Purpose

The major purpose of this study was to determine the readability of selected patient education materials for older adults using the cloze procedure as a criterion. Actual cloze test scores from three selected passages on hypertension were compared with the Coleman readability scores on those same passages. Age and the number of years of schooling completed for each subject were examined to determine their effect upon predicting the cloze test scores on each passage. Variations in the scores on the three selected passages were also examined.

Procedure

The population consisted of adults, 60 years of age and over, who eat a noon meal at the 13 program sites operated by the Oregon District Four Elderly Nutrition Program. A random sample was drawn from a master list of all participants at the 13 sites. A total of 84 older adults comprised the
sample for this study.

Each subject completed one cloze test in his/her own home with no time limit. The tests were scored on the basis of the number of exact completions (synonyms were not scored) for the 50 deletions. The raw scores were converted to percentage of correct completions for the purpose of analysis and interpretation. Each subject also supplied information on his/her age and the number of years of schooling completed. The data for each of the cloze test forms were subjected to multivariate analysis, one-way analysis of variance and multiple comparisons analysis. The cell sizes for all three cloze test forms were equal. For all tests of hypotheses, findings for which the probability is less than .05 were reported as non-significant.

Findings

The major findings were:

1. Older adults made significantly (p=4.01) lower scores on the cloze tests than predicted by the Coleman readability formula.

2. Schooling correlated more significantly (p=4.01) than did age with the actual cloze test scores.

3. Schooling had a more significant (p=4.01) effect than did age upon predicting cloze test scores.

4. Cloze test, Form B, was significantly (p=.05) more difficult than cloze test, Form A.

Based on these findings, it was concluded that the
patient education materials selected were "not very readable" for the older adults in the Oregon District Four Elderly Nutrition Program. Whereas all three passages tested were of approximately equal difficulty in terms of the language variables alone, the cloze procedure was able to distinguish differences in concept difficulty. Discussion of the findings included implications for the use of the cloze procedure by health educators for patient education of older adults and for use in evaluating the mental functioning of older adults. Suggestions for further research included: (1) the provision of additional variables, (2) replication of the study with additional patient education materials, (3) the sampling of other populations, (4) testing of the instruction sheet for readability, and (5) consistency in the use of the instruction sheet.
Use of the Cloze Procedure
As a Criterion for Measuring the Readability
Of Selected Patient Education Materials for Older Adults

by

Carol Ann Holcomb

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USE OF THE CLOZE PROCEDURE
AS A CRITERION FOR MEASURING THE READABILITY
OF SELECTED PATIENT EDUCATION MATERIALS FOR OLDER ADULTS

I. INTRODUCTION

Lawrence Weed (1969), a physician whose efforts have revolutionized diagnostic procedures and medical records in the United States, states succinctly the importance and need for patient education:

Plans for education of the patient have been seriously neglected by the medical profession. When patients are discharged, the physician fully expects that they will understand and manage their own procedures, drugs and diets, when in reality they may often be wholly confused, not only about the character of the treatment but also about the function of it and about what effect a particular drug is supposed to produce or a particular personal regimen is intended to create. In the last analysis, the patient with a chronic disease must in large part be his own physician; if he does not understand his own illness and its treatment, moments of reprimand and irritability in the office of the busy practitioner or busy clinic will provide little in the way of corrections (p. 50).

Chronic diseases affect the lives of millions of older Americans. The statistics are striking: 85 percent of the United States population over age 65 living outside institutions have at least one chronic condition and about half of these individuals suffer some limitation of activity because of chronic conditions (USDHEW, 1971).

Data from research projects (Putt, 1970; Rosenberg,
1971; Lindeman and Van Aernam, 1971; Avery, Green and Kreider, 1972) indicate that when patients are adequately informed and included in the educational process concerning their own care and treatment, they have fewer hospital readmissions and shortened lengths of stay. For the older patient on a limited, fixed income, the prospect of reduced medical expense as a result of fewer readmissions and shorter hospital stays may well be a significant motivational factor for him/her to seek more information about his/her condition.

The ultimate goal of patient education for both young and old alike is to help individuals obtain adequate information, develop more positive attitudes and establish behavior that will promote their ability to care for themselves. Maintenance of a positive state of health and the prevention of possible recurrences of illnesses whenever feasible are also noteworthy goals. Nationwide recognition of the need for preventive health care and self-maintenance as expressed in the ten major priorities of the Health Planning and Resources Development Act of 1974 (USDHEW, 1975) has created an emphasis on individual instruction by health-care professionals and health educators.

**Origin of the Problem**

Samora, Saunders and Larson (1961) have proposed that if the goal of medicine is concern with the person who is sick
and the purpose is to relieve, reassure, and restore him/her, then the quality of communication with the patient assumes instrumental importance, and anything that impedes or distorts it needs to be ascertained, and, if possible, removed. Their research involving a study of the medical vocabulary knowledge among hospital patients in a publicly operated general hospital suggested that vocabulary deficiency on the part of the patient increased the possibility of misunderstanding or non-understanding.

Studies conducted at The New York Hospital in the 1950s (Pratt, Seligmann and Reader, 1957) showed that patients with less than eighth grade education had considerably less knowledge, in general, about ten common diseases than those who had had even a few years of secondary school. The assumption was made that this difference was not related to better courses in health education in secondary school, but rather that those who went beyond the elementary grades had been exposed to a much wider and more diverse set of stimuli through the mass communications media. Further assumptions stated that individuals with more than eight years of schooling read more widely and associated with people who also read more widely, so that information about health problems was much more likely to reach them than those who had not developed adequate reading skills. No attempt was made, however, to evaluate the reading materials themselves for levels of difficulty.
Printed materials are often used by doctors, nurses and others concerned with patient care to communicate information about a laboratory test, a therapeutic diet, general information about an illness, or a specific treatment plan. Countless pamphlets, booklets, and instruction sheets have been written for these purposes. Leventhal and Sproul (1963) delineated some of the major barriers to the internalization of self-help concepts in the field of health and safety information. They stated:

Of the thousands of pamphlets on health subjects available today—and hundreds produced each year, not excluding the articles in newspapers and in laity journals and radio and TV programs—it is no exaggeration to say that only a small percentage have been developed with a specific audience in mind; and with an awareness of the audience's present level of knowledge concerning a specific phase of health and safety; and of their present attitudes and behavior with respect to that phase; or with precise communications objectives established; and with appeals, copy and illustrations pretested with respect to their efficacy in achieving desired action on the part of the reader or viewer (p. 10).

Pamphlets and other forms of printed materials are widely available for use as a medium for communicating health information (Neal, 1962). Reporting the findings and recommendations of the President's Committee on Health Education, Weingarten stated:

We found an enormous amount of health information material and very little effective health education work. We also found
that most of the major providers of health information materials were shoveling them out by the millions. Our actual finding was that the five major voluntary health agencies were spending in excess of $100 million a year for their health information programs. In the course of ten years, however, we could only find two instances of any of those agencies seeking to evaluate the effectiveness of their materials. We found one insurance company that was spending about $2 million a year for health information and health education materials, and in the course of 20 years has never had an evaluation of the materials. In fact, we found relatively little concern with whether the messages were getting across in the way the sponsors hoped they would get across, and a great deal of satisfaction in the idea that "As long as we produced it, we're quite happy with it" (p. 13).

Evaluation of printed materials could save agencies thousands of dollars wasted each year on materials that are too difficult to understand. In addition to research on the media itself, Meirhenry (1962) has suggested that basic research is needed in the category of learner characteristics as well. There is reason to believe that the skillful use of any type of audio or visual material will improve instruction in some way.

Need for this Study

The effectiveness of written communication depends not only on the material itself, but also on its suitability for the particular reader (Mohammed, 1964). Educational efforts with adult patients often involve matching reading materials
to adult reading levels. The source must fit the person if any learning is to take place. If the person who is a patient is viewed as a learner, then those who expect a sheet of instructions to be followed or a pamphlet to be read seem to believe that the patient is a very special kind of learner, not unlike those found in the highly restricted institutions of secondary and higher education in earlier centuries of our history (Ginther, 1971). Such learners possessed highly developed reading skills, were highly motivated, and apparently were without need of emotional support while completing learning tasks.

Printed materials as a source of health information must be readable if that information is to be communicated to the patient and subsequently learned. Lanese and Thrush (1963) concluded from their study of the readability of diabetes literature that when the reading level is beyond that of the patient's ability, comprehension is reduced, recall is sketchy and inaccurate, and motivation to seek further information is decreased.

Readability, according to Webster's Dictionary (Friend and Guralnik, 1960), means "legible ... pleasing, interesting, or offering no great difficulty to the reader ... that can be read with ease." Dale and Chall (1949) stated that

... in the broadest sense, readability could be considered as the sum total of all those elements within a given piece of printed material that affects the success that a group of readers will
have with it. This success means the extent to which readers understand it, read it at optimum speed, and find it interesting (p. 19).

They also pointed out that since reading is a chief means by which persons gain information, the effectiveness with which printed materials convey this information remains an important problem.

A number of different measures, readability formulas, have been developed to evaluate the probable success a reader may have with a piece of printed material (Klare, 1974-75), but there is no magic in any of these. Readability formulas merely use counts of language variables in a piece of writing to provide an index of probable difficulty for readers. They are a predictive device in the sense that no actual participation by readers is needed. Thus it can be said that the purpose and value of readability formulas are to predict and control difficulty and to furnish a tool for matching materials to the reader (McTaggert, 1964). Since patient education materials are somewhat technical in nature, the readability formulas which are most widely known and used at the present time may not be adequate for the task as they are based on mechanics-of-reading components (Schlief and Wood, 1974). The cloze procedure, developed by Wilson L. Taylor in 1953, on the other hand, is a measuring device used to determine the readability level of printed materials in terms of the reader's ability to comprehend what he has read. It is not a formula and hence does not
provide a grade level or school grade completed identification for the readability level of any written material.

Taylor's (1953) definition of cloze, which has become the generally accepted one of those working with the cloze procedure, consisted of a transmitter, mutilation of the transmitter's language patterns (by deleting every nth word), and administering the mutilated language patterns to a receiver who attempts to make the mutilated patterns whole again (see Appendix B). According to Taylor (1953): "One can think of cloze procedure as throwing all potential readability influences in a pot, letting them interact, then sampling the result (p. 417)."

Based on the results of the myriad of studies conducted with cloze procedure since it was developed, Rupley (1973) stated that

... it is fairly safe to assume that cloze can be used reliably in determining readability. A logical analysis of readability formulae that are concerned with polysyllabic words seems to indicate the word attack skills needed to read the material; however, if cloze analysis were used in conjunction with the readability formulae, perhaps a better prediction of the appropriateness of the material could result (p. 498).

Determining the appropriateness of a piece of printed health information so that this material could be fitted into a patient's custom-made health management plan is important. Reader and Schwartz (1973) have discovered that, thus far, commercial efforts to develop health educational
materials that could be prescribed by physicians in much the same way that they prescribe medications have not been successful. If the readability of patient education materials were known and a diagnosis of the patient's reading skills were made, then an "educational prescription" could be written. Obviously physicians do not have the time nor the expertise to obtain the necessary data on the readability of printed materials and the patient's ability to comprehend the material. Health educators must fill this role. Rankin (1959) submitted that the cloze procedure has a tremendous potential for practical use in the field of education. He stated that "... cloze tests can easily be constructed and scored by personnel who are neither experts on the subject matter of the test nor in the intricacies of test construction (p. 131)."

The use of the cloze procedure as a substitute for readability formulas in the measurement of passage difficulty has been investigated by a number of researchers. Various types of written materials have been used in readability studies with the cloze procedure (Taylor, 1953; Gallant, 1964; Schoelles, 1971; Froese, 1971; Schlief and Wood, 1974).

Printed health education materials, both text and non-text, have also been evaluated for their readability (Dale and Hager, 1950; R. M. Taylor, 1953; Zaharko, 1953; Hoyman and McTaggart, 1960; Lanese and Thrush, 1963; McTaggart,
Readability formulas were used by these researchers to make their assessments of the different materials studied. It appears from a review of the literature that the cloze procedure has not been used as a measure of the reading difficulty of printed health materials and that older adults have not been selected as a population of readers for testing this method.

**Statement of the Problem**

The central problem of this investigation was to determine whether the cloze procedure could be used as a criterion for measuring the readability of selected patient education materials for older adults. Is it a valid means whereby the health educator who is not a reading specialist can measure the language variables of a given piece of printed material and predict the success with which a group of older patients can read and comprehend it? Does advancing age among older adults and educational background in terms of years of schooling completed have any effect on predicting the readability of the printed material as determined by the cloze procedure?

In an attempt to answer these questions, the following null hypotheses were formulated and tested:

**Hypothesis I:** There is no significant difference between the predicted mean cloze test score as determined by the Coleman
readability formula for each test form and the actual mean cloze test score for each form.

Hypothesis II: There is no significant correlation between age and the cloze test scores for each form.

Hypothesis III: There is no significant correlation between the number of years of schooling completed and the cloze test scores for each form.

Hypothesis IV: There is no significant correlation between age, number of years of schooling completed and the cloze test scores for each form.

Hypothesis V: There is no significant effect of age on predicting the cloze test scores for each form.

Hypothesis VI: There is no significant effect of the number of years of schooling completed on predicting the cloze test scores for each form.

Hypothesis VII: There is no significant effect of age and the number of years of schooling completed on predicting the cloze test scores for each form.

Hypothesis VIII: There is no significant
difference in the actual mean cloze test scores for the three cloze test forms.

Definition of Terms

1. **Patient education.** Those health experiences designed to influence learning which occurs as a person receives preventive, diagnostic, therapeutic, and/or rehabilitative services, including experiences which arise from coping with symptoms, referral to sources of information, prevention, diagnosis and care, contacts with health institutions, health personnel, family, and other patients (Report of the Joint Committee on Health Education Terminology, 1973).

2. **Readability.** The sum total of all those elements within a given piece of printed material that affect the success that a group of readers will have with it (Dale and Chall, 1949).

3. **Readability formula.** The use of counts of language variables in a piece of writing in order to provide an index of probable difficulty for readers (Klare, 1974-75).

4. **Cloze procedure.** A method of intercepting a message from a "transmitter" (writer or speaker), mutilating its language patterns by deleting parts, and so administering it to "receivers" (readers or listeners) that their attempts to make the patterns whole again potentially yield a considerable number of cloze units (Taylor, 1953).
The amount of research generated in the area of readability since Irving Lorge published the first modern, easy-to-use formula in 1939 has been enormous. For the purpose of this study the review of literature on readability was focused on two specific areas: (1) the readability of health education materials and (2) the cloze procedure as a criterion for measuring readability. Since the population selected for this study consisted of older adults, the influence of age-related changes on cognitive functioning also needed to be considered. The literature in this area was reviewed for its pertinence to reading and learning in the later years of life.

The Readability of Health Education Materials

Probably one of the most extensive uses of readability was made by Edgar Dale for the National Tuberculosis Association between 1945 and 1950 (Chall, 1958). Representative pamphlets intended for lay readers were analyzed using the Flesch Reading Ease formula and other formulas. Jeanne Chall (1958) who worked with Dale on this project reported:

The text of most of these pamphlets was found to be at ninth-grade level and above. Tests and interviews on passages selected from these pamphlets were conducted with school children and adults. The results revealed that the formula predictions were, in general, correct and that most of the educational
materials were too difficult for the non-specialist reader. If the content were to be understood by a majority of adults, changes were necessary (p.149).

In addition to newly written materials for the National Tuberculosis Association, a significant by-product of Dale's research project was the Dale-Chall readability formula. This new formula was validated on health education materials for adults with the 1925 McCall-Crabbs Standard Test Lessons In Reading as the criterion (Chall, 1947).

The Dale-Chall formula, however, did not come into popular use among health education researchers until the 1960s. In the meantime the Flesch Reading Ease formula was widely used. Prior to 1953 no research studies using modern multiple-factor readability formulas to determine the reading difficulty of high school health texts had been reported. R. M. Taylor (1953), Hanson (1953), and Zaharko (1955) conducted studies at the University of Illinois and found that some widely used high school health texts were probably too difficult for average and poor readers while others were probably too easy for superior students.

Hoyman and McTaggert (1960) published a study of the new editions of texts previously tested by R. M. Taylor in 1953 and new health texts published since that time. Eleven widely used high school health texts dating from 1954 to 1959 were tested for grade level of reading difficulty. In general the results confirmed the previous studies by Taylor, Hanson, and Zaharko.
From a researcher's viewpoint, a given formula is applicable only to material similar to the criterion on which it is based (Chall, 1958). Both the Flesch and the Dale-Chall formulas are based on the same criterion, the McCall-Crabbs Standard Test Lessons In Reading. The major difference in these two formulas is that the Flesch formula depends on a syllable count and the Dale-Chall formula on a word list to aid in determining reading difficulty of a passage. The McCall-Crabbs Lessons were intended for use in grades three through seven. If the Flesch and Dale-Chall formulas are used to assess the readability of high school health materials, how valid are they? In the original presentation of his formula, Flesch (1948) presented evidence of its validity with adult magazines. Dale and Chall (1948a) offered evidence of the validity of their new formula in predicting reading difficulty of social studies and health materials. Considering these factors McTaggert (1964) attempted to evaluate both the Flesch and the Dale-Chall readability formulas as objective aids in selecting high school health texts. He concluded that both formulas had essentially equal validity when used to determine various levels of reading difficulty on passages taken from high school health texts.

Non-text materials, such as pamphlets, booklets, and instruction sheets, are written by various public and private health agencies for distribution to mass audiences.
as well as to patients. It is a well-known fact that most diabetic patients must adhere to quite a strict regimen in order to manage their condition. In order to develop a systematic program of self-maintenance, a diabetic must assimilate a tremendous amount of new information. This calls for an understanding of symptoms, medication, physical activity, the dynamics of body chemistry, as well as diet and nutrition. Since much of this new information is predicated on the reading of printed materials, Lanese and Thrush (1963) decided to investigate the potential effectiveness of this teaching medium. The analysis of a sample of the diabetic literature used in 21 teaching hospitals across the country revealed an average grade level of slightly above ninth grade in reading difficulty using the Dale-Chall readability formula. Extrapolating from the United States census data, it was discovered that over half of the national diabetic population over 45 years of age had not completed nine years of schooling. The rationale for presenting this older age group was due to the greater number of diabetic disorders and to the increased likelihood of reading and learning problems.

Although readability formulas can estimate the number of years of schooling needed to comprehend a piece of printed material, they cannot assess the patient's reading ability. Does a person who claims a ninth grade education always read at a ninth grade level? A study published in 1958
by the National Tuberculosis Association showed little correlation between education claimed by adults and actual reading ability.

The Bureau of the Census uses the term "functional literacy" in an attempt to assess the literacy (ability to respond competently to real-world reading tasks) of the population by tabulating the number of people 14 years of age and over who have not completed six years of school. Bormuth (1973-74) stated that

... there seems to be little basis for claiming that a person completing six years of school is literate. Even graduation from high school does not appear to be a very certain criterion of literacy. The fact is that the number of years a person has been in school is a very poor index of his ability to read, for within any grade level it is common to observe very wide variations in the reading abilities of the students. But even if grade level were an accurate index of literacy, the small amount of evidence that is now available would indicate that the grade six criterion is far too low and that the literacy rate is probably much higher than the Census Bureau would lead us to believe (p. 11).

Even if printed health education materials were rated for their grade levels using readability formulas, the reading ability of the patients for whom they are intended would still be unknown. The most widely used of current methods available to test reading ability are standardized tests of reading comprehension which were developed primarily for use with school children. Although these have been
used with adults, their practical application to measuring the ability of adults to comprehend health information is limited (Mohammed, 1964). The reading tests are based on conceptual material in such fields as history, geography, and literature, rather than on more technical subject matter such as would be found in health materials. As predictive tools for an adult's ability to comprehend written health information their validity is unknown. The administration of these tests is time consuming and limited in relevance to the patient's need for information, a factor which would lessen a patient's willingness to take them.

Mohammed (1964) devised a method for rapid assessment of an individual's ability to understand health information written at the fourth, sixth, and eighth grade levels as measured by the Dale-Chall readability formula. A series of five 100-word paragraphs was constructed at known grade levels. Each paragraph was followed by four multiple-choice questions with answers which were clearly stated in the paragraphs. Four trial runs, followed by item analysis and revisions, were completed before the final testing. Final testing was done on 300 ambulatory patients attending a Diabetes Clinic at University Hospitals of Cleveland. The results of Mohammed's study indicated that only 22.3 percent of the patients tested were able to profit from written health material through eighth grade level, 42.7 percent were unable to profit from material written at a
fourth grade level or above, and the ability to profit could not be established by the study for 35 percent of the patients.

Although internal criteria were applied to the test results to help determine their validity, no independent measure or external criterion of the validity of the tests was available for the population tested. Health educators must have a more valid method of finding out whether instructional materials are understandable to their patients. Bormuth (1968) suggested:

> The readability formulas presently available are too inaccurate to provide educators with much help in this matter. And, while it is now possible to construct highly valid readability formulas, such formulas are still in the development stages (p. 429).

The cloze procedure may provide a solution to the problem of determining the readability of patient education materials and the ability of the patient to comprehend them.

**The Cloze Procedure as a Measure of Readability**

Three major aspects of readability have been defined by reviewers such as Chall (1958) and Klare (1963): (1) legibility, (2) interest, and (3) ease of understanding or comprehensibility. This third aspect, the reader's ability to comprehend material due to certain language variables, has been dealt with almost entirely among the research generated relative to the cloze procedure and readability.
Support for the use of the cloze procedure as a technique for measuring readability has been gathered through attempts to determine the strength of the relationship between cloze tests and standard readability formulas. In his original investigation, Taylor (1953) found that cloze scores consistently ranked passages on the basis of difficulty as well as the Flesch and Dale-Chall formulas did. Passages which were easily worded but had a high concept load, such as those written by Gertrude Stein and James Joyce, were ranked more adequately by the cloze procedure in terms of their "true" readability than by either the Flesch or the Dale-Chall formulas. In subsequent studies with the Air Force, Taylor (1957) confirmed that a cloze procedure based on every nth deletion system could effectively contrast relative difficulties of different types of material. He also discovered that this technique had an advantage over the formulas in that it somehow included the idea density of a passage. Its major disadvantage lay in the required administration directly to readers, whereas the readability formulas could be used arithmetically to determine difficulty.

Using intermediate grade level students as subjects, Bormuth (1962, 1963) further confirmed that

... cloze tests were valid and highly reliable predictors of the comprehension difficulties of the passage and appropriate
for use with individuals and groups which vary widely in comprehension ability (1963, p. 134).

Gallant (1964) used the cloze procedure to determine the readability of materials for the primary grades and concluded that the cloze tests were valid and reliable measures of readability for the first three grades.

Materials written for use at the secondary level and above have also been evaluated as to their difficulty. Knight (1966) used the cloze procedure to investigate the comprehension difficulties of occupational information materials written on various readability levels and concluded that the rate of comprehension decreased as the readability of these materials decreased.

The use of cloze scores to determine the difficulty of prose in certain high school textbooks was found by Beard (1967) to be about the same for current textbooks of American government, world history, biology, and chemistry. For high and low ability readers in grades eight through twelve, Jefferson (1969) found that structural cloze units tended to be the best predictor of reading difficulty.

More recent studies, however, have shown conflicting results. Stephens (1971) used cloze tests constructed from passages in elementary science textbooks for grades four, five, and six as the criteria to determine whether the Dale-Chall readability formula, a revised Dale-Chall formula developed specifically for science materials by Holmquist,
or the Fry readability formula provided the most valid estimate of the readability level. He concluded that while readability estimates as determined by the Dale-Chall formula and the revised Dale-Chall formula were more in agreement with the results of the cloze tests than were the readability estimates of the Fry formula, none of the three formulas appeared to provide a valid estimate of the reading difficulty of passages taken from elementary science textbooks.

Although the cloze procedure can be used in placing students in graded materials of the appropriate difficulty and in selecting materials for a group of students (Jongsma, 1970), very little research has been done in assessing the reading status of adults using the cloze procedure. Robinson (1973) conducted a study to evaluate the cloze procedure as a viable alternative to traditional methods of testing adult reading ability and the selection of appropriate materials for this group. The subjects for his study consisted of a group of adults with limited reading ability. Cloze test scores were obtained on a series of seven passages. Four readability formulas: Lorge, Gunning Index, Dale-Chall and Spache were applied to these same passages to obtain predicted reading grade levels. The four traditional readability formulas reflected a wide range of differences in their scores. In contrast to this result, cloze ranked the seven passages as being almost equal in difficulty. A rank order coefficient of correlation was computed
between the ranked cloze scores and the four selected readability formulas. None of the correlations were significant at either the .05 or .01 level. Robinson's results appear to be consistent with those of Stephens (1971) and Schlief and Wood (1974).

None of the three studies just reviewed used a cloze-derived readability formula. All of the formulas used were derived from multiple-choice reading comprehension tests. Miller (1975) states that "the predictive power of a readability formula is heavily affected by the construct validity of the comprehension test from which it was derived (p. 52)." Two leading reading researchers, Bormuth and Coleman, believe that cloze tests measure reading comprehension more accurately than do multiple-choice tests (Bormuth, 1969a; Miller and Coleman, 1967) and also can generate more valid and reliable readability formulas than multiple-choice tests (Bormuth, 1969b; Coleman, 1971). Based on these claims Bormuth and Coleman each derived readability formulas from cloze reading comprehension tests. These formulas generated significantly higher validity coefficients on the cloze tests than did the most popular multiple-choice-derived formulas (Flesch and Dale-Chall) on their original criterion tests (Bormuth, 1969b; Coleman, 1971; Flesch, 1948; Dale and Chall, 1948a). Miller (1975) noted that

... although Bormuth and Coleman had demonstrated that their formulas generate higher validity coefficients on
cloze criterion tests than multiple-choice-derived formulas generate on multiple-choice criterion tests, they did not demonstrate ... the extent to which a multiple-choice-derived formula can predict to a cloze criterion test (p. 53).

Miller (1975) subsequently designed a study to answer the question: "Can a multiple-choice-derived formula predict as well to a cloze criterion test as a cloze-derived readability formula?" Selected for his study were the Flesch Reading Ease formula and the Coleman Number Four formula. The cross-validation tests chosen were the 1961 McCall-Crabbs Standard Test Lessons In Reading (multiple-choice) and the 1969 Bormuth Reading Comprehension Test (cloze). The parametric Pearson Product-Moment statistical tool was used to generate validity coefficients. Using the t-test, the statistical evidence indicated that there were no significant differences between the two formulas in their abilities to predict to the cloze criterion.

Obviously more research is needed before investigators will be able to say conclusively that (1) cloze tests, multiple-choice tests or some other method is the most valid technique for measuring reading comprehension and (2) a cloze-derived, multiple-choice-derived or some-other-method-derived readability formula is the most valid estimate of the reading difficulty of sample passages from printed materials. It is hoped that this present investigation has contributed to the store of information necessary to make
such a judgment.

Age-related Changes in Reading and Learning

While the research in reading is voluminous, the research for adult populations is meager. DeSanti (1976) reviewed the literature and found a definite paucity of research regarding the reading of older persons. It is no surprise to find that "reading research has reflected the attitude of our society as a whole where the young are catered to and the old are at best, tolerated, and at worst, ignored (DeSanti, 1976)."

A National Survey of Adult Functional Reading Performance was undertaken in 1972 and 1973 (Murphy, 1975). Simple reading tasks based on day-to-day reading activities could be answered correctly by most American adults. However, there were significant differences between groups of adults. Data for five test items was reported by age group. The percentage of correct responses for individuals over 60 years of age was lower than for individuals under 60 years of age on four of the five test items.

In studies, such as the one just cited, where chronological age is an independent variable, this parameter is often unsatisfactory. Individuals of identical age may vary widely in attributes that modulate reading ability, learning or any other form of cognition (Maletta, 1975). Education, health, perceptual deficits, and motivation are a few
such attributes.

Quite early, research investigators began to be aware of discrepancies between any universal theory of cognitive decline and the number of older individuals with good mental functioning. In 1930, Sorenson concluded that at least up to age 50 there is no decline in learning ability for those actively engaged in study. Wiersma (1930) believed that mental functions remain unimpaired to a very advanced age in those gifted in earlier life with lively interests. Miles and Miles (1932) also found mental decline with age smaller in the more highly educated than in the less educated.

In working with individuals between the ages of 70 and 100, Kubo (1938) reported that rote memory did not show a sudden fall until the age of 82, when it decreased rapidly. Delving further into the correlates of memory and age, Gilbert (1941) found memory loss less in the brightest than in the less bright older persons. Lorge (1956) believed that memory decline was a function of the educational status of the individuals he tested while Eisdorfer (1962) found differential rates of decline in cognitive ability with increasing age as a function of intellectual level.

In most memory studies, either recall or recognition is measured. It is often held that recognition does not involve retrieval (Botwinick and Storandt, 1974). Instead it involves a matching of information in the memory store with
information in the environment. While ability to recall is seen to decline with age, the ability to recognize does not, or does so to a very much smaller degree (Schonfield, 1965). More recent tests of recognition memory conducted by Botwinick and Storandt (1974), however, showed an unqualified age effect. Eleven percent of the performance variance was accounted for by the age of the subject. In all four tests that were given trends of age decline were seen and were reflected in a significant overall age difference in the multivariant analysis of variance. These data suggest that recognition memory, like recall memory, declines with age, although the decline may not be as easily manifest with simple tasks.

While a failing memory can make learning difficult for the older person, there are three other factors, in addition to those already mentioned, in the learning process which change significantly with increasing age. First, Lorge (1936), Welford (1958), and Birren (1968) have called attention to the effect of speed on test results. Welford (1958) has suggested that the older person's capacity to deal with new learning situations may be maintained either by increasing the span of time allowed for comprehension of visual or verbal data by removing the pressure of time and/or by intensifying the incoming information. Birren (1968) concluded that the only aspect of mental performance that seems to change in most persons is that of slowing speed of
response. He noted that age changes in speed of response do not seem to bear as intimate a relationship to survival as does stored verbal information. Second, anxiety may have more effect on the test performance of older subjects than on younger subjects. Carpenter (1967) found that performance on tests designed to measure changes in information processing capacity and channel capacity of adults declined as age increased. The most significant differences were on the least complex tests which were presented first. It was assumed that a higher anxiety state masked the performance of older subjects in the earlier tests, but as this state faded out older subjects reached their peak performance which was very little, if any, below that of the younger subjects.

Finally, health status may have a significant effect on the ability of older persons to benefit from learning experiences. Schaie and Strother (1968) reported that their studies confirmed that healthy subjects retained useful cognitive function even at ages 70-88. Longitudinal studies of mental abilities in aged men conducted by Birren (1970) implied that some of the higher cognitive processes measured by standard intelligence tests were more related to the health status of the individual than to chronological age. Wilkie and Eis dorfer (1971) found that cognitive decline was correlated better with hypertension than with age. They concluded that

... the presence of large numbers of aged
with cardiovascular illness suggests that the basis for cognitive decline associated with aging after maturity should be considered secondary to some pathologic process and not merely as a "normal" aging process (p. 962).

Although studies giving detailed information about the distribution of mental competence of the elderly in the general population have not been conducted, the existing evidence from smaller populations indicates that there is no gradual decline with age in general mental ability (Birren, 1968).

**Summary**

Readability formulas such as the Flesch Reading Ease and the Dale-Chall have been used to evaluate text and non-text materials in patient education. These formulas can estimate the number of years of schooling needed to comprehend a piece of printed material, but they cannot assess an individual's actual ability to read. Standardized tests of reading comprehension used with school-age children are not always suitable for use with adults, especially older adults. Health educators need a valid measure of the readability of printed materials and a valid measure of the reading ability of adults so that printed materials can be more accurately matched to adult reading levels.

The cloze procedure developed by Taylor (1953) can provide a measure of both the readability of printed materials and the reading comprehension ability of individual readers.
A major advantage of the cloze procedure over readability formulas is its ability to include the idea density of a passage from a piece of printed material. Although the cloze procedure has been used in matching students with materials of appropriate difficulty and in selecting materials for a group of students, very little research has been done in assessing the reading status of adults using this procedure.

Indeed, research in the area of reading among older adults is very scant. Most of the research done on the mental functioning of older adults has been in the areas of intelligence and memory as they relate to learning. Results of this research have shown that cognitive decline is a function of innate native ability, education, interests, motivation, declining speed of neural response, anxiety, and health status rather than chronological age alone. Healthy individuals can and do continue to profit from learning experiences throughout the later years of life.
III. RESEARCH DESIGN AND METHODOLOGY

Population

The population for this study consisted of adults 60 years of age and over who eat a noon meal at the 13 program sites operated by the Oregon District Four Elderly Nutrition Program. The sites are located in Corvallis, Monroe, Philomath, Lincoln City, Newport, Toledo, Waldport, Albany, South Albany, Brownsville, Lebanon, Scio, and Sweet Home.

There are a number of opinions as to what ages constitute young, middle, and older adults, although none are in agreement (Bischof, 1969; Kimmel, 1974). The age level for this study, therefore, was set by the investigator as 60 years and over for older adults to comply with the age requirements in the District Four Elderly Nutrition Program.

Although the population chosen limited the inferences that could be made from this study, this particular group of older adults was chosen for the following reasons:

(1) The investigator was already involved in the Nutrition Program so the subjects were readily available for study.

(2) Emphasis was already placed on educational activities as a part of the total nutritional program at the meal sites.

(3) The Director of the District Four Elderly Nutrition Program expressed interest and cooperation in this type of study.

(4) A non-institutionalized population.
was desired.

(5) The Nutrition Program provided access to a broader range of people in terms of educational background and occupation than would have been found at the Senior Centers in District Four.

(6) Travel and financial factors placed more constraints on the investigator.

A master list of all participants at the 13 program sites was compiled. From this list a random sample was drawn using a table of random numbers (Downie and Heath, 1974). If a subject was not able to read the cloze test due to either poor vision or lack of educational background, or if a participant chose not to take part in the study, another name was randomly selected from the list to serve as a replacement.

Twenty-eight subjects completed each test form. An individual subject, however, completed only one test form. The sample size for each cloze test form was based on research done by Bormuth (1965) to determine the optimum sample size and cloze test length. Reliable results can be obtained on a given passage with a sample size from 25 to 30 (Bormuth, 1968). The total sample size for the three test forms together was 84 subjects.

This present study was reviewed and approved by the Oregon State University Committee for the Protection of Human Subjects. This was done in accordance with the Policy on Protection of Human Subjects of the United States Department of Health, Education and Welfare (Appendix A).
Instruments

The instruments used in this study to gather data on the readability of selected patient education materials were three separate cloze test forms. Each form represented a selected passage from a piece of printed health information. The revised Dale-Chall readability formula by Powers, Sumner, and Kearl (1958) was used to determine the initial difficulty of the selected passages and to revise the readability level to conform to a sixth-grade reading level prior to the construction of the cloze tests. The Coleman readability formula (Klare, 1974-75) was used to predict the cloze score on each of the revised passages.

The cloze tests

In 1953 Wilson Taylor devised a technique for measuring the effectiveness of communication which he called the "cloze procedure." The term "cloze" was coined from the Gestalt concept of closure, a tendency to form a complete whole by filling the gaps in a structure.

Step 1. The first step in using the cloze procedure is to choose a mechanical system of deleting the same number of words from each sample. Words are either counted out (every nth word might be deleted) or they are selected by the use of a table of random numbers. In his later research Taylor (1956) indicated that an analysis of a subject's performances on successive blanks created by every-
fifth-word deletion was statistically independent. A study by MacGinitie (1961) lent further support to a deletion rate of every fifth word. Bormuth (1964) examined the effects of different cloze forms, particularly with respect to their reliability in measuring the comprehension difficulties of passages. The results of his study indicated that cloze exercises of less than 50 items tend to be unreliable. This is consistent with Taylor's (1956) earlier findings. Schlief and Wood (1974), on the other hand, deleted every tenth word in the construction of cloze tests from technical materials. Since health education materials tend to be very technical, perhaps a 30-deletion test would be less difficult than a 50-deletion test. Likewise, older persons may tire more easily with a 50-deletion pattern than with a 30-deletion pattern. Due to the uncertainty of which pattern to use with older persons and the lack of a precedent from the literature on which to base a decision, a short pilot study was conducted prior to the commencement of the actual data gathering for this present study.

**Pilot Study.** Twelve persons over 60 years of age were randomly selected from among acquaintances of the investigator to participate in the pilot study. Two cloze test forms were constructed from an American Heart Association pamphlet on high blood pressure (Appendix B). Form AA consisted of 50 deletions and Form A had 30 deletions. Each person was asked to complete both forms in the presence of
the investigator. No time limit was imposed. A t-value was computed for the correlated data to test the null hypothesis that there is no significant difference between the mean cloze test scores on the two forms. The computed t-value was -0.1685 and the tabular t-value with 11 degrees of freedom at the .05 probability level was 2.201. The null hypothesis was retained and on this basis the decision was made to use a 50-deletion pattern in constructing the cloze tests for the larger study.

Step 2. The second step in the cloze procedure is to reproduce the mutilated passages with all missing words replaced by standard-size blanks. Subjects are asked to close up the gaps in the passages by guessing the identities of the missing words and writing their guesses in the corresponding blanks.

Step 3. The third and final step in the cloze procedure is scoring the test. Each time a subject correctly guesses a missing word, he/she scores one point. His/her cloze score for any particular passage is simply the total number of missing words that he/she guesses correctly. Jongsma (1970) surveyed the research on the scoring aspect of cloze methodology and found that the literature consistently showed the scoring of exact replacements to be the most objective, efficient, and useful scoring system to use with the cloze procedure. Jongsma concluded:

Although slightly higher reliability
has been obtained at times using other procedures, such as a synonym count, the increased time and subjectivity necessary for such systems do not warrant their use (pp. 7-8).

The scores of individual subjects are used to allocate a group mean score, standard deviation, and variance for a given passage of printed material. The raw scores, however, must be converted to percentage of correct completions for the purpose of analysis and interpretation.

Cloze tests are usually administered to subjects who have not read the passages before and are given in an untimed situation.

The Dale-Chall formula

Dale and Chall presented their formula for adult materials in 1948. It quickly became, along with Flesch's Reading Ease formula, one of the two most widely used (Klare, 1974-75). Powers, Sumner, and Kearl (1958) provided a recalculated version of the Dale-Chall formula based upon the 1950 edition of the McCall-Crabbs Standard Test Lessons In Reading. They found a correlation using their recalculated formula with the 1950 McCall-Crabbs scores of .71, which is virtually the same as the .70 found with the 1925 McCall-Crabbs scores by Dale and Chall (1948a).

The recalculated formula is as follows:

$$X_{c50} = 3.2672 + 0.1152X_1 + 0.0596X_2$$

where: $X_{c50}$ = reading grade score of a
pupil who could answer one-half the test questions on a passage correctly;

\[ X_1 = \text{Dale score, or percentage of words outside the Dale list of 3,000.} \]

\[ X_2 = \text{average sentence length in words.} \]

Rules for selecting samples of passages to be analyzed and for computing the average sentence length and percentage of unfamiliar words can be found in a reprint of Dale and Chall's 1948 (b) article. To facilitate a more rapid determination of the Dale-Chall scores Williams (1972) has devised a table for the revised (1958) Dale-Chall readability scores.

The Coleman formulas

Coleman completed a research project in 1965 sponsored by the National Science Foundation in which he presented four readability formulas for general use (Klare, 1974-75).\(^1\)

Coleman's formulas are notable for the first use of the cloze procedure as a criterion rather than the commonly used McCall-Crabbs Lessons or rankings by judges. Coleman's four formulas took the following forms:

\[ C\% = 1.29w - 38.45 \]

\[ C\% = 1.16w + 1.48s - 37.95 \]

\(^1\)Since the final report of the project in which they appeared is not easily obtained, a secondary source was used.
C% = 1.07w + 1.18s + 0.76p - 34.02
C% = 1.04w + 1.06s + 0.56p - 0.36prep - 26.01

where:  C% = percentage of correct cloze completions;

  w = number of one-syllable words per 100 words;

  s = number of sentences per 100 words;

  p = number of pronouns per 100 words;

  prep = number of prepositions per 100 words.

Coleman found multiple correlations of .86, .89, .90, and .91, respectively, for his formulas with cloze criterion scores. In a cross-validation study Szalay (1965) found correlations of .83, .88, .87, and .89, respectively, for the four formulas with cloze scores on a new set of passages. It appears from these two studies that the use of cloze scores as a criterion consistently provides higher validation coefficients than does use of the McCall-Crabbs scores. For the purpose of this present study only the fourth Coleman formula was used.

Procedures

Printed patient education materials are available from individual medical personnel, hospital groups, voluntary and official health agencies, insurance companies, and pharmaceutical companies. Three of these organizations were selected to provide materials for this study. The criteria
used in making the choices of printed materials included:

(1) A topic which presents a major chronic illness among older adults

(2) Use of the printed material in the state of Oregon

(3) Interest of the sponsoring organization and willingness to provide materials

The topic of hypertension was chosen for this study as it is one of the four major chronic diseases which occur more frequently as aging progresses (USDHEW, 1971). Hypertension screening is also conducted regularly at all of the meal sites in the Oregon District Four Elderly Nutrition Program. The following three commonly used pamphlets on hypertension were selected:

(1) "High blood pressure and how to control it." Pamphlet no. 50-009-A. Published by the American Heart Association, 1974.


From each pamphlet a 250-word passage was randomly selected. Each passage was continuous prose and did not make any references to illustrations. Introductory paragraphs were omitted from the choices, as they are usually not typical of the style of the whole piece (Flesch, 1960). Each sample passage, however, started at the beginning of a paragraph and ended in a complete sentence. This produced
more than 250 words but did not affect the structure of the cloze test.

To make the selected passages more readable (Appendix C), each sample was rewritten to conform to a sixth-grade reading level, which is the level of functional literacy as specified by the United States Bureau of the Census (Bormuth, 1973-74). The criteria for readability was the Dale-Chall formula. It was chosen because it was originally validated with health education materials and it is more widely used among health educators in evaluating the reading difficulty of printed health information materials. The fourth Coleman formula was applied to the revised sample passage to determine the predicted percentage of correct completions for each form of the cloze tests.

Each selected passage was then typed omitting every fifth word beginning with the fifth word in the first sentence and continuing this pattern until 50 words had been deleted. In the place of each omitted word was a standard line of 15 typed spaces. Each of the different cloze tests was designated by a form letter: A, B, or C. An instruction sheet accompanied each test (see Appendix C). Two items of descriptive information were elicited from each subject: age and number of years of schooling completed.

The tests were hand scored using exact replacements only as correct answers. Misspelled words were counted as long as they could be read by the investigator. The raw
cloze scores were converted to percentage of correct completions. This step was taken to allow for the comparison of the actual cloze test scores and the predicted scores on each form as determined by the Coleman formula.

**Analysis of Data**

Data from the cloze tests and the descriptive information on each subject were analyzed on the CDC 3300 computer at the Oregon State University Computer Center.

In testing Hypothesis I for significant difference between the predicted cloze test score as determined by the Coleman formula and the actual cloze test scores on each form of the test, a Student's t-test was used. The t-test was selected because (1) the sample size was less than 30 subjects, (2) the data scales were of equidistant interval type, (3) the dependent variable was normally distributed, and (4) two groups of data were to be compared (Courtney and Sedgwick, 1974).

The relationships between age and the cloze test scores and between the number of years of schooling completed and the cloze test scores (Hypotheses II and III) were tested with the Pearson Product Moment Correlation Coefficient (Pearson r). According to Courtney and Sedgwick (1974) the Pearson r is appropriately used for determining the degree of linear relationship which exists between two measures. Such measures must necessarily consist of equidistant
interval scale data and the data must approximate a normal distribution. Multiple correlation was computed for testing Hypothesis IV.

Regression analyses, both linear and multiple, were used as techniques for testing Hypotheses V, VI, and VII. Courtney and Sedgwick (1972) describe regression analysis as a statistical technique used in problems which call for the prediction of Y (the dependent variable) from X (the independent variable) as the goal. In this present study the values for the independent variables were age and the number of years of schooling completed and the values for the dependent variable were the cloze test scores. The following assumptions were met:

(1) The X values were measured and known.

(2) The Y values were normally and independently distributed.

(3) The relationship between predictors (Xs) and the dependent variable (Y) was linear.

The third assumption was determined in the testing of Hypotheses II, III, and IV before regression coefficients were generated.

The F statistic was used to test the difference in the mean cloze test scores on the three cloze test forms. The assumptions of independent random samples drawn from a normal population and having common variances were met (Courtney and Sedgwick, 1973). To determine the location of significant differences between the means separate multiple
comparisons tests were run.

For all tests of hypotheses, findings for which the probability is less than .05 were reported as non-significant.

**Limitations**

Before generalizations or inferences could be made from this study, the following factors had to be taken into consideration:

1. The population was limited to older adults, ages 60 and over, who were participants in the Oregon District Four Elderly Nutrition Program.

2. The selected patient education materials represented a limited number of the organizations publishing such materials and represented only one commonly encountered chronic condition of older adults.

3. Only one deletion pattern was used in the construction of the cloze tests.

4. Only two standard readability formulas were used from among many which are available. Both of these were manually applied to the printed materials.

5. Readability formulas do not take into account such important aspects of readability as organization, the nature of the content, or physical features of the material such as size of type and illustrations. They measure only factors related to style as a determinant of reading
difficulty (McTaggert, 1964).

**Basic Assumptions**

In addition to the already mentioned assumptions related to the analysis of data, the following assumptions must be considered:

1. Printed patient education materials are composed of language variables which can be measured to predict the reading difficulty of a passage.

2. If readability means that a passage is comprehensible, then the scores that measure readability should also measure comprehension.

3. The cloze procedure and readability formulas are reliable measures of readability with short, non-text materials.

4. Cloze tests are affected not only by those factors within the reading material itself but also by specific reader characteristics which affect the difficulty of the materials for that particular group of readers. Age is a specific reader characteristic which could affect the difficulty of the materials for older readers. It is assumed that younger readers will find the same materials less difficult than older readers.

5. Cloze test scores depend more on general knowledge of the printed language than on special knowledge of the material being read.
(6) Cloze test scores depend on short-range constraints; that is, almost entirely on the words on each side of the blank.

(7) The subjects in the study have put forth a sincere effort to complete the cloze tests according to their reading ability and the difficulty of the passage.
IV. RESULTS

Demography of the Sample

The sample for this study was comprised of 84 adults, 60 years of age and over, who eat a noon meal at the 13 program sites operated by the Oregon District Four Elderly Nutrition Program. The sites are located in Corvallis, Monroe, Philomath, Lincoln City, Newport, Toledo, Waldport, Albany, South Albany, Brownsville, Lebanon, Scio, and Sweet Home.

A total of 1114 older adults comprised the master list representing all 13 sites. From this list 145 subjects were randomly selected. A summary of the subjects selected from each site is presented in Table 1. Thirty-six or 24.8 percent of the subjects selected could not be contacted at home after two visits and were thus eliminated from the study sample. The 11.7 percent (17 subjects) who were at home but chose not to participate in the study and the 5.5 percent (8 subjects) who were unable to read the cloze test were also eliminated. The remaining 84 subjects (58 percent) completed the cloze tests and comprised the final sample for this study. These percentages for drop-out and participation are summarized in Table 2.

The data matrices for the three cloze tests are presented in Tables 3-5. The mean age for the entire sample was 74.04 years, with a standard deviation of 6.85 years, a
Table 1. Adults of 60+ years of age selected in the Oregon District Four Elderly Nutrition Program.

<table>
<thead>
<tr>
<th>Program site</th>
<th>Adults randomly selected</th>
<th>Not home (2 visits)</th>
<th>Did not want to participate</th>
<th>Blind</th>
<th>Given test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corvallis</td>
<td>20</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
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</tr>
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<tr>
<td>Lincoln City</td>
<td>15</td>
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<td>2</td>
<td>0</td>
<td>10</td>
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<tr>
<td>Newport</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Toledo</td>
<td>12</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Waldport</td>
<td>10</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Albany (A)</td>
<td>21</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>South Albany (B)</td>
<td>9</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Brownsville</td>
<td>12</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Lebanon</td>
<td>16</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Scio</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Sweet Home</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>145</strong></td>
<td><strong>36</strong></td>
<td><strong>17</strong></td>
<td><strong>8</strong></td>
<td><strong>84</strong></td>
</tr>
</tbody>
</table>
Table 2. Drop-out and participation percentages.

<table>
<thead>
<tr>
<th>Total sample for study</th>
<th>Not home</th>
<th>Did not want to participate</th>
<th>Blind</th>
<th>Given test</th>
</tr>
</thead>
<tbody>
<tr>
<td>145</td>
<td>36</td>
<td>17</td>
<td>8</td>
<td>84</td>
</tr>
<tr>
<td>(100%)</td>
<td>(24.8%)</td>
<td>(11.7%)</td>
<td>(5.5%)</td>
<td>(58.0%)</td>
</tr>
</tbody>
</table>

variance of 46.92 years and a range of 32 years (ages 61-93). The mean number of years of schooling completed for the sample of 84 subjects was 10.55 years, with a standard deviation of 2.93 years, a variance of 8.58 years and a range of 13 years (4-17 years of schooling completed). The descriptive characteristics of the data for each separate cloze test form are summarized in Table 6. The mean age for each test form sample was within one standard deviation of the total sample mean. The mean number of years of schooling completed for each cloze test form sample was likewise within one standard deviation of the total sample mean. Each sub-sample, therefore, was representative of the total sample in age and in the number of years of schooling completed.

Results of the Hypotheses Tested

This study analyzed eight hypotheses concerned with (1) the use of the cloze procedure as a measure of the readability of selected patient education materials, (2) the relationships of age, number of years of schooling completed and actual cloze test scores, (3) the effects of age and
Table 3. Data matrix for cloze test: Form A

<table>
<thead>
<tr>
<th>Subject</th>
<th>Cloze score (%)</th>
<th>Age (years)</th>
<th>Schooling completed (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>62</td>
<td>77</td>
<td>17</td>
</tr>
<tr>
<td>2</td>
<td>54</td>
<td>66</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>54</td>
<td>79</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>71</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>64</td>
<td>68</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>60</td>
<td>61</td>
<td>12</td>
</tr>
<tr>
<td>7</td>
<td>30</td>
<td>77</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>44</td>
<td>73</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>34</td>
<td>80</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>40</td>
<td>73</td>
<td>9</td>
</tr>
<tr>
<td>11</td>
<td>56</td>
<td>81</td>
<td>8</td>
</tr>
<tr>
<td>12</td>
<td>46</td>
<td>78</td>
<td>14</td>
</tr>
<tr>
<td>13</td>
<td>56</td>
<td>73</td>
<td>9</td>
</tr>
<tr>
<td>14</td>
<td>60</td>
<td>65</td>
<td>13</td>
</tr>
<tr>
<td>15</td>
<td>52</td>
<td>69</td>
<td>17</td>
</tr>
<tr>
<td>16</td>
<td>50</td>
<td>78</td>
<td>11</td>
</tr>
<tr>
<td>17</td>
<td>52</td>
<td>80</td>
<td>11</td>
</tr>
<tr>
<td>18</td>
<td>40</td>
<td>77</td>
<td>12</td>
</tr>
<tr>
<td>19</td>
<td>48</td>
<td>73</td>
<td>8</td>
</tr>
<tr>
<td>20</td>
<td>56</td>
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<tr>
<td>21</td>
<td>46</td>
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<td>22</td>
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<tr>
<td>23</td>
<td>54</td>
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<td>12</td>
</tr>
<tr>
<td>24</td>
<td>54</td>
<td>71</td>
<td>12</td>
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<td>25</td>
<td>30</td>
<td>76</td>
<td>8</td>
</tr>
<tr>
<td>26</td>
<td>48</td>
<td>68</td>
<td>10</td>
</tr>
<tr>
<td>27</td>
<td>66</td>
<td>69</td>
<td>14</td>
</tr>
<tr>
<td>28</td>
<td>46</td>
<td>74</td>
<td>8</td>
</tr>
</tbody>
</table>
Table 4. Data matrix for cloze test: Form B.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Cloze score (%)</th>
<th>Age (years)</th>
<th>Schooling completed (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>26</td>
<td>83</td>
<td>4</td>
</tr>
<tr>
<td>30</td>
<td>56</td>
<td>76</td>
<td>13</td>
</tr>
<tr>
<td>31</td>
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<td>78</td>
<td>14</td>
</tr>
<tr>
<td>32</td>
<td>50</td>
<td>81</td>
<td>13</td>
</tr>
<tr>
<td>33</td>
<td>52</td>
<td>62</td>
<td>9</td>
</tr>
<tr>
<td>34</td>
<td>36</td>
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<tr>
<td>35</td>
<td>38</td>
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<td>80</td>
<td>9</td>
</tr>
<tr>
<td>37</td>
<td>58</td>
<td>70</td>
<td>15</td>
</tr>
<tr>
<td>38</td>
<td>44</td>
<td>67</td>
<td>12</td>
</tr>
<tr>
<td>39</td>
<td>28</td>
<td>67</td>
<td>8</td>
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<td>76</td>
<td>7</td>
</tr>
<tr>
<td>41</td>
<td>56</td>
<td>70</td>
<td>17</td>
</tr>
<tr>
<td>42</td>
<td>40</td>
<td>70</td>
<td>12</td>
</tr>
<tr>
<td>43</td>
<td>56</td>
<td>82</td>
<td>8</td>
</tr>
<tr>
<td>44</td>
<td>42</td>
<td>83</td>
<td>9</td>
</tr>
<tr>
<td>45</td>
<td>24</td>
<td>69</td>
<td>10</td>
</tr>
<tr>
<td>46</td>
<td>38</td>
<td>76</td>
<td>8</td>
</tr>
<tr>
<td>47</td>
<td>32</td>
<td>72</td>
<td>8</td>
</tr>
<tr>
<td>48</td>
<td>38</td>
<td>75</td>
<td>8</td>
</tr>
<tr>
<td>49</td>
<td>48</td>
<td>72</td>
<td>12</td>
</tr>
<tr>
<td>50</td>
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<td>26</td>
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<tr>
<td>52</td>
<td>34</td>
<td>62</td>
<td>8</td>
</tr>
<tr>
<td>53</td>
<td>56</td>
<td>69</td>
<td>17</td>
</tr>
<tr>
<td>54</td>
<td>50</td>
<td>82</td>
<td>15</td>
</tr>
<tr>
<td>55</td>
<td>28</td>
<td>86</td>
<td>5</td>
</tr>
<tr>
<td>56</td>
<td>50</td>
<td>74</td>
<td>11</td>
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</table>
Table 5. Data matrix for cloze test: Form C.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Cloze score (%)</th>
<th>Age (years)</th>
<th>Schooling completed (years)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>46</td>
<td>64</td>
<td>10</td>
</tr>
<tr>
<td>58</td>
<td>52</td>
<td>62</td>
<td>12</td>
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<tr>
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<td>70</td>
<td>74</td>
<td>17</td>
</tr>
<tr>
<td>60</td>
<td>34</td>
<td>73</td>
<td>8</td>
</tr>
<tr>
<td>61</td>
<td>58</td>
<td>69</td>
<td>7</td>
</tr>
<tr>
<td>62</td>
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<td>64</td>
<td>12</td>
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<td>71</td>
<td>6</td>
</tr>
<tr>
<td>69</td>
<td>56</td>
<td>63</td>
<td>12</td>
</tr>
<tr>
<td>70</td>
<td>46</td>
<td>71</td>
<td>9</td>
</tr>
<tr>
<td>71</td>
<td>30</td>
<td>87</td>
<td>8</td>
</tr>
<tr>
<td>72</td>
<td>56</td>
<td>74</td>
<td>13</td>
</tr>
<tr>
<td>73</td>
<td>36</td>
<td>79</td>
<td>8</td>
</tr>
<tr>
<td>74</td>
<td>50</td>
<td>63</td>
<td>9</td>
</tr>
<tr>
<td>75</td>
<td>62</td>
<td>75</td>
<td>13</td>
</tr>
<tr>
<td>76</td>
<td>38</td>
<td>93</td>
<td>8</td>
</tr>
<tr>
<td>77</td>
<td>62</td>
<td>71</td>
<td>12</td>
</tr>
<tr>
<td>78</td>
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<td>84</td>
<td>8</td>
</tr>
<tr>
<td>79</td>
<td>34</td>
<td>74</td>
<td>6</td>
</tr>
<tr>
<td>80</td>
<td>28</td>
<td>78</td>
<td>8</td>
</tr>
<tr>
<td>81</td>
<td>38</td>
<td>75</td>
<td>16</td>
</tr>
<tr>
<td>82</td>
<td>52</td>
<td>81</td>
<td>14</td>
</tr>
<tr>
<td>83</td>
<td>48</td>
<td>80</td>
<td>8</td>
</tr>
<tr>
<td>84</td>
<td>46</td>
<td>73</td>
<td>10</td>
</tr>
</tbody>
</table>
Table 6. Descriptive data for cloze tests: Forms A, B, and C.

<table>
<thead>
<tr>
<th>Cloze test</th>
<th>Cloze scores (%)</th>
<th>Age (years)</th>
<th>Schooling (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\bar{x}$</td>
<td>$s$</td>
<td>$\bar{x}$</td>
</tr>
<tr>
<td>Form A</td>
<td>48.71</td>
<td>10.96</td>
<td>74.89</td>
</tr>
<tr>
<td></td>
<td>$s^2$ range</td>
<td>$s^2$ range</td>
<td>$s^2$ range</td>
</tr>
<tr>
<td></td>
<td>120.12</td>
<td>20-66</td>
<td>45.43</td>
</tr>
<tr>
<td>Form B</td>
<td>41.64</td>
<td>10.80</td>
<td>73.71</td>
</tr>
<tr>
<td></td>
<td>$s^2$ range</td>
<td>$s^2$ range</td>
<td>$s^2$ range</td>
</tr>
<tr>
<td></td>
<td>116.64</td>
<td>24-58</td>
<td>41.34</td>
</tr>
<tr>
<td>Form C</td>
<td>46.92</td>
<td>12.50</td>
<td>73.50</td>
</tr>
<tr>
<td></td>
<td>$s^2$ range</td>
<td>$s^2$ range</td>
<td>$s^2$ range</td>
</tr>
<tr>
<td></td>
<td>156.25</td>
<td>22-70</td>
<td>56.25</td>
</tr>
</tbody>
</table>
number of years of schooling completed on predicting cloze test scores, and (4) the differences in the three cloze test forms.

Hypothesis I: There is no significant difference between the predicted mean cloze test score as determined by the Coleman readability formula for each test form and the actual mean cloze test score for each form.

The Coleman readability formula was applied to each revised sample passage (see Appendix C) from which a cloze test was constructed. The actual mean cloze test score for each form was compared with the predicted Coleman mean score for each form using the Student's t-test for correlated data. The summary of these results is given in Table 7. There was a significant difference between the predicted Coleman mean score and the actual mean score for all three forms (p = <.01).

The following three hypotheses deal with the relationships of age, number of years of schooling completed and cloze test scores.

Hypothesis II: There is no significant correlation between age and the cloze test scores for each form.

As illustrated in Figures 1-3, the relationship between
Table 7. Summary of means and t-test results for predicted Coleman scores and actual cloze test scores: Forms A, B, and C.

<table>
<thead>
<tr>
<th>Cloze test</th>
<th>Predicted mean score (Coleman formula)</th>
<th>Actual mean score (cloze test)</th>
<th>df</th>
<th>t Values</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>53.82</td>
<td>48.71</td>
<td>27</td>
<td>2.2314</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>B</td>
<td>57.19</td>
<td>41.64</td>
<td>27</td>
<td>4.2956</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>C</td>
<td>55.60</td>
<td>46.92</td>
<td>27</td>
<td>2.9952</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>
Figure 1. Scatterplot of age and cloze test scores: Form A

Figure 2. Scatterplot of age and cloze test scores: Form B
Figure 3. Scatterplot of age and cloze test scores: Form C

Figure 4. Scatterplot of number of years of schooling completed and cloze test scores: Form A.
Table 8. Summary of correlation coefficients for age and cloze test scores: Forms A, B, and C.

<table>
<thead>
<tr>
<th>Cloze test form</th>
<th>Correlation coefficient</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-0.2095</td>
<td>27</td>
<td>N.S.</td>
</tr>
<tr>
<td>B</td>
<td>-0.0336</td>
<td>27</td>
<td>N.S.</td>
</tr>
<tr>
<td>C</td>
<td>-0.2400</td>
<td>27</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

Table 9. Summary of correlation coefficients for number of years of schooling completed and cloze test scores: Forms A, B, and C.

<table>
<thead>
<tr>
<th>Cloze test form</th>
<th>Correlation coefficient</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>+0.4480</td>
<td>27</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>B</td>
<td>+0.6958</td>
<td>27</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>C</td>
<td>+0.5110</td>
<td>27</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Table 10. Summary of correlation coefficients for age, number of years of schooling completed and cloze test scores: Forms A, B, and C.

<table>
<thead>
<tr>
<th>Cloze test form</th>
<th>Correlation coefficient</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>+0.4835</td>
<td>27</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>B</td>
<td>+0.7087</td>
<td>27</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>C</td>
<td>+0.5433</td>
<td>27</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>
Figure 5. Scatterplot of number of years of schooling completed and cloze test scores: Form B.

Number of years of schooling completed

Figure 6. Scatterplot of number of years of schooling completed and cloze test scores: Form C.

Number of years of schooling completed
age and the cloze test scores on each of the three forms was negative. With increasing age there was a decrease in the cloze test score. Table 8 summarizes the correlation coefficients for each form. Since none of the coefficients were significant, this hypothesis was retained.

Hypothesis III: There is no significant correlation between the number of years of schooling completed and the cloze test scores for each form.

Figures 4-6 illustrate the positive linear relationship between the number of years of schooling completed and the cloze test scores on each of the three forms. This relationship means that with an increase in the number of years of schooling completed there is an increase in the cloze test score. The correlation between these two variables was significant for all three forms. Hypothesis III was, therefore, rejected. Table 9 contains a summary of this data.

Hypothesis IV: There is no significant correlation between age, number of years of schooling completed and the cloze test scores for each form.

Results of the three combined variables: age, number of years of schooling completed and the cloze tests, revealed a significant correlation at $p < .01$ for Form A and at
\[ p = 0.001 \text{ for Forms B and C. Table 10 gives a summary of the multiple } R \text{ (correlation coefficient) for each form. Hypothesis IV was rejected.} \]

The next three hypotheses assert that age and the number of years of schooling completed have no effect on predicting the cloze test scores.

Hypothesis V: There is no significant effect of age on predicting the cloze test scores for each form.

The analysis of variance results shown in Tables 11-13 indicate that age alone has no significant effect on predicting the cloze test scores for each form. Hypothesis V, therefore, was retained. The percentage of variance between the actual and predicted scores which is attributed to age is indicated by the \( R^2 \) for each form. The following regression equations were generated with age alone as the independent variable:

\[
\begin{align*}
\text{Form A: } & \quad Y = 74.226 - 0.3406X_1 \\
\text{Form B: } & \quad Y = 45.796 - 0.0563X_1 \\
\text{Form C: } & \quad Y = 76.435 - 0.4015X_1
\end{align*}
\]

where: \( Y = \text{predicted cloze test score}; \)
\[
X_1 = \text{age of the individual taking the test.}
\]

Hypothesis VI: There is no significant effect of the number of years of schooling completed
on predicting the cloze test scores for each form.

The F values for this hypothesis were significant ($p < .01$ and $p < .001$); therefore, this hypothesis was rejected. The analysis of variance results appear in Tables 14-16. The percentage of the variance ($R^2$) attributed to the effect of the number of years of schooling completed was much greater than that attributed to the age effect. The regression equations generated with schooling alone as an independent variable appear below:

Form A: $Y = 27.348 + 1.911X_2$
Form B: $Y = 18.007 + 2.267X_2$
Form C: $Y = 24.555 + 2.229X_2$

where: $Y =$ predicted cloze test score;

$X_2 =$ number of years of schooling completed by the individual taking the test.

Hypothesis VII: There is no significant effect of age and the number of years of schooling completed on predicting the cloze test scores for each form.

The multivariate analysis of variance resulted in a significant effect of age and the number of years of schooling completed on predicting the cloze test scores for each form. The significant F values are shown in Tables 17-19.
Table 11. Analysis of variance summary for age effect upon predicted cloze test scores: Form A.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>142.339</td>
<td>142.339</td>
<td>1.194</td>
<td>N.S.</td>
</tr>
<tr>
<td>Residual</td>
<td>26</td>
<td>3099.375</td>
<td>119.207</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>3241.714</td>
<td>120.063</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ R^2 = .0439 \]

Table 12. Analysis of variance summary for age effect upon predicted cloze test scores: Form B.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>3.541</td>
<td>3.541</td>
<td>0.0295</td>
<td>N.S.</td>
</tr>
<tr>
<td>Residual</td>
<td>26</td>
<td>3124.887</td>
<td>120.188</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>3128.429</td>
<td>115.868</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ R^2 = .0011 \]

Table 13. Analysis of variance summary for age effect upon predicted cloze test scores: Form C.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>244.483</td>
<td>244.483</td>
<td>1.589</td>
<td>N.S.</td>
</tr>
<tr>
<td>Residual</td>
<td>26</td>
<td>3999.373</td>
<td>153.822</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>4243.857</td>
<td>157.180</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ R^2 = .0576 \]
Table 14. Analysis of variance summary for schooling effect upon predicted cloze test scores: Form A.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>650.685</td>
<td>650.685</td>
<td>6.529</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Residual</td>
<td>26</td>
<td>2591.029</td>
<td>99.655</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>3241.714</td>
<td>120.063</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ R^2 = .2007 \]

Table 15. Analysis of variance summary for schooling effect upon predicted cloze test scores: Form B.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>1514.651</td>
<td>1514.651</td>
<td>24.403</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Residual</td>
<td>26</td>
<td>1613.777</td>
<td>62.068</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>3128.428</td>
<td>115.868</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ R^2 = .4842 \]

Table 16. Analysis of variance summary for schooling effect upon predicted cloze test scores: Form C.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>1108.159</td>
<td>1108.159</td>
<td>9.188</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Residual</td>
<td>26</td>
<td>3135.698</td>
<td>120.604</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>4243.857</td>
<td>157.180</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ R^2 = .2611 \]
Table 17. Analysis of variance summary for age and schooling effect upon predicted cloze test scores: Form A.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>2</td>
<td>757.667</td>
<td>378.833</td>
<td>3.812</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Residual</td>
<td>25</td>
<td>2484.047</td>
<td>99.362</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>3241.714</td>
<td>120.063</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R² = .2337

Table 18. Analysis of variance summary for age and schooling effect upon predicted cloze test scores: Form B.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>2</td>
<td>1571.361</td>
<td>785.681</td>
<td>12.610</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Residual</td>
<td>25</td>
<td>1557.067</td>
<td>62.283</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>3128.429</td>
<td>115.868</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R² = .5023

Table 19. Analysis of variance summary for age and schooling effect upon predicted cloze test scores: Form C.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>2</td>
<td>1252.596</td>
<td>626.298</td>
<td>5.234</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Residual</td>
<td>25</td>
<td>2991.260</td>
<td>119.650</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>4243.857</td>
<td>157.179</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R² = .2951
Hypothesis VII was rejected. The $R^2$ for each form gives the combined percentage of variance attributed to both independent variables. The regression equations generated with both the age and schooling variables are:

Form A: $Y = 50.056 - 0.2959X_1 + 1.8624X_2$
Form B: $Y = -0.2094 + 0.2320X_1 + 2.3732X_2$
Form C: $Y = 48.277 - 0.3105X_1 + 2.1396X_2$

where: $Y =$ predicted cloze test score;

$X_1 =$ age of the individual taking the test;

$X_2 =$ number of years of schooling completed by the individual taking the test.

The final hypothesis relates to the cloze tests themselves, independent of the effects of age and/or schooling.

Hypothesis VIII: There is no significant difference in the actual mean cloze test scores for the three cloze test forms.

The above hypothesis was retained. Results of the one-way analysis of variance test, shown in Table 20, revealed no significant difference in the actual mean scores on the three cloze test forms used in this study. Since all of the actual mean scores had differed significantly from the Coleman predicted scores, a multiple comparisons analysis was made on the three actual mean scores. The results of the $t$-tests are shown in Table 21. A significant difference
Table 20. Analysis of variance summary for the actual mean cloze test scores: Forms A, B, and C.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>2</td>
<td>757.238</td>
<td>378.619</td>
<td>2.889</td>
<td>N.S.</td>
</tr>
<tr>
<td>Error</td>
<td>81</td>
<td>10614.000</td>
<td>131.037</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>83</td>
<td>11371.238</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 21. Multiple comparisons analysis of actual mean cloze test scores: Forms A, B, and C.

<table>
<thead>
<tr>
<th>Actual means</th>
<th>Form B</th>
<th>Form C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form A</td>
<td>2.4361*</td>
<td>0.5675</td>
</tr>
<tr>
<td>Form B</td>
<td></td>
<td>1.6926</td>
</tr>
<tr>
<td>Form C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*significant at the .05 level
(p = .05) was found between the actual mean scores for Forms A and B.

**Discussion**

Hypothesis I: There is no significant difference between the predicted mean cloze test score as determined by the Coleman readability formula for each test form and the actual mean cloze test score for each form.

The Coleman Number Four formula was derived from cloze tests as a criterion of readability rather than from multiple-choice reading tests such as the McCall-Crabbs *Standard Test Lessons in Reading*. This formula, which predicts the percentage of correct completions on a cloze test, is based on four language variables: (1) the number of one-syllable words per 100 words, (2) the number of sentences per 100 words, (3) the number of pronouns per 100 words, and (4) the number of prepositions per 100 words (Klare, 1974-75). Validation studies done by Coleman (Klare, 1974-75) and Szalay (1975) were conducted with populations of school-age children and young adults. It does not appear from the literature that any of these studies have been conducted with older adults.

In this present study, the Coleman formula predicted the percentage of correct completions for Form A as 53.82 percent, Form B as 57.19 percent, and Form C as 55.60
percent. According to these data, Form B should be the easiest and Form A the hardest. The Dale-Chall formula for grade level difficulty, however, predicted just the opposite on the revised sample passages from which the cloze test forms were developed. On the Dale-Chall scale, Form B scored 5.79 and Form A scored 5.65. Both were within the same corrected grade level of difficulty (5th-6th grade). With the Dale-Chall formula the higher number indicates a greater difficulty. Form C was ranked in the middle by both the Coleman and the Dale-Chall formulas (Dale-Chall raw score = 5.71).

The actual mean percentage of correct completions scored on each form determines the actual readability score for the sample passage from which the cloze test was derived. The sample of older adults who actually took the cloze tests scored significantly lower than predicted by the Coleman formula. The lowest actual mean score was on Form B, which was predicted to be the easiest, and the highest actual mean score was on Form A, which was predicted to be the hardest. What explanation can be offered for this reversal of difficulty and the variation between the Coleman predicted mean scores and the actual mean cloze test scores?

Taylor (1953) found in his original studies that passages with a high concept load were more adequately ranked by the cloze procedure for their true difficulty or
readability than by readability formulas. In an experiment which used trainees at Sampson Air Base, New York, as subjects, Taylor (1957) again discovered that the cloze procedure showed an advantage over the formulas in that it somehow included the idea density of a passage. Perhaps the concept load or idea density in Form B was more difficult than in Forms A and C for the subjects in this present study.

Although each of the sample passages tested using the Cloze procedure was on the topic of hypertension, the concepts in each of the three passages varied in difficulty. The concept of air pressure and its relationship to blood pressure discussed in passage B was more difficult than the concepts of damage done by high blood pressure (Form A) and treatment of high blood pressure (Form C) in the other two passages. This study appears to verify Taylor's observation of the advantage of the cloze procedure to effectively contrast the relative difficulties of different samples of printed material.

Both the Coleman formula and the Dale-Chall formula measure only language variables, not concepts or ideas. The fact that the Dale-Chall formula ranked Form B as being more difficult than the ranking given by the Coleman formula may be due to vocabulary. Vocabulary is a variable in the Dale-Chall formula, whereas it is not included in the Coleman formula.
The concept load and vocabulary of the sample passages used in this study only partially account for the variation between the predicted Coleman and actual mean cloze test scores. From the outset of this study it was assumed that school-age children and young adults would score higher than older adults on these cloze tests. Since the problem of this study was to determine the readability of selected patient education materials for older adults only, the results of the actual cloze tests revealed that this age group scored significantly lower than predicted by the Coleman formula for anyone reading the same materials. While the assumption of variation between younger and older adults has not actually been proven nor disproven, the low scores do indicate that other variables may have been affecting the scores.

Six hypotheses were formulated to study two possible variables: age and the number of years of schooling completed.

Hypothesis II: There is no significant correlation between age and the cloze test score for each form.

Hypothesis III: There is no significant correlation between the number of years of schooling completed and the cloze test scores for each form.

Hypothesis IV: There is no significant correlation between age, number of years of schooling completed and the cloze test scores for each form.

The relationship between age and the cloze test scores
on all three forms was negative (see Figures 1-3). The strength of this relationship was about the same for Forms A and C but was considerably less for Form B (see Table 8). None of the correlation coefficients were statistically significant.

Since reading tests are not usually given to older adults, it is difficult to find studies which use age as a variable. The results of a recent National Survey of Adult Functional Reading Performance (Murphy, 1975) showed that the percentage of adults over age 60 who responded correctly on five reading tasks was lower on four of the five tasks than younger adults (ages 16-59). Statistical analysis of these differences was not reported.

A significant positive relationship was found between the number of years of schooling completed and the cloze test scores on all three forms (see Figures 4-6 and Table 9). The relationship was strongest on Form B and weakest on Form A. These results are consistent with the studies conducted by Pratt, Seligmann and Reader (1957) concerning the relationship between education and knowledge of medical information. The longer a person remains in school the more reading he/she does, thus increasing an individual's exposure to general information and ideas. This would have been especially true of the cohort represented in this study, as the schooling of even the youngest subject took place before the advent of television and the newer forms
of communications media.

The multiple correlation coefficients for each form also indicate a significant positive relationship among age, number of years of schooling completed, and the cloze test scores on all three forms (Table 10).

Hypothesis V: There is no significant effect of age on predicting the cloze test scores for each form.

Hypothesis VI: There is no significant effect of the number of years of schooling completed on predicting the cloze test scores for each form.

Hypothesis VII: There is no significant effect of age and the number of years of schooling completed on predicting the cloze test scores for each form.

Since the actual mean cloze test scores for this sample of older adults were significantly lower than predicted by the Coleman formula, it was desirable to generate a more valid formula using the regression model. The formulas generated would account for the language variables and concept difficulty of each form separately as well as account for the negative effect of age and the positive effect of schooling.

The results of the multivariate analysis showed that
age alone accounted for a very small percentage of the variance between the actual and predicted scores for this group of older adults on all three forms. The percentage for Form B was less than one percent and Forms A and C were approximately four and six percent, respectively. Schooling alone, on the other hand, accounted for approximately twice as much variance for Form B (48 percent) as for Form A (20 percent) and Form C (26 percent). The combined effects of age and schooling accounted for 50 percent of the variance for Form B, but only 23 percent and 29 percent of the variance for Forms A and C, respectively. The regression equation for Form B, therefore, would be approximately twice as accurate in predicting a cloze test score based on the two variables of age and schooling.

Hypothesis VIII: There is no significant difference in the actual mean cloze test scores for the three cloze test forms.

The F value for the analysis of variance was small and indicated no significant difference when the scores for all three forms were contrasted at once. Previous differences had already been noted in this study between Forms A and B in the contrasts between actual and Coleman predicted scores. When a multiple comparisons test was conducted on the actual mean cloze test scores, a significant ratio did occur between Forms A and B (see Table 21). Although the difference
between these two forms is small, it is regarded as significant and not due merely to chance.

**Summary of the Major Findings**

The major findings of this study were:

1. Older adults made significantly lower scores on the cloze tests than predicted by the Coleman readability formula.

2. Schooling correlated more significantly than did age with the actual cloze test scores.

3. Schooling had a more significant effect than did age upon predicting cloze test scores.

4. Cloze test, Form B, was significantly more difficult than cloze test, Form A.
V. SUMMARY, CONCLUSIONS AND IMPLICATIONS

The major purpose of this study was to determine the readability of selected patient education materials for older adults using the cloze procedure as a criterion. Actual cloze test scores from three selected passages on hypertension were compared with the Coleman readability scores on these same passages. The age and the number of years of schooling completed for each subject who completed a cloze test were examined to determine their effect upon predicting the cloze test scores on each passage. Variations in the scores on the three selected passages were also examined.

Interest in this problem arose out of the suggestion by Reader and Schwartz (1973) for an "educational prescription" which could be written by physicians, other health professionals or health educators. Printed materials are often used as the means of communicating health information to the patient. If these materials are beyond the patient's reading level, comprehension is reduced, recall is sketchy and inaccurate, and motivation to seek further information is decreased (Lanese and Thrush, 1963). Obviously physicians do not have the time nor the expertise to obtain the necessary data on the readability of printed materials and the patient's ability to comprehend the material. The health educator, then, must fill this role. Since the health educator is not a reading specialist, a simple valid means
for measuring the readability of printed materials and the patient's comprehension of these materials must be available.

In an attempt to determine the usefulness of the cloze procedure with older patients, who are most often in need of educational services for chronic illnesses, the following hypotheses were tested:

1. There is no significant difference between the predicted mean cloze test score as determined by the Coleman readability formula for each test form and the actual mean cloze test score for each form.

2. There is no significant correlation between age and the cloze test scores for each form.

3. There is no significant correlation between the number of years of schooling completed and the cloze test scores for each form.

4. There is no significant correlation between age, number of years of schooling completed and the cloze test scores for each form.

5. There is no significant effect of age on predicting the cloze test scores for each form.

6. There is no significant effect of the number of years of schooling completed on predicting the cloze test scores for each form.

7. There is no significant effect of age and the number of years of schooling completed on predicting the cloze
test scores for each form.

8. There is no significant difference in the actual mean cloze test scores for the three cloze test forms.

The population consisted of adults, 60 years of age and over, who eat a noon meal at the 13 program sites operated by the Oregon District Four Elderly Nutrition Program. A random sample was drawn from a master list of all participants at the 13 sites. A total of 84 adults comprised the sample for this study.

Each subject completed one cloze test in his/her own home with no time limit. The tests were scored on the basis of the number of exact completions (synonyms were not scored) for the 50 deletions. The raw scores were converted to percentage of correct completions for the purpose of analysis and interpretation. Each subject also supplied information on his/her age and the number of years of schooling completed. The data for each of the cloze test forms were subjected to multivariate analysis, one-way analysis of variance and multiple comparisons analysis. The cell sizes for all three forms were equal.

The major findings of this study revealed that (1) older adults made significantly lower scores on the cloze tests than predicted by the Coleman readability formula, (2) schooling correlated more significantly than did age with the actual cloze test scores, (3) schooling had a more significant effect than did age upon predicting cloze test
scores, and (4) cloze test, Form B, was significantly more difficult than cloze test, Form A.

Based on the results of this study, it can be concluded that the patient education materials selected were "not very readable" for a specific group of older adults. "Not very readable" simply means that some readers had difficulty understanding the concepts contained in the sample passages. Whereas all three passages tested were of approximately equal difficulty in terms of the language variables alone, the cloze procedure was able to distinguish differences in concept difficulty. Rankin has said that "in the final analysis the only real criterion of readability is the reader response and this is what the cloze procedure gets at (Greene, 1969, p. 577)." The cloze procedure can be used by health educators to assess an individual patient's comprehension of health concepts as well as recognition of words and sentence structure.

**Implications**

Using the Coleman formula score as an index the health educator could administer a cloze test to a patient to aid in the writing of an individual "educational prescription." If the patient's score on the cloze test is higher than the Coleman formula predicts, a program of independent study could be prescribed. If, on the other hand, a patient's score on the cloze test is lower than the Coleman formula
predicts, an individual and/or group instructional program could be prescribed. Certainly more research is needed to establish the reliability of such a procedure with older adults and with other age groups.

The cloze procedure also has implications as a diagnostic tool for physicians and other health professionals concerned with the care of older adults. Birren (1968) has suggested that it may be desirable to sort out the consequences of disease from the relatively normal physiology of aging. One may also need to make judgments about the relative reversibility or irreversibility of the level of mental functioning shown in an individual. For example, Birren states that...

... one may note the limitations of cognitive function accompanying significant losses of brain tissue as in senile dementia, cerebral arteriosclerosis, and other diseases. The relationships between behavior and hypertension are just beginning to be explored and it would appear that hypertension is related to patterns of cognitive functioning. It is reasonable to expect that a well-controlled and objective assessment of mental abilities will be increasingly useful in evaluation and diagnostic efforts of the adult (p. 17).

The regression equations generated in this study or future equations generated with more variables could be used to estimate one type of mental performance: reading comprehension. The cloze procedure could perhaps better estimate mental decline from a present mental performance on
comprehension compared with knowledge about the individual's previous educational level than currently used measures of mental deterioration.

Suggestions for Further Research

Suggestions for further research include: (1) the provision of additional variables, (2) replication with additional patient education materials, (3) the sampling of other populations, (4) testing of the instruction sheet for readability, and (5) consistency in the use of the instruction sheet.

Prediction efficiency usually increases up to the addition of the fourth or fifth predictor, but after that the slight gains in predictive ability are not worth the amount of time required to include them (Downie and Heath, 1974). Since adults of identical age and schooling may still vary widely in attributes that modulate reading comprehension, it is desirable to consider one or two additional variables to predict cloze test scores. Wilkie and Eisdorfer (1971) found that cognitive decline was correlated better with hypertension than with age. Since the diagnosis of hypertension must be made by a physician, the adult patient will know of his/her condition. This information could be recorded categorically under the simple headings of yes and no. Sex is another variable that should be considered. It has been a common research finding among school-age
children that females are generally better readers than males (Dwyer, 1973). The magnitude of sex differences in reading is usually found to be greater than for sex differences in other measures of verbal abilities. In the National Survey of Adult Functional Reading Performance (Murphy, 1975) all ages of adult females scored higher on three out of five reading tasks than did all ages of adult males. In the present study, 23 subjects (27.4 percent) were male and 61 subjects (72.6 percent) were female. It is not likely that this relatively low percentage of males would have lowered the mean cloze test scores significantly.

Both additional variables, hypertension and sex, would be recorded as nominal rather than interval data. Multiple regression, however, is robust enough to accommodate either type of data (George and Okun, 1976).

Replication of this study with the same population but with different patient education materials may be warranted. Diabetes and arthritis are other chronic conditions which increase in frequency among older adults (USDHEW, 1971). Printed materials on these two topics are available for the general public and are widely used by clinics, hospitals, and private physicians. Interest in diabetes and arthritis has been expressed orally by participants at all of the meal sites in the Oregon District Four Elderly Nutrition Program.

Other populations may be sampled; for example, adults
between the ages of 22 and 59. In the past it has been difficult to locate adults who are willing to have their reading skills tested. With the growth and expansion of community colleges and continuing education programs, the increase in the number of older adults returning to universities and the emphasis on education in Health Maintenance Organizations, this should no longer be a deterrent.

The instruction sheet which accompanied each cloze test in this study was not evaluated for readability. In future studies involving the cloze procedure, the level of reading difficulty for the instruction sheet should be ascertained. Revision should be made in the level of difficulty, if necessary, to conform to the same level as the cloze test for which it is written.

Jongsma (1970) notes that "in general, very little research has been done on the aspects of cloze test administration (p. 5)." The effects of various types of directions or the influence of introductory sample exercises have not been considered. How does the pre-reading of a passage change the nature of the task? Should subjects be encouraged to guess? In this present study, each subject was given the same instruction sheet, but there was inconsistency in the use of the sheet among the 84 subjects in the sample. Some subjects read the sheet independently while others received help from the investigator. Future investigators need to employ consistency in the use of the instruction sheet as
well as exploring some of the areas of test administration mentioned above.


Lorge, I. The influence of the test upon the nature of mental decline as a function of age. *Journal of Educational Psychology* 27:100-110, 1936.


National Tuberculosis Association. Tuberculosis patients: how well they read and how much they know about tuberculosis. Focus (file 19A), March 1958.


Rosenberg, S. Patient education leads to better care for heart patients. HSMHA Health Reports 86:793-802, September 1971.


Weed, L. Medical Records, Medical Education and Patient Care. Cleveland, Ohio: Western Reserve University Press, 1969.


APPENDICES
APPENDIX A

APPROVAL FROM THE COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS
Title: Use of the Cloze Procedure As a Criterion for Measuring the Readability of Selected Patient Education Materials for Older Adults

Program Director: John K. Ellis (Carol Ann Holcomb)

Recommendation:

_____ XX Approval

______ Provisional Approval

_______ Disapproval

_______ No Action

Remarks:

Date: March 9, 1977

cc: Dr. MacDonald

mep

Signature J. Ralph Shay

Assistant Dean of Research

Phone: 754-3437
APPENDIX B

PILOT STUDY

Sample Passages
Instruction Sheet for the Cloze Test
Cloze Test Form AA
Cloze Test Form A
Results
Everyone has blood pressure. It is the force of the blood against the walls of the arteries. This force is generated by the heart as it pumps blood to all parts of the body. In some people, blood pressure is nearly always higher than it should be because their arteries clamp down or shut off making it harder for the blood to pass through. This makes their blood pressure rise. High blood pressure adds to the workload of the heart and arteries. The heart must pump with more force, and the arteries must carry blood that is moving under greater pressure. If high blood pressure continues for a long time, the heart and the arteries may not function as well as they should and other body organs may also be affected. There is increased risk of stroke, heart failure, kidney failure and heart attack. Most people with high blood pressure have no symptoms at all! There are no specific warning signs. Although persistent headaches, dizziness, fatigue, tension, and shortness of breath sometimes go with high blood pressure, they are also common in many people and may result from a variety of causes. The only way to find out whether you have high blood pressure is to have your blood pressure checked. You must go to your doctor or the nearest health center and ask to have your blood pressure checked. If a person has high blood pressure, he can be helped if he has his blood pressure checked periodically
and stays under medical treatment. There are many medications which can be used to reduce and control blood pressure, and a medical program can be found that is suited to individual needs. In addition, low-fat and low-salt diets are often prescribed. And changes in living habits, including rest and recreation, are sometimes recommended, depending upon the person's condition.

Source: "High blood pressure." Pamphlet no. 51-022A. Published by the American Heart Association, 1974.

Dale-Chall readability raw score = 6.65; corrected grade level= 7th-8th grade.
Everyone has blood pressure. It is the power of the blood against the walls of the arteries. This power is caused by the heart as it pumps blood to all parts of the body. In some people, blood pressure is nearly always higher than it should be because their arteries shut off making it harder for the blood to pass through. This makes their blood pressure rise. High blood pressure adds to the workload of the heart and arteries. The heart must pump with more power, and the arteries must carry blood that is moving under greater pressure. If high blood pressure lasts for a long time, the heart and arteries may not work as well as they should and other body organs may also be affected. There is a greater chance of stroke, heart failure, kidney failure and heart attack. Most people with high blood pressure have no symptoms at all! There are no certain warning signs. Even though constant headaches, dizziness, being tired out, tension, and being short of breath sometimes go with high blood pressure, they are also common in many people and may be caused by many different things. The only way to find out if you have high blood pressure is to have your blood pressure checked. You must go to your doctor or the nearest health center and ask to have your blood pressure checked. If a person has high blood pressure, he can be helped if he has his blood pressure checked regularly and
stays under medical treatment. There are many medicines which can be used to lower and control blood pressure. A medical program can be found that is suited to each person's needs. Also, low-fat and low-salt diets are often prescribed. And changes in living habits, including rest and recreation, are sometimes suggested, depending upon the person's condition.

Source: "High blood pressure." Pamphlet no. 51-022A. Published by the American Heart Association, 1974.

Dale-Chall readability raw score = 5.81; corrected grade level = 5th-6th grade.
INSTRUCTION SHEET

Directions for completing the cloze test:

1. Write only one word in each blank.

2. Fill in every blank, if possible; guess if uncertain.

3. Skip hard blanks and come back to them later, if necessary.

4. Write down a word even if you are unsure of its spelling.

5. Note that all the blanks are the same length and that the lengths of the blanks and of the desired words are not related.

6. Most of the blanks can be answered with ordinary words, but a few may be

   numbers like.........................3,427 or $12 or 1954
   contractions like......................can't or weren't
   abbreviations like...................Mrs. or U.S.A.
   parts of hyphenated words like......self in the word self-made

7. REMEMBER THAT ALTHOUGH THE PASSAGE LOOKS LIKE A TEST, IT IS NOT A TEST OF INDIVIDUALS BUT RATHER OF THE MATERIAL ITSELF.

Try this short example before turning to the next page.

Mary had a little __________. Its fleece was white

___________ snow. Everywhere that Mary __________,
the lamb was sure __________ go.

We need two more items of information and then you will be ready to turn the page. Tell us:

Your age __________

Number of years of schooling completed __________

TURN THE PAGE...
FORM AA

Everyone has blood pressure. It is the power of the blood against the walls of the arteries. This power is caused by the heart as it pumps blood to all parts of the body. In some people, blood pressure is nearly always higher than it should be because their arteries shut off making it harder for the blood to pass through. This makes their blood pressure rise. High blood pressure adds to the workload of the heart and arteries. The heart must pump with more power, and the arteries must carry blood that is moving under greater pressure. If high blood pressure lasts for a long time, the heart and other body organs may also be affected. There is a greater chance of stroke, heart failure, kidney failure and heart attack. Most people with high blood pressure have no symptoms at all! There are no certain warning signs. Even though constant headaches, dizziness, being tired out, tension, and being short of breath sometimes go with high blood pressure, they are also common in many people and may be caused by many different things. The only way to find out if you have high blood pressure is to have your blood pressure checked. You must go to your doctor or the nearest health center and ask to have your blood pressure checked. If a person has high blood pressure, he can be helped if he has his blood pressure checked regularly and stays under medical treatment. There are many medicines which can be used to lower and control blood pressure. A medical program can be found that is suited to each person's needs. Also, low-fat and low-salt diets are often prescribed. And changes in living habits, including rest and recreation, are sometimes suggested, depending upon the person's condition.

Everyone has blood pressure. It is the power of the blood against the walls of the arteries. This power is caused by the heart as it pumps blood to all parts of the body. In some people, blood pressure is nearly always higher than it should be because their arteries shut off making it harder for the blood to pass through. This makes their blood pressure rise. High blood pressure adds to the workload of the heart and arteries. The heart must pump with more power, and the arteries must carry blood that is moving under greater pressure. If high blood pressure lasts for a long time, the heart and arteries may not work as well as they should and other body organs may also be affected. There is a greater chance of stroke, heart failure, kidney failure, and heart attack. Most people with high blood pressure have no symptoms at all! There are no certain warning signs. Even though constant headaches, dizziness, being tired out, tension, and being short of breath sometimes go with high blood pressure, they are also common in many people and may be caused by many different things. The only way to find out if you have high blood pressure is to have your blood pressure checked. You must go to your doctor or the nearest health center and ask to have your blood pressure checked. If a person has high blood pressure, he can be helped if he has his blood pressure checked regularly and stays under medical treatment. There are many medicines which can be used to lower and control blood pressure. A medical program can be found that is suited to each person's needs. Also, low-fat and low-salt diets are often prescribed. And changes in living habits, including rest and recreation, are sometimes suggested, depending upon the person's condition.

Table 1. Cloze test scores: Forms AA and A.

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<th>Subject</th>
<th>Form AA (50 deletions)</th>
<th>Form A (30 deletions)</th>
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<td>50.0</td>
</tr>
<tr>
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<td>66.7</td>
</tr>
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<td>80.0</td>
</tr>
<tr>
<td>12</td>
<td>70.0</td>
<td>76.7</td>
</tr>
</tbody>
</table>

Mean 61.42  61.94
APPENDIX C

SELECTED PATIENT EDUCATION MATERIALS

Sample Passages

CLOZE TESTS

Instruction Sheet

Form A
Form B
Form C
High blood pressure adds to the workload of the heart and arteries. That's why it must be controlled. The heart, forced to work harder than normal over a long period, tends to enlarge. A slightly enlarged heart may function well, but a heart that is very much enlarged has a hard time keeping up with the demands put upon it. After the wear and tear of years of high blood pressure, the arteries and arterioles may become hardened, less elastic, and scarred. This process may take place gradually as people grow older even when they do not have high blood pressure. High blood pressure, however, tends to speed up this hardening process. When the arteries become narrowed or hardened, they may not be able to deliver as much blood as the organs of the body need for good functioning. Or a blood clot may lodge in a previously narrowed artery and deprive some part of the body of its normal blood supply. For these reasons, doctors look for signs of damage to three vital areas of the body: the heart, the kidneys, and the brain. The possibility of stroke, blood vessel damage in the brain, is increased if you have high blood pressure. But, if you treat high blood pressure, this stroke risk is dramatically reduced. Prolonged elevated pressure can also affect the heart, kidneys, and nervous system. However, these widespread effects can be prevented or reduced if the elevated blood pressure is
treated early—before the function of the heart, kidneys and brain becomes impaired—and if this treatment is maintained.

Source: "High blood pressure and how to control it." Pamphlet no. 50-009-A. Published by the American Heart Association, 1974.

Dale-Chall readability raw score = 7.28; corrected grade level = 9th-10th grade.
High blood pressure adds to the workload of the heart and arteries. That's why it must be controlled. The heart, made to work harder than normal for a long time, becomes larger. A slightly larger heart may work well, but a heart that is very large has a hard time keeping up with the demands put upon it. After the wear and tear of years of high blood pressure, the arteries and arterioles may become hardened, less elastic and scarred. This process may take place slowly as people grow older even when they do not have high blood pressure. High blood pressure, however, does seem to speed up this hardening process. When the arteries become narrowed, they may not be able to deliver as much blood as the organs of the body need to be in good working order. Or a blood clot may lodge in an artery that has become narrowed. This will keep some part of the body from getting its normal amount of blood. For these reasons, doctors look for signs of damage to three vital areas of the body. These areas are the heart, the kidneys and the brain. Blood vessel damage in the brain is more likely if you have high blood pressure. But, if you treat high blood pressure, this chance of blood vessel damage in the brain is much, much less. High blood pressure for a long time can also damage the heart, kidneys and nervous system. However, this damage can be prevented or be made less if the high blood pressure is
treated before the work of the heart, kidneys and brain becomes worse. This treatment must be carried on.

Source: "High blood pressure and how to control it." Pamphlet no. 50-009-A. Published by the American Heart Association, 1974.

Dale-Chall readability raw score = 5.65; corrected grade level = 5th-6th grade.
To understand blood pressure, think of your heart as a pump which keeps blood circulating throughout your body. The systolic pressure is the pressure in the arteries when the heart contracts to pump blood. It is always the first and higher of the two pressure readings. The diastolic pressure is the pressure in the arteries when the heart relaxes to fill with blood. The second and lower of the two readings, it is the pressure when the heart rests between beats. When your doctor takes your blood pressure, he reads the systolic "over" the diastolic pressure. Blood pressure is measured on a gauge which shows the air pressure in the cuff around your arm. The physician pumps up the cuff to squeeze the artery and momentarily cut off the blood flow. As he lets air out of the cuff, he listens through his stethoscope for the sounds made by the blood as it starts to flow again through the re-opened artery. The first sound occurs when the air pressure in the cuff is equal to your highest blood pressure. The sound continues until the artery is fully open. The cuff pressure now equals your lowest pressure. By matching the sounds with the numbers indicated on the dial, the physician "reads" your blood pressure. There is no blood pressure reading that is normal for everyone. Your age, sex and overall health determine what is "normal" for you. And blood pressure varies throughout the day. It
is lowest when you are sleeping or resting. Physical exercise or emotional stress can raise your blood pressure briefly.


Dale-Chall readability raw score = 6.46; corrected grade level = 7th-8th grade.
To understand blood pressure, think of your heart as a pump which keeps blood moving throughout your body. The systolic pressure is the pressure in the arteries when the heart squeezes to pump blood. It is always the first and higher of the two pressure readings. The diastolic pressure is the pressure in the arteries when the heart rests to fill with blood. The second and lower of the two readings, it is the pressure when the heart rests between beats. When your doctor takes your blood pressure, he reads the systolic "over" the diastolic pressure. Blood pressure is measured on a scale which shows the air pressure in the cuff around your arm. The doctor pumps up the cuff to squeeze the artery for a short time to cut off the blood flow. As he lets air out of the cuff, he listens through his stethoscope for the sounds made by the blood as it starts to flow again through the artery. The first sound happens when the air pressure in the cuff is equal to your highest blood pressure. The sound continues until the artery is fully open. The cuff pressure now equals your lowest pressure. By matching the sounds with the numbers shown on the scale, the doctor "reads" your blood pressure. There is no blood pressure reading that is normal for everyone. Your age, sex and health determine what is normal for you. Blood pressure changes throughout the day. It is lowest when you are
sleeping or resting. Physical exercise or emotional stress can raise your blood pressure for a short time.


Dale-Chall readability raw score = 5.79; corrected grade level = 5th-6th grade.
Doctors can do much to help control high blood pressure. When it is definitely diagnosed, whether mild or very severe, it's wise to start treatment as soon as your doctor prescribes it. Certainly you need therapy if the condition is damaging some part of your body or if the hypertension is "accelerating." In any case you should be under a doctor's care. Whatever the treatment, the dual purpose is not only to keep blood pressure down but also to avoid possible complications. While in most instances the hypertension can be controlled with one or more drugs, your doctor may have some additional recommendations. Some cases can be handled effectively without medicines through a change of diet which cuts down your intake of calories and/or sodium. Especially if you are overweight, you may be told to reduce because loss of weight could lower your blood pressure. As you probably are aware, obesity imposes an added circulatory burden on your heart, blood volume increases with body weight, and the body's fat reserves must be supplied with blood. Consequently, the heart of an overweight person is forced to pump more blood through a much larger system of blood vessels. The diet prescribed would limit the amount or type of fat in your food, as well as your total calorie intake. Whether or not you're overweight, your doctor may urge you to restrict your sodium intake, generally as an adjunct to
other modes of treatment. This would curb your body's retention of fluid. In about one out of three hypertension cases, a stringent low-sodium diet has led to some lowering of blood pressure.


Dale-Chall readability raw score = 7.53; corrected grade level = 9th-10th grade.
Doctors can do much to help control high blood pressure. When your doctor tells you, "you have high blood pressure," it is wise to start treatment as soon as he prescribes it. Certainly you need to be treated if the condition is damaging some part of your body. You also need to be treated if the high blood pressure is getting higher. In any case you should be under a doctor's care. The purpose of the treatment is to keep blood pressure down and to prevent possible damage to the body. In most cases the high blood pressure can be controlled with one or more drugs. Your doctor, however, may have some more suggestions. Some cases can be handled without medicines. A change of diet is needed to cut down your intake of calories and/or salt. If you are overweight, you may be told to lose weight. A loss of weight could lower your blood pressure. As you probably know, being overweight puts an added load on your heart to pump blood. The amount of blood increases with body weight. The body's fat reserves must be supplied with blood. The heart of an overweight person is forced to pump more blood through a much larger system of blood vessels. The diet prescribed would limit the amount or kind of fat in your food and your total calorie intake. Even if you are not overweight, your doctor may want you to lower the amount of salt you use. This would lower the amount of fluid your
body holds. In about one out of three high blood pressure cases, a strict low-salt diet has led to some lowering of blood pressure.


Dale-Chall readability raw score = 5.71; corrected grade level = 5th-6th grade.
INSTRUCTION SHEET

Directions for completing the cloze test:

1. Write only one word in each blank.

2. Fill in every blank, if possible; guess if uncertain.

3. Skip hard blanks and come back to them later, if necessary.

4. Write down a word even if you are unsure of its spelling.

5. Note that all the blanks are the same length and that the lengths of the blanks and of the desired words are not related.

6. Most of the blanks can be answered with ordinary words, but a few may be
   numbers like....................3,427 or $12 or 1954
   contractions like..................can't or weren't
   abbreviations like..................Mrs. or U.S.A.
   parts of hyphenated words like......self in the word self-made

7. REMEMBER THAT ALTHOUGH THE PASSAGE LOOKS LIKE A TEST, IT IS NOT A TEST OF INDIVIDUALS BUT RATHER OF THE MATERIAL ITSELF.

Try this short example before turning to the next page.

Mary had a little ___________. Its fleece was white

___________ snow. Everywhere that Mary ____________,
the lamb was sure ____________ go.

We need two more items of information and then you will be ready to turn the page. Tell us:

Your age ____________

Number of years of schooling completed ____________

TURN THE PAGE...
High blood pressure adds _______ to _______ the workload of the _______ heart _______.

That's why _______ it _______ must be controlled. The _______ heart _______, made to work harder _______ than _______ normal for a long _______ time _______, becomes larger. A slightly _______ larger _______ heart may work well, _______ but _______ a heart that is _______ very _______ large has a hard _______ time _______ keeping up with the _______ demands _______ put upon it. After _______ the _______ wear and tear of _______ years _______ of high blood pressure, _______ the _______ arteries and arterioles may _______ become _______ hardened, less elastic and _______ scarred _______. This process may take _______ place _______ slowly as people grow _______ older _______ even when they do _______ not _______ have high blood pressure. High _______ blood pressure, however, does _______ seem _______ to speed up this _______ hardening _______ process. When the _______ arteries _______ become _______ narrowed, they may not _______ be _______ able to deliver as _______ much _______ blood as the organs _______ of _______ the body need to _______ be _______ in good working order. Or _______ a blood clot may _______ lodge _______ in an artery that _______ has _______ become narrowed. This will _______ keep _______ some part of the _______ body _______ from getting its normal _______ amount _______ of blood. For these _______ reasons _______, doctors look for signs _______ of _______ damage to three vital _______ areas _______ of the body. These _______ areas _______ are the heart, the _______ kidneys _______ and the brain. Blood _______ vessel _______ damage in the brain _______ is _______ more likely if you _______ have _______ high blood pressure. But, _______ is _______ if you treat high blood _______ pressure _______, this chance of blood _______ vessel _______ damage in the brain _______ is _______ much, much less. High _______ blood _______ pressure for a long _______ time _______ can also damage the _______ heart _______, kidneys and nervous system. However _______, this damage can be _______ prevented _______ or be made less if the high blood pressure is treated before the work of the heart, kidneys and brain becomes worse. This treatment must be carried on.

To understand blood pressure, think of your heart as a pump which keeps blood moving throughout your body. The systolic pressure is the pressure in the arteries when the heart squeezes to pump blood. It is always the first and higher of the two pressure readings. The diastolic pressure is the pressure in the arteries when the heart rests to fill with blood. The second and lower of the two readings, it is the pressure when the heart rests between beats. When your doctor takes your blood pressure, he reads the systolic "over" the diastolic pressure. Blood pressure is measured on a scale which shows the air pressure in the cuff around your arm. The doctor pumps up the cuff to squeeze the artery for a short time to cut off the blood flow. As he lets air out of the cuff, he listens through his stethoscope for the sounds made by the blood as it starts to flow again through the artery. The first sound happens when the air pressure in the cuff is equal to your highest blood pressure. The sound continues until the artery is fully open. The cuff pressure now equals your lowest pressure. By matching the sounds with the numbers shown on the scale, the doctor "reads" your blood pressure. There is no blood pressure reading that is normal for everyone. Your age, sex and health determine what is normal for you. Blood pressure changes throughout the day. It is lowest when you are sleeping or resting. Physical exercise or emotional stress can raise your blood pressure for a short time.

Doctors can do much **to** help control high blood **pressure**. When your doctor tells **you** you have high blood **pressure**, it is wise to **start** treatment as soon as **he** prescribes it. Certainly you **need** to be treated if **the** condition is damaging some **part** of your body. You **also** need to be treated **if** the high blood pressure **is** getting higher. In any **case** you should be under **a** doctor's care. The purpose **of** the treatment is to **keep** blood pressure down and **to** prevent possible damage to **the** body. In most cases **the** high blood pressure can **be** controlled with one or **more** drugs. Your doctor, however, **may** have some more suggestions. **Some** cases can be handled **without** medicines. A change of **diet** is needed to cut **down** your intake of calories **and**/or salt. If you **are** overweight, you may be **told** to lose weight. A **loss** of weight could lower **your** blood pressure. As you **probably** know, being overweight puts **an** added load on your **heart** to pump blood. The **amount** of blood increases with **body** weight. The body's fat **reserves** must be supplied with **blood**. The heart of an **overweight** person is forced to **pump** more blood through a **much** larger system of blood **vessels**. The diet prescribed would **limit** the amount or kind **of** fat in your food **and** your total calorie intake. Even if you are not **overweight**, your doctor may want **you** to lower the amount **of** salt you use. This **would** lower the amount of fluid your body holds. In about one out of three high blood pressure cases, a strict low-salt diet has led to some lowering of blood pressure.