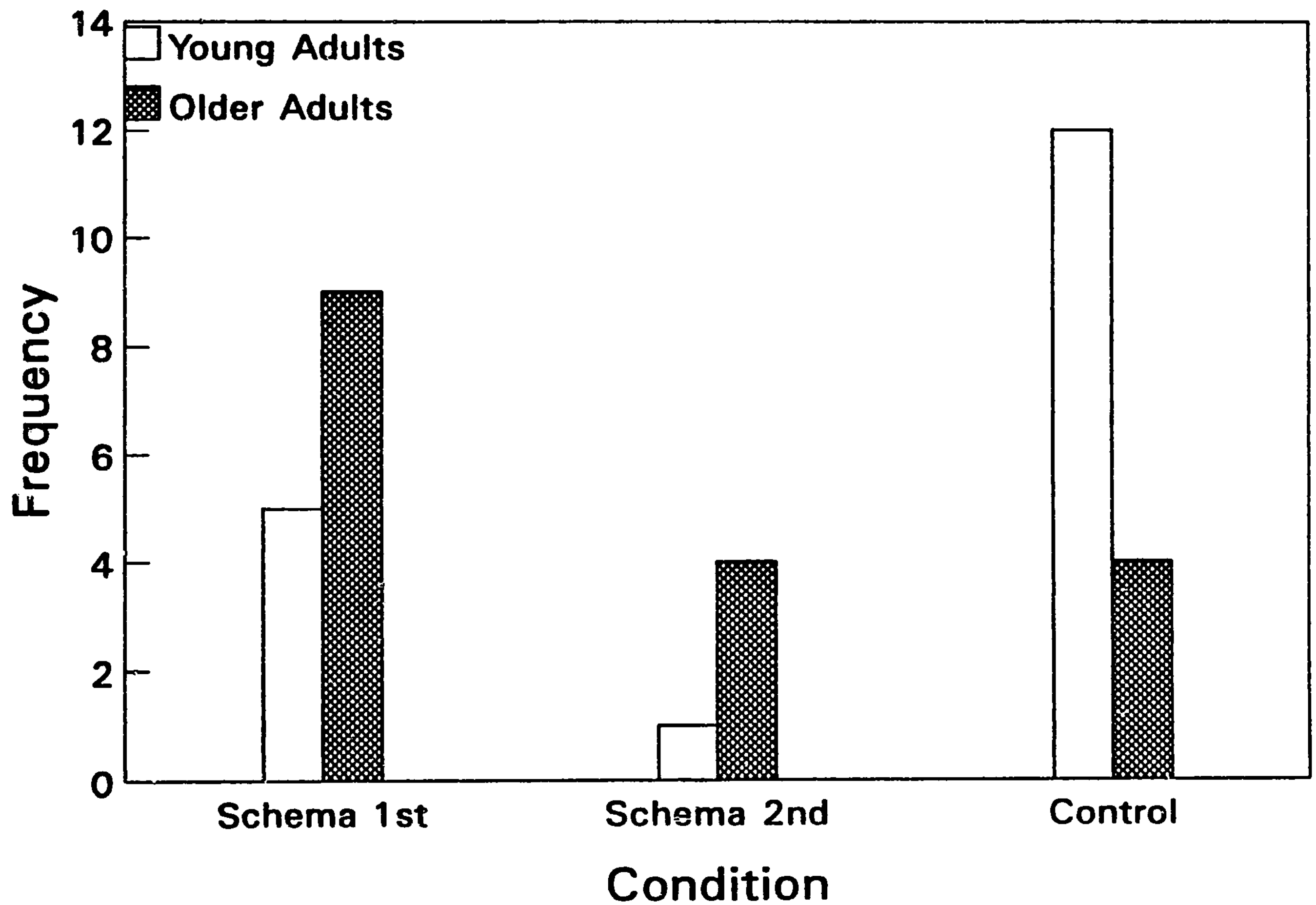
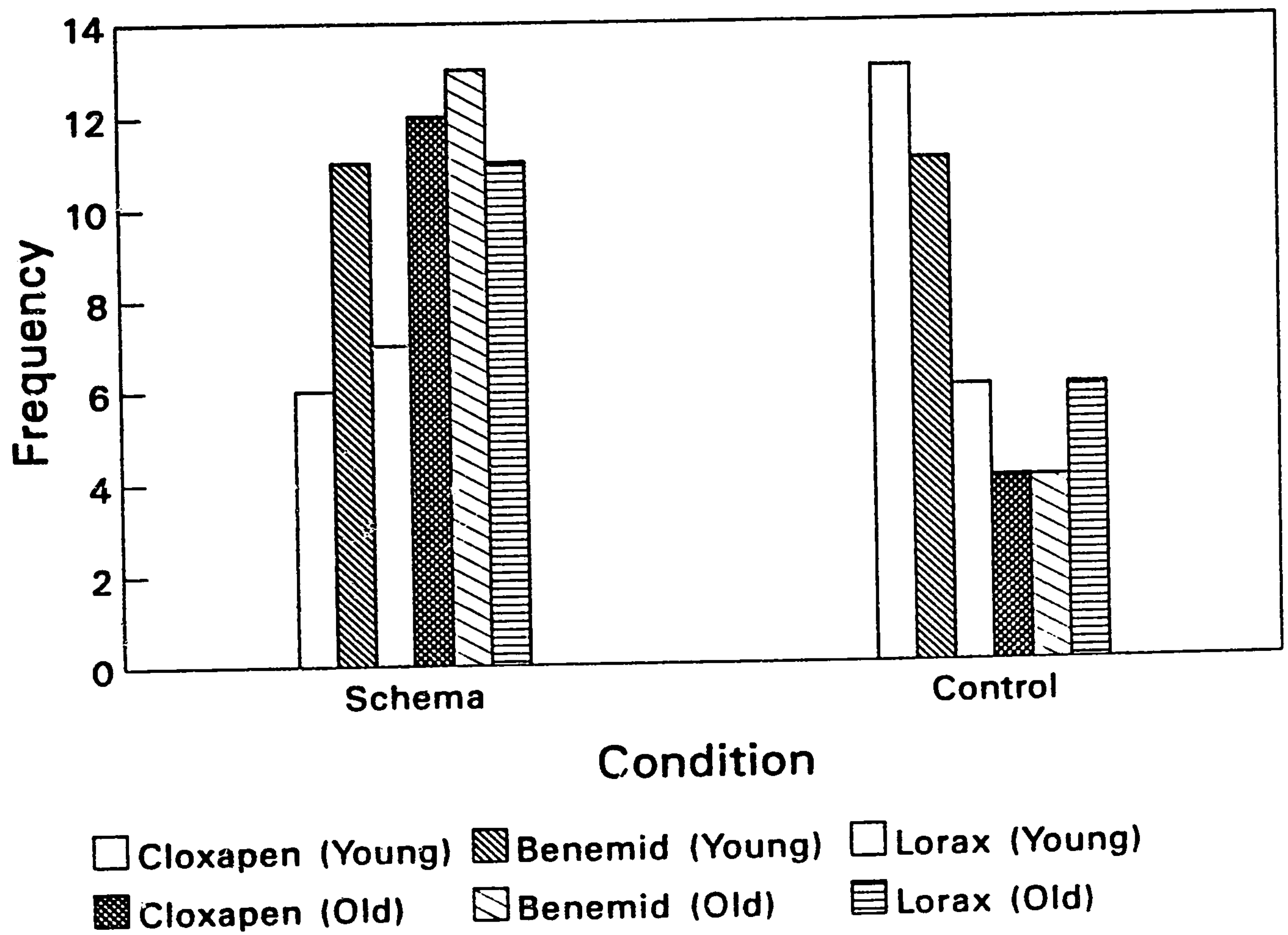


Figure 12. Frequency of Checking Labels More than Once by Age, Condition, and Medication



when scheduling Cloxapen they required fewer label checks in the experimental than control conditions. By contrast, the older adults in the control condition checked the label fewer times than in the experimental conditions.

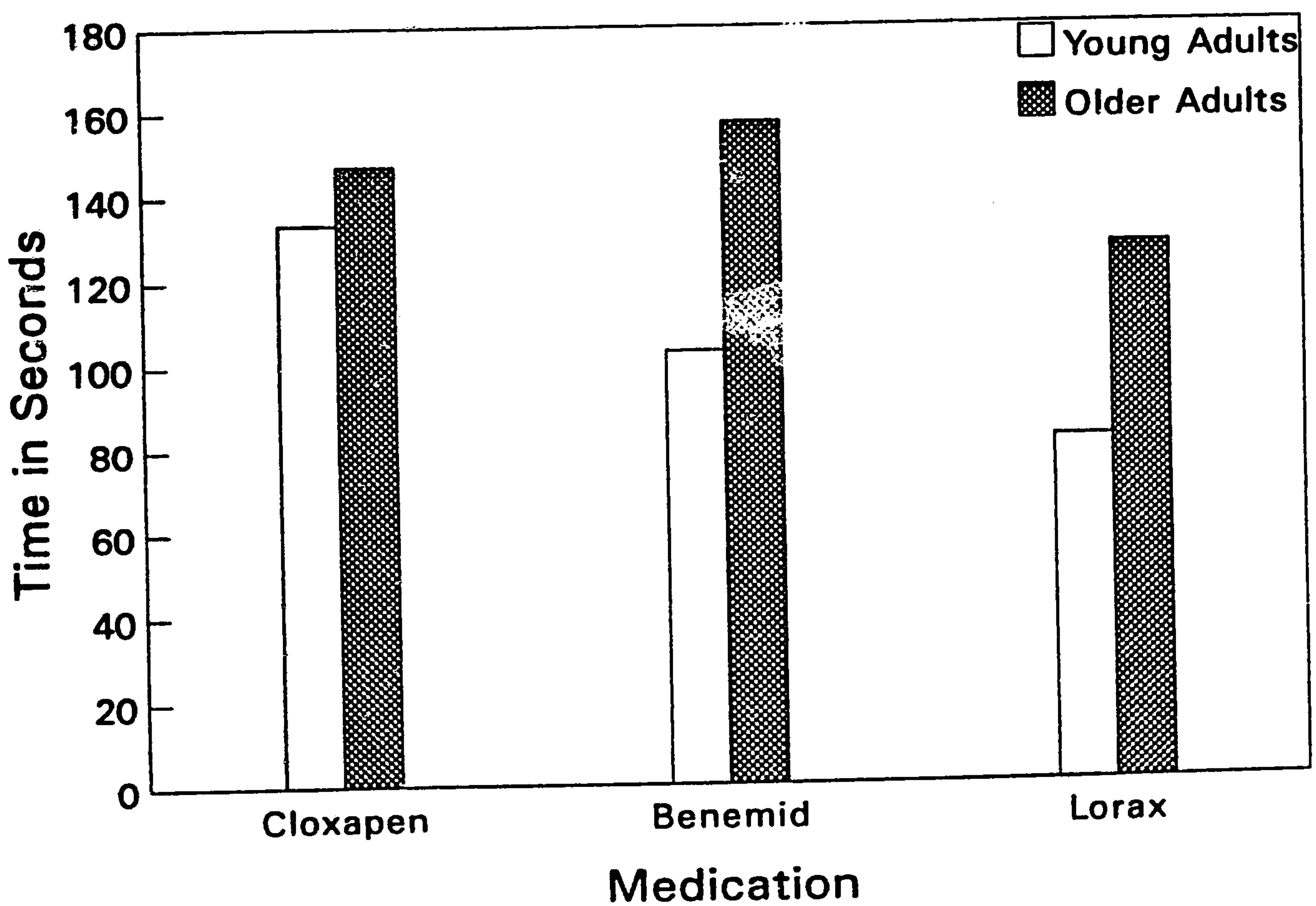
4. Checking labels (time). Participants were monitored for the total time, in seconds, spent studying each medication label during planning. A 2(Age) x 3(Condition) x 3(Medication) ANOVA with repeated measures across Age and Condition was carried out on these time periods. The old adults spent significantly more time examining the medication labels while forming their plan then did young adults, $F(1,102) = 11.52$, $p < .002$. The age group means were 480.78 s and 419.94 s respectively. The main effect for Medication was also significant, $F(2,204) = 8.36$, $p < .001$. Both groups spend less time examining the label for Lorax (M = 104.57 s) than they did for either Benemid (M = 129.99 s) or Cloxapen (M = 140.18 s). (Appendix H: Table H-15)

The Age by Medication interaction approached significance, $F(2,204 = 2.81$, $p < .07$. An examination of Figure 13 shows that the older adults spent significantly more time examining the labels for Benemid and Lorax than did young adults, whereas both groups spent more but an equal among time studying the Cloxapen label. As the remaining Condition effect and interactions failed to reach significance (largest $F < 1.00$), there was no support for the hypothesis that schema acquisition prior to hearing the prescription information shortened the time needed to create a prescription schedule.

Retention Interval.

Group differences in duration of the retention interval, the time between listening to the medication prescription information and responding to the Medication Recall questionnaire, could have affected performance on Medication Recall and Prescription Scheduling. The duration of this interval, in seconds, was subjected to a 2(Age) x 3(Condition, schema first or second and control) ANOVA. The interval proved to be significantly longer for the older adults (M = 24.02 min) than for the young adults (M = 20.21 min), $F(1,100 = 73.68$, $p .001$. (Two data points were missed due to experimental error.) The Condition main effect was also significant,

Figure 13. Time in Seconds Spent Checking Prescription Labels by Age and Medication



$F(2,100) = 90.67$, $p < .001$. The retention interval in the schema second condition was appreciably longer at 26.08 min than in either the control condition at 20.5 min or schema first condition at 20.4 min which were equal. The interaction was not significant ($F < 2.00$). The longer retention interval in the schema second condition was due to the fact that in this condition the interval included presentation and verification of the Medication Module. Both age groups, but especially the older adults took longer to complete the learning module than they did the auditory working memory task, the alternate task in the other two conditions.

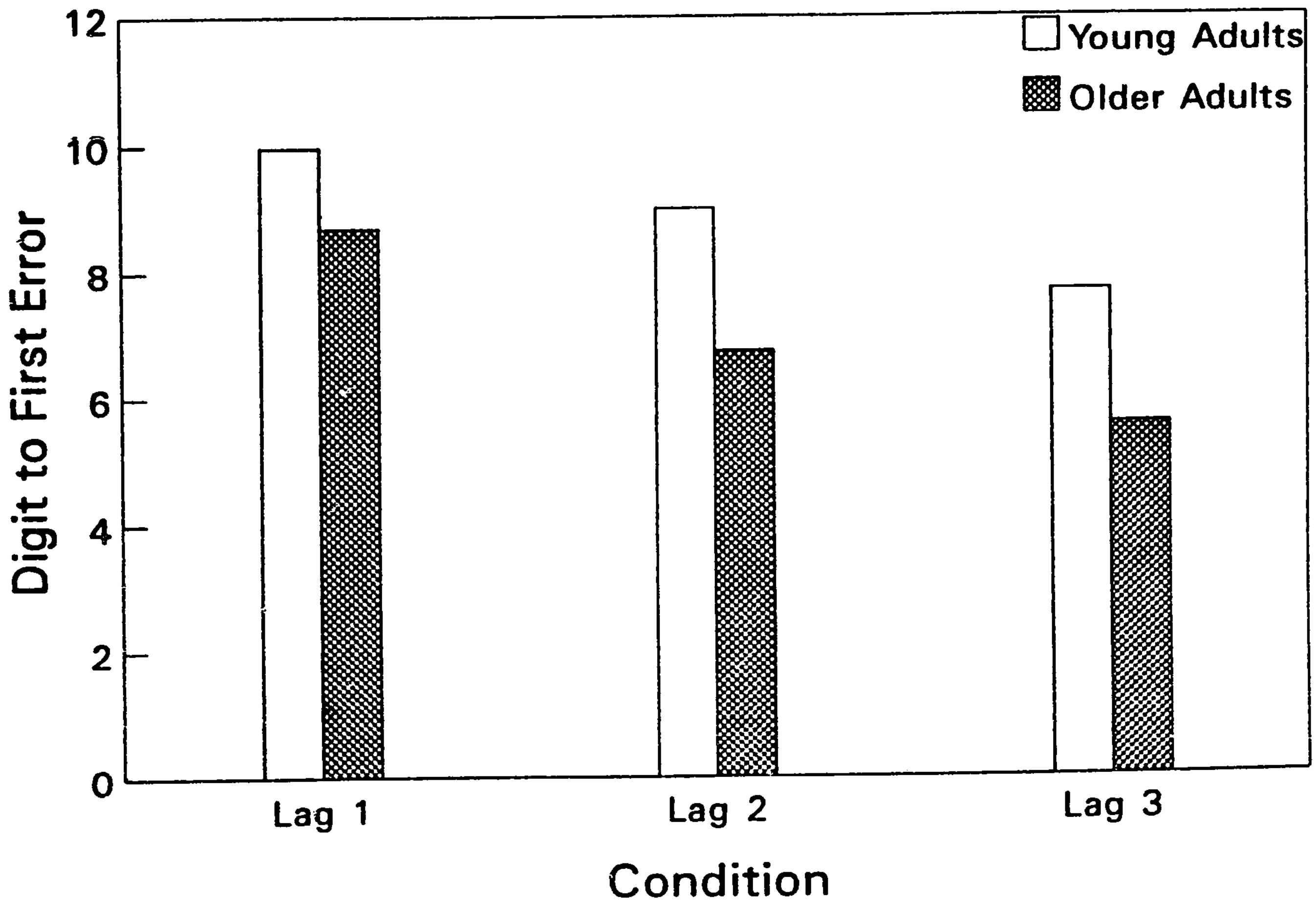
Working Memory Tasks

It was hypothesized that age-differences in performance on the working memory tasks used in this study would provide insight into the age-difference expected in Medication Recall and Planning Accuracy. Age-differences in performance on auditory working memory and listening span are reported below.

1. Auditory working memory. A 2(Age) x 3(Lag) ANOVA was carried out on the mean scores for the one, two, and three Lag Conditions of the auditory working memory task. Zero lag condition was not included in this analysis because all participants were expected and did achieve perfect scores. As expected, on average, young adults attained significantly higher scores at each level than did old adults, $F(1,106) = 35.56$, $p < .001$. The Lag main effect, $F(2,212) = 80.33$, $p < .001$, was also significant and both were qualified by a significant Age by Lag interaction, $F(2,212) = 3.61$, $p < .03$. Figure 14 shows that for both age groups, mean scores decreased as the task became more difficult (Lag 1 to 2 to 3). The decline was slightly more pronounced for the older adults especially from Lag 1 to Lag 2. (Appendix H: Table H-17)

2. Listening span task. Data from the Listening Span Task was scored in two different ways and analyzed separately. Using the Baddeley et al. (1985) scoring method, the number of correctly recalled sentence last words out of 42 were entered into the analysis. As anticipated, young adults ($M = 33.17$) achieved significantly higher scores than did the older adults ($M = 25.66$), $t(105) = 8.70$, $p < .001$). There was one missing data point for this analysis because one older participant did not wish

<u>Figure 14</u>. Mean Digits to First Error on the Auditory Working Memory Task



to go on to Level Five. Using the Daneman and Carpenter (1980) scoring method, listening span levels from two to five were entered into the analysis. The young adults (M = 3.34) achieved a significantly higher level than did older adults (M = 2.47), $t(106) = 5.54$, $p < .001$. Thus, as expected and regardless of scoring method, young adults performed significantly better at this working memory task than did older adults. (Appendix H: Table H-18)

Correlations and Regression Analyses

A series of intercorrelations among and correlations between age, variables related to verbal ability (education and vocabulary), health related variables (self-rated health, current prescription and medication experience), performance variables (Medication Recall and Planning Accuracy), and working memory variables (auditory working memory and listening span) were carried out. These analyses were performed to confirm that the verbal ability, health related, performance, and working memory variables were intercorrelated and to learn if any correlations were present between them and age. Of considerable interest was whether there was a correlation, as predicted, between the performance and working memory variables. In examining Table 5 it is evident that the anticipated intercorrelations within the variable groupings listed above were generally significant. The correlation between the two methods of scoring the listening span task were the most highly related ($r = 0.81$). These findings confirm that the variables within the groupings were related to each other and would share some common variance in predicting performance on a variable outside the group.

Age, as expected, was negatively correlated with education and the working memory variables and positively with vocabulary and two of the four health related variables. Listening span (using the Baddeley et al. (1985) scoring procedure) and age were the most highly correlated, $r = -0.67$. There proved to be a paucity of significant correlation among the health related variables and the working memory or performance variables. This result is perhaps not surprising given the overall level of wellness evident in both young and old participants. Also of interest was the finding that there were no significant correlations between the number of current prescriptions

Table 5

Correlations among Age, Verbal and Health Related Variables, Working Memory Tasks, Medication Recall and Planning Accuracy.

	AGE	EDUC	VOC	HLTH	RX	MX	ADL
EDUC	-0.31*						
VOC	0.39*	0.37*	1.00				
HLTH	0.23	-0.09	-0.15	1.00			
RX	0.37*	0.03	0.25*	0.33*	1.00		
MX	0.19	-0.04	0.09	0.35*	0.76*	1.00	
ADL	0.36	-0.29*	-0.07	0.39*	0.41*	0.33*	1.00
LAG1	-0.31*	0.13	-0.02	-0.10	-0.06	-0.06	0.10
LAG2	-0.46*	0.24	-0.05	-0.14	-0.13	-0.09	-0.07
LAG3	-0.41*	0.30*	-0.01	-0.01	-0.07	0.07	-0.10
LS(D)	-0.47*	0.21	0.00	-0.13	-0.17	-0.07	-0.07
LS(B)	-0.67*	0.36*	0.04	-0.20	-0.23	-0.13	-0.17
RECALL	-0.60*	0.38*	0.08	-0.19	-0.09	-0.05	-0.28*
PLAN	-0.28*	0.26*	0.10	0.02	-0.03	0.07	0.01

	LAG1	LAG2	LAG3	LS(D)	LS(B)	RECALL	PLAN
LAG2	0.53*	1.00					
LAG3	0.40*	0.59*	1.00				
LS(D)	0.27*	0.28*	0.39*	1.00			
LS(B)	0.38*	0.41*	0.44*	0.81*	1.00		
RECALL	0.32*	0.41*	0.28*	0.50*	0.61*	1.00	
PLAN	0.16	0.19	0.23	0.34*	0.45*	0.47*	1.00

* = $p < .05$, $df = 104$, significant $r = 0.25$

NOTE: EDUC = Education, VOC = Vocabulary, HLTH = Self-rated health, RX = Current Prescriptions, MX = Medication Experience, LAG(1,2,3) = Levels 1,2,3, of auditory working memory, LS(D) and LS(B) = Listening Span Task as scored by Daneman and Carpenter (1980) and Baddeley et. al. (1985) methods, RECALL = Medication Recall, PLAN = Planning Accuracy.

taken or medication experience and either Medication Recall or Planning Accuracy.

As had been predicted, there were significant (though modest) correlations between measures of working memory and Medication Recall and Planning Accuracy. Specifically, auditory working memory correlated with Medication Recall ($\underline{r}$ = 0.28 to 0.41 depending upon Lag) but not with Planning Accuracy. Listening span correlated significantly (higher using the Baddeley et al. (1985) method) with both Medication Recall ($\underline{r}$ = 0.61) and Planning Accuracy ($\underline{r}$ = 0.45). The higher correlations between listening span and Planning Accuracy, and especially Medication Recall, possibly reflects the greater dependence of these performance tasks on storage than on manipulation functions of working memory during encoding (Dobbs & Rule, 1989). Age was significantly correlated with both Medication Recall ($\underline{r}$ = 0.60) and Planning Accuracy ($\underline{r}$ = 0.28), though the correlation with Recall was considerably higher.

Hierarchial multiple regression analyses were carried out to determine if the process measures of listening span and auditory working memory would make unique contributions to the variability in performance on the criterion variables of Medication Recall and Planning Accuracy once the variability for chronological age and the verbal measures of vocabulary and education had been controlled. With the exception of vocabulary, these predictor variables had correlated significantly with the performance variables of Medication Recall and Planning Accuracy (Table 5). Vocabulary was included because performance on vocabulary measures has been implicated in performance on discourse recall (see Meyer, 1987 for review). As the independent measures were correlated with each other, they will necessarily share some common variance.

In both analyses, age was entered first, followed by education and vocabulary and then alternatively listening span and auditory working memory. An alpha level of .05 was used to enter and remove the variable. In Medication Recall, listening span scored by the Daneman and Carpenter (1980) method was determined to be marginally the better predictor and was used in the equation. As Table 6 shows, when listening span was entered last it added 3.1% unique variance to the equation

Table 6

Regression Analysis for Medication Recall on Age, Education, Vocabulary, and Working Memory.

	Step	Cum R^2	R^2 Change	p
Unique Variance for Auditory Working Memory				
Step 1	Age	.378	.378	0.001*
Step 2	Education Vocabulary	.498	.080	0.001*
Step 3	Listening Span	.526	.028	0.01*
Step 4	Auditory Working Mem	.553	.027	0.06
Unique Variance for Listening Span				
Step 1	Age	.378	.378	0.001*
Step 2	Education Vocabulary	.498	.080	0.001*
Step 3	Auditory Working Mem	.522	.024	0.06
Step 4	Listening Span	.553	.031	0.01*
Unique Variance for Age				
Step 1	Education Vocabulary	.146	.004	0.001*
Step 2	Auditory Working Mem	.282	.136	0.06
Step 3	Listening Span	.410	.128	0.10
Step 4	Age	.553	.143	0.001*

Table 6 (Continued)

Beta weights: Age = -.589, Education = .044, Vocabulary = .300, Listening Span = .212, Auditory Working Memory: Lag1 = .086, Lag2 = .142, Lag3 = -.166.
Note: (*) = significant

---

and the full equation accounted for 55.3% of the observed variability in Medication Recall ($F(7,100) = 17.69$, $p < .001$). When auditory working memory was entered last, it failed to contribute (2.7%) any additional unique variance to the variability in Medication Recall already accounted for by the predictors already entered.

In the multiple regression analysis for Planning Accuracy, listening span scored by the Baddeley et al. (1985) method was used in the equation because it was marginally the better predictor. Table 7 shows that when listening span was entered last, it accounted significantly for 6.4% of unique variance in Medication Planning after the variability contributed by age, verbal ability and auditory working memory had been entered ($F(7,99) = 3.87$, $p < .002$). This full equation, however, only accounted for 21.5% of the variability in Planning Accuracy performance. When auditory working memory was entered last, it failed to account for any further unique variability (0.2%) in Planning Accuracy performance. Thus, when auditory working memory was entered last into the hierarchial multiple regression analyses, it failed to contribute significantly to the variability in either Medication Recall or Planning Accuracy.

Hierarchial multiple regression analyses were carried out on the same equations except that age was entered last. From Table 6, it can be observed that for Medication Recall, age made a unique contribution of 14.3% to the variability in performance even after the variability of both working memory tasks had been accounted for. As can be seen in Table 7, age failed to contribute significantly to Planning Accuracy after the variability of the other variables had been accounted for. It would appear, therefore, that performance on Medication Recall is dependent on age while Planning Accuracy performance is independent of age.

Table 7
Regression Analysis for Planning Accuracy on Age, Education, Vocabulary, and Working Memory.

	Step	Cum R^2	R^2 Change	p
Unique Variance for Auditory Working Memory				
Step 1	Age	.093	.093	0.55
Step 2	Education Vocabulary	.145	.027	0.30
Step 3	Listening Span[a]	.213	.068	0.01*
Step 4	Auditory Working Mem	.215	.002	0.72
Unique Variance for Listening Span				
Step 1	Age	.093	.093	0.55
Step 2	Education Vocabulary	.145	.027	0.30
Step 3	Auditory Working Mem	.151	.006	0.72
Step 4	Listening Span[a]	.215	.064	0.01*
Unique Variance for Age				
Step 1	Education Vocabulary	.060	.001	0.30
Step 2	Auditory Working Mem	.094	.034	0.72
Step 3	Listening Span[a]	.212	.118	0.01*
Step 4	Age	.215	.003	0.55

2

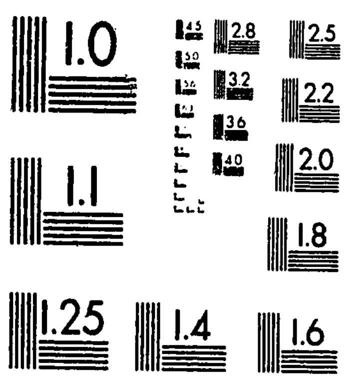


Table 7 (Continued)

Beta weights: Age = -.093, Education = .028, Vocabulary = .126, Listening Span = .374, Auditory Working Memory: Lag1 = -.030, Lag2 = -.011, Lag3 = .042.
Note: (a) One missing data point due to experimenter error.
(*) = significant.

Discussion

An initial goal of Experiment 2 was to show that it was possible to promote the instantiation of a schema for managing prescription medications equally for both young and old adults. The primary goal, however, was to demonstrate that acquisition of the instantiated schema would significantly improve the recall and practical interpretation of Prescription Information when the schema was learned before listening to the Prescription Information, rather than afterwards or not at all. In addition, it was predicted that performance on recall and scheduling by the older adults in the schema first condition would be differentially better than in schema second or control conditions.

The initial goal was realized in that performance scores on the Medication Module verification task were high and equally so for both age groups. Other major findings reported in Experiment 2 were the significant age-related differences, favouring the young adults, in Medication Recall and in most analyses involving Prescription Scheduling, e.g. Planning Accuracy and Checking Labels (Time). There was, however, limited support for a condition effect in which acquisition of the schema first significantly improved performance on Medication Recall or Prescription Scheduling over acquisition of the schema second or not at all. Trends apparent in the data suggested that schema instantiation, as inferred by the high scores on Medication Module verification, had only a marginal and inconsistent effect on memory for prescription information and on prescription scheduling.

Schema Acquisition

In Experiment 1 the young adult participants were shown to have an inadequately developed schema for managing prescription medicines. Concepts that were poorly understood by these participants and also supported in the literature formed the bases of the concepts introduced in the Medication Module in Experiment 2. Every effort was made to facilitate comprehension of and memory for Medication Module information. Rate of oral delivery was slower than the average conversational speaking rate, verbal emphasis was placed on certain words to signal their importance (Cohen & Faulkner, 1986a), facts were explicitly stated, a simple vocabulary was used, and there was a logical flow of ideas.

In addition, to promote understanding of the concepts presented, simple line drawings illustrating the more abstract concepts were shown to participants as they were developed in the text (Glenberg & Langston, 1992; Levin et al., 1987; Peeck, 1987). It had been anticipated that these format and delivery techniques would facilitate formation of an accurate representation of the concepts and would promote participants' development of an instantiated schema for medication management. Analysis of the scores on the Medication Module verification task showed that this goal appeared to be realized. Both age groups performed equally well, scoring over 80% on the test. Absence of an Age main effect and the high scores obtained by both groups on the Medication Module verification questionnaire indicated that the concepts presented had been comprehended and could be recalled.

Of considerable interest was the accuracy of responding to the three items that tested understanding of changing medication serum levels under specific conditions. In these questions, participants were asked to correctly sequence a series of illustrations to depict the changing medication serum levels requested by the question. The accuracy shown by participants in sequencing these picture cards was impressive and suggested that the illustrations had successfully portrayed the abstract concepts addressed in the script. Furthermore, the level of response accuracy indicated participants had comprehended the text and could at least portray what the text was about.

Using schema theory as a framework and performance scores as the evidence, it could be suggested that these participants had acquired an instantiated schema for managing medications. That is, they had comprehended the episodic information contained in the Medication Module and had integrated it with their existing global schema for managing medications to arrive at an instantiated schema (Brewer, 1987). The permanence and completeness of this instantiated schema and its effect on related global schematic structures within semantic memory, however, must be questioned given subsequent performance on Medication Recall and Prescription Scheduling. As the discussion progresses, this concern and others will be raised and clarified. It had been planned that the rate of delivery would be the same for both age groups and in both experimental conditions. The pace of delivery to the older participants, however, proved to be significantly slower than to the young adults. The slower pace of delivery most likely reflected the experimenter's sensitivity to the paralinguistic demands (Perfetti, 1985) of the listening older participant. Unintentionally, the older adults were given additional time, as they listened, to comprehend and then to integrate the text with the semantically related illustrations (Pezdek & Miceli, 1982) and with their global schema (Brewer, 1987). As comprehension, and ultimately, schema instantiation was desired, this discrepancy in delivery time between age groups was not considered detrimental to the outcome of the study. In fact it may have been instrumental in achieving the desired absent Age effect on the verification task that followed. Furthermore, presentation time was essentially the same for each age group across both experimental conditions, thus neither experimental condition was favoured. (Appendix H: Table H-1)

The older adults were shown to take longer than the young adults to complete their responses to Medication Module verification questions. This time interval also included the constructive feedback provided by the experimenter to correct any misconceptions revealed by the responses. As there was no time constraint imposed on this activity, all participants had time to carefully consider their responses. The elimination of a time constraint may have aided correct responding by both groups, especially the older adults.

Medication Recall

The desired Condition effect on Medication Recall was not realized.

Performance on Medication Recall was similar between schema first and second conditions which were not different from the control condition. Thus, there was no evidence to support the hypothesis that acquisition of an instantiated schema for managing medications prior to receiving the to-be-remembered Prescription Information would significantly improve recall performance. This finding was disappointing because there was evidence to suggest, given performance on the Medication Module verification task, that participants had formed an instantiated schema for managing prescription medications.

Failure of the manipulation to result in a condition effect cannot be attributed to differences in participant variables because these were essentially similar across conditions for each age group. That is, the groups of older adults across the three conditions were statistically equal on age, education and vocabulary as were the young adults on the same variables. Overall, the young adults had slightly more formal education than the older adults but the older adults achieved significantly higher vocabulary scores than the young adults. These age-related individual differences in education and vocabulary are not uncommon in the literature (e.g. Gick et al., 1988; Hultsch & Dixon, 1983). In some studies, high verbal ability appears to attenuate age-related differences in discourse recall (See Meyer, 1987 for a review). In the present study, the higher vocabulary scores achieved by the older adults demonstrated the positive effect life experiences had on their verbal ability and may have offset their slightly lower level of formal education. Although the two age groups were reliably different on the health related variables, both groups rated themselves in good to excellent health. Thus, changes in cognitive functioning secondary to health problems does not appear to be in effect here. Not unexpectedly, older adults had more medication experience than the younger adults. When medication experience was entered as a covariate in the ANOVA on Medication Recall, the effect was not significant. In summary, then, differences in participant variables cannot be implicated in the lack of a Condition effect.

Conceivably the most compelling reason for the inconclusive treatment effects noted was that participants were provided with insufficient opportunity, during

Medication Module presentation, to induce a lasting schema for managing medications. On immediate recall of Medication Module information, verification accuracy was high and provided evidence that comprehension of, and immediate memory for, content about the Medication Module had been achieved. As will be made clear in the following discussion, it can only be inferred from verification performance that an instantiated schema had been formed.

Perhaps, text processing had been effective only to the episodic mental model (Brewer, 1987; Johnson-Laird, 1983) or situational (Kintsch, 1988) level (See Figure 1). That is, during Medication Module presentation, participants translated the surface meaning of the text they had heard into "text propositions" (Kintsch, p. 167). Then, with the aid of illustrations in the Medication Module and local schematic knowledge drawn from their global schema about medicines, participants constructed an integrated episodic mental model that represented the concepts being described (Bower & Morrow, 1990; Glenberg & Langston, 1992; Johnson-Laird; Kintsch). For some participants, aspects of the information represented in the mental models formed during Medication Module comprehension did augment their developing global schema for managing medications. The effect, however, was not pervasive enough to result in a condition effect across schema first participants. Quite possibly it was the lack of opportunity for review and application of the episodic mental models generated during text processing that resulted in the ineffective instantiation of a schema for medication management. Application of concepts to analogous problems appears to be a necessary element in schema development (Gick, 1986; Gick & Holyoak, 1983).

Medication Module presentation made no provision for assessment of the form of the participants' global schema for managing medications. It was quite possible that participants held misconceptions about how prescription information should be interpreted. As will be explained later in the General Discussion, misconceptions are resistant to change, requiring interactive learning modes to effect conceptual change (Vosniadou & Brewer, 1987). Should participants have held misconceptions, it is likely that few would have been altered by the method of module presentation used in this study.

As could be expected, older adults were significantly less accurate than young adults on the Medication Recall questionnaire. This relationship between age and performance on Medication Recall also was observed in the significant negative correlation found between these two variables. Age-related differences in memory for discourse has been reported in other studies that asked for responses to explicit questions and to questions that required a conclusion or an inference be drawn from information learned within the discourse (Cohen, 1979, 1981; Light & Anderson, 1985). The seemingly poor overall performance, 62.62% and 40.96% by young and old adults respectively, may reflect previous findings that less information is recalled following listening than reading and that delayed recall is further compromised (Belmore, 1981; Byrd, 1985; Cohen & Faulkner, 1981; R. Dixon et al., 1984). Although it is difficult to compare recall accuracy across studies, two studies were found to suggest that accuracy of recall in this study was fairly typical. Light and Anderson (1985) reported that after reading short passages, fact recall scores were .59 and .42 for young and older adults respectively. Somewhat similarly, Cohen (1979) reported that after listening to story narratives, accuracy in recall of propositions by highly educated young and old adults was 60.5% and 44.3% respectively. In both studies, recall was immediate, rather than delayed as it was in the current study. After listening to logically presented treatment information followed by an activity filled delay of four minutes, Ley, Bradshaw, Eaves, and Walker (1973) showed that a group of young adults could recall just 60% of the information.

In the present study, participants listened to the Prescription Information approximately 20 minutes before Medication Recall was requested. As well, accuracy on Medication Recall required participants to integrate nonadjacent pieces of information within and between two different discourses: Medication Module and Prescription Information. Cohen (1979) and Light, Zelinski, and Moore (1982), reported that older adults experienced more difficulty than young adults in integrating nonadjacent information within one text even immediately after presentation. Thus, given the demands of the Medication Recall task for integration of nonadjacent information and delayed recall, it is perhaps remarkable that performance was as high as was found.

One of the items of information to be recalled was the name of each medication. The Age effect for this item was significant with young and old adults scoring 80.03% and 50.30% respectively. Recall of medication names was of interest because older adults do experience difficulty remembering proper names (Cohen & Faulkner, 1986b) and names of medications (Kim & Grier, 1981). Medicine trade names may be particularly difficult to remember because they should be distinctive yet not easily confused with names in common use (Canadian Pharmaceutical Association, 1991). Cohen and Faulkner asked their young and old participants to listen to four one sentence biographies and then to immediately recall the proper names mentioned in the discourse. Recall reported was less than half that found in the current study, possibly reflecting the fact that names had only been mentioned once. Less than half the group of older adults studied by Kim and Grier could immediately recall the name of one medication after hearing and viewing the name once. In the current study where three medication names were mentioned three times and viewed once, delayed recall was considerably better.

While the Age main effect for recall of medication names is clearly of greater interest, the age by condition interaction for Benemid should be discussed. The young participants in both treatment conditions recalled the drug name, Benemid, with considerable accuracy, whereas the older adults did not. Across all three medications, trends in the data suggested that the young adults may have benefited from hearing the Medication Module, regardless of sequence. As the Medication Module did not include a concept that dealt directly with drug names, it is not obvious why a condition effect should be expected for these data.

Scrutiny of the application question items in the Medication Recall data suggested trends for condition effects across and within the individual medications. With the experimental conditions combined, the Condition effect approached significance. For Cloxapen, the age by condition effect was significant and stronger when the two experimental conditions were combined. The application questions asked participants how to handle late and missed doses. This information was not directly required to integrate and remember the prescription information. Thus, regardless of whether it was heard before or after the prescription information, participants in both experimental conditions should have been more or less equally facilitated in applying this concept during Medication Recall. From this analysis, it was evident that the young adults benefited from learning about this concept, but the older adults did not. As the same concept was similarly applicable to both Benemid and Lorax, it is not clear why the knowledge transfer was not made to these two medications by the young adults. It could be hypothesized, however, that the local schema used to answer these questions for Cloxapen recall, was in some way inadequate for the participants to see its relevance to the other two medications. Perhaps the fact that the Medication Module did not include applicable examples of how to handle late and missed doses precluded concept transfer to similar problems (Gick & Holyoak, 1983).

<u>Prescription Scheduling</u>

The parameters measured in the prescription scheduling task included Planning Accuracy, specific errors, and frequency and time expended in checking the prescription labels during Prescription Scheduling.

1. <u>Planning accuracy</u>. In the overall analysis, acquisition of the Medication Module before or after listening to the Prescription Information, had no apparent effect on Planning Accuracy. An examination of the means for Planning Accuracy, however, seemed to suggest that there were trends in the data for a Condition effect for individual medicines: Cloxapen and Benemid. Statistical exploration of this possibility was useful, in that an Age by Condition effect was shown for Benemid. The effect was increased when the two treatment conditions were combined. The young adults appeared to respond to learning the Medication Module regardless of whether this happened before or after hearing the Prescription Information. The older adults in the control condition for Benemid made better plans then those in the experimental conditions, a finding that cannot be explained. If the data in this cell were ignored, the performance of the older adults is not unlike that of

the younger adults, though at a lower level (Cloxapen and Benemid), or similar level (Lorax) of accuracy.

In retrospect, the trend in the Planning Accuracy data for a nonsignificant difference between the two experimental condition may have an explanation. The knowledge learned from the Medication Module, regardless of when it was learned, could serve to guide the Prescription Scheduling task. Had the medication management schema been fully instantiated, Planning Accuracy might have even been higher in the experimental conditions as compared to the control condition.

With an overall score of 81.98%, the young adults made significantly more accurate 24 hour prescription schedules than did the older adults, whose average score was 71.40%. The age-related difference in Planning Accuracy was also reflected in the marginally significant negative correlation between these two variables. Planning Accuracy scores were considerably more accurate than Medication Recall, a finding also reported by Morrell, Park, and Poon (1990) and Morrell, Park, Poon, and Cherry (1989). The differences between these scores reflects task demands; in planning where review was possible, and in recall where it was not.

The different degrees of inferencing demanded by the three prescription orders affected both the overall accuracy of the plans generated and the types of errors made by both groups. These findings corroborated D. Morrow et al.'s (1988) suggestion that inferencing could affect interpretation of prescription information. From Figure 7 it is apparent that the schedules for Lorax were planned with greater and equal accuracy by both young and old participants than were the other two medications. Lorax demanded little inferencing in that the prescription label almost told participants when to schedule the medicine. As long as one pill was scheduled morning and afternoon and at least four hours apart, with two pills scheduled for administration near the usual bedtime hour, the plan was considered accurate. The prescription information was so directing, few timing and quantity errors were made in interpretation (Figure 10).

To correctly plan Cloxapen and Benemid, participants needed to integrate two pieces of information from the prescription label and then to make an inference as to when to schedule the medicine. For example, when scheduling Cloxapen, participants had to interpret "every six hours" in conjunction with taking the medicine on an empty stomach (one hour before or two hours after eating). This latter piece of information was located on an adjacent auxiliary label. Benemid was to be taken "twice a day", but with food and the dosage increased after two days. Even though the information was readily available for reference, integration of these pieces of information and the formation of an accurate plan proved to be demanding of information processing and was reflected in the poorer accuracy of the plans for these two medicines. The older adults were shown to have considerably more difficulty in making these inferences, a finding observed by others (Cohen, 1979; Light et al., 1982).

Both the "every/times" and "with/without food" concepts had been addressed in the Medication Module. Although there appeared to be trends in the data for an experimental effect, only in scheduling Benemid was there an age by condition effect, providing some support that Medication Module information was used in planning. The higher incidence of errors in timing and application of special instructions in scheduling Cloxapen attests to the difficulty experienced by participants, especially the older adults, in interpreting the prescription order. Across the two treatment conditions and age groups, seven participants continued to schedule Cloxapen three times (rather than four) over a 24 hour day. Persistence of this error suggested that listening to module content failed to change old habits.

It was easier to carry out the order for Benemid as it could be conveniently scheduled with breakfast and dinner. The fewer errors made, in timing and following special instructions, by both groups, confirmed this observation. A note of caution, however, must be raised in interpreting the results for Planning Accuracy. After the plan was completed, it was reviewed with the participant. At this time, it was not uncommon for a participant who had made errors in scheduling Cloxapen or Benemid to say that they had not noticed the auxiliary label located immediately above the main label. The experimenter, in introducing the task, had pointed to the prescription label on the Cloxapen bottle and had instructed the participant to consider special instructions. Had these participants been more aware of the auxiliary labels, it is likely fewer errors would have been made.

2. Checking labels. Not only were young adults more accurate in creating their plans, but they required significantly less time than the old adults to do so. There was, however, no correlation between Checking Labels (Time) and Planning Accuracy (r = .10), a further indication that a longer time taken in planning did not assure accuracy. Both groups checked the labels on the bottles more than once with similar frequency but the duration of these checks was longer for the older adults. Thus intuitively, these older adults knew they must allow themselves a longer period of time to examine the medication label during each check and to implement their plan. Morrell et al. (1989, 1990) reported a like finding for creation of 24 hour medication plans by young and old adults.

Both age groups spent about the same amount of time planning the schedule for Cloxapen, but young adults were considerably more accurate than the older adults. It appears that the young adults were aware of the difficulty inherent in planning a schedule for Cloxapen (every six hours on an empty stomach) and adjusted their planning time to improve accuracy. In scheduling Benemid, older adults took considerably longer than young adults to make their plans and were observed to experience particular difficulty in determining when to increase the dose of the medicine. Only for Lorax did the longer planning time taken by the older adults aid them in making plans that were as accurate as those by young adults. It is to be noted that the implementation of the prescription for Lorax required the least amount of inferencing.

Interestingly, in the schema second condition, both age groups, but more consistently the young adults, checked the medication labels fewer times and for slightly shorter durations, during planning than they did in either of the other two conditions. The closer proximity of learning the Medication Module to the scheduling activity in the schema second condition may have positively affected the efficiency with which scheduling was accomplished.

Retention Interval

A comment is in order concerning the retention interval being significantly longer in the schema second condition than in either of the other two conditions. The retention interval was the time between presentation of the Prescription Information and the Medication Recall task. A justifiable concern is that participants in the schema second condition were disadvantaged because of this longer retention interval. If participants in the schema second condition were disadvantaged, then participants in the schema first condition, with the shorter retention interval, should have been favoured. Given, however, that performance on Medication Recall was not significantly different across the three conditions, variation in the retention interval had no apparent effect in either experimental condition.

Working Memory Capacity

In this study, both listening and auditory working memory spans of young adults were shown to be significantly larger than were those for older adults. Stine and Wingfield (1987) and Tun et al., (1991) reported similar findings for listening span as did Dobbs and Rule (1989) for auditory working memory. Thus, for this sample of older adults, working memory capacity as estimated by these two span tasks, showed an age-related decline. Using the reading span version of the Daneman and Carpenter (1980) working memory task, Light and Anderson (1985) and Tun et al. reported similar age-related declines in working memory capacity whereas Hartley (1986, 1988) did not.

Daneman and Carpenter (1980) have argued that a larger working memory capacity would improve temporary storage capability which in turn could potentially increase the amount of information available for on-line integration during discourse processing (Kintsch, 1988; Spilich, 1983). Measures of working memory used in this study should predict performance on Medication Recall and in Planning Accuracy. Findings from the correlation and regression analyses supported this assumption.

In the correlation analysis, performance on listening span and at Lags 2 and 3 of auditory working memory did predict performance on Medication Recall with listening span the stronger predictor. Similar correlations have been reported between reading span and text recall by Hartley (1988) and paragraph memory by Light and Anderson (1985). Findings in the correlational analysis in this research were supported by those in the multiple regression analyses. The regression analyses showed that listening span made a unique contribution to the variability in Medication Recall performance when it was entered last, whereas auditory working memory did not. Somewhat similarly, performance on Planning Accuracy was correlated with listening span but not with auditory working memory. Regression analyses supported these findings showing that listening span, but not auditory working memory, made a unique contribution to the variability in Planning Accuracy.

Dobbs and Rule (1989) suggested that the listening span and auditory working memory tasks make somewhat different demands on working memory processing. The auditory working memory task, especially at Lags 2 and 3 places emphasis not only on the temporary storage function of working memory, but also the "speed or agility with which processing changes occur" (Dobbs & Rule, p. 502). In contrast, the listening span task places somewhat more emphasis on the storage component of working memory. Hartley (1988), however, showed that reading span factored onto both a general processing speed component and a verbal component. Thus listening span would also have a general processing speed component. Hence, Planning Accuracy, but especially Medication Recall, likely made demands on the speed or agility component of working memory, although to a considerably lesser extent than on storage. As age-related slowing in the efficiency of mental operations within working memory has been suggested (Hartley, 1988; Salthouse, 1990; Stine & Wingfield, 1987), it is quite possible that slowing, as well as decreased capacity, played a role in the poorer performance by older adults on both Medication Recall and Planning Accuracy, but especially the former.

Prescription scheduling required that small portions of information be interpreted and temporarily held in memory while the prescription plan was completed. As the medication labels were always available as a reference, manipulation and even the demands on storage would have been somewhat minimized.

Thus, it seems logical that it was listening span and not auditory working memory that modestly correlated with Planning Accuracy and contributed uniquely to the variability in performance of this task. The degree of correlation was less than that observed for Medication Recall and reflects the different processing demands of the two tasks.

Age-related differences in working memory capacity may partly explain the greater difficulty older adults experienced in scheduling Cloxapen and Benemid. Scheduling both these medicines required the interpretation and integration of more than one piece of information. Inferencing is more process demanding and older adults have been shown to perform less effectively on such tasks (Cohen, 1979; Light et al., 1982). Where inferencing requirements were minimal, as they were for scheduling Lorax, older adults performed as well as young adults.

When age was entered last into the regression equations on Medication Recall and Planning Accuracy, age made a unique contribution to predicting variability in performance on the former but not the latter task. Therefore, age made a contribution to Medication Recall performance over and above the contributions made by age-related differences in processing as measured by listening span and auditory working memory and verbal ability as measured by vocabulary and education. Other studies have reported that age contributed to performance; Stine et al. (1986), Stine and Wingfield (1987) and Wingfield, Poon, Lombardi, and Lowe (1985). Stine and Wingfield (1990) stated that under difficult text processing conditions, age alone becomes a good predictor of recall performance and can account for 25% of the variance. Medication Recall must, therefore, be considered a difficult task in that age alone accounted for 37.8% of the variability in performance. By comparison, Prescription Scheduling would be considered a less difficult task. As indicated above, performance on Planning Accuracy was independent of age and age alone was shown to only account for 9.0% of the variability in performance. As age, verbal ability and working memory only accounted for 21.5% of the variability in performance on this task, other factors must be at work here.

It is interesting that performance on Medication Recall was dependent upon age whereas Planning Accuracy was not. This difference could be attributed to the fact that Medication Recall performance was highly dependent upon comprehension and storage of Prescription Information during on-line processing, an experimenter paced operation. By contrast, Prescription Scheduling was participant paced and the prescription information was always available. Participants could take as long as they wished to make their plans. The smaller working memory capacities and declining efficiency in processing of the older adults would have contributed to the poorer performance in both tasks when compared to the young adults.

Before moving on to the General Discussion, a note of caution must again be raised regarding the exploration of the Medication Recall and Planning Accuracy data for Condition effects. At the risk of committing Type I errors, it was judged important to explore the data for condition effects where trends were observed because the treatment used in this study was essentially untried. That marginally significant, though inconsistent, Condition effects were found was of considerable interest and provided encouragement for further exploration of schema induction methodologies.

GENERAL DISCUSSION

The primary goal of this research project was improving memory for, and interpretation of, prescription information through the instantiation of a schema for managing medications. In the schema first condition, young and old adults listened to the Medication Module, an illustrated text about the management of prescription medicines. Integration of this episodic information package with participants' global schema in the same domain was meant to foster the instantiation of a schema for medication management. Participants then listened to prescription information for three medicines. After an activity filled delay of approximately 20 minutes, participants were asked to recall the prescription information and to create a 24 hour prescription schedule for the three drugs. In the schema second condition, schema instantiation occurred after the prescription information was heard. In the control condition, a filler module was provided before participants listened to the prescription information.

The outcomes expected from the manipulation were selectively realized. Regardless of whether participants acquired the schema first, second, or were not provided with the opportunity, performance on a short answer questionnaire asking recall of prescription information (Medication Recall), was minimally affected by the manipulation. Planning Accuracy, a performance measure of the 24 Hour Prescription Scheduling task, showed similar outcomes. For these dependent variables, there were consistent Age and Medication effects but minimal evidence for Condition effects. The young adults, as expected, correctly recalled more prescription information and created more accurate plans than did the older adults. In Medication Recall analyses, Medication effects failed to show a consistent pattern across question type. For example, on explicit recall, Lorax was recalled better than Cloxapen, whereas on integration recall, the reverse was shown. Regardless of which medication or question type, young adults recalled more information than did older adults. In Prescription Scheduling, the pattern was consistent; both young and older adults made schedules of equal and greater accuracy for Lorax as compared to the other two medications.

In both Medication Recall and Planning Accuracy, the young adults seemed to benefit somewhat more from the manipulation than did the older adults, especially when the two experimental conditions were combined and compared to the control condition. That is, there were trends for a Condition effect, favouring the young adults, in name and application recall across all medications, in name recall for Benemid, and application recall for Cloxapen. In Planning Accuracy, when the two experimental conditions were combined and compare with control condition, the Condition effect was significant for Cloxapen alone and for errors combined across all three medicines.

The study paradigm and interpretation of the findings were guided by theories of schema development and working memory and by expected age-related differences. The activation of a relevant schematic knowledge structure provides individuals with a framework for comprehension and integration of incoming domain related information. The comprehensiveness of the representation created of the to-be-remembered discourse should be enhanced by domain related schema guided processing (Hess, 1990; Spilich et al., 1979). Because one of the study populations was the older adult, it was reassuring to understand that activation of schematic knowledge structures remains unchanged across age (Arbuckle, et al., 1991; Hess, 1990; Light & Anderson, 1983). As well, on line comprehension by older adults, though slightly slower (Burke & Harrold, 1988), has been reported adequate at the pace of a typical conversation (Kausler & Hakami, 1983).

Relevant to schema theory, as conceptualized for this study, was the understanding that processing resources decline with age. Working memory capacity (Rabinowitz et al., 1982; Zacks & Hasher, 1988) as well as agility (Dobbs & Rule, 1989) and speed or efficiency of processing (Burke & Harrold, 1988; Hartley, 1988; Salthouse, 1990) have been reported to show an age-related decline. Changes in working memory that accompany the aging process are implicated in the changes associated with discourse processing. Just as high verbal ability is believed to attenuate observed decline in discourse processing (Meyer, 1987; Meyer & Rice, 1983), aspects of cognitive aging can also be counteracted by the presence of a well developed domain related schema (Charness, 1985). The related schema, once activated provides a framework to guide processing, increasing the efficiency with which the incoming knowledge can be organized and integrated (Fincher-Kiefer et al., 1988; Hess, 1990; Spilich et al., 1979). It is likely that a more complete representation of the information would be retained for later recall.

Well developed domain specific schemas, therefore, have the potential to serve as powerful adjuncts for processing efficiency and for memory of schema related discourse. A guiding premise of the study was that high scores on the Medication Module verification questionnaire would indicate that a schema for managing medication had been instantiated. In the schema first condition, and according to schema theory, local schematic knowledge would be drawn from this instantiated schema to serve as a framework for the integration of prescription information. Activated in working memory, the local schematic structure would increase the efficiency with which the prescription information was processed resulting in a more complete episodic mental model of this content. Performance on the Medication Recall and Prescription Scheduling tasks would therefore benefit. Furthermore, performance by older adults was expected to be differentially affected in the schema first condition as the presence of the schematic framework might attenuate age-related changes in working memory (Hess, 1990).

Analysis of the dependent measures, however, revealed that the expected condition effect was not clearly realized. This outcome, notwithstanding, there were trends within the data that were of interest. These, as well as an exploration of reasons why the desired condition effects were not achieved will be discussed, first for Medication Recall and then Prescription Scheduling. The discussion will conclude with implications for future study and for health care professionals who are involved with monitoring medication self-administration.

One of the most rewarding outcomes of the study was the absence of an age effect on the Medication Module verification questionnaire and the better than 80% accuracy achieved on the task by both groups. This finding was important because it showed that the strategies used to promote acquisition of module content had been effective in overcoming the obstacles present. Obstacles included the following: the content in the Medication Module was expository, a type of prose that older adults have more difficulty remembering (Byrd, 1985; R. Dixon et al., 1982; Hartley, 1986); the listening modality was used, a modality that makes recall more difficult for both young adults and old adults (R. Dixon, et al., 1982); and the appreciation that older adults just do not remember as much content as do young adults regardless of the type of prose or the modality in which it is presented (e.g. Cohen, 1979, R. Dixon, et al., 1982).

In presenting the Medication Module, every effort was made to enhance comprehension and subsequent memory for content, especially by the older adults. Thus, information was explicitly stated in simply worded prose and logically sequenced. Speech rate was deliberately slowed, to approximately 135 words per minute and certain words and phrases were emphasized to signal their importance in the text (Cohen & Faulkner, 1986a). To further aid the formation of accurate mental representations of the rather abstract concepts presented, simple line drawings illustrating these ideas were displayed as the text was read (Glenberg & Langston, 1992; Levin et al., 1987; Morrell & Park, 1992; Peeck, 1987).

The formation and delivery techniques used in presenting the Medication Module did appear to foster schema instantiation. Performance on the Medication Module verification questionnaire provided support that understanding of, and immediate memory for, Medication Module content had been achieved. It could be inferred from the success on the questionnaire, that schema instantiation had also occurred. This assumption, however, must be tempered given the limited Condition effects observed on both the Medication Recall and Prescription Scheduling tasks.

It could be that a more temporary mental representation had been structured and that it needed to be reinstated to effect a more lasting schematic representation. Following schema theory (refer to Figure 1), it is possible that instead of an instantiated schema, an episodic mental model of the Medication Module had been acquired (e.g. Brewer, 1987, Johnson-Laird, 1983). Support for this hypothesis lies in the finding that in module verification, participants could accurately sequence carded illustrations to show changes in medication serum levels under specified conditions. As well, they could respond accurately to explicit questions about module content. In other words, participants could describe what the Medication Module was about and could do so immediately after listening. The nature of these responses suggested that formation of an episodic mental model had at least been achieved (Brewer, 1987; Johnson-Laird, 1983; Kintsch, 1988).

Alternately, an instantiated schema for managing medications had been formed but was not activated for use in processing Prescription Information. If, however, the instantiated schema had been available, listening to the domain related Prescription Information should have caused schema activation. As there was no Condition effect to indicate that a schematic structure had enhanced the efficiency with which domain related information had been comprehended and integrated

(Fincher-Kiefer et al., 1988; Hess, 1990; Spilich et al., 1979), it is likely that the necessary instantiated schema was not available for activation.

Trends in the Medication Recall and Prescription Scheduling data provide some evidence that participants had drawn upon Medication Module content when responding. What is not clear is whether the referent representation was an episodic mental model or an instantiated schema. It also is not known when or how episodic mental model(s) may affect an instantiated schema, or how both mental models and instantiated schematic structures may become part of developing global schemas. Furthermore, it is also not known if a mental model has the potential to function as a local schema under certain conditions. That is, could aspects of episodic mental models formed of the Medication Module information, in the schema first condition, have been used to guide processing of the Prescription Information rather than local schematic knowledge drawn from an instantiated schema? The dependent measures were not sensitive enough to pick up such subtleties of representation.

Without the availability of the instantiated schema to guide processing of the prescription information in the schema first condition, processing would proceed the same as in the schema second and control conditions. As Condition effects were limited and inconsistent, this may have been what happened. Processing of prescription information across all three conditions would have been aided by each individual's existing global schema and for the young adults, by practice at remembering lecture content. Medication experience should have exerted a positive effect on at least Planning Accuracy but as there was no change in the pattern of results when this variable was entered as a covariate in the analyses, such was not the case. As well, the correlations between medication experience and Medication Recall and Planning Accuracy were not significant. These findings suggested that health care professionals involved in monitoring the self-medication administration practices of these participants had contributed minimally to the development of the patient's global schema for managing prescription medicines.

Performance on the 24 hour Prescription Scheduling task was evaluated on two different aspects. One aspect examined the accuracy of the plan (Planning

Accuracy) and types of errors, and the other looked at the frequency and time spent checking labels on the medicine bottles while planning. The demands of the Prescription Scheduling task were considerably different from those for the Medication Recall task. Performance on Medication Recall relied heavily on the extent to which prescription information had been encoded at the time of presentation. In Prescription Scheduling, the data to be interpreted, including special instructions, were present at all times for reference. This meant that it was most likely irrelevant as to whether the Medication Module was received before or after listening to the prescription information. Module content would guide the participants in their interpretation of the "every" and "times" aspects of the prescriptions, cue them to look for special instructions, and to schedule the pills over the day in order to maintain serum medication levels within the therapeutic range. Trends in the data provided support that accuracy in planning was influenced by the presence of the Medication Module, but primarily for the young adults. Accuracy, however, was also affected by the amount of inferencing that was required to interpret the prescription. Young and older adults made very accurate plans for Lorax, where inferencing was minimal. Both groups, but especially the older adults, made more errors in scheduling Cloxapen and Benemid where demands for inferencing were greater.

Age differences prevailed across most of the analyses on Prescription Scheduling; for example, Planning Accuracy and time spent in planning. Although both young and old adults checked the labels with equal frequency, the older adults spent longer periods of time checking each bottle. This extra planning time, however, did not tend to translate into more accurate plans for the older adults. The exception was Lorax. For this medication, both groups were equally accurate in their plans. No doubt the limited inferencing required in interpreting this prescription was the primary reason for the accuracy.

While the learning conditions in this study did promote immediate recall of the Medication Module, schema instantiation was not fully realized. It is still believed, however, that schema instantiation is possible, but that Medication Module presentation will have to be significantly changed in order to achieve this goal. In the discussion following Experiment 2, it was suggested that module presentation did not provide participants with sufficient opportunities to review and practice using the mental models of the concepts they had formed. As a result, these new models possibly failed to become part of an instantiated schema. In the following sections several alternative forms of concept presentation, reported to foster schema instantiation, will be discussed. These learning methods could be incorporated into the Medication Module presentation and have the potential of enhancing schema induction.

Gick and Holyoak (1983) reported that the inclusion of a sufficient number of example problems early in schema induction promotes schema instantiation and subsequent knowledge transfer. According to Gick and Holyoak, schema induction for analogous problem transfer is usually achieved if at least two examples of each type of problem are worked out by the learner during schema development (Gick, 1986). The Medication Module did work though two examples but each illustrated a different principle (e.g. "every" four hours and four "times" a day). Purposefully, none of the test prescriptions made use of "four" but did incorporate the principles of "every" and "times". Had at least two sample prescriptions been provided for participants to interpret, the schematic representation formed may have been more transferable.

Gick and Holyoak (1983) also reported that using illustrations to depict principles and stating underlying principles in words were only helpful in developing problem solving schemas if used in conjunction with working out example problems. This finding may explain why there was limited application of the late and missed dose concepts during Medication Recall. The concepts were described and illustrated during Medication Module presentation, but worked examples were not provided. Had at least two sample problems been provided for each principle (late and missed doses), there may have been more consistent evidence of a condition effect in Medication Recall.

Schema induction has been shown to be fostered if learners are urged to make comparisons between analogous examples (Gick & Holyoak, 1983; Catrambone

& Holyoak, 1985). In addition, Gick and Holyoak showed that solving transfer problems during testing improved when a hint was given to use the appropriate analogue. In the present study, participants were not urged, during schema acquisition, to make comparisons between the prescription examples. Also, they were not provided with any hint, at the start of Medication Recall or Prescription Scheduling tasks, to make use of the Medication Module information learned earlier. Perhaps if, as recommended by Gick (1986), both groups, but especially the older adults, had been provided with a hint to make use of module information, performance in the experimental conditions might have improved.

Past experiences with prescription medicines and possibly over the counter medications would contribute to an individual's developing global schema for managing medications. The knowledge represented in this schema would be relevant to how new medication information would be interpreted and integrated with old information (Osborne & Wittrock, 1983; Roth, 1990; Vosniadou, 1991; Vosniadou & Brewer, 1987). Schematic knowledge structures tend to be resistant to change because they have reliably predicted outcomes in the past (Osborne & Wittrock). Problems arise, however, when knowledge structures based on past life experiences are perceived to be different from new incoming pieces of information (Vosniadou).

According to Vosniadou (1991), the kind of mental models formed, as individuals attempt to integrate two pieces of conflicting information, will be constrained by the old knowledge structure. Unless the new incoming information is persuasive enough to effect a change in the global schema, misconceptions result. Misconceptions are schematic representations, usually of experienced physical principles that have been altered just enough to accommodate new scientific principles without really effecting change in the old model. The phenomena of misconceptions have been described by Helm (1980) for principles of physics, by McCloskey (1983) for Neutonian mechanics, by Roth (1990) for photosynthesis, and by Vosniadou (1991) for astronomy. Most of these studies were conducted on school age children who were learning scientific principles. Helm, however, showed that misconceptions in basic physics persisted over many years and hindered the acquisition of more advanced principles by college students.

Evidence for misconceptions was present in this study. For example, in Experiment 1, several respondents believed that addiction to narcotics was a common sequelae of the administration of these drugs for the management of acute pain. As well, respondents frequently scheduled an antibiotic prescribed "every six hours", three times a day rather than four. The misconception observed in this instance was that the medication was to be taken only during waking hours rather than spaced over the 24 hour day.

In Experiment 2, an attempt was made to instantiate the concept that, in a prescription, the term "every" meant over the 24 hour day. In reviewing the data in Experiment 2, seven participants across the two experimental conditions and seven in the control condition scheduled Cloxapen three, rather than four, times in the 24 hour period. Because the incidence of this error was less in the experimental conditions, there was some evidence that the Medication Module may have changed the behaviour for some participants. Nonetheless, the fact that any participant in the experimental conditions made this error shows that the misconception had persisted.

Misconceptions tend to resist change (Roth, 1990), and overcoming examples such as those described above, presents a challenge to the health care professional. Vosniadou and Brewer (1987) suggested two teaching modes that could enhance schema induction and the correction of misconceptions; use of analogies and interactive dialogue. In using analogies, these authors followed the method reported by Gick and Holyoak (1983) and described above. In the interactive dialogue learning mode, misconceptions are explored in light of scientific explanations and the learner is guided to resolve the discrepancies. Learning in both these teaching modes is interactive, a condition that Roth (1990) and Osborne and Wittrock (1983) assert is necessary to facilitate a conceptual change in schematic structure.

The obvious implication to be drawn from the above discussion on analogue transfer and misconceptions is that a more interactive style of module presentation would most likely have enhanced schema instantiation in this study. Future attempts at schema instantiation, therefore, should actively pursue a more interactive learning style.

In conclusion, then, even though schema instantiation seemed not to occur under the learning conditions used in this study, it is still believed that schema induction is possible for managing medication and other therapeutic interventions. Furthermore, it is also believed that, if both young and older adults had acquired an instantiated schema for managing medication, their ability to remember prescription information and to carry out prescription orders with greater accuracy would have significantly improved. If concepts for managing medications acquired during episodes of schema instantiation became part of the individual's global schema, then processing of prescription information encountered at future points in time would proceed with increased efficiency and possibly with improved recall.

Given the characteristic of this study sample, the results in this study cannot be generalized to the same or other age groups in different life situations. For example, larger age-related differences might be expected in the less healthy and frail elderly (Poon, Krauss, Bowles, 1984). The methodology in this study was based on receiving three new medications at one time. Although older adults, on average, do take that many prescriptions, seldom would they receive three new medicines at one time. Thus, the results here can only be generalized to those situations. However, the findings reported here are not at odds with other studies employing similar methodologies and study populations. Older adults and even young adults do not remember or interpret medication prescription information as effectively as health professionals would like. Thus, there still remains the need to learn ways to improve communication techniques for the dissemination of health related information to people of all ages. It is possible that if a schema for managing medications was well learned and available for processing related prescription information that memory for, and interpretation of, this important information could be substantially improved and would have a significant impact on the health of Canadians.

IMPLICATIONS AND DIRECTIONS FOR FURTHER RESEARCH

As is evident from the outcome of this study, the method used in presenting the Medication Module probably failed to instantiate a schema or to appreciably alter a developing global schema for managing medications. Rather, the learning conditions were sufficient to make it possible for older adults to retain, at least in the short term, as much information about the Module as did the young adults. The absence of Condition effects in the data, however, mean that changes in at least the method of presentation must be made to promote the formation of an instantiated schema that could modify, in a lasting way, the developing global schema for managing medications. In future research, techniques discussed in the General Discussion such as analogue transfer, should be employed to promote schema development.

For example, if the learning module included a minimum of two worked examples for each principal introduced, as was suggested by Gick and Holyoak (1983), schema induction should be more complete and lasting. This addition to the module should also improve problem transfer during Prescription Scheduling. Should misconceptions be observed, these must be explored and convincing arguments presented to effect a conceptual change in schematic structure (Vosniadou & Brewer, 1987). Hints to use the concepts covered in the module when working out analogous problems should also be used to hasten schema development (Gick & Holyoak).

As it is still not clear how schemas do develop (Alba & Hasher, 1983; Garnham, 1987; Hess, 1990), it would be instructive to explore, at a more basic level, how schema development progresses. The Schema Theory Hierarchy (Figure 1) proposed in the introduction could be used guide this exploration. A first step would be to identify what schematic structure would lend itself to a straight forward developmental process. Persons considered experts in this domain would be asked to identify concepts basic and important to their developed schema. The concepts consistently identified could serve as the bases for learning module content. Module presentation would incorporate techniques used in the research study reported here including use of illustration as well as methods described by Gick and Holyoak (1983) to promote schema development and Vosniadou (1991) to overcome misconceptions.

At entry to the study, the level of schema development in the chosen domain held by each participants would need to be thoroughly documented. After the first review of the learning module, understanding of the concepts would be evaluated in both the short and long term. These evaluations would provide insight into the development of a global schema in the chosen domain. Quite possibly, there would be evidence for progression from the episodic mental model level to the instantiated schema level and finally to the global schema level. Timing of the assessments could prove to be critical. Exposure to additional versions of the learning module would most likely be necessary for some participants dependent upon level of schema development at entry and its subsequent modification. Those who held or developed misconceptions would benefit from a more interactive module presentation. Thus, it could be expected that schema development would occur over time and would need to be individualized as participants would enter the study with differing life experiences that could affect the progression of schema acquisition.

Trends observed in the data, especially when the experimental conditions were combined, suggested that the young adults seemed to benefit more from learning the Medication Module than did the older adults or controls. This possibly implies that young and old adults may differ in their trajectories of progression from acquisition of mental models of the Medication Module to schema instantiation and/or modification of global schematic structures for managing medication. Step by step analysis of schema development, as suggested above, may provide insight into any age-related differences in this process.

Exploration of the data also suggested implications for health care professionals in clinical practice involved in monitoring medication self-administration. The majority of the participants in both experiments, but especially the older adults, had taken at least one prescription medication in the past two years as well as over the counter medicines. It is also likely that taking prescription medicines had been experienced prior to this two year period. Thus, the finding that there was no correlation between medication experience and performance in scheduling prescription medicines, is of concern and indicates that current methods of disseminating prescription management guidelines are likely ineffective. Ways to promote the retention in memory of a lasting and readily usable schematic structure for managing medications should be explored.

Although the literature explored for this study, provided guidelines about the concepts to include in the Medication Module, concepts deemed important to the expert may be at variance with those of the patient. Hence, it would be useful to determine the similarities and differences between expert and novice evaluation of what concepts are appropriate and important to a schema for managing medications.

It was assumed that generic information, rather than specific drug information, was most appropriate for inclusion in the learning module. Logically, drug specific information could lead to fragmentation of concepts whereas generic information would be applicable across medications. Generic information should guide the patient to anticipate what prescription information to listen for and should result in improved integration of the incoming information and its subsequent recall and application. There is also the consideration of when this generic information about managing medications should be taught. Perhaps the school public health nurse could incorporate this knowledge into a series on health teaching.

This research project reported that both young and old participants, regardless of medication experience, experienced little difficulty in interpreting medication prescription that required minimal inferencing, e.g. Lorax. This finding leads to the question of whether varying levels of expertise in managing medications are truly of no consequence when prescription interpretation requires minimal inferencing.

Outcomes in this study should provide guidance for health care professionals who give patients, especially elderly patients, drug related information. These professionals should appreciate that most older adults will likely experience a decline in working memory capacity, in processing efficiency or both. Those over the age of 75 (Burns et al., 1990) and especially those with poor memory or confusion are of course particularly at risk for decreased comprehension (Report, 1984). Understanding the implications these changes in cognition have for learning should guide the amount and rate at which information is provided. For example and as Ascione and Shimp (1984) point out, older adults are more likely to improve their drug knowledge when provided with specific information in small amounts. Regardless of the patient's age, the vocabulary and syntax of the information should be kept simple. Where inferencing and the integration of two or more pieces of information becomes necessary, understanding of the message should be verified. Generally, the health care professional should realize that the patient who is well informed about his treatment regimen is less likely to unintentionally fail to comply (Kenrick & Bayne, 1982; Lundin, et al., 1980).

Outside the laboratory, oral presentation of the generic learning module may not be feasible because of time constraints. Other learning modalities, however, could prove to be just as effective. For example, the module content could be made available in an illustrated pamphlet, presented in an interactive video or by computer assisted instruction. Modified Medication Recall and Prescription Scheduling tasks could evaluate the efficacy of the various modalities.

Understanding and application of other treatment regimens could also lend itself to schema instantiation techniques. For example, diabetic care including diet, exercise, foot care, and medication regimens, both oral hypoglycemic agents and insulin injection, would be an excellent and useful area to explore.

Although Age effects were pervasive in this study, Condition effects were minimal. This being the case, there is ample scope for further research. Research projects in the fields of cognitive psychology, medication administration, as well as gerontology are possible and several possibilities were suggested above.

REFERENCES

Alba, J. W., & Hasher, L. (1983). Is memory schematic? Psychology Bulletin, 93, 203-231.

AMA Department of Drugs (1986). AMA drug evaluations (6th ed.). Chicago, IL: American Medical Association.

Arbuckle, T. Y., Vanderleck, W. F., Harsany, M., & Lapidus, S. (1990). Adult age differences in memory in relation to availability and accessibility of knowledge-based schemas. Journal of Experimental Psychology: Learning, Memory, and Cognition, 16, 305-315.

Ascione, R. J., Kirscht, J. P., & Shimp, L. A. (1986). An assessment of different components of patient medication knowledge. Medical Care, 24, 1018-1028.

Ascione, F. J., & Shimp, L. A. (1984). The effectiveness of four education strategies in the elderly. Drug Intelligence and Clinical Pharmacy, 18, 926-931.

Baddeley, A. (1986). Working memory. Oxford Psychology Series Number 11. Oxford: Clarendon Press.

Baddeley, A., Logie,R., Nimmo-Smith, I., & Brereton, N. (1985). Components of fluent reading. Journal of Memory and Language, 24, 119-131.

Bartlett, F. C. (1932). Remembering. A study in experimental and social psychology. Cambridge: Cambridge University Press.

Belmore, S. M. (1981). Age-related changes in processing explicit and implicit language. Journal of Gerontology, 36, 316-322.

Bower, G. H., & Morrow, D. G. (1990). Mental models in narrative comprehension. Science, 247, 44-48.

Bransford, J. D., & Johnson, M. K. (1972). Contextual prerequisites for understanding: Some investigations of comprehension and recall. Journal of Verbal Learning and Verbal Behavior, 11, 717-726.

Brewer, W. F. (1987). Schemas versus mental models in human memory. In P. Morris (Ed.), Modelling Cognition (pp. 187-197). Chichester: John Wiley & Sons Ltd.

Brewer, W. F., & Nakamura, G. V. (1984). The nature and function of schemas. In R. S. Wyer Jr. & T. K. Srull (Eds.), Handbook of Social Cognition (pp. 120-160). Hillsdale, NJ: Lawrence Erlbaum Associates.

Burke D. M., & Harrold, R. M. (1988). Automatic and effortful semantic processes in old age: Experimental and naturalistic approaches. In L. L. Light & D. M. Burke (Eds.), Language, Memory and Aging (pp. 100-116). New York: Cambridge University Press.

Burns, E., Austin, C. A., & Bax, N. D. S. (1990). Elderly patients' understanding of their drug therapy: the effect of cognitive function. Age and Ageing, 19, 236-240.

Byrd, M. (1985). Age differences in the ability to recall and summarize textual information. Experimental Aging Research, 11, 87-71.

Canadian Pharmaceutical Association (1991). Compendium of Pharmaceuticals and Specialties. Ottawa: Author.

Canada Health Survey (1981). The health of Canadians. Report of the Canada Health Survey. (Catalogue No. 82-538E). Ottawa: Ministry of Supply and Services.

Catrambone, R., & Holyoak, K. J. (1989). Overcoming contextual limitations on problem-solving transfer. Journal of Experimental Psychology: Learning, Memory, and Cognition, 15, 1147-1156.

Cavanaugh, J. C. (1983). Comprehension and retention of television programs by 20- and 60- year olds. Journal of Gerontology, 38, 190-196.

Chafe W., & Danielewicz, J. (1987). Properties of written and spoken language. In R. Horowitz & S. J. Samuels (Eds.), Comprehending Oral and Written Language (pp. 83-116). San Diego: Academic Press.

Charness, N. (1985). Aging and problem-solving performance. In N. Charness (Ed.), Aging and Human Performance (pp. 225-259). Chichester: John Wiley & Sons.

Cohen, G. (1979). Language comprehension in old age. Cognitive Psychology, 11, 412-429.

Cohen, G. (1981). Inferential reasoning in old age. Cognition, 9, 59-72.

Cohen, G. (1988). Age differences in memory for texts: Production deficiency or processing limitations? In L. L. Light & D. M. Burke (Eds.), Language, Memory and Aging (pp. 171-190). New York: Cambridge University Press.

Cohen, G., & Faulkner, D. (1981). Memory for discourse in old age. Discourse Processing, 4, 253-265.

Cohen, G., & Faulkner, D. (1986a). Does "elderspeak" work? The effect of intonation and stress on comprehension and recall of spoken discourse in old age. Language and Communication, 6, 91-98.

Cohen, G., & Faulkner, D. (1986b). Memory for proper names: Age differences in retrieval. British Journal of Developmental Psychology, 4, 187-197.

Cole, C. A., & Houston, M. J. (1987). Encoding and media effects on consumer learning deficiencies in the elderly. Journal of Marketing Research, 26, 55-63.

Cramer, J. A., Mattson, R. H., Privey, M. L. Scheyer, R. D., & Ouellette, V. L. (1989). How often is medication taken as prescribed? a novel assessment technique. Journal of the American Medical Association, 261, 3273-3277.

Daneman, M., & Carpenter, P. A. (1980). Individual differences in working memory and reading. Journal of Verbal Learning and Verbal Behavior, 19, 450-466.

Dixon, P. (1987a). Action and procedural directions. In R. R. Tomlin (Ed.), Coherence and Grounding in Discourse. Typological Studies in Language (Vol. III) (pp. 69-89). Amsterdam: John Benjamin Publishing.

Dixon, P. (1987b). The processing of organizational and component step information in written directions. Journal of Memory and Language, 26, 24-35.

Dixon, R. A., Simon, E. W., Nowak, C. A., & Hultsch, D. F. (1982). Text recall in adulthood as a function of level of information, input modality, and delay interval. Journal of Gerontology, 35, 358-364.

Dixon, R. A., Hultsch, D. F., Simon, E. W., & von Eye, A. (1984). Verbal ability and text structure effects on adult age differences in text recall. Journal of Verbal Learning Behavior, 23, 569-578.

Dobbs. A. R., & Rule, B. G. (1989). Adult age differences in working memory. Psychology and Aging, 4, 500-503.

Ekstrom, R. B., French, J. W., Harman, H. H., & Derman, D. (1976). Manual for Kit of Factor References Cognitive Test. Princeton, NJ: Education Testing Service.

Fincher-Kiefer, R., Post, T. A.,Greene, T. R., & Voss, J. F. (1988). On the role of prior knowledge and task demands in the processing of text. Journal of Memory and Language, 27, 416-428.

Friedman, A. (1979). Framing pictures: The role of knowledge in automatized encoding and memory for gist. Journal of Experimental Psychology: General, 108, 316-355.

Garnham, A. (1987). Mental models as representations of discourse and text. New York: John Wiley & Sons.

Gentner, D., & Gentner, A. L. (1983). Mental models. Hillsdale, NJ: Lawrence Erlbaum Associates.

Gick, M. L. (1986). Problem-solving strategies. Educational Psychologist, 21, 99-120.

Gick, M. L., Craik, F. I. M., & Morris, R. G. (1988). Task complexity and age differences in working memory. Memory and Cognition, 16, 353-361.

Gick, M. L., & Holyoak, K. J. (1983). Schema induction and analogical transfer. Cognitive Psychology, 15, 1-38.

Glenberg, A. M. & Langston, W. E. (1992). Comprehension of illustrated text: Pictures help to build mental models. Journal of Memory and Language, 31, 129-151.

Glenberg, A. M., Meyer, M., & Linden, K. (1987). Mental models contribute to foregrounding during text comprehension. Journal of Memory and Language, 26, 69-83.

Griffith, H. W. (1990). Complete guide to prescription and non-prescription drugs (7th ed.). Los Angeles: The Body Press.

Gunning, R. (1952). The technique of clear writing. New York: McGraw-Hill Book Co.

Hartley, J. T. (1986). Reader and text variables as determinants of discourse memory in adulthood. Psychology and Aging, 1, 150-158.

Hartley, J. T. (1988). Aging and individual differences in memory for written discourse. In L. L. Light & D. M. Burke (Eds.), Language, Memory and Aging (pp. 36-57). New York: Cambridge University Press.

Hasher L., & Zacks, R. T. (1988). Working memory, comprehension, and aging: A review and a new view. The Psychology of Learning and Motivation, 22, 193-225.

Hayes, D. A., & Henk, W. A. (1986). Understanding and remembering complex prose augmented by analogic and pictorial illustrations. Journal of Reading Behavior, 18, 63-77.

Helm, H. (1980). Misconceptions in Physics amongst South African students. Physics Education, 15, 92-97, 105.

Hess, T. M. (1990). Aging and schematic influences on memory. In T. M. Hess (Ed.), Aging and Cognition: Knowledge Organization and Utilization (pp. 93-160). North Holland: Elsevier Science Publishers.

Hess, T. M., Donley, J., & Vandermaas, M. O. (1989). Aging-related changes in the processing and retention of script information. Experimental Aging Research, 15, 89-96.

Howell, D. C., (1987). Statistical methods in psychology (2nd ed.). Boston: Duxbury Press.

Hultsch, D. F., & Dixon, R. A. (1983). The role of pre-experimental knowledge in text processing in adulthood. Experimental Aging Research, 9, 17-22.

Hultsch, D. F., & Dixon, R. A. (1984). Memory for text material in adulthood. Life-Span Development and Behavior, 6, 77-108.

Improving patient compliance. (1991, September). NARD Journal, 113(9), 40-43.

Johnson-Laird, P. N. (1983). Mental models. Towards a cognitive science of language, inference, and consciousness. Cambridge, MS: Harvard University Press.

Kausler, D. H., & Hakami, M. K. (1983). Memory for topics of conversation: Adult age differences and intentionality. Experimental Aging Research, 9, 153-157.

Kemper, S. (1987). Life-span changes in syntactic complexity. Journal of Gerontology, 42, 323-328.

Kemper, S. (1988). Geriatric psycholinguistics. Syntactic limitations of oral and written language. In L. L. Light & D. M. Burke (1988). Language, Memory, and Aging (pp. 58-76). New York: Cambridge University Press.

Kendrick, R., & Bayne, J. R. (1982). Compliance and prescribed medication by elderly patients. Canadian Medical Association Journal, 127, 961-962.

Kim, K. K., & Grier, M. R. (1981). Pacing effects of medication instruction for the elderly. Journal of Gerontological Nursing, 7, 464-468.

Kintsch, W. (1988). The role of knowledge in discourse comprehension: A construction-integration model. Psychological Review, 95, 163-182.

Kintsch, W., & van Dijk, T. A. (1978). Toward a model of text comprehension and production. Psychological Review, 85, 363-394.

Levin, J. R., Anglin, G. L., & Carney, R. N. (1987). On empirically validating functions of pictures in prose. In D. M. Willows & H. A. Houghton (Eds.), The Psychology of Illustration (pp. 51-85). New York: Springer-Verlag.

Ley, P. (1986). Cognitive variables and noncompliance. The Journal of Compliance in Health Care, 1, 171-188.

Ley, P., Bradshaw, P. W., Eaves, D., & Walker, C. M. (1973). A method for increasing patients' recall of information presented by doctors. Psychological Medicine, 3, 217-220.

Light. L. L., & Anderson, P. A. (1983). Memory for scripts in young and older adults. Memory and Cognition, 11, 435-444.

Light, L. L., & Anderson, P. A. (1985). Working memory capacity, age, and memory for discourse. Journal of Gerontology, 40, 737-747.

Light, L. L., & Burke, D. M. (1988). Patterns of language and memory in old age. In L. L. Light & D. M. Burke (Eds.), Language, Memory, and Aging (pp. 244-271.

Light, L. L., Zelinski, E. M., & Moore, M. (1982). Adult age differences in reasoning from new information. Journal of Experimental Psychology: Learning, Memory and Cognition, 8, 435-447.

Lundin, D. V., Eros, P. A., Melloh, J., & Sands, J. E. (1980). Education of independent elderly in the responsible use of prescription medications. Drug Intelligence and Clinical Pharmacy, 14, 335-342.

Mandler, J. M. (1984). Stories, scripts, and scenes: Aspects of schema theory. Hillsdale, NJ: Lawrence Erlbaum Associates.

Mayer, R. E. (1989). Models for understanding. Review of Educational Research, 59, 43-64.

McBean-Cochrane, B. (1989a, June). Counselling matters. Pharmacy Practice, 16-20.

McBean-Cochrane, B. (1989b, July/August). Counselling matters. Pharmacy Practice, 19-22.

McCloskey, M. (1983). Intuitive physics. Scientific American, 248(4), 122-130.

McKim, W. A., & Mishara, B. (1987). Drugs and aging. Toronto: Butterworth.

Meyer, B. J. F. (1987). Reading comprehension and aging. In K. W. Schaie & C. Eisdorfer (Eds.), Annual Review of Gerontology and Geriatrics, (Vol. 7, pp. 93-115). New York: Springer Publishing.

Meyer, B. J. F., & Rice, E. (1983). Learning and memory from text across the adult life span. In J. Fine & R. O. Freedle (Eds.), Development Issues in Discourse (261-306). Norwood, NJ: Ablex Publisher.

Minsky, M. A. (1975). A framework for representing knowledge. In P. H. Winston (Ed.), The Psychology of Computer Vision (pp. 211-280. New York: McGraw-Hill Book Company.

Morrell, R. W., & Park, D. C. (1992, April). The effects of age, illustrations, and task variables on the comprehension of procedural text and the performance of procedural assembly tasks. Poster presented at Cognitive Aging Conference, Atlanta, GA.

Morrell, R. W., Park, D. C., & Poon, L. W. (1990). Effects of labelling techniques on memory and comprehension of prescription information in young and old adults. Journal of Gerontology, 45, P166-172.

Morrell, R. W., Park, D. C., Poon, L. W., & Cherry, K. (1989). Quality of instructions on prescription drug labels: Effects on memory and comprehension in young and old adults. The Gerontologist, 29, 345-354.

Morrow, D. G., Bower, G. H., & Greenspan, S. L. (1989). Updating situation models during narrative comprehension. Journal of Memory and Language, 28, 292-312.

Morrow, D., Leirer, V., & Sheikh, J. (1988). Adherence and medication instructions: Review and recommendations. Journal of the American Geriatrics Society, 36, 1147-1160.

Olin, B. R. (Ed.). (1991). Drug facts and comparison. St. Louis, MO: J. B. Lippincott Company.

Osborne, R. J., & Wittrock, M. C. (1983). Learning science: A generative process. Science Education, 67, 489-508.

Pagliaro, A. M., & Pagliaro, L. A. (1986). Pharmacologic aspects of nursing. St. Louis: The C. V. Mosby Company.

Peeck, J. (1987). The role of illustrations in processing and remembering illustrated text. In D. M. Willows & H. A. Houghton (Eds.), The Psychology of Illustration (pp. 115-151). New York: Springer-Verlag.

Perfetti, C. A. (1985). Reading ability. New York: Oxford University Press.

Petros, T., Tabor, L., Cooney, T., & Chabot, R. J. (1983). Adult age differences in sensitivity to semantic structure of prose. Developmental Psychology, 19, 907-914.

Pezdek, K., & Miceli, L. (1982). Life-span differences in memory integration as a function of processing time. Developmental Psychology, 18, 485-490.

Poon, L. W., Krauss, I. K., & Bowles, N. L. (1984). On subject selection in cognitive aging research. Experimental Aging Research, 10, 43-49.

Priebe, D. C. (1991). The effect of age and concept-placement on the comprehension of written directions. Unpublished honours thesis. University of Alberta, Edmonton, AB., Canada.

Rabinowitz, J. C., Craik, F. I. M., & Ackerman, B. P. (1982). A processing resource account of age differences in recall. Canadian Journal of Psychology, 36, 325-334.

Radvansky, G. A., Gerard, L. D., Zacks, R. T., & Hasher, L. (1990). Younger and older adults' use of mental models as representations for text materials. Psychology and Aging, 5, 209-214.

Radvansky, G. A., Spieler, D. J., & Zacks, R. T. (1993). Mental model organization. Journal of Experimental Psychology: Learning, Memory, and Cognition, 19, 95-114.

Radvansky, G. A., & Zacks, R. T. (1991). Mental models and the fan effect. Journal of Experimental Psychology: Learning, Memory, and Cognition, 17, 940-953.

Report of the Royal College of Physicians. (1984). Medications for the elderly. Journal of the Royal College of Physicians of London, 18, 7-17.

Remington, R. D., & Schork, M. A., (1970). Statistics with application to the biological health sciences. Englewood Cliffs, NJ: Prentice Hall.

Richardson, J. L. (1986). Perspectives on compliance with drug regimens among the elderly. The Journal of Compliance in Health Care, 1, 33-45.

Roth, K. J. (1990). Developing meaningful conceptual understanding in science. In B. F. Jones & L. Idol (Eds.), Dimensions of Thinking and Cognitive Instruction (pp. 139-175). Hillsdale, NJ: Lawrence Erlbaum.

Rumelhart, D. E. (1984). Schemata and the cognitive system. In R. S. Wyler Jr. & J. K. Srull, Handbook of Social Cognition (pp. 161-188). Hillsdale, NJ: Lawrence Erlbaum Associates.

Salthouse, T. A. (1990). Working memory as a processing resource in cognitive aging. Developmental Review, 10, 101-102.

Schallert, D. L. (1980). The role of illustrations in reading comprehension. In R. J. Spiro, B. B. Bruce, & W. F. Brewer (Eds.), Theoretical Issues in Reading Comprehension. Perspectives from Cognitive Psychology, Linguistics, Artificial Intelligence, and Education (pp. 503-524). Hillsdale, NJ: Lawrence Erlbaum Associates.

Schank, R. C., & Abelson, R. (1977). Scripts, plans, goals, and understanding. Hillsdale, NJ: Lawrence Erlbaum Associates.

Schmitt, J. F., & Carroll, M. R. (1985). Older listeners ability to comprehend speaker-generated rate alteration of passages. Journal of Speech and Hearing Research, 28, 309-312.

Spilich, G. J. (1983). Life-span components of text processing: Structural and procedural differences. Journal of Verbal Learning and Verbal Behavior, 22, 231-244.

Spilich, G. J., Vesonder, G. T., Chiesi, H. L., & Voss, J. F. (1979). Text processing of domain-related information for individuals with high and low domain knowledge. Journal of Verbal Learning and Verbal Behavior, 18, 275-290.

Stine, E. L., (1990). On-line processing of written text by younger and older adults. Psychology and Aging, 5, 68-78.

Stine, E. L., & Wingfield, A. (1987). Process and strategy in memory for speech among younger and older adults. Psychology and Aging, 2, 272-279.

Stine, E. L., & Wingfield, A. (1990). How much do working memory deficits contribute to age differences in discourse memory? European Journal of Cognitive Psychology, 2, 289-304.

Stine, E. A. L., Wingfield, A., & Myers, S. D. (1990). Age differences in processing information from television news: The effects of bisensory augmentation. Journal of Gerontology: Psychological sciences, 45, P1-5.

Stine, E. L., Wingfield, A., & Poon, L. W. (1986). How much and how fast: Rapid processing of spoken language in later adulthood. Psychology and Aging, 1, 303-311.

Stine, E. L., Wingfield, A., & Poon, L. W. (1989). Speech comprehension and memory through adulthood: The roles of time and strategy. In L. W. Poon, D. C. Rubin, & B. A. Wilson (Eds.), Everyday Cognition in Adulthood and Late Life (pp. 195-221). Cambridge: Cambridge University Press.

Taub, H. A. (1979). Comprehension and memory of prose materials by young and old adults. Experimental Aging Research, 5, 3-13.

Tun, P. A. (1989). Age differences in processing expository and narrative text. Journal of Gerontology: Psychological Sciences, 44, P9-15.

Tun, P. A., Wingfield, A., & Stine, E. A. L. (1991). Speech-processing capacity in young and older adults: A dual-task study. Psychology and Aging, 6, 3-6.

Vosniadou, S. (1991). Designing curricula for conceptual restructuring: Lessons from the study of knowledge acquisition in astronomy. Journal of Curriculum Studies, 23, 219-237.

Vosniadou, S., & Brewer, W. F. (1987). Theories of knowledge restructuring in development. Review of Educational Research, 57, 51-67.

Wilson, J. R., & Rutherford, A. (1989). Mental models: Theory and application in human factors. Human Factors, 31, 617-634.

Wingfield, A. Lahar, C. J., & Stine, E. A. L. (1989). Age and decision strategies in running memory for speech: Effects of prosody and linguistic structure. Journal of Gerontology: Psychological Sciences, 44, P106-113.

Wingfield, A., Poon, L. W., Lombardi, L., & Lowe, D. (1985). Speed of processing in normal aging: Effects of speech rate, linguistic structure and processing time. Journal of Gerontology, 40, 579-585.

Zacks, R. T., & Hasher, L. (1988). Capacity theory and the processing of inferences. In L. L. Light & D. M. Burke (Eds.), Language, Memory, and Aging (154-170). New York: Cambridge University Press.

Zelinski, E. M., & Gilewski, M. J. (1988). Memory for prose and aging: a meta-analysis. In M. L. Howe & C. J. Brainerd (Eds.), Cognitive Development in Adulthood (pp. 133-158). New York: Springer-Verlag.

Zelinski, E. M., & Miura, S. A. (1988). Effects of thematic information on script memory in young and old adults. Psychology and Aging, 3, 292-299.

Appendix A

CODE#_______

Questionnaire

In responding to this questionnaire, please complete your answer to each question before going on to the next one. Please do not go back to previous questions to review your response.

Section A:

1. Your age is______. 2. Your sex is male___, female___.

3. English is your first language? Yes____, No____.

4. Make a list of the prescription medications and the over the counter medications you have taken in the last two years. If you cannot remember the name of the medication, provide the group or family classification. If the same prescription was recommended more than once, indicate how often.

5. List as many groups or families of medications as you can.

6. Your doctor prescribes a medication. List the information you would expect the prescription to contain to enable you to take the medication correctly.

Section B:

For the following questions, use the rating scale to make your response and where indicated, provide a brief written response.

1. How important for you is it to know the names of the medications you are taking?

   Not important — Very Important

   1 2 3 4 5

2. How important for you is it to understand the purpose of the medications you are taking?

   Not important — Very Important

   1 2 3 4 5

3. How important for you is it to know that your illness symptoms are improving because of the prescribed medicine.

   Not important — Very Important

   1 2 3 4 5

4. How important for you is it to know what side effects may be expected when taking a particular medication?

Not important				Very Important
1	2	3	4	5

Section C:

In this section there are three types of questions. In the first question type, using the rating scale provided, circle the number that best estimates your rating. In the second question type, provided a brief written response usually in the form of specific times, i.e. 6 p.m. In the third question type (multiple choice), circle the letter beside your best response.

1. How important is it to keep the blood level of an antibiotic constant.

Not important				Very Important
1	2	3	4	5

2. The prescription label for an antibiotic reads "Take one capsule every six hours." At what times during the day would you plan to take the medication.

   ____

3. The antibiotic prescribed must be taken on an empty stomach and only with water. Now, when would you take this medication and still take it every six hours. ______________________________

4. Medications recommended to be taken on an empty stomach, are prescribed this way because food in the stomach
   a) activates the pill rapidly, suddenly increasing blood levels.
   b) activates gastric acids which partially destroy the medication.
   c) causes the medication to be poorly absorbed.
   d) would carry the pill too rapidly into the small bowel.

5. A meeting has run overtime and you could not take your antibiotic as planned. You are scheduled to go out for dinner immediately. You should
   a) take the medication immediately and go out to dinner.
   b) consider the delayed dose as missed and resume your usual schedule on the next scheduled dose.
   c) take the medication immediately and not go to dinner.
   d) consider the delayed dose missed but resume your usual schedule with a double dose.

6. You realize when taking a scheduled dose of antibiotic that you totally forgot to take the previous one. You should
   a) consider the dose as missed and resume your regular schedule.
   b) resume your regular schedule but take a double dose now.
   c) phone your doctor to ask what should be done.
   d) shorten the intervals between the next three doses to make up the missed dose.

7. You have missed at least two scheduled doses of the antibiotic in a row. These omissions
   a) should not affect the action of the medication in treating the infection.
   b) could lessen the effectiveness of the medication in treating the infection.
   c) could make it more difficult for the body to maintain the desired blood level.
   d) should alert you to call the doctor to change the type of antibiotic being prescribed.

8. You have been on the antibiotic for five days. Last night you noticed a red rash on your chest. This morning it appears worse and is also itchy. You should
   a) stop taking the antibiotic immediately.
   b) apply Calamine lotion to control the itching.
   c) decrease the amount of antibiotic to be taken by half.
   d) phone your doctor to report the itchy red rash.

9. How important is it to keep the blood level of an <u>antianxiety</u> medication constant?

Not important				Very Important
1	2	3	4	5

10. The prescription label for an antianxiety medication reads "Take one tablet three times daily. List the times during the day when you would take this medication.

    ____

11 The prescription label for the antianxiety medication was changed and it now reads "Take one tablet every eight hours". List the times during the day that you would take this medication. ______________________________

12. You forget to take the antianxiety medication at the scheduled time; it is three hours late. You should
    a) take the delayed tablet now and resume your regular schedule.
    b) consider the delayed tablet missed and take double the dose at the next regularly scheduled time.
    c) take the delayed tablet now. Permanently revise your schedule starting with the delayed dose.
    d) consider the delayed tablet missed and simply resume your original

schedule.

13. It is sometimes recommended that antianxiety medications be take with food. Taking this medication with food
    a) aids the absorption of the medication from the stomach.
    b) prevents irritation of the stomach by this medication.
    c) moves the pill more rapidly into the small bowel.
    d) prevents the nausea that may occur when taking these medications.

14. Taking antianxiety medications over long periods of time can result in tolerance to the medication. This means that
    a) if the medication is continued, nausea and vomiting may occur.
    b) the dose of the medication must be increased to achieve the same effect.
    c) the person will experience increased drowsiness on the same dosage.
    d) the person will experience ataxia and dizziness if the medication is withdrawn.

15. You have missed taking three consecutive doses of your antianxiety medication. In starting to take it again you realize that you should
    a) return to your previous dosing schedule as the potency of the medication on the body was not changed.
    b) double the first two doses to re-establish the correct blood level as soon as possible.
    c) return to the same dosing schedule used when you first started taking the medication.
    d) first contact your doctor to determine if the dosing schedule should be changed.

16. You realize when taking a scheduled dose of antianxiety medication that you totally forgot to take the previous dose. You should
    a) consider the dose as missed and resume your regular schedule.
    b) resume your regular schedule but take a double dose now.
    c) phone your doctor to ask what should be done.
    d) take one tablet now and another one in four hours, then resume your regular schedule.

17. How important is it to keep the blood level of a <u>medication for pain</u> constant?

Not important				Very Important
1	2	3	4	5

18. A prescription label for an oral pain medication reads "Take one-two tablets every four-six hours as needed for pain." The maximum number of tablets you could safely take in one 24 hour period is ____________________.

19. If a narcotic oral pain medication is taken as prescribed for moderate acute pain, the risk of developing a drug addiction is
    a) almost non existent.
    b) moderate.
    c) quite high.
    d) not an issue for this group of medications.

20. The dosing schedule for pain medication differs from most other prescription medications in that pain medication
    a) usually needs to be taken more times in one day.
    b) needs to be taken on a set schedule to manage pain.
    c) may be taken as needed to treat the pain.
    d) should be taken just before eating for maximum pain relief.

21. You have been taking two pain killer tablets every four hours but you still cannot get adequate relief for your pain. You should
    a) take two tablets every three hours.
    b) take three tablets every four hours.
    c) watch more television to distract your attention from the pain.
    d) consult your doctor.

22. It is 4 p.m. and you realize that you did not take a 10 o'clock or 12 noon dose of pain medication. You should
    a) immediately take a pill because its been at least six hours since your last dose.
    b) assess your need for pain medication now as it does not matter that a dose was missed.
    c) immediately take two tablets to make up for the dose you missed during the morning.
    d) wait until 6 p.m., assess your need for pain medication and take one-two tablets as needed.

23. You realize that it is over eight hours since you took your last pain medication. The pain has returned and you sense that you need something for pain now. You should
    a) wait another hour or so because you can only take the medication once in every four hours.
    b) take one tablet now and then another one two hours later to raise the blood level of the medication.
    c) try and wait another two hours before takin the medication to avoid any risk of becoming addicted.
    d) take two tablets now because you need the pain relief.

24. You realize that it has been several weeks since you took a medication for acute pain. The acute pain has returned. In starting to take the pain medication again you realize that
    a) you should take the maximum dose all the time because the medication will no longer be as effective.
    b) the medication will be as effective now as it was the first time you took it.
    c) you are increasing your risk of addiction by having to start taking the medication again.
    d) you need to take the maximum dose for one day, then you can reduce the amount as needed.

25. How important is it to keep the blood level of a <u>thyroid supplement</u> constant?

Not important				Very Important
1	2	3	4	5

26. The prescription label for a thyroid supplement reads "Take one tablet once daily." This medication could be taken
    a) first thing in the morning.
    b) at lunch time.
    c) before going to bed.
    d) at any time, as long as its always taken at the same time each day.

27. The main reason for taking thyroid supplements at a consistent time each day is because
    a) its easier to remember to take a pill at a consistent time each day.
    b) the blood level will be increased at a the same time each day.
    c) body function would be disrupted too frequently if the dosing times kept changing.
    d) none of the above apply.

28. At 4 p.m. you realize that you missed taking your scheduled morning dose of thyroid supplement. You should
    a) take the missed dose now and return to regular schedule in the morning.
    b) take the missed dose now and continue taking the medication at 4 p.m. each day.
    c) consider the dose as missed and return to your regular schedule in the morning.
    d) consider the dose as missed but take double the usual dose at the scheduled time the next morning.

29. You realize when taking a scheduled dose of thyroid supplement that you totally forgot to take the previous one. You should consider the dose as
    a) missed and continue with your regular schedule.
    b) missed but double the present dose.
    c) delayed taking one dose now and one in 12 hours, then resume your regular schedule.
    d) delayed, but phone your doctor about a replacement.

30. You have been feeling so well lately that you think you should stop taking your thyroid supplement. Which of the following actions is correct.
    a) Discuss your decision with a neighbour who also takes a thyroid medication.
    b) Be cautious and decrease the dose in half to see what happens.
    c) Stop taking the medication but carefully monitor how you feel during the next week.
    d) Continue taking the medication as prescribed because it should not be discontinued.

31. You failed to take your thyroid supplement for three consecutive days. When you start taking it again you should
    a) double the dose because the previous dosing schedule will no longer be strong enough.
    b) take the regular dose twice a day for two days and then revert to your previous dosing schedule.
    c) resume the original dosing schedule.
    d) call your doctor first to see if its okay to start the medication again.

32. You notice that you have started to put on weight and feel more tired. You feel certain the weight gain is not due to overeating. Because you are taking a thyroid supplement, you wonder it this could be the cause. You should
    a) double the dose for the next week and see if it makes you have more energy.
    b) reduce your food intake for the next week and see if that allows you to return to you normal weight.
    c) increase the amount of sleep you get to see if that will improve you energy level.
    d) schedule a doctor's appointment to discuss these new symptoms.

Scoring Guide - Medication Questionnaire

Section A

5. Accept antibiotic (or penicillin), painkiller (analgesic), decongestant, antihistamines, cold medicines, sedatives, barbiturates, birth control medicines, etc.

6. Name of medicine, action or purpose for taking the medicine, how much of the medicine (number of pills), how often or when to take the medicine, route of administration (oral, topical etc.), special instructions such as take with/without food, when to stop taking the medicine, side effects and how to handle these, pharmacy information such as doctor's name, prescription number etc., other such as drug interactions, expected therapeutic effect, what to do if dose was late or missed.

Section B

1. The number circled was entered.

2. As above.

3. As above.

4. As above.

5. Question not entered into analysis.

Section C

1. The number circled was entered.

2. Must provide specific times, approximately six hours apart and four doses in 24 hours. For example, 6am, 12noon, 6pm, 11pm.

3. Must provide specific times, one hour before or two hours after meals, approximately six hours apart and four doses in 24 hours. For example, 6am, 11am, 5pm, 11pm.

4. b

5. a

6. a

7. b

8. d

9. The number circled was entered.

10. Must provide specific times, approximately 4-6 hours apart and three doses in 24 hours. For example, 8am, 12noon, 6pm.

11. Must provide specific times, eight hours apart, and three doses in 24 hours. For example, 8am, 2pm, 10pm.

12. a

13. d

14. b

15. c

16. a

17. The number circled was entered.

18. Correct response was 12.

19. a

20. c

21. d

22. b

23. d

24. b

25. The number circled was entered.

26. d

27. b

28. a

29. a

30. d

31. c

32. d

Appendix B

Medication Management Learning Module

When you receive a medicine prescription from your doctor you might ask yourself, why must I take these pills as often as my doctor recommends? Also, how am I to know when is the best time to take the pills?

To answer these questions begin by imagining what happens to the medicine after you swallow it. The pill passes into your stomach and small intestines where it is absorbed into the blood stream. The medicine is carried by the blood to the place in your body where it is needed. [Figure B-1: Point to pill in stomach and green medication dots in blood stream saying...] As you see here.

A goal when taking medicines is to keep the amount of the medicine in the blood at the needed level for treating the problem. When the medicine is first absorbed, the amount in the blood rises. Some medicines are used quickly by the body causing the amount in the blood to fall fairly rapidly. It will go below treatment level unless the medicine is taken again. [Figure B-2: Point to green medication dots in the drawings saying...] As you see here, the blood level is high and here it is below treatment level.

Other medicines are used more slowly and thus the amount in the blood falls gradually. This means the steady treatment level is maintained longer. [Figure B-3: Point to green medication dots in the drawings saying...] As you see here, the blood level is high and is still falling slowly here.

Medicines that are used quickly by the body must be taken more often and at regular intervals. These tend to be prescribed "every" 4,6, or 8 hours. The "every" means you need to take the medicine at quite regular intervals around the clock. By doing this, the amount of medicine in the blood will be maintained at a steady treatment level. [Figure B-4: Point to the places where the pill must be taken again saying...] The pill must be taken here and here, "every" so hours to maintain a steady treatment level.

Medicines that are used more slowly by the body can often be taken less frequently. As well, the interval between doses is more flexible because a treatment level of the medicine in the blood is maintained longer after each dose. These medicines are usually recommended to be taken once, twice, three or sometimes four "times" a day. It is still best to take these pills at spaced intervals across the day. You can be more flexible, however, with spacing and still keep a steady level of the medicine in the blood at all times. [Figure B-5: Point to the places where the pill may be taken and changing concentration of the medicine in the body saying...] These kinds of pills may be taken at more flexible "times" because it is used more slowly by the body.

Some medicines must be taken on an **empty stomach** and with only water. If you do this, the right amount of the medicine will get into the blood. If these medicines are taken with food, the stomach juices used to digest the food would also destroy the pills. Thus, very little of the medicine would get into the blood. [Figure B-6: Point to empty stomach illustration saying...] As you see here. If your doctor gives you this special instruction, it is best to take the medicine one hour before or two hours after you eat.

Other medicines **irritate the lining of the stomach** making your stomach feel upset. The amount of medicine that goes into the blood is not affected by the upset stomach. Your doctor will tell you to take these kinds of medicines with food or milk so that the stomach lining is protected from the medicine. [Figure B-7: Point to stomach with food illustration saying...] As you see here.

After getting a prescription from your doctor, your task is to establish a routine for taking the medicine. The **desired outcome** of your routine is that you will remember to take your medicine as planned. In planning your routine consider [Figure B-8: Point to the goal statement and each consideration as is said.]

First: the prescription given by your doctor. It tells you how often you are to take the medicine and how many pills you are to take each time.

Second: special instructions; e.g. "take with food."

Third: your usual eating and sleeping patterns.

Try to fit the prescription, as much as possible, onto a typical day. [Demonstrate Slide Rule saying...] If your pills were to be taken "**every**" four hours, you could perhaps start taking them when you got up at 7am. Then you need to take them again at 11am, 3pm, 7pm, 11pm and so on during the night. Fortunately no many pills must be taken that often. Instead, you are more likely to get a prescription where you are to take the pills four "**times**" a day. In this case, you could take the pills with breakfast, lunch, dinner, and at bedtime because you are allowed more flexibility in timing.

Once you have planned your routine, try to stick to it. Sticking to the routine will help you remember to take your medicines as planned. Forgotten doses decrease how well medicine works because the blood level falls.

Sometimes we **forget** to take a medicine at the planned time. When you do remember, the question is, should I take the medicine now? Your objective is to keep the blood level from falling below the treatment level. A common suggestion is to take the pill as soon as you remember, up to two hours late. If its later than this wait for the next scheduled dose. [Figure B-9: Point to the places on the illustrations where the pills are to be taken saying...] So you would take you pill at its regular time here, and up to two hours late here. There may be exceptions to this suggestion, so ask your pharmacist when you get the prescription. Its very important to **resume your planned schedule** as you are more likely to remember future doses. So take your pill at its regular time here.

If you honestly **miss a dose**, consider it missed. Note that the blood level does get too low. Do continue on with your usual schedule. [Figure B-10: Point to the places in the Figure as these statements are made.]

Do **not** double a dose because this could raise the blood level of the medicine too high for treatment safety. [Figure B-11: Point to places in the Figure that illustrate these points.]

After taking a medicine for awhile you may also ask when can I stop taking the medicine? This is best answered by knowing why you are taking the medicine. Some medical problems are short term, for example a headache. It may be cured after one dose of pain medicine. Other problems take longer to treat. This means you need to take the medicine for days, weeks or even a life time. Your doctor will tell you how long you must take a medicine.

[1175 words in total]

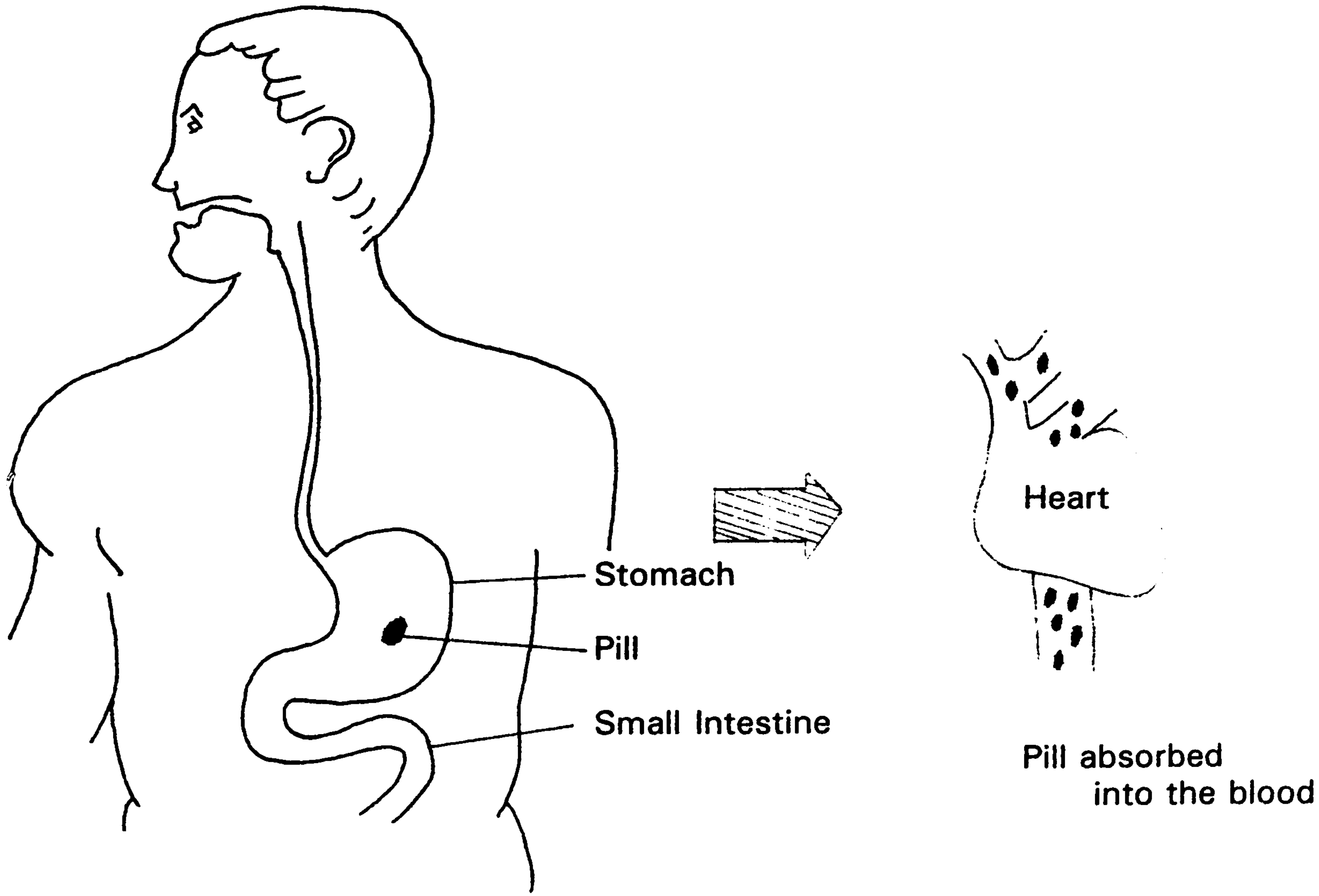

Stomach
Pill
Small Intestine
Heart
Pill absorbed
into the blood.

Figure B-1.

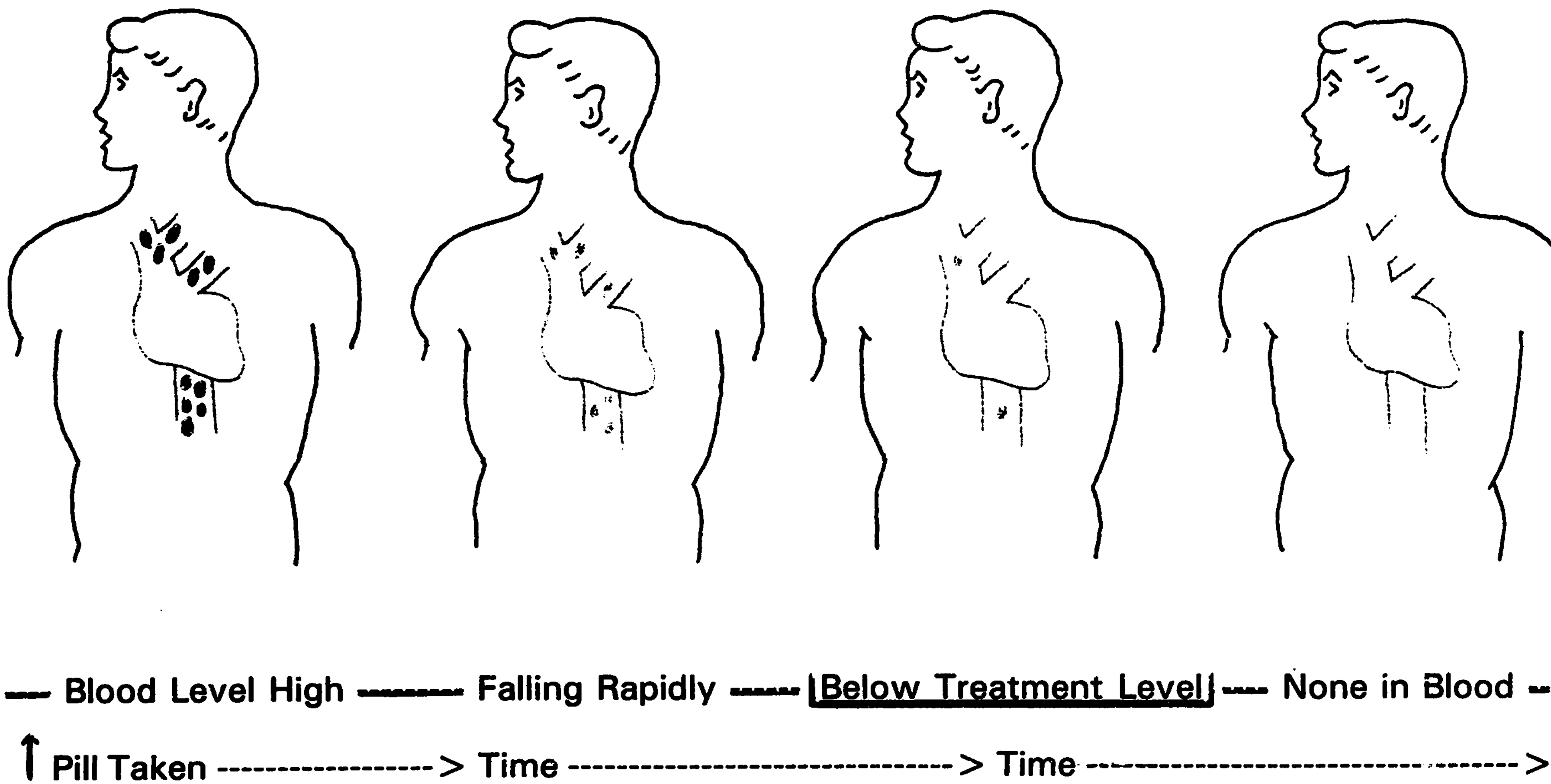

Blood Level High
Falling Rapidly
Below Treatment Level
None in Blood
Pill Taken
Time
Time

Figure B-2.

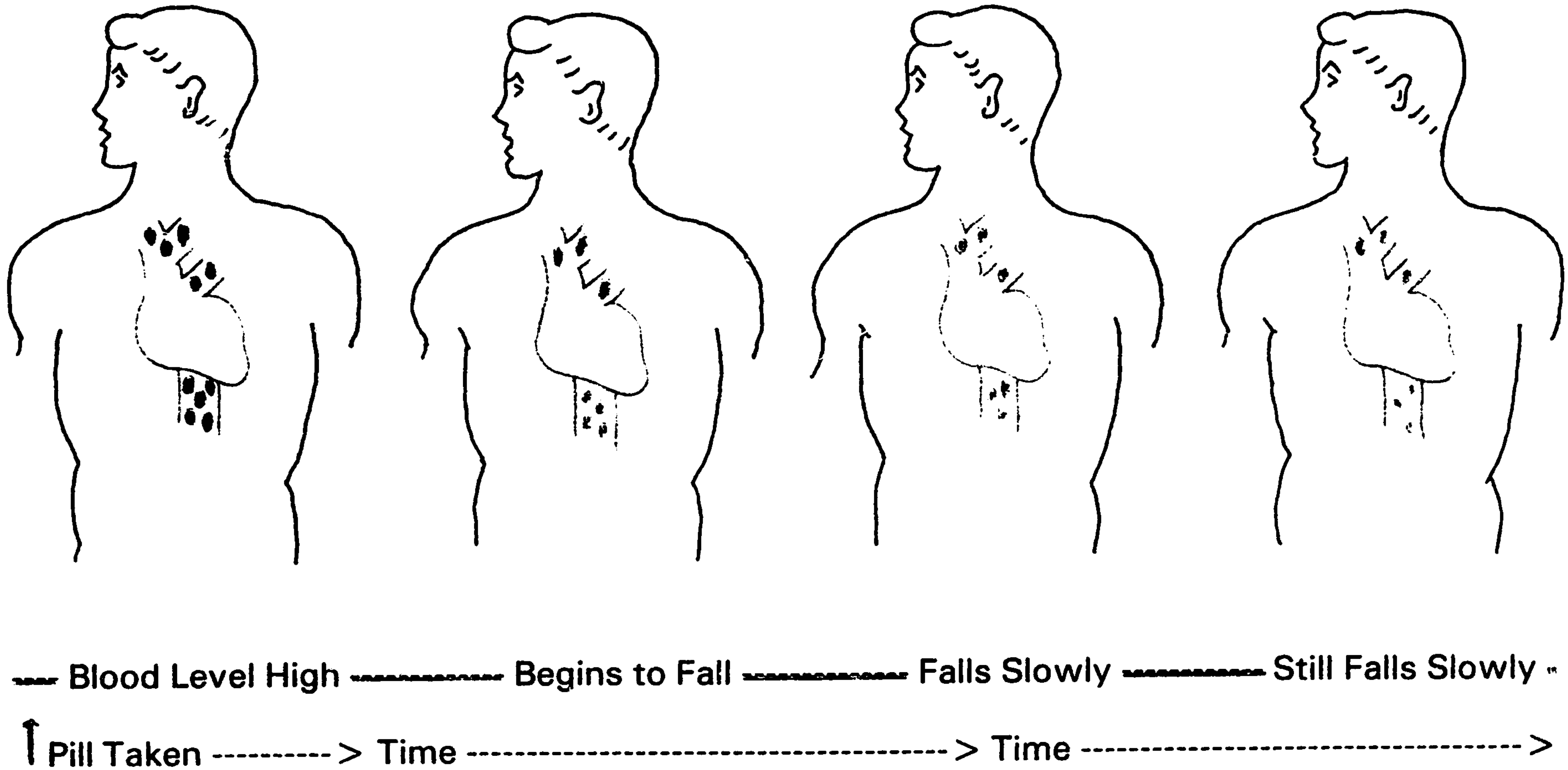
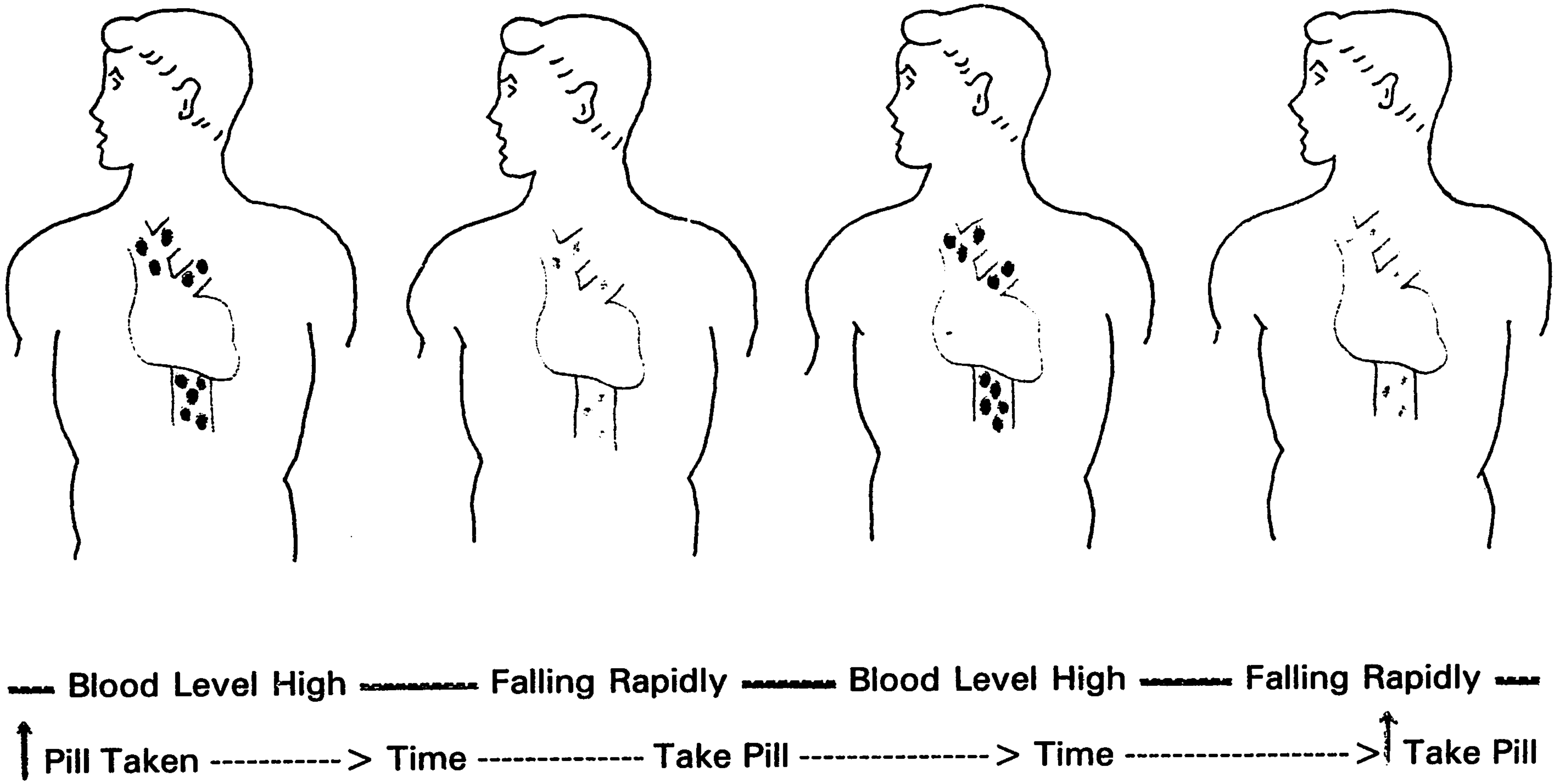

Blood Level High
Begins to Fall
Falls Slowly
Still Falls Slowly
Pill Taken
Time
Time

Figure B-3.



Blood Level High Falling Rapidly Blood Level High Falling Rapidly
Pill Taken ----------> Time ------------- Take Pill ---------------> Time ----------------->Take Pill

Figure B-4.

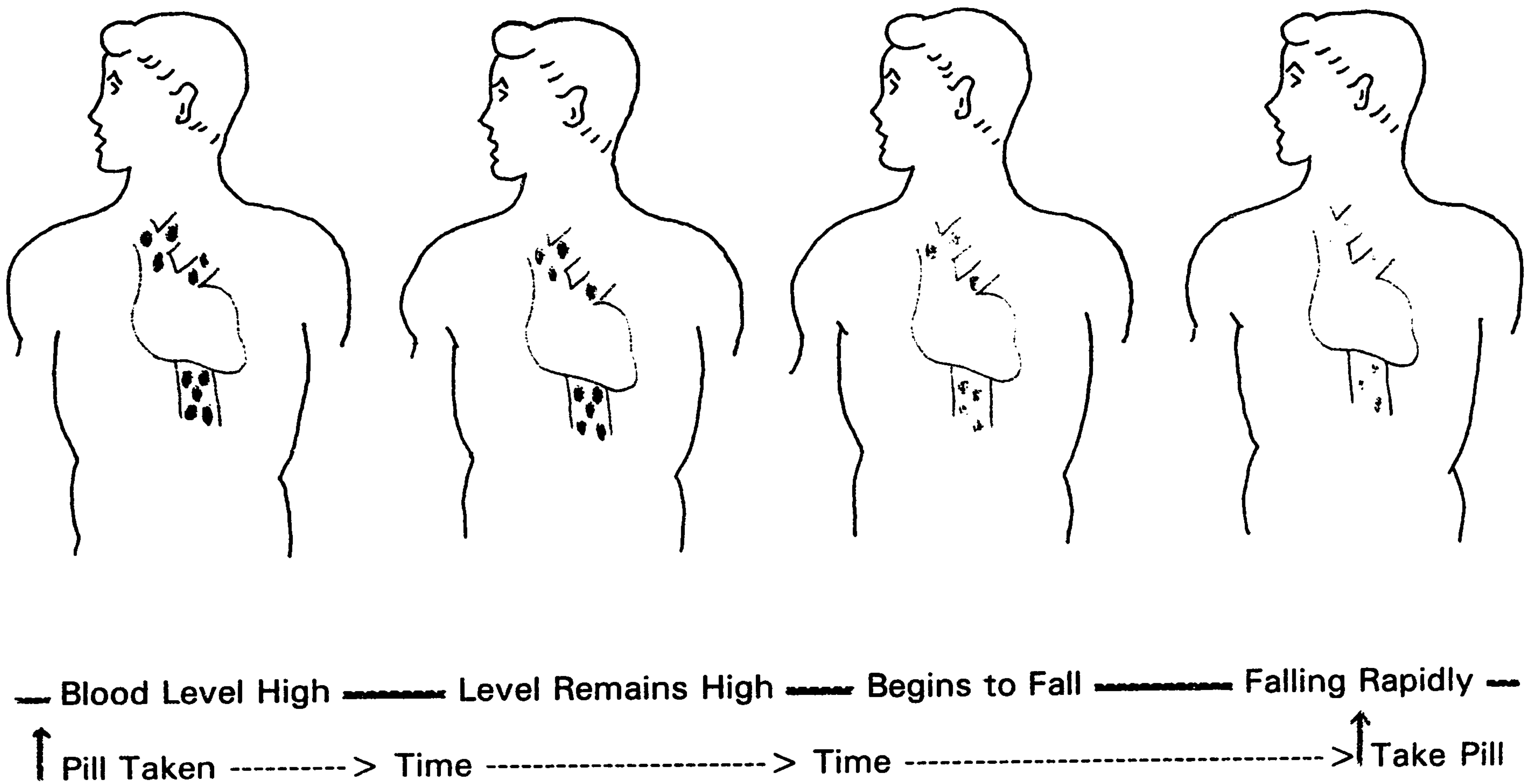
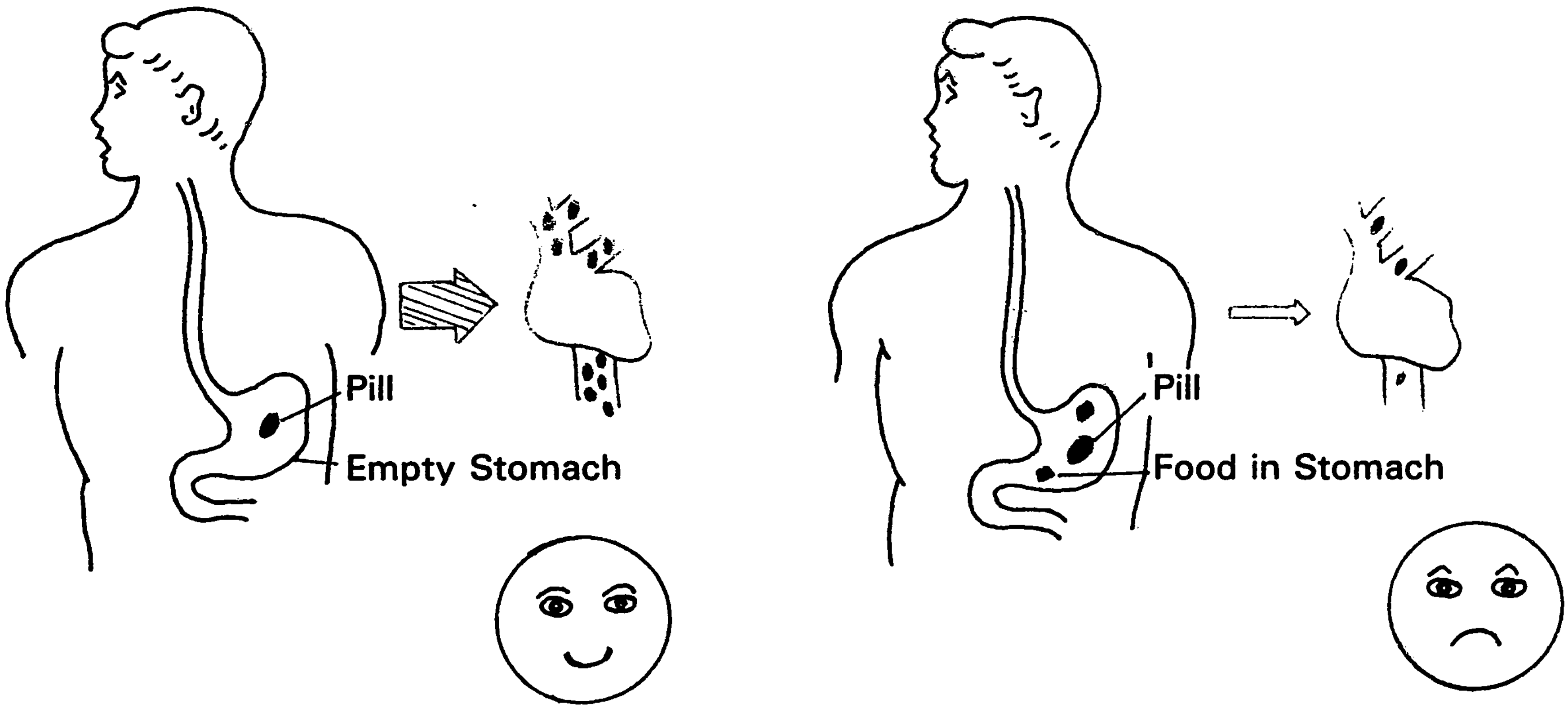

Blood Level High
Level Remains High
Begins to Fall
Falling Rapidly
Pill Taken ----------> Time ------------------------> Time ------------------------------------->
Take Pill

Figure B-5.



Take pill on empty stomach.

Figure B-6.

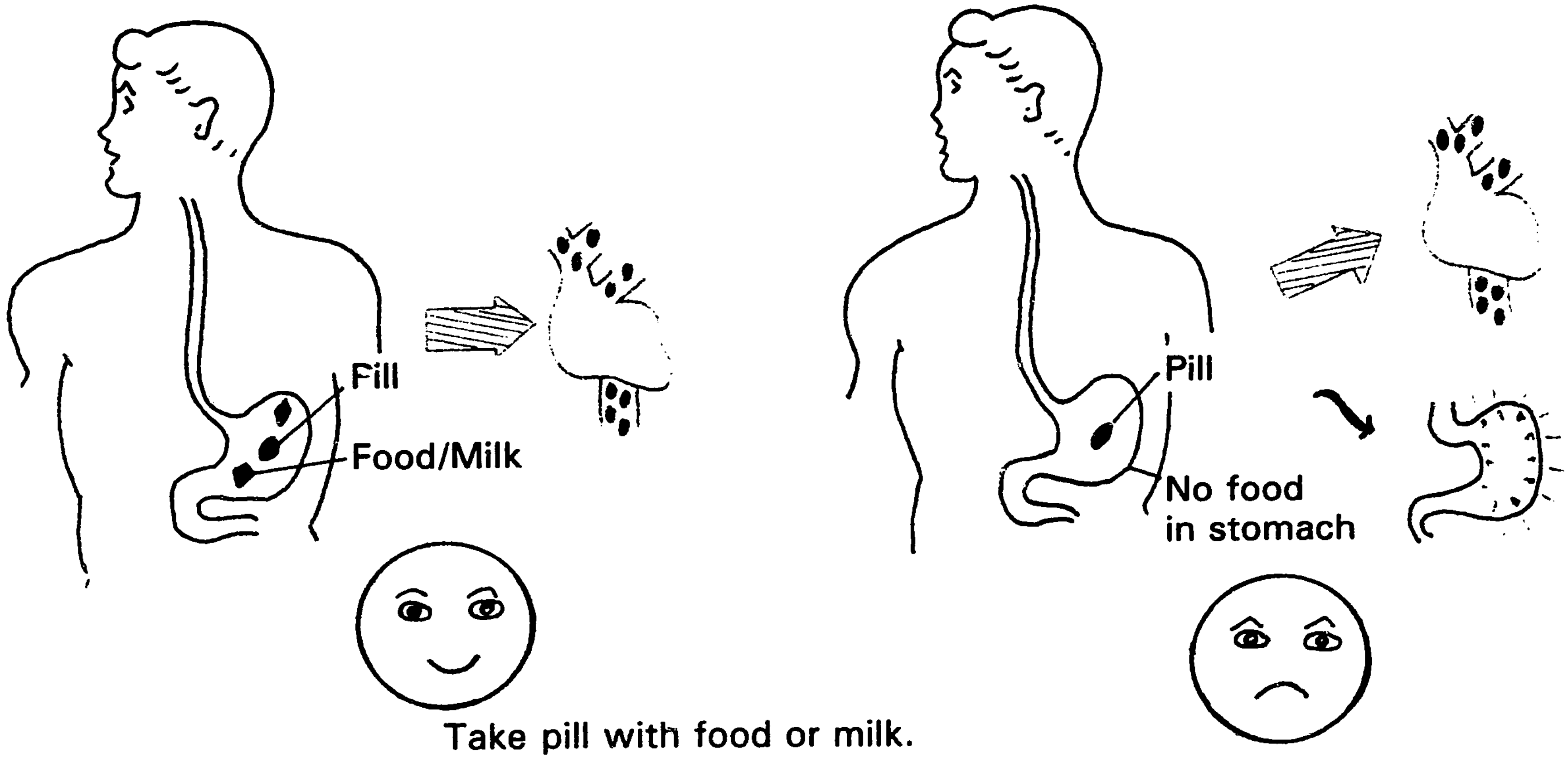

Fill
Food/Milk
Pill
No food
in stomach
Take pill with food or milk.

Figure B-7.

Planning Your Routine

Goal: To establish a routine that will help you remember to take your medicines as planned.

Consider:

1. The Prescription.
   How often?
   How many?

2. Special Instructions.

3. Usual eating and sleeping patterns.

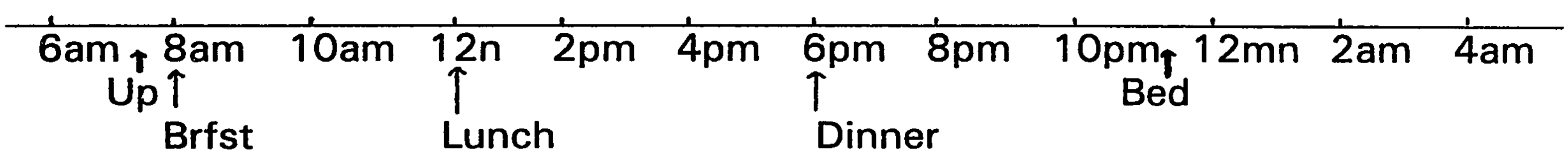


Figure B-8.

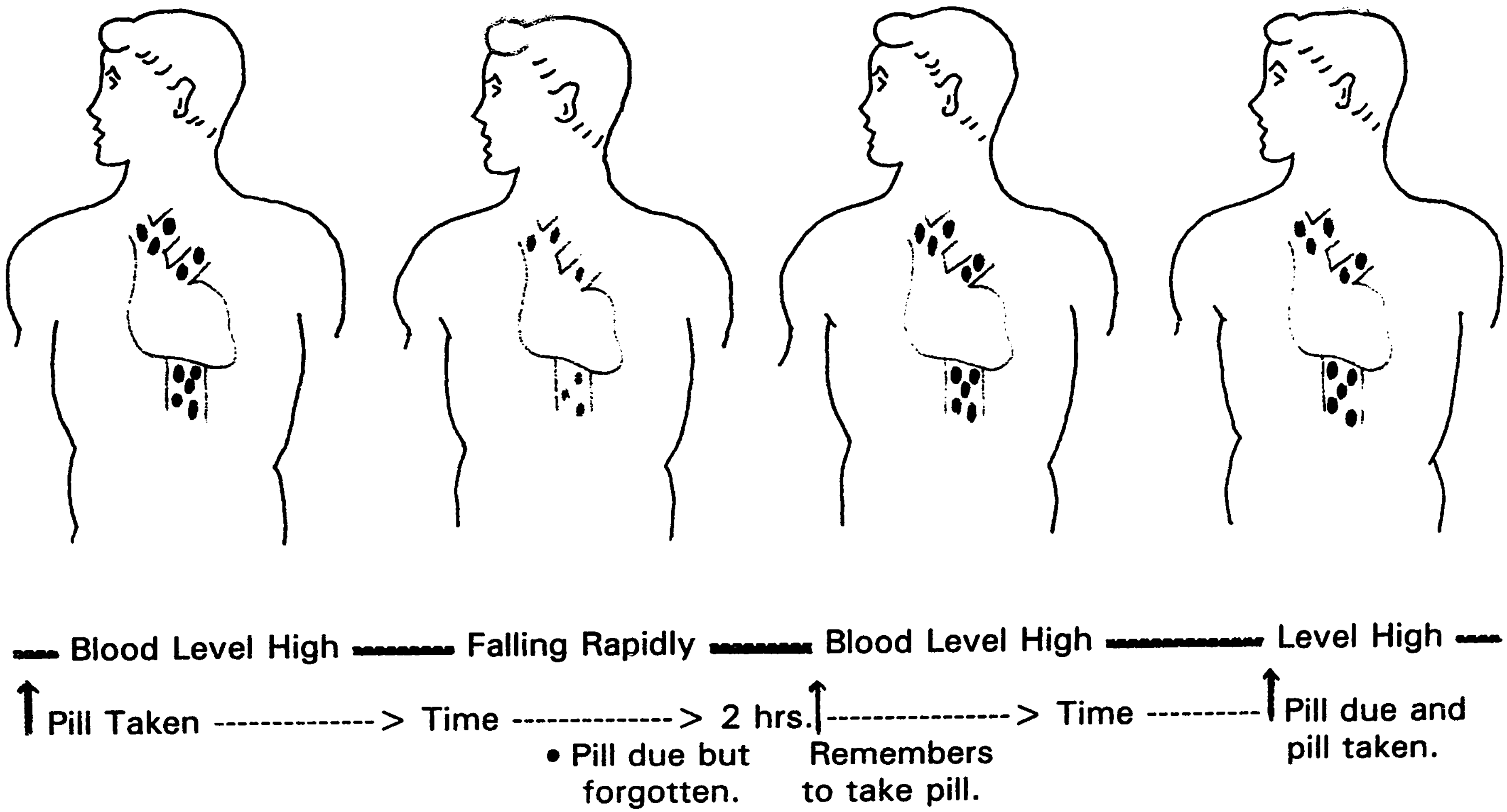

Blood Level High
Falling Rapidly
Blood Level High
Level High
Pill Taken --------------> Time --------------> 2 hrs.
• Pill due but forgotten.
----------------> Time ----------
Remembers to take pill.
Pill due and pill taken.

Figure B-9.

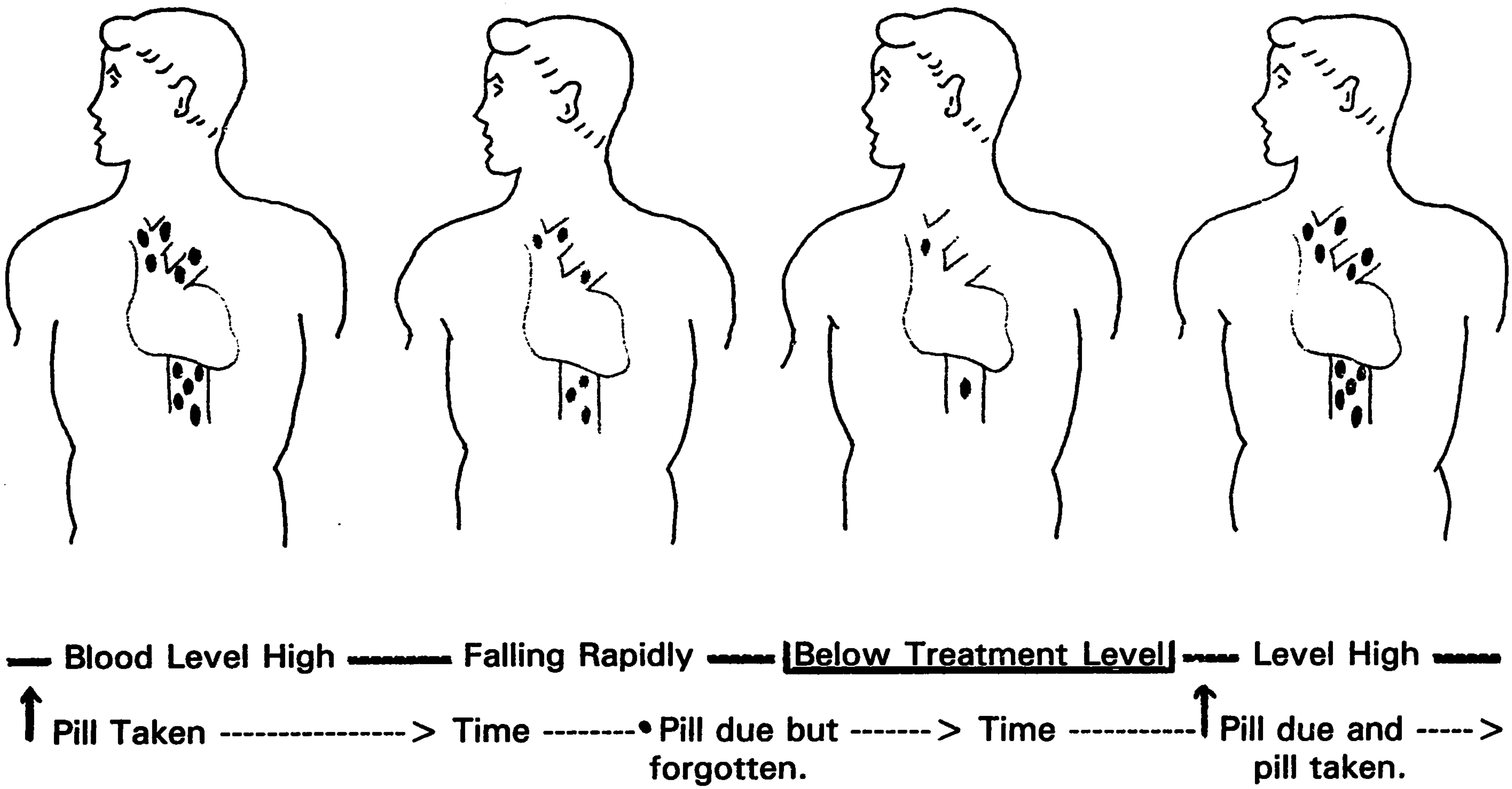

Blood Level High
Falling Rapidly
Below Treatment Level
Level High
Pill Taken ----------------> Time --------
Pill due but -------> Time -----------
forgotten.
Pill due and ----->
pill taken.

Figure B-10.

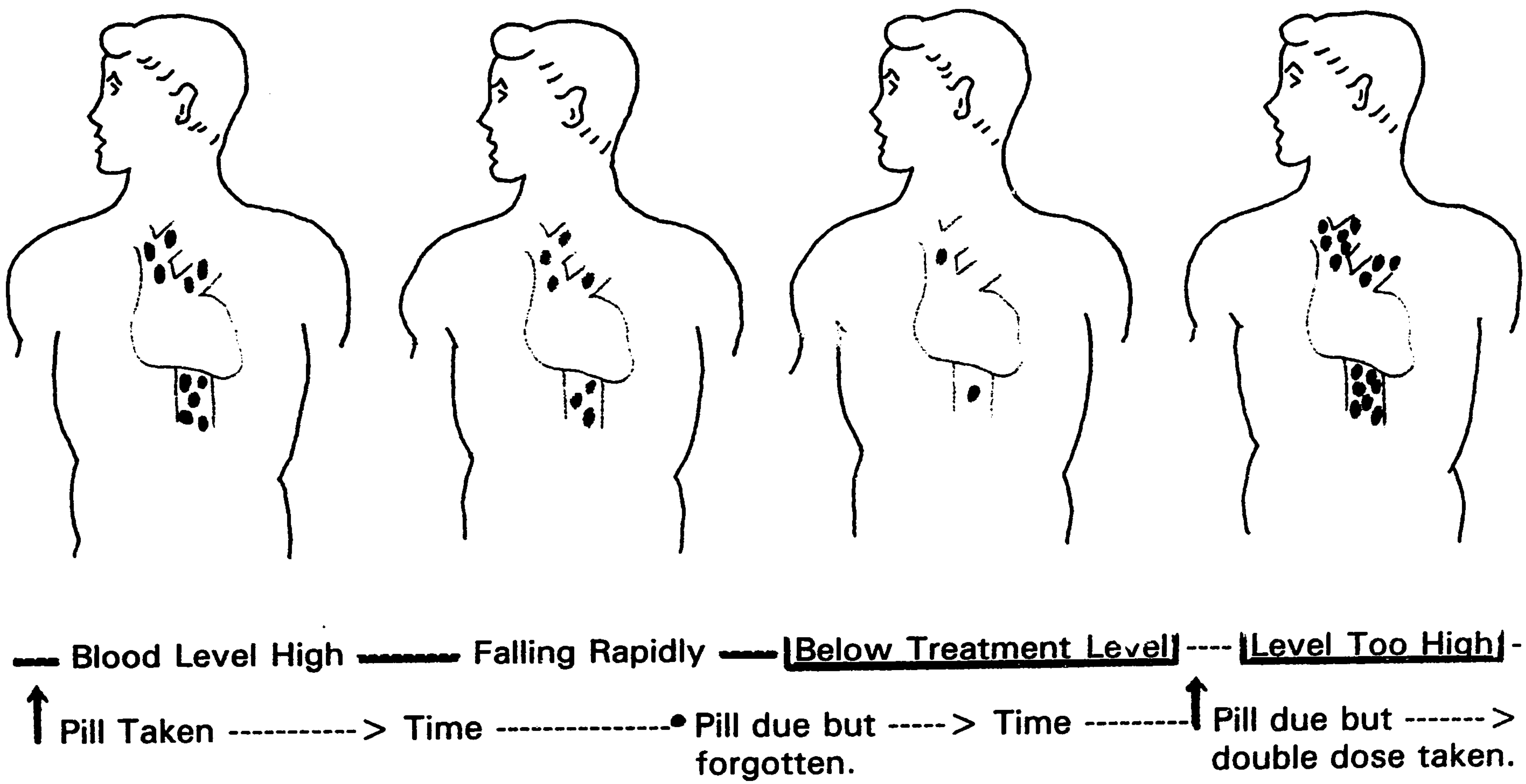

Blood Level High
Falling Rapidly
Below Treatment Level
Level Too High
Pill Taken ----------> Time
Pill due but -----> Time
forgotten.
Pill due but ------->
double dose taken.

Figure B-11.

Medication Module Validation Questions and Scoring

Here are some figures similar to those used earlier to illustrate the amount of medicine in the body under different conditions.
You will need to use some of them to answer several of the questions that will follow.

Maintaining blood levels:

1. First, arrange a sequence that will show what happens to the amount of medicine in the blood when the medicine is used slowly by the body.
   Answer: B, C, D. (2 points)

2. Now arrange a sequence to show what happens to the amount of medicine in the blood when a medicine is be taken "every" four hours.
   Answer: B, E. (2 points)

3. Can you tell me why some medicines must be taken on an empty stomach?
   Answer: Stomach juices will destroy the medicine, decreasing the amount that will enter into the blood. (2 points)

4. A medicine is to be taken four "times" a day. What does this tell you about how the medicine is used by the body? And how it could be spaced across the day?
   Answer: The body uses the medicine slowly. Spacing may be at irregular intervals/more flexible. (2 points)

Planning:

1. Can you tell me two factors that must be considered when planning a schedule for taking medicines.
   Answer: Any two of - the prescription, special instruction, usual sleeping and eating patterns. (2 points)

2. What is the desired outcome of following your planned schedule?
   Answer: Any two of - get better, blood level maintained, will not forget the medicine. (2 points)

Problems:

1. Again, use as many of these figures as you need. This time arrange them in a sequence that will show what happens to the amount of medicine in the blood when you miss a dose of medicine.
   Answer: B, E, F. (2 points)

2. Can you tell me how you would know when you can stop taking a medicine.
   Answer: When the doctor tells you. Knowing why you are taking the medicine. (2 points)

Appendix C

Control Learning Module

You are probably most familiar with taking medicines by mouth. That is, swallowing them. There are of course several other ways that medicines may be taken that I will talk about in a few moments. First, though, I would like to talk about certain aspects of oral medicines that might interest you.

Because of their convenience and economy, **oral medicines** are the most common kind available. They come in capsule, tablet, and liquid forms. Before taking any medicine, carefully read the label on the bottle to make sure you have the right bottle and know how much medicine you are to take. After being swallowed, medicines taken orally pass into the stomach and small intestines where they are absorbed into the blood. [Figure C-1: Point to the pill in the stomach and green medication dots in the blood stream saying...] As you see here.

Some oral tablets come in a **chewable form**. These should be chewed thoroughly before swallowing. Read the label on the bottle to learn if a tablet is to be chewed. [Figure C-2: Point to the chewable tablet saying...] This tablet here.

Most **capsules and tablets**, however, are meant to be swallowed whole. Most people are able to do this without difficulty. For many reasons, though, some people do have **problems swallowing** capsules and tablets whole. If you ever experience this problem, consult your pharmacist. A liquid form of the prescribed medicine might be available. If you prefer, you can crush most tablets into a powder between two spoons. Capsules can be opened up to get at the liquid or powder inside. Mix these contents in a small amount of jam or apple sauce to make them more palatable. [Figure C-2: Point to various tablets and capsules saying...] These tablets could be crushed and this capsule could be taken apart and emptied and this one, cut open and emptied.

Please note that not all pills are meant to be crushed. You should not chew or crush a tablet or the contents of a capsule that is marked "**time release**". Time release medicines are designed with a coating that allows parts of them to be absorbed at different times.

Also, you should not chew or crush a tablet marked "**enteric coated**". These kinds of medicines are designed with a protective coating that is meant to be dissolved in the small intestines. They should not be taken with milk as milk causes the protective coating to be broken down too soon. If crushed, the special coating on both these types of medicines is destroyed, thus defeating its purpose. [Figure C-2: Point to the appropriate tablet or capsule saying...] Do not crush these ones (time release tablet and enteric coated tablets), do not open this one up (time release capsule), and do not take this one with milk (enteric coated tablet).

Before pouring a **liquid medicine**, read the label and shake the bottle thoroughly if so directed. When stored, medicines in suspension settle to the bottom of the bottle and must be shaken to restore the suspension. Others, like syrups do not have to be shaken. Liquid medicines should be measured out carefully using household measuring spoons or the spoon provided by the pharmacy. Most can be taken with water if the taste is unpleasant. Some medicines, such as cough mixtures, are given for their soothing effects and should not be taken with water. [Figure C-3: Point to the appropriate bottle as the above words are said.]

A few medicines are to be taken **sublingually**; that is the tablet is placed under the tongue as you see here. There the tablet readily dissolves and is absorbed quite quickly into the blood stream. [Figure C-4: Point to the tablet under the tongue.]

As suggested above, there are several other routes by which medicines can be given. I will go on to briefly describe some of the common ones that you can use on yourself.

First, there are **ophthalmic or eye medicines**. These are administered for their local effects on the eye. They come in small plastic bottles of liquid or small tubes of ointment. Before giving these, first wash your hands thoroughly. If someone else is giving you this medicine, its best to lie on a bed with your head on a small pillow. If giving it to yourself, stand in front of a mirror, close enough to see your eye with your glasses off. Gently pull away the lower lid from the eye to create a small pouch between the lower lid and the cornea. Usually only one drop of the liquid medicine is dropped into the pouch or a small amount (1/2 inch) of the ointment is placed inside the lower lid. Gently close the eye lid and move your eye under the lid to encourage the medicine to be distributed over the surface of the eye. Wipe away any excess. [Figure C-5: Point to the appropriate places in the illustration as the small bottles of liquid, tubes of ointment, pouch, drops and ointment are mentioned.]

Second, **nasal sprays**. These are usually given in small amounts for their local effect on the tissue inside the nose. In some conditions this tissue becomes swollen or congested, making breathing difficult. Before administering, blow your nose gently (if this is allowed) to clear the nasal passage of excess mucus. Sit with your head held slightly back. Use one hand to position the nozzle of the spray bottle just below one nostril. Close the opposite nostril with your free hand. Breathe in gently as you squeeze the bottle. This should distribute the spray onto your nasal membranes. Repeat for the other nostril as directed. [Figure C-6: Point to the appropriate places in the illustration as spray bottle and nasal membrane are mentioned.]

Third, **topical medicines** applied to the skin. These come in the form of lotions, powders, cremes, solutions, shampoos and ointments. The skin normally acts as a barrier to the absorption of most drugs. Therefore, these medicines are used locally on the skin to treat burns, wounds, rashes and other skin conditions. Before you administer topical medicines, wash your hands thoroughly. Then, putting a small amount on a finger, apply a thin coat to the affected area. If you prefer, you can pour or squeeze the medicine onto a sterile gauze and apply it to the affected area. [Figure C-7: Point to the appropriate places in the illustration as small amount and spread thinly are mentioned.]

Sometimes the area must be covered to protect your clothing from the ointment. At other times, the area is covered to improve the working of the medicine. Read the label on the medicine to clarify these instructions.

[1107 words]

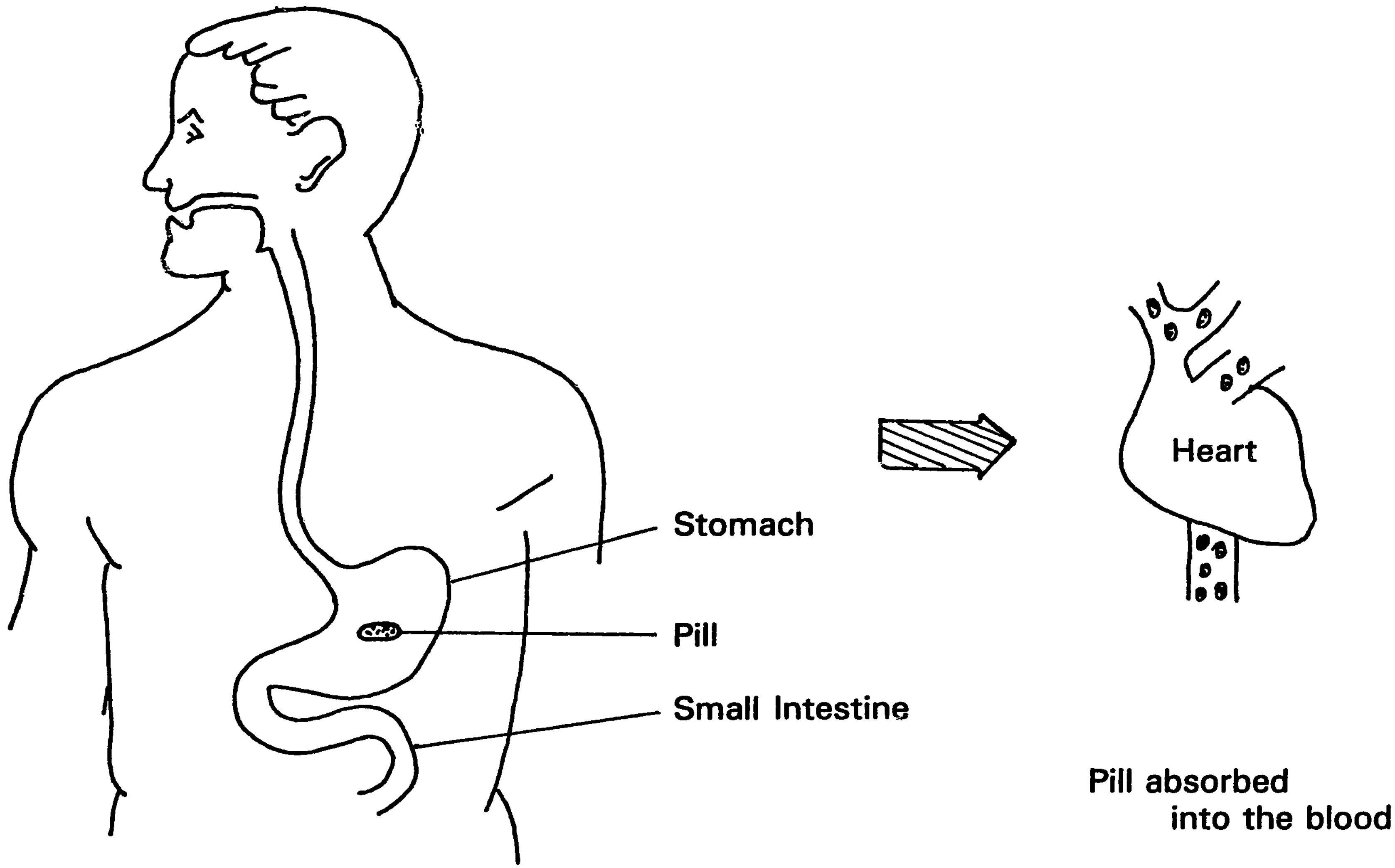

Stomach
Pill
Small Intestine
Heart
Pill absorbed
into the blood.

Figure C-1.

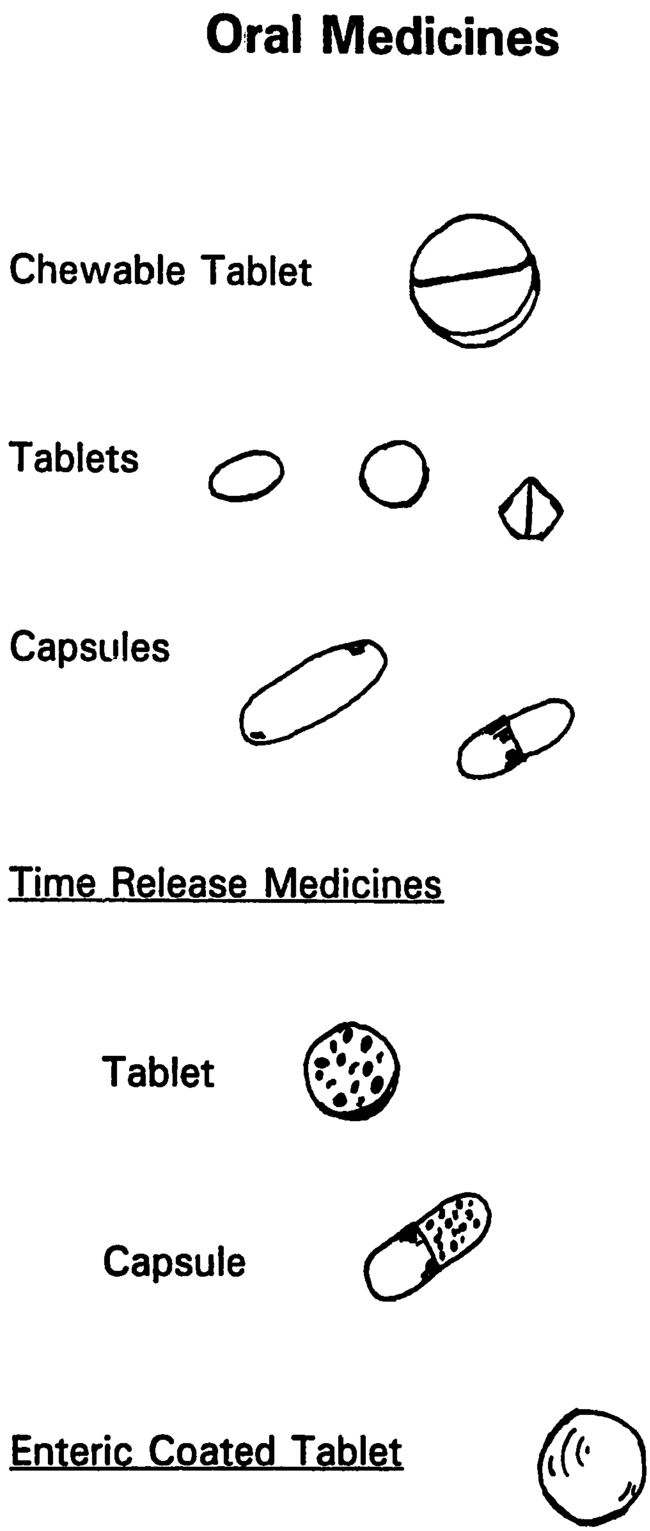
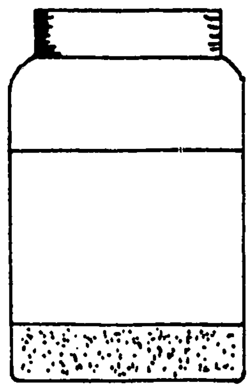

Oral Medicines
Chewable Tablet
Tablets
Capsules
Time Release Medicines
Tablet
Capsule
Enteric Coated Tablet

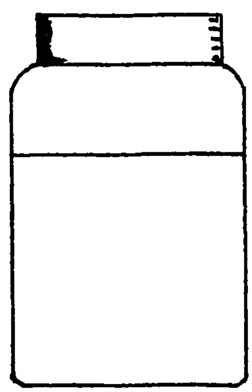
Figure C-2.

Liquid Medicines



Shake well

Suspension



No need to shake

Syrup

Figure C-3.

Sublingual Medicines

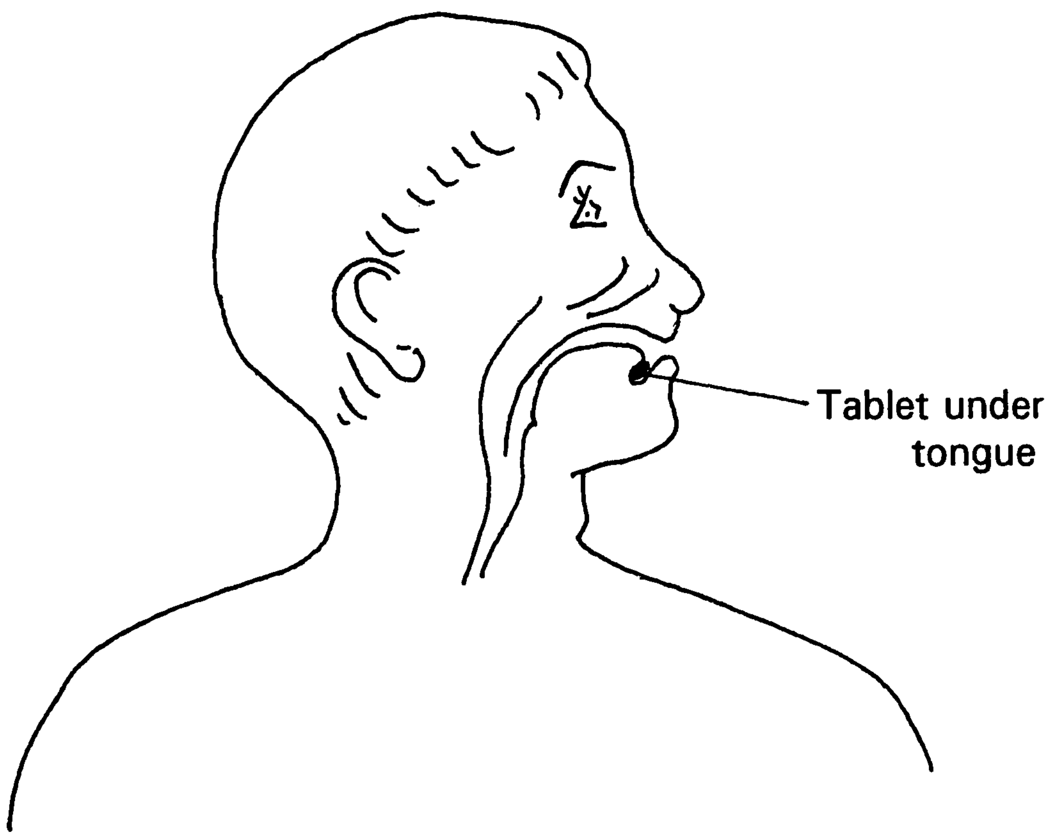
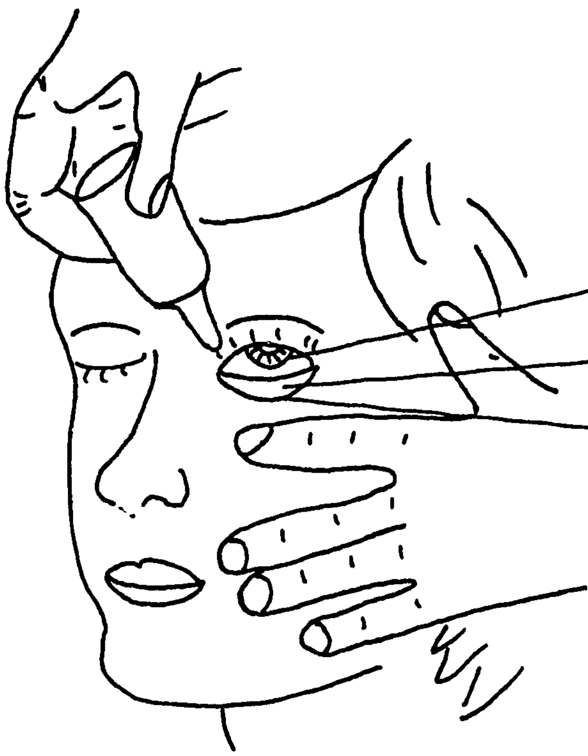


Figure C-4.

Ophthalmic (Eye) Medicines

Drops



Ointment

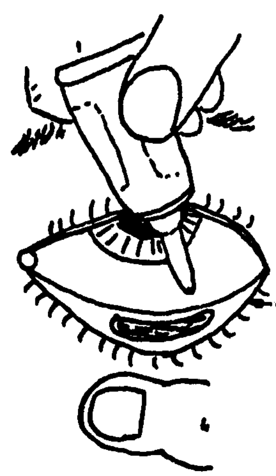


Figure C-5.

Nasal Sprays

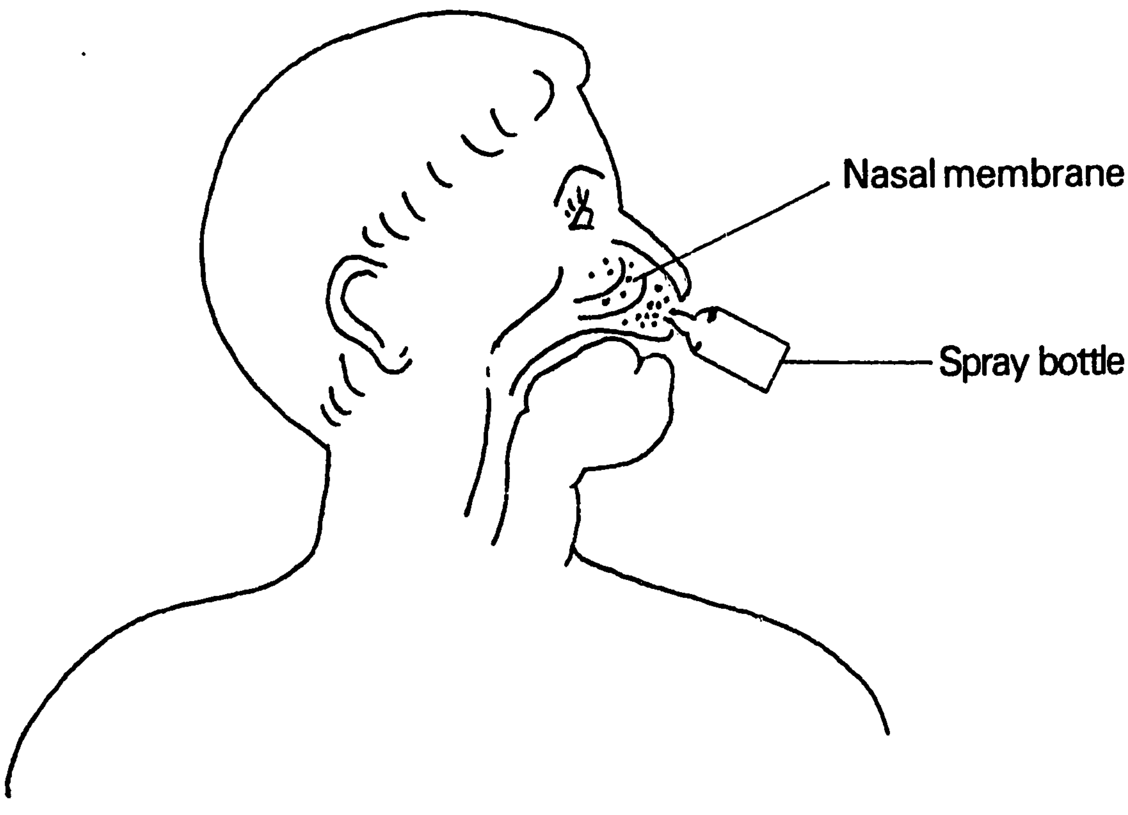


Figure C-6.

Topical Medicines

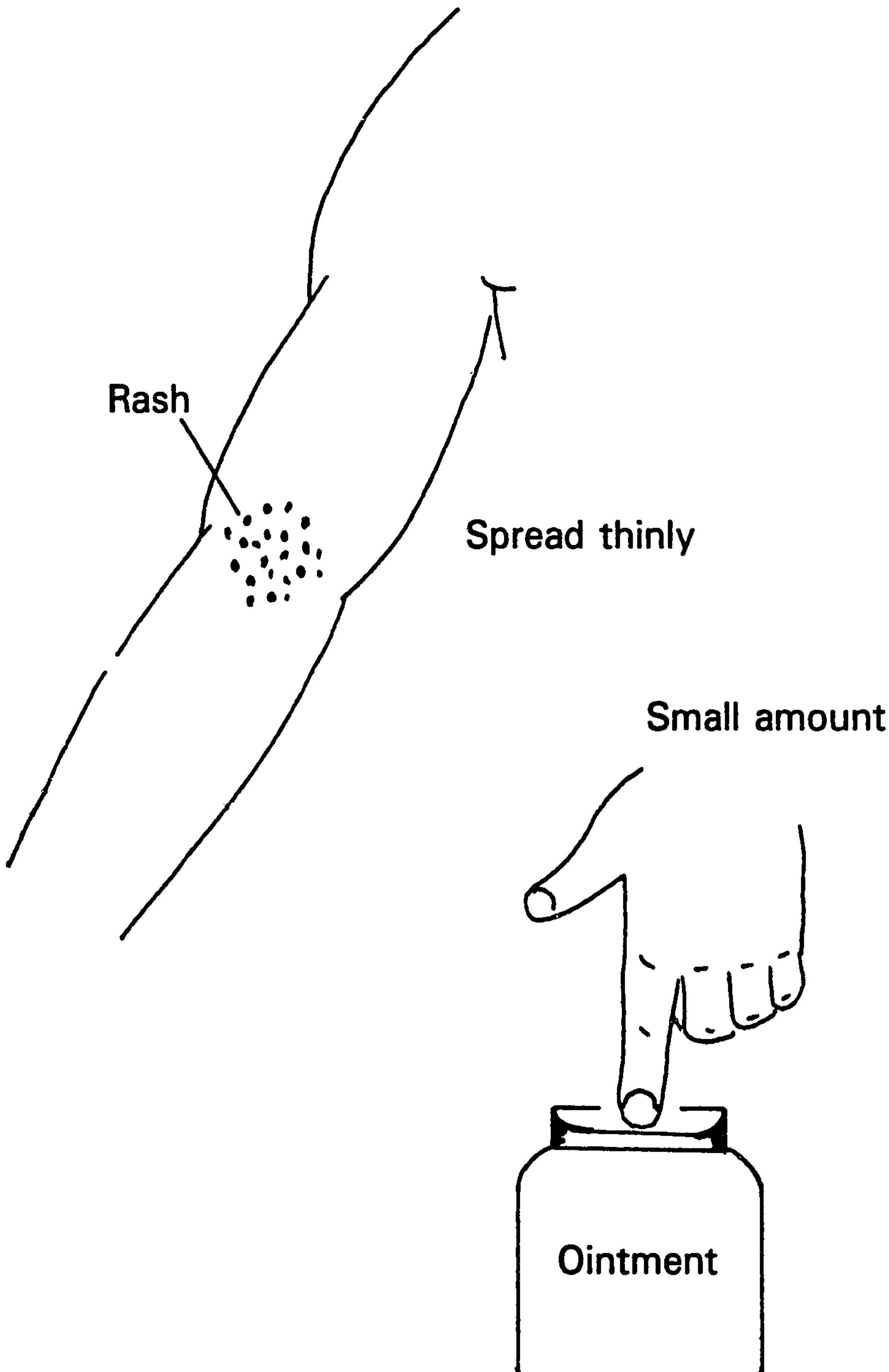


Figure C-7.

Control Concept Validation Questions and Scoring Guide

1. Other than orally, what other ways may medicine be given?
   Answer: ___Eye, ___Nasal, ___Topical. (1 point each)

2. What is important to remember when taking an enteric coated medicine?
   Answer: ___Do not chew/crush. ___Not with milk. (1 point each)

3. What should you do before giving an eye medicine or applying a topical ointment?
   Answer: ___Wash your hands. (1 point)

4. Where should you place an eye medicine.
   Answer: ____Pound between lid and cornea. (1 point)

5. Demonstrate how would give yourself a nasal spray?
   Answer: ____ Close opposite nostril. _____Inhale as you squeeze the spray bottle. (1 point each)

6. How much of a prescribed ointment would you apply to a rash on your arm.
   Answer: ____Thin layer over entire rash. (1 point)

Total of 10 points.

Appendix D

Medication Prescription Information

Cloxapen

I would like you to take one red capsule of this first medication every six hours. It should be taken on an empty stomach and only with water. Cloxapen is an antibiotic that should kill the bacteria causing your chest infection. In about three days you should notice that the phlegm you cough up becomes clearer and your breathing is easier. Call me if this does not happen. Also call me if you notice an itchy skin rash anywhere on your body or experience severe diarrhea. I have given you a ten day supply of Cloxapen. Its important to finish taking all the capsules in the bottle.

Benemid

You will know that this second medicine I am prescribing for you is working if your chest begins to feel better. You see, Benemid works along with the antibiotic. It slows down how fast the kidney gets rid of the antibiotic from your body. Thus the amount of antibiotic in your blood will remain higher longer making it able to fight the infection better. Take one of the yellow tablets twice a day for two day, then increase the dose to two tablets twice a day. Take the tablets with food and at least one large glass of water. I have given you a ten day supply of Benemid, so pleas finish taking all the tablets in the bottle. Please let me know if you experience sensations of nausea or vomiting that are not relieved by taking the medication with food.

Lorax

Your third medicine should relieve some of the anxiety you are experiencing at work and at home, but especially Lorax should help you get back into a regular sleep pattern. The slight drowsiness you may feel when you first start taking these pills should decrease in a few days. Do not drink alcohol while you are taking this medication because it will increase the drowsiness. Do not drive or use machinery if you feel drowsy. I would like you to take these green pills three times a day, one tablet in the morning, one tablet in the afternoon, and two tablets before bedtime. I have given you a six week supply of Lorax. Please call my office in a month to make a follow up visit. By the end of the week you should notice that you feel less anxious at work and that you fall asleep more easily at night. Call me if this does not happen.

(410 words)

Appendix E

NUMBER CODE:_____

Medication Recall

In the spaces provided please respond to these questions in accord with the prescription information you heard on the audiotape about the three medicines. The same questions are being asked of all three medicines.

Part A.

1. Name one of the medicines. ________________________________

2. What is the purpose of this medicine? ________________________________

____

3. List the times during the day you would take this medicine to comply with the prescription. ________________________________

4. How many pills would you take at each scheduled time during the first three days of therapy? ________________________________

5. Briefly describe any special instructions you were asked to follow when taking this medication. ________________________________

6. When can you stop taking this medication? ________________________________

7. You forgot to take a dose of this medication. It is now two hours overdue. What action would you take? ________________________________

8. When you come to take a scheduled dose of this medication, you realize that you totally forgot to take the previous one. What action would you take?

____

9. Briefly describe how you would know that this medication was working properly.

____

10. Briefly describe a side effect you may experience when taking this medication. How would you cope with it? ________________________________

____

Parts B and C.

1. Name a second (Part B)/third (Part C) medicine. (Same questions repeated.)

Medication Recall Scoring Guide

Cloxapen

1. Name: (1 point)
   1.0 = Cloxapen or four correct letters--(be lenient!)
   0.5 = red (colour) or first letter

2. Purpose: (2 points)
   2.0 = to kill/fight the bacteria causing chest infection
   1.0 = to fight/cure the infection or to clear chest/cough/phlegm
   0.5 = antibiotic

3. Times: (2 points)
   2.0 = 0700hrs--1130hrs--1730hrs--2330hrs (exact times)
   should be four times in a day, about 6hrs apart and one hr. before or two hours after meals. (0.5 = for each correct time.)
   1.0 = "every 6 hours." or early am, before noon, late pm, bedtime. (Must be 4 times a day.)
   0.5 = for two of these times correct or four times a day.
   0.0 = every four hours.

4. How many: (1 point)
   1.0 = one(1), or 12 (4x3 = 12, in three days)

5. Special instructions: (2 points)
   1.0 = on empty stomach or 1 hr. before/2 hrs. after meals.
   1.0 = only with water

6. Stop taking: (1 point)
   1.0 = 10 days or all capsules gone.

7. Late dose: (2 points)
   1.0 = take pill now.
   1.0 = resume usual schedule.
   0 = Do not accept: "wait until next scheduled dose" but make comment -- "next"

8. Missed dose: (2 points)
   2.0 = take pill/medicine now, do not double dose.
   2.0 = take regular amount/dosage (infer, do not double).
   2.0 = continue/keep on schedule (infer, do not double).
   2.0 = take one pill only (infer, do not double).
   1.0 = omit/skip forgotten dose (?to take regular dose).
   0.5 = consultation with Doctor/Pharmacist.

9. Therapeutic Response: (2 points)
   1.0 = phlegm becomes clear/thin.
   1.0 = breathing becomes easier/less congested/coughs less.
   0.5 = chest becomes better
   0.0 = feels better

10. Side effects: (2 points)
   1.0 = itchy red rash or severe diarrhea
   1.0 = call doctor

Benemid

1. Name: (1 point)
   1.0 = Benemid or four correct letters (be lenient!)
   0.5 = yellow (colour), first letter.

2. Purpose: (2 points)
   2.0 = to slow down excretion of antibiotic by the kidney.
   2.0 = to help level of the antibiotic last longer in the body/blood.
   1.5 = nearly gets the idea expressed at 2.0 point level.
   1.0 = works along with/aids the first medicine/antibiotic.

3. Times: (2 points)
   2.0 = e.g. State specific times, e.g. 0800hrs and 1800hrs. Must be with meals/snack and at least six hours apart.
   or, Breakfast and dinner (shows with meals).
   1.0 = for one correct specific time entry, e.g. 0800hrs.
   1.0 = twice/two times a day.
   0.5 = one time is correct, i.e. breakfast/dinner.
   0.0 = "at meal times" -- could mean three times a day.

4. How many: (1 point)
   0.5 = one (1) each time for two days or (1).
   0.5 = two (2) each time for the remainder or (2).
   1.0 = (8) -- (2x2 = 4 and 4x1 = 4; total = 8).

5. Special instructions: (2 points)
   1.0 = take with food.
   1.0 = take large glass of water.

6. Stop taking: (1 point)
   1.0 = 10 days or finish all the tablets.

7. Late doses: (2 points)
   See Cloxapen.

8. Missed doses: (2 points)
   See Cloxapen.

9. Therapeutic response: (2 points)
   2.0 = chest feels better or clearing up of chest.
   1.0 = feels better (this is close to script).
   0.5 = you don't really know (action is indirect).

10. Side effects: (2 points)
   1.0 = (sensations of) nausea or vomiting.
   1.0 = take with food or call doctor.

Lorax

1. Name: (1 point)
   1.0 = Lorax or three correct letters (be lenient!).
   0.5 = green (colour), first letter.

2. Purpose: (2 points)
   1.0 = to relieve anxiety (at work/home).
   1.0 = to aid sleep.

3. Times: (2 points)
   2.0 = 0800hrs--1400hrs (12noon to 1800hrs)--2200hrs. Must show three times a day.
   0.5 = if get one specific time correct (repeat for a second correct time for a total of 1.0 point).
   1.0 = morning, afternoon and bedtime or three (3) times a day. (0.5=if get two entries correct).

4. How many: (1 point)
   1.0 = 1, 1, 2 pills or 12 pills (4x3 = 12).
   0.5 = if just give 1 or 2.

5. Special instructions: (2 points)
   2.0 = do not drink alcohol.
   1.0 = do not drive/operate machinery (if given without mention of no drinking alcohol)

6. Stop taking: (1 point)
   1.0 = six (6) weeks or when doctor says or all finished.

7. Late doses: (2 points)
   See Cloxapen.

8. Missed doses: (2 points)
   See Cloxapen.

9. Therapeutic response: (2 points)
   1.0 = less anxious at work/home.
   1.0 = sleep better at night.
   0.0 = feels better.

10. Side effects: (2 points)
    1.0 = drowsiness and one of
    1.0 = do not drive/operative machinery.
    1.0 = avoid alcohol as will increase drowsiness.
    1.0 = call doctor if drowsiness increases.
    1.0 = will decrease over time.

Appendix F

NUMBER CODE:________

24 Hour Prescription Schedule

Time	Monday	Tuesday	Wednesday	Thursday
6:00am		C-1	C-1	C-1
7:00am	(Breakfast)	B-1,L-1	B-1, L-1	B-2, L-1
8:00am				
9:00am				
10:00am				
11:00am		C-1	C-1	C-1
12noon	(Lunch)			
1:00pm				
2:00pm		L-1	L-1	L-1
3:00pm				
4:00pm				
5:00pm	C-1,L-1	C-1	C-1	C-1
6:00pm	B-1 (Dinner)	B-1	B-2	B-2
7:00pm				
8:00pm				
9:00pm				
10:00pm				
11:00pm	C-1, L-2	C-1, L-2	C-1, L-2	C-1, L-2
12midnight				
1:00am				
2:00am				
3:00am				
4:00am				
5:00am				

Key: C = Cloxapen, B = Benemid, L = Lorax

Scoring Guide for Prescription Scheduling

Basic Criteria

Cloxapen - One capsule was to be scheduled one hour before a meal or two hours after and 5-6 hours apart. Should usually not be scheduled during regular sleeping hours unless the participant routinely awakens at the time charted. Total maximum points = 28

Benemid - One pill was to be scheduled with food or milk and more than or equal to six hours apart. Dosage to be increased to two tablets after the fourth dose. Total maximum points = 14

Lorax - One tablet in the morning, one in the afternoon (12 noon to 6 pm), and two tablets near bedtime. Total maximum points = 22

2 points: Awarded for each correct entry; both time and number of capsules/tablets had to be correct.

1 point: Awarded for correct time but incorrect dose. e.g. Benemid not increased to 2 tablets after the fourth dose.
Awarded for correct dose but timing not conducive to compliance. e.g. scheduling Cloxapen at 4 am.

0 points: Awarded if timing totally incorrect.
Cloxapen taken with food and less than 5 hours apart.
Benemid taken without food or milk and less than 6 hours apart.
Lorax not scheduled with one dose in the morning, one in the afternoon and one near bedtime.

Scoring Guide for Errors in Planning

Cloxapen

Errors in Timing:

0=no errors - four entries 5-7 hours apart.
1=three entries were correct (one unrealistic).
2=two entries were correct.
3=one entry was correct.

Errors in Quantity:

0=no errors in quantity, entered one tablet.
1=failed to specify one tablet per entry.

Errors in Implementation of Special Instructions:

0=special instructions correctly implemented - medication scheduled one hour before or two hours after meals or food.
1=three entries were correct.
2=two entries were correct.
3=one entry was correct in relation to eating.

Total = 7

Benemid

Errors in Timing:

0=no errors - two entries at least 6 hours apart.
1=one entry was correct.

Errors in Quantity:

0=no errors - one tablet scheduled for first four entries, increasing to two tablets at the fifth entry.
1=increased to two tablets at the wrong entry or failed to increase to two tablets.
2=entered two tablets at start of plan.

Errors in Implementation of Special Instructions:

0=special instructions correctly implemented - scheduled medications with meals or with snack.
1=one error in scheduling medication with meals/snack.
2=scheduled both doses of medication incorrectly in relation to meals/snack.

Total = 5

Lorax

Errors in Timing:

0=three entries correct - one dose scheduled for morning (until 12 noon), one in the afternoon (until 6 pm), one near bedtime. Must be 4-6 hours apart.
1=two entries were correctly scheduled.
2=one entry was correctly scheduled.

Errors in Quantity:

0=no errors - one tablet morning and afternoon, two at bedtime.
1=one error made in dosage, e.g. one tablet at bedtime.
2=two errors made in dosage.

Total = 4

Appendix G

INTERVIEW PROTOCOL (SCHEMA FIRST)

TAPES(2)___CONSENT___ NUMBER CODE: S1___
MEDQUES(2)___VOCAB___ DATE: _______

Memorability for Instructions

Time:_____

Thank you for volunteering to participate in this study. Without your assistance this research would not be possible. I am trying to learn if the way in which instructions are given affects how younger adults and older adults remember and carry out instructions. In this study, you will be asked to listen to a set of instructions and then to give verbal or written answers to questions about the information you just heard. You will then be asked to put the instructions into practice.

You will also be asked to do several other tasks that involve memory and to answer some questions about your general health.

Before we continue, I would like to remind you that you are free to with draw from the study or any task at any time and without penalty to yourself. As well, all the information you provide will be kept strictly confidential. To do this, only a coded number will appear on the information you provide; that is, your name is never associated with the information you give.

Do you have any questions at this time?

PSYCO Students: Do you still wish to participate in the study. Yes/No?

Volunteers: Please read this consent form and if you find it satisfactory, please sign it. [Consent form, next page.]

Screening Information

Before we begin the actual study tasks, there is some basic information that must be gathered.

The participant is (circle) Male Female.

What is your present age? _____

What is your highest level of public or separate school education (i.e.grades 1-13)?____________________________

The Department of Psychology
University of Alberta
Edmonton, Alberta
T6G 2E9

Date:____________________

I agree to participate in a research project designed to study memory for instructions. I understand that I will be asked questions about my physical health and to take some memory tests. I understand that this information will be confidential and that I can withdraw from the project, or any test, at any time.

______________________________________(please print)
NAME

____
SIGNATURE

How many years of further education do you have (include years and degree, certificate etc. obtained)?__________________

How would you rate your current state of general health?
____Excellent ____Good ____Fair ____Poor

Are you currently taking any prescription medication?
Yes____ No____

If yes, list in detail____________________________________

Can you tell me what medicines are for? ____________________

Could you give me the names of any other prescription and over the counter medications you have taken in the past two years.

____

____

Have you assisted anyone else with their medications in the past two years?
Yes ____; No ____

How much would you say these illness interfere with your activities of daily living?
Not at all___, A little___, Some___, Quite a bit___.

Vision Screen

I will be showing ten index cards with one word printed on each card. Please read the words outloud. Thank you.

Sound__, Thigh__, Family__, Abdomen__, Problem__,
Bladder__, House__, Chest__, Nine__, Heart__.

Hearing Screen

From the audiotape, you will hear ten brief instructions. The instructions make use of these token that I am placing in front of you. Please carry out the instructions as best you can. There will be a brief pause between each instruction for you to perform the action.

TOUCH THE --

red square	_____	red circle	_____
blue circle	_____	green square	_____
white circle	_____	white square	_____
blue square	_____	green circle	_____
black circle	_____	black square	_____

Thank you. We can now proceed to the first memory tasks.

TIME:___ **MANAGING PRESCRIPTION MEDICINES**

I would like you to imagine that it is Monday afternoon about 1:00 pm and you are at a doctor's appointment. You have had a bad cold for about a week. It has settled in your chest and you are now coughing up thick brownish phlegm. There also seems to be several problems in your life right now that worry you. Lately you have been sleeping poorly because you take your worries to bed with you. You just feel generally exhausted and anxious. Your doctor examines your chest and listens thoughtfully as you describe your sleeping problems.

The doctor tells you that you have pneumonia. He plans to give you some prescriptions. First, though, his nurse will give you some information about taking medicines.

In a few moments I will read you this information. As well, I will show you some illustrations that should help you understand the message. I can only say the information once, so please carefully. When the message is over, I will ask you to answer several questions about the information you just heard. Do you have any questions at this time?

[Read Message, Appendix B] [Show Illustrations]

(TIME:___) [Verification Questions, record responses.]

1. Cards were arranged in this sequence:___[BCD]___________
2. Cards were arranged in this sequence:___[BE]____________
3. If taken with food, digestive juices destroy the medicine____.
   Blood level would be low______.
4. Its used more slowly by the body _____. Can take at irregular intervals. _____
5. The prescription _____. Special instruction _____.
   Usual sleeping and eating patterns _____.
6. Blood level of medicine will be sustained _____. Medicines will be remembered _____. Get better _____.
7. Cards were arranged in this sequence: __[BEF]____________
8. Reason why are taking medicine _____. Doctor's advice _____.

TIME:___ **MEDICATION INSTRUCTIONS**

Now, I would like you to imagine that the doctor has returned and is giving you the prescriptions for the three medicines he wished you to take home with you.

This information has been audiotaped, so when I turn it on, please listen carefully. I will also show you the names of medicines printed on index cards. When this message is finished, I will stop the tape. A little while later, you will be asked some questions about these prescription medicines. Therefore, listen carefully at this time. Do you have any questions.

[Play Audiotape: Appendix D] [Show Medication Names}

____

____

Time: ____ AUDITORY WORKING MEMORY TASK

0-LAG SCORING:
In a moment I will be playing you a tape with some recorded numbers on it. To start with, you just repeat the numbers out loud as soon as you hear them. So if your hear 9 you say 9. If you hear 2, you say 2 right away. Okay? We'll begin.

TRIAL 1:

stim	8	7	1	2	1	9	5	6	3	9	# Correct
cor	8	7	1	2	1	9	5	6	3	9	1st Error__
resp	__	__	__	__	__	__	__	__	__	__	Total___

TRIAL 2:

stim	9	4	1	2	7	3	6	8	5	4	# Correct
cor	9	4	1	2	7	3	6	8	5	4	1st Error__
resp	__	__	__	__	__	__	__	__	__	__	Total___

1-LAG SCORING:
This time I want you to give me the number 1-back from the one you just heard. When you hear the first number, don't day anything. When you hear the second number say the first number. After you hear the third number, say the second number and so on. I always want you to tell me the number that came one before the number just presented. Do you understand?

<u>IF NOT</u>, say:
Let's say the tape says 1,2,3 (show card). You are to say 1 (point) after you hear number 2 (point). After you hear the number 3, you are to say the number 2 and so on. Do you have any questions?

Let's practice one set. You may find it helpful to close your eyes or look away to concentrate.

Are you ready? 9 2 7 5 1

Begin tape if person is able to do practice; if not, use display card pointing to numbers as you go.
REMEMBER TO DO BOTH TRIALS!

TRIAL 1:

stim	5	8	1	2	6	3	4	9	2	8	5	# Correct
cor		5	8	1	2	6	3	4	9	2	8	1st Error__
resp		_	_	_	_	_	_	_	_	_	_	Total___

TRIAL 2:

stim	7	6	2	4	9	1	5	7	2	9	3	# Correct
cor		7	6	2	4	9	1	5	7	2	9	1st Error__
resp		_	_	_	_	_	_	_	_	_	_	Total___

2-LAG SCORING

This time I want you to give the number 2-back from the one you just heard. Say nothing when you hear the first two numbers. When you hear the third number, say the first number. When you hear the fourth number, say the second number and so on. I always want you to tell me the number that came two before the number being presented. Do you understand?

IF NOT, say: For example, if you hear the sequence 1,2,3,4,5 (point to number card) you should wait until you hear the number 3 before you respond. After you hear the number 3, you should say the number 1. After you hear the number 4, say the number 2. And after you hear the number 5, you should say the number 3 because the number 3 came two numbers before the number 5. Do you have any questions.

Okay. Let's practice one. Once again, you may find closing your eyes or looking away will help you concentrate on the numbers.

Are you ready? 4 9 1 6 3 5

Begin tape if person is able to do practice; if not, use display card pointing to numbers as you go.

REMEMBER TO DO BOTH TRIALS.

TRIAL 1:

stim	6	2	9	1	3	5	7	2	8	1	9	6	#Correct
cor			6	2	9	1	3	5	7	2	8	1	1st Error___
resp			_	_	_	_	_	_	_	_	_	_	Total___

TRIAL 2:

stim	1	7	6	9	3	8	2	1	6	5	7	4	# Correct
cor			1	7	6	9	3	8	2	1	6	5	1st Error___
resp			_	_	_	_	_	_	_	_	_	_	Total___

3-LAG SCORING

This time give me the number 3-back from the one you just heard. When you hear the fourth number, say the first number. After you hear the fifth number, say the second number and so on. I always want you to tell me the number that came three before the number just presented. Do you understand?

IF NOT, say: For example, if you hear the sequence 1,2,3,4,5,6 (point to number card) you should wait until you hear the number 4 before you respond. After you hear the number 4, you should say the number 1. After you hear the number 5, you should say the number 2. And after you hear the number 6, you should say the number 3 because the number 3 came three numbers before the number 6. Do you have any questions?

Okay. Lets practice one set. Once again, you may find closing your eyes or looking away will help you concentrate on the numbers.

Are you ready? 6 1 2 8 5 3 7 2

Begin tape if person is able to do practice; if not, use display card pointing to numbers as you go.
REMEMBER TO DO BOTH TRIALS!

TRIAL 1:

stim	8	1	9	3	2	6	4	8	5	1	9	7	4	# Correct
cor				8	1	9	3	2	6	4	8	5	1	1st Error___
resp				_	_	_	_	_	_	_	_	_	_	Total___

TRIAL 2:

stim	3	8	7	4	2	9	1	6	3	5	9	4	7	# Correct
cor				3	8	7	4	2	9	1	6	3	5	1st Error___
resp				_	_	_	_	_	_	_	_	_	_	Total___

Comments: ______________________________

TIME: ______

TIME:________ **LISTENING SPAN TASK**

In this next task, you will be listening to sets of two, three, four and five short sentences. There will be three sets of sentences at each level. Some of the sentences make sense and some of them do not. Listen to each sentence and decide if it makes sense or not. If it makes sense say "yes", if it dose not makes sense, say "no". There will be a brief pause after each sentence for you to say "yes" or "no".

As well, as you listen to the sentences, try to remember the last word in each sentence. After you have listened to all the sentences in each set, you will be asked to recall the last word of each sentence in that set. You can recall the sentence last words in any order. Do you have any questions?

Lets begin with a practice set of two sentences:

The elephant used its trunk to lift up the man. Y___

The flute swam slowly over the other players. N___

SCORING

Level Two:

1) Y___, Y___. tree___, song___.

2) Y___, N___. prairie___, stone___.

3) N___, N___. river___, parcel___. Total Correct_____

Level Three:

1) Y___, N___, Y___. lunch___, bedroom___, land___.

2) N___, N___, Y___. party___, water___,moonlight___.

3) N___, Y___, Y___. snowball___, milk___, dark___.

Total Correct_____

Level Four:

1) N___, N___, Y___, N___. crackers___, room___, gown___, pool___.

2) Y___, Y___, Y___, N___. cheated___, bend___, domain___, sunset___.

3) N___, Y___, N___, Y___. bed___, table___, idea___, yard___.

Total Correct____

Level Five:

1) Y___, N___, Y___, N___, Y___.

noses___, envelope___, crowd___, cars___, window___.

2) Y___, N___, N___, Y___, N___.

annoying___, candy___, pencil___,breeze___,peanuts___.

3) N___, N___, Y___, N___, Y___.

light___, livers___, plane___, pillow___, shower___.

Total Correct____

Sentences for Listening Span Task

(N or S denotes nonsense or sense respectively)

Level Two:

S The last refuge of the parrots was the tall tree.
S The sad clown sang a depressing song.

S The tiny antelope ran swiftly across the prairie.
N The shards of broken ice cream littered the empty stone.

N The hungry carpet swam the rushing river.
N The empty house warbled gracefully to the parcel.

Level Three:

S The particle of soot landed on my lunch.
N The silent morning pounded in the bedroom.
S The waves of vicious bees swept across the land.

N The deep green thoughts hurried furiously to the party.
N The drunken sailor sand the cold water.
S The empty pasture was quiet in the moonlight.

N The last word was eaten by the voracious snowball.
S The purring kitten lapped up the last dregs of milk.
S The baseball game continued till after dark.

Level Four:

N The herds of tiny buffalo galloped across the crackers.
N The typewriter walked quickly through the deserted room.
S The passionate seamstress sewed busily on the gown.
N The pesky napkins lolled at the side of the pool.

S The truth of the matter was that the dealer had cheated.
S The large signs warned of the danger around the bend.
S The quiet mouse crept through the cat's domain.
N The crazy quilt laughed acorns at the sunset.

N The innocent victims parcelled mittens for the bed.
S The yards of beautiful cloth were draped across the table.
N The angry turtle beat the bad idea.
S The cooperative children played quietly in the back yard.

Level Five:

S The sporting dolphins pushed the ball with their noses.
N The past craze carpeted the happy envelope.
S The movie did not make a profit in spite of the big crowd.
N The thousands of screaming chinchillas waxed the cars.
S The occasional headlight lit up the bedroom window.

S The sound of the rain on the roof was very annoying.
N The last straw caressed the overloaded candy.
N The energy of the small digit carried across the pencil.
S The tall trees swayed gently in the soft breeze.
N The blue pages of the autograph book tinkled with peanuts.

N The difficult story panted in the evening light.
N The few patient spiders angled for hearty livers.
S The careful pilot safely landed the burning plane.
N The golden harvest was toasted on the pillow.
S The captain of the team was the first one in the shower.

MEDICATION RECALL

TIME:____

Instructions: In the spaces provided in this questionnaire, please respond to the questions in accord with the information you heard on the audiotape about the three medications. The same questions are being asked of all three medicines.

[Give Questionnaire: Appendix E]

PRESCRIPTION SCHEDULING

TIME:_____

On this prepared paper, [Give Plan] I would like you to make a plan of when you would take the three medicines prescribed for you. You are to start the plan after getting home on Monday afternoon and to end the plan at bedtime on Thursday.

Please note both the name of the medicine and how many capsules/tablets you would take.

In this small box are the bottles of pills you were prescribed. The pill bottles are available to help you do this task, just at you would use them at home. [Show Cloxapen bottle.] The labels accurately represent the medicine prescription you heard on the audiotape.

As you make your plan, keep in mind [point to label]:

____the prescription order.
____your sleeping and eating patterns.
____any special instructions you were given.
____you can schedule more than one pill at a given time.

Remember that you are to record the name (letter) of the medicine and the number of pills you are going to take at each time you plan to take the medicine. You can use the first letter of the medicine as shown here. [show tops of bottles].

You may look at the bottles as often and as long as you wish. The one limitation in their use and is that you may only take one bottle out of the box at a time. You must return it to the box before taking out another bottle. Do you have any questions?

[Give 24 Hour Prescription Scheduling Guide: Appendix F]

Prescription Scheduling Timing

Bottle	Time Out	Time In	Time (Sec)	Comments
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________
____	____:____	____:____	________	____________________

Ask: Breakfast, Lunch, Dinner, Bedtime (Circle Times)
Now check each medicine, if incorrect provide the following prompts. Put checks beside prompts used. Note changes in erasable pen.

1. Cloxapen: No prompts given. ____
   Have you considered "on an empty stomach"?___
   Review meaning of "on an empty stomach". ____
   Have you considered "every six hours"?___
   Times per day is "every six hours"?___

2. Benemid: No prompts given. ____
   Have you considered "with food/milk"?___
   If "with food/milk" and twice daily, when to schedule?___
   Have you considered "change in dosage"?___
   When should the dose be increased to two tablets?___

3. Lorax: No prompts given. ____
   Have you considered "three times a day"?___
   What is the interval involved between pills?___
   How many pills should you take at bedtime?___

ADVANCED VOCABULARY TASK

TIME:____

In this next task, I will be looking at your knowledge of word meanings. SHOW EXAMPLE

Look at this example. One of the five numbered words has the same meaning as the underlined word. Your task is to circle the number of the word that has the same meaning as the underlined word.

Example A: jovial

1. refreshing
2. scare
3. thickset
4. wise
5. jolly

The answer to example A is number 5, therefore, a circle has been drawn around number 5.

Now try the next two examples.

Example B: bayonet

1. small tent
2. basket
3. helmet
4. sharp weapon
5. short gun

Example C: astound

1. scold severely
2. make angry
3. surprise greatly
4. drive out
5. ascertain

The answer to example B is "sharp weapon". Therefore, you would have circled number 4. The answer to example C is "surprise greatly"--you would have circled number 3. Are there any questions?

You will have 4 minutes to complete this task. Don't worry if you don't recognize all the words. This is an advanced vocabulary task. If you don't know an answer, try to make your best guess.

Remember, circle the number in front of the word that has the same meaning, or nearly the same meaning, as the underlined word.

Hand out Vocabulary Task face down.

Okay, you can turn over the paper and begin. Start Timer.

Collect task after 4 minutes are up.

Number Correct______ Number Omitted______ Number Incorrect________

Vocabulary Task

1. mumble
   1-speak indistinctly
   2-complain
   3-handle awkwardly
   4-fall over something
   5-tear apart

2. perspire
   1-struggle
   2-sweat
   3-happen
   4-penetrate
   5-submit

3. gush
   1-giggle
   2-spout
   3-sprinkle
   4-hurry
   5-cry

4. massive
   1-strong and muscular
   2-thickly populated
   3-ugly and awkward
   4-huge and solid
   5-everlasting

5. feign
   1-pretend
   2-prefer
   3-wear
   4-be cautious
   5-surrender

6. unwary
   1-unusual
   2-deserted
   3-incautious
   4-sudden
   5-tireless

7. veer
   1-change direction
   2-hesitate
   3-catch sight of
   4-cover with a thin layer
   5-restful

8. orthodox
   1-conventional
   2-straight
   3-surgical
   4-right-angled
   5-religious

9. stripling
   1-stream
   2-narrow path
   3-engraving
   4-lad
   5-beginner

10. salubrious
   1-mirthful
   2-indecent
   3-salty
   4-mournful
   5-healthful

11. limpid
   1-lazy
   2-crippled
   3-clear
   4-hot
   5-slippery

12. procreate
   1-sketch
   2-inhabit
   3-imitate
   4-beget
   5-encourage

13. replete
   1-full
   2-elderly
   3-resentful
   4-discredited
   5-slide

14. frieze
   1-fringe of curls on the forehead
   2-statue
   3-ornamental band
   4-embroidery
   5-sherbet

15. treacle
   1-sewing machine
   2-framework
   3-leak
   4-disgraceful
   5-molasses

16. ignominious
   1-inflammable
   2-elf like
   3-unintelligent
   4-disgraceful
   5-mysterious

17. abjure
   1-make certain
   2-arrest
   3-renounce
   4-abuse
   5-lose

18. duress
   1-period of time
   2-distaste
   3-courage
   4-hardness
   5-compulsion

Debriefing

I would like to thank you sincerely for participating in this study. Before you go, I would like to better understand how you felt about the study.

Could you tell me what you thought about the medication instructions you listened to today?

Are there ways in which these instructions might affect how you take medicines in the future?

After listening to these instructions, do you have any concerns about your current medicine taking practices?

(Do refer to their own doctor or pharmacist should they have any concerns about a current prescription.)

___[Volunteers] Would you be prepared to participate in any other research project?
Yes ______ No _____

[PSYCO 104/105 Participants] Also, before you go, I would like to give you this handout [Debriefing Information] that provides a more in depth explanation about the study. Do you have any questions.

____ Debriefing
____ Participation Card
____ Participation Record

TIME: ____

Appendix H

Table H-1

Mean Time in Seconds (SD) by Age Group and Condition to Talk Through the Medication Module.

Age Group	Schema 1st	Schema 2nd	Control
Young	456.78 (23.56)	454.18* (26.17)	434.94 (30.50)
Old	497.17 (20.38)	494.39 (30.55)	463.06* (29.89)

* missing data point(s).

Table H-2

Mean Time in Seconds (SD) for Responding to Medication Module Verification by Age Group and Condition.

Age Group	Schema 1st	Schema 2nd	Control
Young	383.62 (176.52)	349.82* (75.59)	133.06 (38.35)
Old	455.89 (110.18)	445.11 (120.07)	181.31* (62.83)

* missing data point(s)

Table H-3

Mean Scores in Percent (SD) for Medication Module Verification by Age Group and Condition.

Age Group	Schema 1st	Schema 2nd	Control
Young	81.60 (12.95)	85.78 (8.25)	90.56 (9.38)
Old	87.50 (5.25)	82.29 (4.42)	94.44 (6.16)

Table H-4

Mean Percent Scores (SD) on Medication Recall by Age Group, Condition and Medication.

Age Group	Schema 1st	Schema 2nd	Control
Cloxapen			
Young	63.89 (12.55)	69.77 (12.51)	58.66 (14.64)
Old	44.77 (16.93)	42.16 (21.04)	42.97 (16.83)
Benemid			
Young	62.09 (18.84)	64.87 (15.90)	56.86 (18.35)
Old	39.38 (17.68)	34.31 (21.06)	35.79 (20.03)
Lorax			
Young	64.87 (13.78)	59.97 (11.29)	62.74 (15.33)
Old	48.37 (20.90)	38.56 (29.84)	39.87 (20.28)

Table H-5

Mean Score in Percent (SD) for Recall of Medication Name On Medication Recall Task by Age Group, Condition and Medication.

Age Group	Concept 1st	Concept 2nd	Control
Cloxapen			
Young	75.00 (34.40)	86.10 (28.70)	77.60 (35.20)
Old	38.90 (43.90)	47.20 (46.90)	66.70 (38.30)
Benemid			
Young	86.10 (28.70)	100.00 (00.00)	69.40 (42.50)
Old	30.60 (42.50)	47.20 (46.90)	55.60 (41.60)
Lorax			
Young	83.30 (34.40)	88.90 (32.30)	80.60 (43.90)
Old	52.80 (46.99)	55.60 (45.00)	58.30 (46.20)

Table H-6

Mean Scores in Percent (SD) for Explicit Recall Questions on Medication Recall by Age Group, Condition, and Medication.

Age Group	Schema 1st	Schema 2nd	Control
Cloxapen			
Young	53.24 (23.94)	68.98 (19.56)	55.56 (26.04)
Old	41.20 (20.90)	34.72 (23.61)	30.09 (19.20)
Benemid			
Young	64.35 (31.80)	65.28 (22.17)	61.57 (31.72)
Old	33.80 (29.08)	30.56 (24.42)	33.80 (25.64)
Lorax			
Young	70.37 (18.93)	73.15 (19.08)	68.52 (28.52)
Old	62.04 (26.70)	43.52 (36.67)	45.37 (31.73)

Table H-7

Mean Percent Recall for Integration Recall Questions on the Medication Recall Task by Age Group, Condition, and Medication.

Age Group	Schema 1st	Schema 2nd	Control
Cloxapen			
Young	66.20 (18.85)	66.20 (19.90)	64.35 (16.62)
Old	47.69 (25.21)	50.00 (29.29)	50.00 (23.74)
Benemid			
Young	53.24 (18.56)	55.56 (18.52)	53.24 (13.45)
Old	37.50 (20.66)	29.17 (18.58)	28.70 (18.79)
Lorax			
Young	53.70 (30.68)	43.06 (21.05)	61.57 (24.61)
Old	32.87 (25.96)	29.63 (27.00)	31.02 (20.77)

Table H-8

Mean Percent Scores (SD) for Application Recall Questions on Medication Recall Questionnaire by Age Group, Condition, and Medication.

Age Group	Schema 1st	Schema 2nd	Control
Cloxapen			
Young	73.61 (13.48)	72.22 (18.96)	50.00 (29.70)
Old	47.22 (24.09)	40.28 (29.88)	45.83 (33.49)
Benemid			
Young	65.97 (25.66)	69.44 (23.57)	52.08 (30.09)
Old	52.78 (33.09)	44.44 (32.72)	44.44 (33.82)
Lorax			
Young	68.75 (20.22)	58.33 (29.70)	51.39 (29.04)
Old	50.00 (28.44)	40.28 (36.52)	40.28 (37.51)

Table H-9

<u>Mean Percent Scores (SD) for Planning Accuracy by Age Group, Condition, and Medication</u>.

Age Group	Schema 1st	Schema 2nd	Control
Cloxapen			
Young	75.20 (21.34)	77.38 (25.55)	68.65 (33.96)
Old	64.88 (23.88)	60.12 (30.43)	52.58 (25.72)
Benemid			
Young	82.14 (29.93)	86.91 (25.73)	66.27 (18.35)
Old	50.79 (30.88)	59.52 (30.30)	70.64 (33.85)
Lorax			
Young	93.94 (13.59)	96.97 (6.97)	90.40 (21.71)
Old	96.47 (9.43)	96.21 (11.27)	91.41 (22.59)

Table H-10

Mean Percent Scores (SD) for Timing Errors Made During Prescription Scheduling by Age Group, Condition, and Medication.

\ge Group	Concept 1st	Concept 2nd	Control
Cloxapen			
Young	20.37 (20.26)	11.11 (16.17)	29.63 (32.11)
Old	14.82 (20.52)	22.22 (25.57)	20.37 (25.92)
Benemid			
Young	11.11 (32.34)	0.00 (0.00)	16.67 (38.35)
Old	5.56 (23.57)	11.11 (32.38)	11.11 (32.34)
Lorax			
Young	1.85 (7.86)	1.85 (7.71)	5.56 (17.15)
Old	0.00 (0.00)	1.85 (7.86)	3.70 (10.78)

Table H-11

Mean Percent Scores (SD) For Quantity Errors Made During Prescription Scheduling by Age Group, Condition, and Medication.

Age Group	Concept 1st	Concept 2nd	Control
Cloxapen			
Young	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Old	5.56 (23.57)	0.00 (0.00)	5.56 (23.57)
Benemid			
Young	22.22 (25.57)	19.44 (25.08)	22.22 (25.57)
Old	22.22 (25.57)	19.44 (25.08)	33.33 (34.30)
Lorax			
Young	0.00 (0.00)	2.78 (11.79)	8.33 (25.76)
Old	0.00 (0.00)	5.56 (16.17)	2.78 (11.79)

Table H-12

Mean Scores (SD) for Errors Combined Made During Prescription Planning by Age Group, Condition, and Medication.

Age Group	Concept 1st	Concept 2nd	Control
Cloxapen			
Young	19.05 (15.50)	14.29 (13.86)	26.19 (25.58)
Old	22.22 (14.88)	26.19 (19.75)	34.92 (18.48)
Benemid			
Young	15.56 (17.56)	12.22 (17.00)	25.56 (22.55)
Old	28.89 (17.11)	25.56 (19.17)	26.67 (22.75)
Lorax			
Young	1.11 (4.71)	2.22 (6.47)	6.67 (19.40)
Old	0.00 (0.00)	3.33 (10.29)	3.33 (10.29)

Table H-13

Mean Scores (SD) for Errors Made in Following Special Instruction During Prescription Scheduling by Age Group, Condition, and Medication.

Age Group	Concept 1st	Concept 2nd	Control
Cloxapen			
Young	24.07 (29.83)	22.22 (30.25)	31.48 (37.00)
Old	35.19 (26.75)	38.89 (34.77)	59.26 (35.34)
Benemid			
Young	11.11 (27.42)	11.11 (27.42)	33.33 (38.35)
Old	47.22 (31.96)	38.89 (36.60)	27.78 (35.24)

Table H-14

Frequency (Expected Frequency) of Checking Prescription Labels More than Once by Age Group, Condition, and Medication.

Age Group	Concept 1st	Concept 2nd	Control
Cloxapen			
Young	5 (7.2)	1 (2.6)	12 (8.2)
Old	9 (6.8)	4 (2.4)	4 (7.8)
Benemid			
Young	5 (7.5)	6 (6.4)	11 (8.1)
Old	8 (5.5)	5 (4.6)	3 (5.9)
Lorax			
Young	5 (5.2)	2 (2.6)	6 (5.2)
Old	7 (6.8)	4 (3.4)	6 (6.8)

Table H-15

Mean Time in Seconds (SD) Spent Checking Medicine Bottle Labels while Prescription Scheduling by Age Group, Condition, and Medication.

Age Group	Schema 1st	Schema 2nd	Control
Cloxapen			
Young	152.44 (97.97)	116.72 (76.72)	130.89 (161.04)
Old	166.72 (67.73)	132.61 (71.55)	141.67 (107.47)
Benemid			
Young	106.61 (37.67)	95.94 (59.88)	106.39 (84.57)
Old	166.39 (68.62)	156.29 (79.49)	148.33 (69.66)
Lorax			
Young	94.50 (49.36)	83.28 (54.59)	67.61 (56.49)
Old	125.06 (50.63)	127.22 (61.13)	129.72 (81.59)

Table H-16

Mean Time in Seconds (SD),and Minutes for the Retention Interval between Prescription Information and Medication Recall by Age Group and Condition.

Age Group	Schema 1st	Schema 2nd	Control
Young	1153.50 (105.13) 19.2 min	1440.17 (94.77) 24.0 min	1115.50 (103.02) 18.6 min
Old	1294.56 (135.01) 21.6 min	1689.56 (172.92) 28.2 min	1339.56 (105.44) 22.3 min

Table H-17

Mean Scores (SD) for Auditory Working Memory by Age Group and Lag Condition.

Age Group	Lag 1	Lag 2	Lag 3
Young	9.96 (0.19)	9.00 (1.84)	7.69 (1.83)
Old	8.76 (2.44)	6.72 (2.55)	5.56 (2.61)

Table H-18

Mean Scores (SD) for Listening Span Task by Age Group and Two Scoring Methods.

	Listening Span Task	
Age Group	Baddeley*	D&C**
Young	33.17 (4.25)	3.34 (0.99)
Old	25.66 (4.39)	2.47 (0.59)

* Baddeley et al. (1985), Maximum score is 42.

** Daneman & Carpenter (1980), Maximum score is Level 5