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Pilot Study of The Efficacy of Computer Aided Instruction as a Supplemental Teaching Instrument for Dialysis Patients

Joyce J. Daugherty
University of North Florida

PILOT STUDY OF THE EFFICACY OF COMPUTER AIDED INSTRUCTION AS A SUPPLEMENTAL TEACHING INSTRUMENT FOR DIALYSIS PATIENTS

by

Joyce J. Daugherty, M.S.H., R.D., L.D.

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The thesis of Joyce Daugherty is approved: (Date)

Signature deleted

Chudley E. Werch, Ph.D., Committee Chairperson

Signature deleted

Betty Meers, Ph.D., Committee Member

Signature deleted

John J. Whitehouse, Committee Member

Signature deleted

Patti M. Dean, Committee Member

Accepted for the Department:

Signature deleted

7/2/97

Terry Tabor, Ph.D., Interim Chair Health Science Department

Accepted for the College/School:

Signature deleted

7/24/97

Joan Farrell, Ph.D., Dean of the College of Health

Accepted for the University:

Signature deleted

8/5/97

Dean of Graduate Studies

DEDICATION

This thesis is dedicated to: Robert Daugherty, whose advocacy encouraged this study; to the memory of Mabel E. Phillips, who modeled continuous learning throughout her life; to Janet Daugherty and to Debora Daugherty, whose impertinence actualized this study; and to the patients of a northeastern Florida chronic dialysis clinic, who want to improve their nutritional status.

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ABSTRACT

This pilot study examined the feasibility of computer aided instruction (CAI) as supplemental interactive nutrition education for patients requiring chronic dialysis. The CAI prototype was developed using Gagne's Model of Instructional Design and the Theory of Planned Behavior. Forty-two patients were enlisted from a chronic dialysis clinic and assigned randomly to either treatment or comparison group. All subjects completed pre- and post-test questionnaires regarding their phosphorus-rich food consumption habits. Each group received the usual phosphorus control education adjunct to the monthly lab review. The experimental group also received supplemental education by CAI. Serum phosphorus lab results were assessed for change after use of the CAI. Near significance was observed between the study groups' phosphorus lab results difference means, $t = 1.79$, $df = 40$, $p = .08$. Comparison of pre-test and post-test data assessed changes in the dependent variables, attitude, perceived control, intent and behavior. The differences for the behavioral dependent variables means were not significant as determined by *t*-tests. The CAI was well accepted ($m = 1.47 \pm 0.95$) by the subjects without respect to gender or age. Interactive CAI nutrition education was acceptable. Replication with a larger sample would allow opportunity to determine the significance of differences.

CHAPTER 1

INTRODUCTION

Statement of Problem

End Stage Renal Disease (non-reversible kidney failure), requires treatment by the complex life-changing regimen of dialysis, diet restrictions and medications. Failure to follow the prescribed treatment regimen multiplies the likelihood of hospitalizations due to increased morbidities, and of mortality. Maintaining the necessary balance of various nutrients is arduous (Plourd, 1995). The modification of diet is taught by Registered Dietitians using personal and group counseling, supplemented with printed materials. Counseling is labor intensive, frequently repetitive, and may have variable quality. Printed materials are inexpensively produced and easily disseminated, but may fail to actively involve the audience. An innovative teaching tool which will engage the interest of the End Stage Renal Disease (ESRD) patient while effectively augmenting nutrition education is needed.

The purpose of this study was to examine the efficacy of computer aided instruction (CAI) as a supplemental teaching instrument for ESRD dialysis patients. Efficacy of the CAI was defined as the ability of the CAI to influence subjects' phosphorus-rich food consumption behavior so that serum phosphorus lab results will be reduced to, or remain within, the reference range for normal values.

This study proposed to provide computer aided instruction about dietary phosphorus control to patients receiving chronic dialysis treatments. The Theory of Planned Behavior was used to measure the relationship of changes in attitude, social norm (influence of significant others), perceived control, intention, and reported behavior of consumption of phosphorus-rich foods. Gagne's Model of Instructional Design was the basis for format and the Theory of Planned Behavior was used as a guide for the content of the instructional courseware.

Significance

Failure of the kidney to function impairs the body's ability to remove the end products of protein metabolism, excess fluids, and excess amounts of potassium, sodium, and phosphorus. Renal diet therapy is individually prescribed and planned to limit these nutrients, and maintain chemical balance. Foods enjoyed over a lifetime frequently provide an excess of these minerals and electrolytes that cannot be removed by dialysis. To meet the parameters of the renal treatment regimen ESRD patients are counseled to change lifestyle and eating behaviors. The necessary change of cultural, ethnic, regional, and lifetime habits is difficult.

Behaviors are affected by changing attitudes, beliefs, peer influence (subjective norms), perceived control, and intention toward a behavior. The Registered Dietitian attempts to change behavior by providing information regarding appropriate food choices, thereby influencing beliefs, perceived control of nutrient consumption, and intention to follow the diet prescription. Patients are instructed by use of one-to-one

counseling, group counseling, and printed materials (Carron, 1995). Due to the complexity of renal diet therapy ESRD patients are frequently re-instructed (the typical diet prescription limits amounts of proteins, sodium, potassium, phosphorus, fluids and frequently calories.) The inadequacy of "telling" as the instructional method is recognized (Bostow, Kritch & Tompkins, 1995).

Computer based learning is a modern teaching method (Bostow et al., 1995). Computers have been used in adult basic education programs and in health promotion programs. Adults have been taught arthritis treatment methods, appropriate prenatal alcohol behavior, and cardiac disease risk reduction by appropriate food choices (Fleury, 1992; Kinzie, Schorling & Siegel, 1993; Rachal, 1993; Rippey, Dee, Abeles, Day, Downing & Pfieffer, 1987). Computer based learning allows repetition of instruction, self-paced active learning, consistency of lesson materials, and standardized instructional delivery, as well as privacy while executing the lesson (Bostow, 1991). Examination of this technology, as applied to nutrition education, and especially to the frequently re-instructed ESRD patient, was warranted.

Control of serum phosphorus was chosen as the focus of education for this study. The kidney hemodialysis machine is able to remove significant amounts of urea nitrogen, potassium, sodium, glucose and fluids from an ESRD patient's blood. Significant amounts of the larger phosphate molecule are not removed from the patient's body during dialysis requiring the dialysis patient to control serum phosphorus by limiting foods that contain large amounts of this mineral. These foods are dairy products (such as milk, ice cream and cheese), dried beans and peas (navy beans, lima beans, black-eyed peas, etc), peanut

butter, and combination foods made with these ingredients. Medically prescribed binders that chemically prevent phosphorus absorption are also consumed with each meal and snacks.

Excess phosphorus consumption has an insidious result. Initial evidence of hyperphosphatemia (excess serum phosphorus) is serum phosphorus blood test results greater than 6.0 mg/dL. Continued hyperphosphatemia is progressively evidenced by intense itching, bone and joint pain, renal osteodystrophy, debilitation, and finally, immobility. The latent effect of over-consumption adds to the difficulty of control. Additionally, the socioeconomic factor must be acknowledged. Many phosphorus-rich foods provide calories and proteins inexpensively. Innovative supplemental teaching regarding this critically important mineral to the ESRD patient was warranted.

Hypotheses

The null hypotheses are:

1. There is no significant difference in attitude toward consumption of phosphorus-rich foods by ESRD patients who are presented phosphorus education by CAI in addition to the standard instruction and those who receive only the standard instruction.
2. There is no significant difference in perceived control of consumption of phosphorus-rich foods by ESRD patients who are presented phosphorus education by CAI in addition to the standard instruction and those who receive only the standard instruction.

3. There is no significant difference in intention to consume phosphorus-rich foods by ESRD patients who are presented phosphorus education by CAI in addition to the standard instruction and those who receive only the standard instruction.
4. There is no significant difference in the influence of subjective norms on the consumption of phosphorus-rich foods by ESRD patients who are presented phosphorus education by CAI in addition to the standard instruction and those who receive only the standard instruction.
5. There is no significant difference in self-reported consumption behavior of phosphorus rich foods by ESRD patients who are presented phosphorus education by CAI in addition to the standard education and those who receive only the standard instruction.
6. There is no significant difference in serum phosphorus lab results of ESRD patients who are presented phosphorus education by CAI in addition to the standard education and those who receive only the standard instruction.
7. There is no significant difference in preference of educational method for phosphorus education by ESRD patients who are presented CAI education in addition to the standard instruction and those who receive only the standard instruction.

Definition of Terms

Bone Healthy Foods: Most fruits and vegetables, breads and other starches, fats and oils, meat, fish and poultry.

CAI: Computer Aided Instruction. Method of using computer software to provide instruction or supplement instruction on a given subject. May use tutorials and simulations consisting of text and possibly graphics, which provide training by means of a mainframe or personal computer. Also known as CAL (computer-assisted learning), or CBT (computer based training), or CBI (computer-based instruction).

Courseware: The application software used to develop a CAI course.

Dialysis: A mechanical filtering process used to cleanse the blood of waste products, to draw off excess cellular fluids, and to regulate body chemistry when the kidneys fail to function normally. The two methods of dialysis are hemodialysis and peritoneal dialysis.

Dialysis Team: Patient care technicians, physician, dietitian, nurses, social worker, and equipment technicians who coordinate activities to provide dialysis treatments for individuals with ESRD.

ESRD: End Stage Renal Disease: Non-reversible failure of kidney functions resulting in the accumulation of protein metabolism waste products in the body.

Hemodialysis: A process of removing toxins and excess fluid from the tissues and blood by continually circulating blood through a filter. The filter known as a dialyzer or artificial kidney is used with an artificial kidney machine.

Hyperphosphatemia: Expression of excess serum phosphorus (phosphorus in the blood). Biochemical level of serum phosphorus greater than 6.0 mg/dL.

Kidney: One of two glandular bodies that secrete urine to remove non-protein nitrogen and toxic substances from the blood.

Peritoneal Dialysis: A process of filtering waste products and excess fluid that uses the peritoneum, the thin membrane that lines the abdominal cavity, as the filter. This treatment method is usually performed by the patient or an assistant at home.

Phosphorus: A mineral found in human bone and blood. Closely linked with calcium in bone metabolism. Excess amounts not excreted by kidneys may cause intense itching, bone/joint pain, hypocalcemia, hyperparathyroidism, renal osteoporosis, and immobility.

Phosphorus binders: Medically prescribed medications that when taken with food, bind phosphorus compounds and excrete them from the body through the stool.

Phosphorus-Rich Foods: Milk and milk products, dried beans, and dried peas (includes peanuts and related products), seeds, and nuts.

Registered Dietitian: Qualified nutrition professional who teaches medical nutritional therapy (diet modifications) appropriate to an individual's nutritional needs.

Renal Disease: Malfunction of the kidney.

Renal Nutrition: Individualized diet therapy that provides an optimal nutrition plan for an individual with renal disease (kidney failure). The amount of protein, sodium (salt), potassium, phosphorus, calories, and fluids allowed daily may be restricted.

CHAPTER 2

REVIEW OF LITERATURE

End Stage Renal Disease (ESRD) can be treated with chronic dialysis or kidney transplantation. Dialysis is a complex regimen of artificial kidney machine, diet therapy and medication treatments. The development of sophisticated artificial kidney technology, increased knowledge and efficacy of appropriate medications, as well as optimal nutrition practices have resulted in long term survival of many dialysis patients. Accompanying survival is the development of long-term complications, such as renal osteoporosis, which are influenced by lack of behavior change and dietary control (Abbott Renal Care, 1991).

Theory of Planned Behavior

Behavior change research is derived from the traditional cognitive theory of psychology that attempts to provide an understanding of the decision making process preceeding the performance of a particular behavior (Fleury, 1992). Attitudes, social relationships and beliefs are advanced as major influences of health behavior, not just knowledge of appropriate behaviors (Chapman, Ham, Liesen & Winter, 1995; Rogers, 1983).

The Theory of Planned Behavior (TPB) was used as the theoretical basis for this study. The theory permits prediction and explanation of behavior since an individual's intent to perform a behavior "is considered to be the immediate determinate of action,"

(Fleury, 1992, p. 233). Variables that independently affect the intent toward a behavior are attitude, subjective norm, and perceived control (Ajzen, cited in Courneya, 1995). Figure 1 is a schematic diagram of this theory.

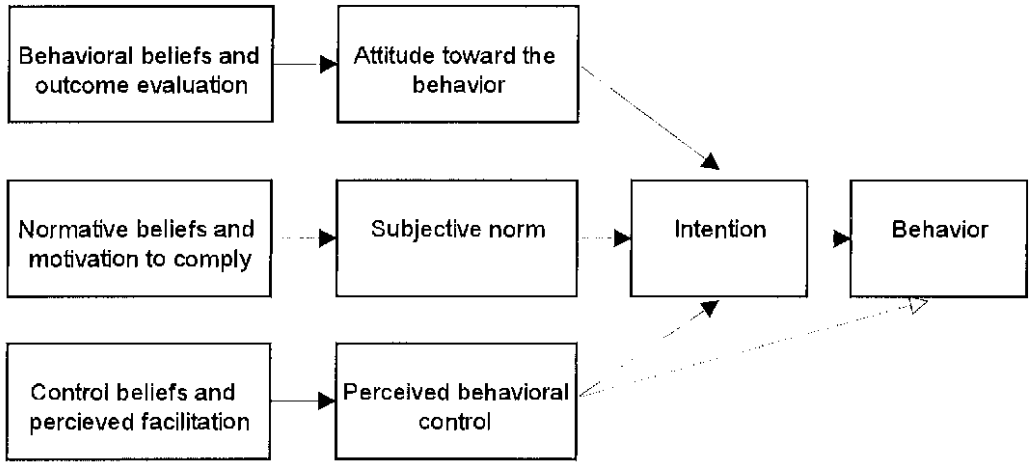

Figure 1. The Theory of Planned Behavior. From "Attitude, Structure and Behavior" by I. Ajzen. In Attitude, structure and function (p. 252) by A.R. Pratkanis, S.J. Breckler, and A.G. Greenwald (Eds.), 1989 Hillsdale, NJ: Lawrence Erlbaum. Reprinted by permission.

These variables can be described as:

> **Attitude** toward a behavior: a function of the perceived consequences of performing the behavior and the outcome evaluation. Attitudes can be changed by influencing primary beliefs and by providing information which can lead to changes in corresponding proximal beliefs (Fishbein & Ajzen, 1975).
>
> **Subjective norms**, or social determinants: an individual's perceived expectation of one or more relevant other's opinion that a behavior should or should not be performed (Blue, 1995).
>
> **Perceived control of a behavior:** the anticipated ease or difficulty of achieving desired outcome. Perceived control has an indirect effect on behavioral intentions by influencing intention and a direct effect on behavior (Blue, 1995; Brownell & Cohen, 1995; Fleury, 1992), and is considered a reflection of actual control or a partial substitute for actual control (Ajzen, 1988). It can be a predictor of behavior directly in situations that are not completely volitional (Courneya, 1995; Fleury, 1992).

Change in behavior is brought about by producing changes in beliefs (Ajzen & Fishbein, 1980). Influencing beliefs about the consequences of performing a behavior, can produce changes in attitude toward a behavior. Likewise, by influencing beliefs about the expectations of specific referents, the subject norm can be affected (Ajzen & Fishbein,

1980). To influence intention or a corresponding behavior it is necessary to change either behavioral beliefs or normative beliefs, or both.

"To change beliefs, a persuasive communication should contain information linking the behavior to various positive or negative outcomes, or it should provide information about the normative expectations of specific referents." (Azjen & Fishbein, 1980). Effective messages must contain arguments addressing primary beliefs that underlie or determine the behavior, as well as factual evidence and recommendations for action. Positive attitude toward the behavior and/or positive subjective norm and strong perception of behavior control will lead to a stronger intention to perform the considered behavior (Blue, 1995; Fleury, 1992).

The Theory of Planned Behavior has been applied to research in individual behaviors including exercise, weight control, physical exercise, cardiovascular risk reduction, and nutrition education. Fleury (1992) examined the primary motivational theories used to predict cardiovascular risk reduction in ten studies reported between 1981 and 1988. Attitude toward a behavior was found to be the main consideration when predicting behavior changes. Normative influence was found to be statistically insignificant toward intention and behavior. In all studies evaluation of behavioral outcomes occurred after measures of intent, and did not provide a measure of long-term change (Fleury, 1992).

Blue (1995) reviewed literature regarding exercise research and the predictive capacity of the Theory of Planned Behavior. Four of these studies used exercise behavior as the dependent variable and one used intention as the dependent variable. As expected,

intention was predictive of performance of a specific behavior in most of the studies reporting this correlation. Evaluation of the studies reviewed revealed that the behavioral component positively correlated with attitude and that attitude was predictive of intention in the studies. The correlation of behavioral intention and subjective norm were not significant, and in these studies the influence of social pressure on exercise behavior was small in all but one study (Blue, 1995).

Courneya (1995), conducting a study to determine influencing factors for physical activity in older individuals, combined TPB and the Transtheoretical Model, (or Stages of Readiness). To collect data from the 288 older individuals recruited from the Kerby Center in Calgary, Alberta, Canada, each was mailed a questionnaire requesting demographic information, history of physical activity, and stage of readiness to engage in regular physical activity. Subjects were also queried regarding behavioral and control beliefs. The open-ended responses were used to structure the second questionnaire containing measures of attitude, subjective norm, perceived behavioral control, intention and stage of readiness to participate in regular physical activity. The results demonstrated that all subjects could be classified into one of five stages of change, and that each of the TPB constructs related to the stages of physical activity. These indicated that intention, perceived behavioral control, and attitude related directly with stages of readiness (Courneya, 1995).

Hounsa, Godin, Alihonou, Valois and Girard (1993) applied TPB when identifying the factors that influenced the use of oral rehydration therapy (ORT) in the treatment of diarrhea in rural South Benin. One hundred twenty eight illiterate and animist mothers

were randomly selected, and interviewed at home, using a pre-tested instrument to identify the motivation predictors defined in TPB. The results suggested that the promotion of the ORT for treatment of diarrhea would be facilitated if the mothers perceived the advantages of the ORT, and if the village health workers were more accessible (Hounsa et al., 1993, Abst). The authors demonstrated that knowledge of the potential result is important to intention and thus, to behavior.

Brownell and Cohen (1995) after reviewing and describing effective dietary interventions, suggested that behavioral models are more effective in changing health behaviors, than educational models. They concluded that dietary change is best accomplished by a combination of models, such as the Stages of Change and the Theory of Planned Behavior (Brownell & Cohen, 1995).

While discussing the theoretical basis used for nutrition education, Achterberg and Clark (1992) suggested that attitudes and behaviors related to nutrition are influenced by family, peers, and society. Food habits are generally habitual, and part of long established patterns. Individuals bring "more subjective knowledge and attitudes towards food despite age or life stage than to the study of other health-related behaviors" (Achterberg & Clark, 1992, p. 227). Few theories or models are consistently used in studying effective nutrition education, causing these authors to describe nutrition education as being preparadigmatic (Achterbery & Clark, 1992).

Chapman, Ham, Liesen, and Winter (1995) utilized both the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) to prepare a questionnaire evaluating the influences on the adherence of medical behavior among elderly diabetic patients. The

questionnaire was developed to measure diabetic patients' health beliefs, as well as attitude, intention, subjective norm, and perceived control over behavior, antecedents of the TPB. Subjects were chosen randomly for the cross-sectional, prospective study at the Veterans' Affairs Medical Centers in Danville, and Peoria, IL. The 61 subjects were characterized by a mean age of 67 years, and having been followed in the clinics for at least one year. Utilizing the HBM, subjects on insulin therapy were found to perceive more barriers than those on other regimens. Subjects reported recognizing the advantages of changing eating habits. Lack of understanding was correlated with difficulty in dietary adherence. The advantage of the HBM is to identify the barriers to adherence. Utilizing TPB, the investigators found that attitude was significantly correlated with adherence and that educators who encourage a change in attitude can change adherence intention. Diabetes intervention programs depend on the willingness of patients to initiate and maintain appropriate health practices. "Knowledge alone seldom predicts behavior change" (Chapman et al., 1995, p. 75). The theoretical foundation helps identify and develop education that focuses on changing beliefs and improving attitudes toward adherence (Chapman et al., 1995; Ham & Chapman, 1995).

Computer Aided Instruction

The use of programmed learning provides intensive application of learning principles, with meaningful interaction. This can result in successful behavior, which, in turn, strengthens the student's motivation. Many educators, including health educators, have not yet fully utilized this technology of instruction as provided by computer and multimedia software (Bostow, et al., 1995)

Computers are frequently used to supplement teaching in primary, secondary, and some college classrooms. The use of interactive computer based programs for most other disciplines is still being developed. The electronic technology of video and audio tapes, of computer based training, and of multimedia in innovative health education programs has been reported with small cohorts. The use of electronic instruction technology for teaching or for supplemental training is not standard nutrition education practice of Registered Dietitians. Appropriate interactive multimedia software is not readily available and is both time-consuming and expensive to develop. Hardware (computers, keyboards, printers, monitors, etc.) is expensive and medical facility administrators are reluctant to appropriate funds for this untried purpose. Due to the advancement of technology and cost containment, the use of CAI, multimedia. hypermedia, and hypertext may be expected in patient education in a few short years (Doak, Doak & Root, 1996).

CAI in Adult Education

An interactive, self-administered, computerized, food frequency questionnaire was developed for a study by Suitor and Garner (1992). The study targeted low-income women in the Supplemental Food Program for Women, Infants, and Children (WIC). The questionnaire, designed to collect dietary data from low income women, was offered women visiting WIC clinics. Sixty-four women participated; prior to use 58% indicated they would prefer to use the computerized questionnaire rather than completing the paper questionnaire. After using the computer 87% indicated they preferred the electronic form. A similar change was observed when participants were asked their preference for a computer versus personal interview (45.4% before using the program and 75.0%

afterward). The authors found the advantages included completeness of the answered questions, standardization of the interview and response, self-paced response, and economy, (nutrition counselors had more time for counseling or teaching diet therapy). The noted disadvantages were: (a) additional space, equipment and maintenance were needed for the hardware; (b) quality software and printed materials were needed and difficult to find; (c) participants expressed anxiety regarding use of the computer. The program did not present educational materials to the population but only collected information regarding their eating habits. Since the questionnaire was well received by this small cohort, the authors encouraged nutrition educators to apply similar strategies to developing other materials for this population (Suitor & Garner, 1992).

Kinzie, Schorling and Siegal (1993) developed and tested a computer-based multimedia format to educate rural low-income pregnant women of the adverse outcome of alcohol use during pregnancy. The program provided user interaction in a cartoon format that required little reading. The 20 minute multimedia program was field tested twice, with a total of 98 women participating in two trials. The 39 women in the first trial had an average educational level of eleventh grade, and 85% were less than 25 years old. Eighty-one percent preferred the interactive computer format to other educational methods, and 95% stated they would use the method again when available. The second trial contained a four-item pre-/post-test administered by the computer in addition to the multimedia format. Fifty-nine women participated in a second trial at a public clinic. Their average age was 23.5 years and average educational level was the eleventh grade. Sixty-eight percent had infrequently used a computer. Comparison of the pre- and post-

tests revealed that 100% would choose non-alcoholic beverages after the program compared to 61% before. Ninety percent of the participants would use a similar program at another time; 97% felt the program was easy to use. The study participants liked the format and information, and requested that other topics be covered in a similar manner. "The behavioral (Theory of Reasoned Action) and educational approaches utilized in the development," the authors concluded, " have potential for producing effective health education" (Kinzie, et al., 1993 p. 51).

From these studies the conclusion was made that CAI is a useful tool for presenting and motivating health-related behavior change. The authors found the CAI used in the reviewed studies to be accepted by their subjects.

CAI Used for Older Adult Education

Rachal's (1993) review of 12 research studies comparing computer assisted instruction (CAI) to traditional methods of instruction in adult basic and secondary education found there was a great variation in the objectives, settings, software examined, skills, design sophistication, and conclusions. He concluded that the CAI was only as good as the software used, that adequately trained teachers using appropriately developed software were needed, and that the CAI is not a "miracle cure for teaching and learning". The author noted several trends:

1. age was not a factor, and actually favored the older student;
2. the attrition rate was less when CAI was used;
3. self-confidence was enhanced by a sense of mastery of the materials;

4. students liked the privacy (which allowed errors with out embarrassment), immediate feedback, and self-paced learning (Rachal, 1993, p 171);

Rippey and colleagues (1987) demonstrated that older individuals can use the computer to learn health related information. They developed eight lessons on various aspects of osteoarthritis treatment and self-care. The lessons provided an introduction to the computer, overview of osteoarthritis, medication, exercise, communication, quackery, coping, and home helps. After formative evaluation by health professionals, the lessons were field tested in Connecticut community centers by 72 senior citizens, 11 men and 61 women. Their ages ranged from 52 to 88 years. Length of education ranged from 5 years to 20 years. The study goal was to cause changes in patient behavior and knowledge. Their findings indicate a significant increase in knowledge, motivation for behavior changes, and significant increase in desired behaviors. The authors concluded that the older individual can learn a significant amount in a short lesson. The increased knowledge and motivation resulted in increased desired behaviors (Rippey et al., 1987).

McNeely's (1988) dissertation explored the potential of CAI as a health teaching method with older adults. Three versions of computer aided instruction health lessons were created, providing feedback in three forms:

1. corrective feedback without remediation or reinforcement;
2. drill and practice utilizing remediation and or reinforcement;
3. examples juxtaposed for remediation and or reinforcement.

One hundred twenty participants, aged 60-89 years were from 6 older adult congregate living facilities. They were randomly assigned to 1 of the 3 versions of the CAI. After the study, the investigator concluded that the older adults had successfully used the computer, increased their knowledge about good health practices with use of CAI, and had accepted the technology with enthusiasm (McNeeley, 1988).

The conclusion drawn by these authors is that older adults can learn from computer aided instruction, knowledge of appropriate health habits is increased, and the technology is well accepted.

CAI Used in Chronic Disease and Nutritional Therapy

Wheeler, Wheeler, Ours and Swider (1985) describe a study of 32 individuals with newly diagnosed diabetes mellitus referred to an inner city out-patient clinic. Participants were randomly assigned to traditional or computer- assisted instruction groups. Traditional instruction groups received two 30 minute dietitian-led instruction sessions during the four-week study. Computer assisted instruction groups received a combination of dietitian led instruction and computer-based instruction (included an interactive videodisc system). After the intervention, the CAI group demonstrated increased knowledge of the Exchange Lists, recognition of foods with concentrated carbohydrates and reduction of reported fat intake. But there was no observable improvement in caloric consumption during a standardized buffet lunch. The authors concluded that the computer based techniques were an acceptable supplement to traditional education methods in the patient group (Wheeler et al., 1985).

Hernandez, Ellinger and Heine (1994) reported the useability and acceptability of a computer-simulated meal planning program to assist diabetic individuals with meal planning. Their subjects were 13 adults, aged 27-44 years, with insulin dependent diabetes mellitus, and little or no computer experience. For six weeks the subjects planned weekly meals on the computer using a pictorial interface to make "real world" choices at home, in cafeterias, restaurants and at a party. The meals were instantly analyzed, then compared to each subject's diet prescription. All subjects reported that the program was easy to understand, provided acceptable meal planning and they were willing to use it on a regular basis. The author concluded that meal planning by patients was improved by supplementary, computer simulations (Hernandez et al., 1994).

Responding to dialysis patients' desire for knowledge about their disease and its treatment, Luker & Caress (1991) developed six programs of computer assisted learning (CAI) to teach all aspects of care for individuals initiating Continuous Ambulatory Peritoneal Dialysis (CAPD). Review of available CAI materials in England and elsewhere revealed no suitable commercial package was available. After the CAI was designed and produced, a descriptive study was designed to evaluate the usefulness and acceptability of the medium to CAPD patients and staff in a single study center. Complete data were collected from thirty patients during the one year study. The mean age was 50.9 years, with a range of 19 to 71 years. Eighteen of the participants were men, and 12 were women. This population was atypical of the general English CAPD population, since the average age was younger, and pre-dialysis experience likely extended due to polycystic kidney disease.

The study results found the CAI to be acceptable. Most participants preferred a combination of teaching resources, generally disliking books and leaflets as primary sources of information. Patients preferred instruction from the nursing staff or physician. The results demonstrated an insignificant correlation of biochemical data as a correlate of knowledge or preference for the CAI. Confounding elements of self-reported data and several interpretive qualifications of biochemical data kept the use of the CAI from being adequately evaluated (Luker & Caress, 1991, 1992). While they found their CAI acceptable to the patient population, the authors propose that a more critical review of techniques to measure and evaluate collected data be instituted in further studies (Luker & Caress, 1992).

Implications of Using CAI

The authors of these studies concluded that CAI is a useful tool adjunct to teaching by health care providers. They cite the advantages of using computer aided instruction as providing (a) self-paced, self-directed, active learning, without fear of failure, (b) standardized instruction in consistent and ordered sequences, (c) constant availability to patient /family/relevant other, (d) cost effectiveness, (e) . maintenance of education records, and (f) conveniently accessible data for research opportunities.

Several disadvantages of using CAI for health education were cited. These are (a) limited availability of appropriate software, (b) cost of developing applicable software; (c) illiterate patients benefit less than the literate, and (d) fear of using computers (Baston, 1991; Bostow et al., 1995; Reinhardt 1995).

The number of studies using CAI in health education as a teaching supplement or as a health promotion tool is small. The use of CAI for dialysis patients education is negligible. This phenomena may be explained by the following factors:

1. developing appropriate software is costly;
2. adequate hardware to run the software is costly;
3. U.S. Health care industry is currently cost conscious;
4. new technology is added slowly by health care administrators;
5. cost of dialysis treatment is covered, and limited by Medicare.

CAI Instructional Design

A broad repertoire of teaching methods is needed by Registered Dietitians to teach medical nutritional therapies (Hayes, 1993). "Multiple teaching methods are necessary and appropriate when teaching adults" (Hayes, 1993, p. 183) Computer assisted instruction is seldom a "stand alone" tool, normally being combined with other teaching methods to stimulate learning (Price, 1991). "Understanding learning phenomena is necessary to design effective educational intervention, therefore, a learning and teaching theory is needed" (Hayes, 1993, p.230). In recent years computer mediated instructional program developers have used behavioristic theories as the basis for active response, immediate reinforcement and behavior shaping (Smith, 1989). Guidelines for developing CAI with each of five theoretical approaches (behaviorism, neobehaviorism (or imitation/modeling), information processing, cognitive psychology, and learning styles)

were summarized by Smith. He suggests these basic guidelines when developing computer aided instructional materials:

1. Frequent, positive feedback
2. Varied, frequent practice opportunities beyond the initial mastery.
3. Task analysis to determine learning task sequences and hierarchies
4. Internal mediators prompted.
5. Prompts and cues provided; performance modeled
6. Opportunities for cooperative work arrangements should be provided, if appropriate. (Smith, 1989, p.19).

When planning a CAI utilizing Gagne's Model for Instructional Design, the following tasks are completed (a) determine the audience's skill level; (b) determine instructional tasks, goals, design, and develop learning activities; (c) outline key concepts and facts to be presented before developing the program; (d) evaluate for effectiveness, and appropriateness during and after the development of the program (Price, 1991).

Little information regarding nutrition education or the effectiveness of written or oral nutrition education among functionally literate adults is available (Ruud, Betts, & Dirkx, 1993). Functionally literate adults may possess nutrition knowledge, but lack sufficient information to understand the issues (Rudd et al., 1993). These adults relate best to an education format that is defined as:

1. being perceived as personally relevant;
2. presenting all information in a simple, direct and conversational manner;
3. progressing from simple concept to complex information;
4. presenting a minimum of unnecessary information;

5. using illustrations (enlarged) in addition to text ;

6. using variety and boldness in the text (Ruud et al, 1993).

7. using a simpler vocabulary whenever possible (Brucia, 1993).

These strategies are similar to Keller's ARCS Model of four general requirements to motivate individuals to learn. Keller's four requirements are:

1. to obtain and sustain the individual's attention;

2. to define relevance to the student;

3. to help the individuals believe that they will succeed;

4. to satisfy the student with the process of learning (Keller,1987).

Literature Review Summary

End Stage Renal Disease (ESRD) is treated with transplantation or chronic dialysis, a complex regimen of treatment by artificial kidney, diet therapy and medications. Long-term complications are influenced by lack of behavior change regarding dietary control and prescribed medications.

Behavior theory helps identify and develop education that focuses on changing beliefs and improving attitudes toward adherence (Chapman et al., 1995). The Theory of Planned Behavior proposes that attitudes, subjective norms and perceived behavioral control are antecedents to intention and thus to behavior. To influence intention, or a corresponding behavior, it is necessary to change either behavioral beliefs or normative beliefs, or both (Azjen & Fishbein, 1980). The effective message influences primary

beliefs by containing information linking the behavior to various positive or negative outcomes (Azjen & Fishbein, 1980).

Computer based learning is a modern teaching method (Bostow et al., 1995), useable and acceptable to adult learners in adult basic education, and in health-related education programs for adult diabetics, pregnant women and arthritics (Kinzie et al., 1993; McNeely, 1988; Rippey et al., 1987; Rachal, 1993;). While educational software has been developed for a variety of subjects, interactive Computer Aided Instruction (CAI) for ESRD nutrition education is not readily available. Studies report CAI for diet therapy only as an experimental teaching tool (Hernandez et al., 1994; Luker & Caress, 1991, 1992).

As demonstrated by these studies CAI is an effective tool for educating older adults. It is also an effective tool when combined with behavior theory to change attitude and intention toward a behavior. Utilizing these two theories to develop a behavior theory-based CAI program of phosphorus education for ESRD patients is feasible and potentially effectual in augmenting change to adherring to a limited phosphorus consumption.

CHAPTER 3

METHODS

This study developed and pilot tested a Computer Aided Instruction (CAI) software program of phosphorus education for End Stage Renal Disease (ESRD) patients receiving chronic hemodialysis. The study examined the CAI as a practical and effective supplementary tool to the standard nutrition education provided by Registered Dietitians for individuals with ESRD.

Setting

This study was conducted in a free-standing (not hospital-affiliated) chronic hemodialysis clinic. Dialysis treatments were provided in large open rooms with each patient seated in a recliner-style chair beside a dialysis machine. A space of six to eight feet separated each patient/dialysis machine unit, allowing accessibility by the nursing and nutrition staff, and conversation among patients. Most patients dialyzed 2 to 4 hours three times weekly. Patients were provided nutrition education while receiving their dialysis treatments.

Participants

Selection

Participants were recruited from the convenience population of 79 patients at the hemodialysis clinic. Patients were not qualified for the study if they (1) were blind, (2) had an acute medical condition, (3) had documented intoxication and/or dementia, (4) were unable to read and understand English, (5) resided in a nursing home, or (6) had received dialysis treatments less than two months. Fifty-eight patients qualified for participation. Fifty-one expressed a willingness to participate in the study, a recruitment rate of 88%.

Qualified participants completed an Informed Consent document (see Appendix A3). Subjects were assigned a code number to protect their identity, and to link their laboratory results and the questionnaire results for statistical analysis. A random number table was used to assign each participant either to the experimental CAI (Treatment) Group or Comparison Group. Two qualified participants who were unable to read the computer screen after beginning the study withdrew. Co-morbidities, and hospitalizations prevented seven participants from completing the study. Forty-two subjects completed the study, 22 in the Treatment Group and 20 in the Comparison Group.

Demographic Data

Target Population

Descriptive statistics were used to delineate the study population. The demographic data, by gender, are shown in Table 1. The convenience population of 79 patients was 53.2% female, and 91.1% African-American. The age range was 31 to 88

Table 1. Demographic Characteristics of the Target Population.

	All (N=79)		Males (n=37)		Females (n = 42)	
Age (y)	n	%	n	%	n	%
30-39	5	6.3	2	5.4	3	7.1
40-49	11	13.9	7	18.9	4	9.5
50-59	14	17.8	9	24.3	5	11.9
60-69	23	29.1	12	32.5	11	26.2
70-79	23	29.1	6	16.2	17	40.5
80 and older	3	3.8	1	2.7	2	4.8
Range: (years)	31 to 88		to 88		31 to 86	
Mean Age (years ± S.D.)	61.8 ± 13.4		59.9 ± 12.7		63.1 ± 13.5	
Ethnicity						
African American	72	91.1	32	86.5	40	95.2
Caucasian	6	7.6	4	10.8	2	4.8
Other	1	1.3	1	2.7	0	0.0
Education Attained						
Grades 1 - 8	20	25.3	11	29.7	10	23.8
Grades 9 - 11	23	29.1	7	19.0	16	38.1
H.S. Graduate/GED	22	27.8	11	29.7	10	23.8
Technical/ Vocational/ Community College	9	11.4	4	10.8	5	11.9
University Degree	3	3.8	2	5.4	1	2.4
Master's Degree	2	2.5	2	5.4	0	0.0
Range: (Grade)	1 - 18		1 - 18		2 - 16	
Mean Education: (years ± S.D.)	10.4 ± 3.4		10.4 ± 4.1		10.5 ± 2.6	

years; the mean age was 61.8 ± 13.4 (S.D.) years; 62.0% were 60 years or older. Education ranged from completion of first grade to Master's Degree; 45% had completed the twelfth grade. The largest group of the women (40.5%) were 70 to 79 years; the largest group of men (32.5%) were 60 to 69 years.

The most current national data for ESRD patients indicates that in 1994 the U.S. ESRD population was 46% female, 28% were African-American, and 57% were 60 years and older (U.S. ERDS, 1995). By comparison this study population has 7% less women, 63% more African-Americans, and an additional 4% are older than 60 years.

When the mean age and education of the males and females in this population were compared by *t*-tests, no significant differences were found. Ethnicity and gender were compared by chi-squares and no significant differences were found.

Study Population

Demographic data (age, gender, ethnicity, and educational level completed) for the 42 study participants were compiled from responses on the Pre-Test Questionnaire. The demographic data for Treatment and Comparison Groups are shown in Table 2.

Age: The age of all subjects ranged from 34 through 79 years; the mean age was 60.0 ± 11.6 years; 57.2% were 60 years or older. The Treatment Group participants' ages ranged from 34 to 79 years; their mean age was 59.9 ± 13.6 years; 54.6% were 60 years or older. The Comparison Group participants' ages ranged from 43 to 76 years; the mean age was 61.2 ± 8.8 years; 60.0% were 60 years or older. When compared by *t*-test, no significant

Table 2

Demographic Characteristics of Subjects Completing the Study

	All Subjects N = 42		Treatment Group n = 22		Comparison Group n = 20	
AGE:	n	%	n	%	n	%
30-39	2	4.8	2	9.0	0	0.0
40-49	6	14.3	4	18.2	2	10.0
50-59	10	23.7	4	18.2	6	30.0
60-69	11	26.2	6	27.3	5	25.0
70-79	13	31.0	6	27.3	7	35.0
Mean (years)	60.0 ± 11.6		59.9 ± 13.6		61.2 ± 8.8	
Range (years)	34 - 79		34 - 79		43 - 73	
% > 60 years	57.1%		54.5%		60.0%	
GENDER:						
Female	26	61.9%	13	59.1%	13	65.0%
Male	16	38.1	9	40.9	7	35.0
ETHNICITY						
African-American	39	92.9%	20	90.9%	19	95.0%
Caucasian	3	6.8	2	9.1	1	5.0
Other	0	0.0	0	0.0	0	0.0
EDUCATION						
Completed (mean)	11.4 years ± 2.7 (S.D.)		12.0 years ± 2.9 (S.D.)		11.0 years ± 2.3 (S.D.)	
Range (years)	6 - 18		6 - 18		6 - 15	

age difference was found for the Treatment and Comparison Groups.

Gender: Sixty two percent of all subjects were female. The Treatment Group was 59.1% female; the Comparison Group was 65.0% female. When compared by chi-square test for gender, no significant difference was found between the Treatment and Comparison Groups.

Ethnicity: Of all subjects 91.9% were African-American. By comparison the Treatment Group was 90.9% African-American and the Comparison Group was 95.0%. When compared by gender, no significant difference was found for the ethnic proportions of the Treatment and Comparison Groups.

Additional calculation of *t*-tests comparing mean education of male and females revealed no significant differences between the Treatment and Comparison Groups.

Human Subject Approval

Approval for the use of human participants in this study was obtained from the Medical Directors and Administrators of the dialysis clinic, and the Institutional Review Board of the University of North Florida. Participants were asked to sign an Informed Consent indicating (1) that the purpose and procedure of the study had been explained, 2) that they were willing to participate in the study, and understood they could withdraw at any time, and (3) that their phosphorus laboratory data could be accessed by the chief investigator. Examples of approval and consent forms are found in Appendix A.

Nutrition and Phosphorus Education

Nutrition education was provided for each patient by the Registered Dietitian during the monthly review of the patient's laboratory test results. The monthly nutrition education review was individualized for each patient to include pertinent information regarding the protein, potassium, sodium, phosphorus and fluid restriction as ordered in the diet prescription. Phosphorus education reviewed (1) the effect of excessive serum phosphorus on bone metabolism, (2) appropriate phosphorus lab result values (compared

to current lab results), and (3) identity of foods containing large amounts of phosphorus and appropriate low phosphorus substitutes. Printed materials were distributed to reinforce the teaching and to guide care-givers.

The CAI Program

Development

Since suitable CAI software for teaching phosphorus control was not commercially available, a CAI program was developed using Gagne's Model of Instructional Design (Price, 1991) as the format basis and The Theory of Planned Behavior (Azjen & Fishbein, 1980) as the theoretical basis. The instructional goal was that students would be able to improve bone health by limiting phosphorus-rich foods in their daily diets, and taking medically prescribed phosphorus binders with their meals. The performance objectives, or the performance expected of the student after completing the CAI course, were that students would be able to:

- classify foods as "phosphorus-rich" or "bone healthy,"
- select a meal of "bone healthy foods" from a cafeteria menu,
- identify causative factors of chronic itching and bone pain,
- choose to reduce serum phosphorus by taking phosphorus medications as medically prescribed,
- correlate reduced consumption of phosphorus-rich foods and reduction of laboratory reports of phosphorus to less than 6.0 mg/dL.

The CAI course was developed using an interactive format, asking the user to give solicited advice to a "friend," a fellow patient at the dialysis clinic, who requested information regarding appropriate food choices. The CAI course reviewed the role of phosphorus in renal bone disease; posed questions regarding the roles of phosphorus in ESRD; provided an opportunity to select appropriate foods when dining out; and reviewed the correct timing of prescribed phosphorus medications (Price, 1991). The CAI software identified incorrect answers, and offered the student opportunity to enter the correct answer. After two incorrect answers the student was presented with the corrected answer and a brief explanation of the rationale of the correct response.

This CAI course was developed by the investigator. The CAI software was developed by an instructional design programmer using Microsoft Visual Basic, Version 3.0 (Microsoft Corporation, 1993). The completed software, along with Visual Basic 3.0, was installed on a file allowing execution on any computer operating Windows programs.

Formative Evaluation

Formative evaluation allows insight into the response by the targeted population to the intervention being planned. This method allows investigators to obtain reaction to the method of presentation, (text, graphics and illustrations), and to change appropriate items before use in the experimental study (Iszler et al., 1995).

Prior to its use in the study, the CAI course was evaluated at the dialysis clinic by the professional staff and by a group of patient leaders. The CAI course was evaluated for:

- appropriateness of program content and accuracy of information,
- appeal and acceptability of the format to the target population,
- efficacy of the interactive format (Kinzie et al., 1993),
- program adequacy (an appropriate amount of information is presented) (Price, 1991).

The professional staff of Registered Nurses, Registered Dietitians, Administrators, and Physicians used a check off questionnaire, with additional open-ended questions. This questionnaire is in Appendix B1. A group of patient leaders (the Patient Council), participated in a focus group to evaluate the CAI course (questions are in Appendix B2). Based on these evaluations, changes were made to the CAI course to include only one correct answer to all but one question, to clarify statements regarding the action of phosphorus medications, and to increase the font size for better readability.

Delivery of the CAI

The CAI software was installed on a note-book style pentium personal computer with a 9.5" active matrix color display. The screen's active matrix feature allowed the Registered Dietitian, seated beside the dialyzing subject, to view the screen while instructing the patient how to use the CAI course. Neighboring patients were unable to read the screen, thus preserving each subject's privacy while using the CAI course. Patients used the CAI course without direct supervision although assistance was provided as questions arose. Color coded keys were used to simplify question response and to progress from screen to screen. The length of time required to complete use of the CAI course varied with each subject's ability to read, and respond to the interactive questions.

The average time spent using this CAI course was 20 minutes, with a range of 15 to 35 minutes.

Measures

Pre-Test and Post-Test Questionnaires

The behavior-related dependent variables were measured using a questionnaire adapted from Chapman, et al., (1995) who applied the Theory of Planned Behavior to a study of elderly diabetic veterans. Chapman et al.'s questionnaire was modified to include foods with high phosphorus content that are favored by the clinic population. Since the Theory requires a "particular behavior within a specific time frame" (Chapman et al., 1995, p. 76), the questions were formatted to evaluate behavior in the context of "next month." The modified questionnaire tested for (1) attitude toward consumption of phosphorus-rich food; (2) the influence of the subjective norm (an individual's perceived expectation of one or more relevant other's opinion regarding a behavior); (3) perceived control of consumption of phosphorus-rich foods; (4) intention to consume phosphorus-rich foods; and (5) self-reported consumption behavior of phosphorus-rich foods. The Treatment Group Post-test Questionnaire also included three additional questions rating subject's satisfaction and experience with the CAI course on the 5-point bi-polar scale. A sample of the questions is found in Table 3. The complete text of the Pre-Test questionnaire and the Post-Test questionnaire is in Appendix C. Reliability for Chapman et al.'s questionnaire, as assessed by Cronbach's alpha, was perceived control = 0.52,

Table 3

Sample Questions from the Pre-Test/Post-Test Questionnaire

Directions: Circle the answer that is most correct for you. There are no right or wrong answers.

Intention[+]: That I intend to eat macaroni and cheese, black-eyed peas or peanut butter in the next month is

Very Likely	Somewhat Likely	Neither/ Unsure	Somewhat Unlikely	Very Unlikely

Attitude*: My eating macaroni and cheese, black-eyed peas or peanut butter in the next month is:

Very Beneficial /	Beneficial	Neither/ Unsure	Foolish	Very Foolish

Subjective norm[#]: My friends and family member think that I . . .

Definitely Should	Should	Neither/ Unsure	Should not	Absolutely Should not

. . . . eat foods such as macaroni and cheese, black-eyed peas, or peanut butter in the next month.

Perceived behavioral control[##]: How much control do you have over eating macaroni and cheese, black-eyed peas, or peanut butter in the next month?

Complete Control	Some Control	Neither/ Unsure	Little Control	Absolutely No Control

Reported behavior: During the last month I have eaten macaroni and cheese, black-eyed peas and peanut butter

6 to 8 times	3 to 4 times	1 to 2 times	Once	Did not eat them

[+]Questions 11, 12 and 16, also about intention, were asked in a similar manner.
[*] Questions 2, 3, 4, 5, 8, 15, 18, also about attitude, were asked in a similar manner.
[#] Questions 6, 7, 9, 14, also about the influence of subjective norms, were asked in a similar manner.
[##] Question 13, also about control, was asked in a similar manner.

subjective norm = 0.79, attitude = 0.86, and intent = 0.86. Intentions were strongly related to subjective norm, attitude, and perceived control (Chapman et al., 1995).

Serum Phosphorus Laboratory Analysis

Monthly laboratory analysis of each ESRD patient's blood allows the dialysis clinic's medical staff to monitor current health status of the patients. Blood samples were

drawn by the nursing staff per standardized clinic protocol. Samples were sent to nationally rated LifeChem Laboratories, Newark, New Jersey, for analysis by the standard method. The normal range for serum phosphorus is 2.3 - 4.5 mg/dL. The upper limit of the acceptable range of serum phosphorus as established by U.S. End State Renal Disease Network for ESRD patients is 6.0 mg/dL (USRDS, 1995).

Procedure

Study Design

The study utilized an experimental design with participants randomly assigned to either the Treatment or the Comparison Group. The independent variable was the experimental use of the CAI program. The dependent variables were (1) attitude toward consumption of phosphorus-rich foods, (2) perceived control of consumption of phosphorus-rich foods, (3) influence of the subjective norm, (4) intention to consume pbosphorus-rich foods, (5) self-reported behavior of consumption of phosphorus-rich food, (6) serum phosphorus lab results, and (7) participants' satisfaction with the CAI program.

The study was conducted during a five week period. During the initial week of the study, participants had monthly blood tests drawn and completed the Pre-Test Questionnaire. Two days later, participants received their regular laboratory test review and nutrition education.

During the second and third weeks supplemental phosphorus education was presented to Treatment Group subjects by the CAI course. Participants were offered the

CAI twice. All Treatment Group participants used the CAI when it was initially offered to them. Five participants did not repeat the education due to illness or preferential interest in afternoon television programming. During the fifth week all participants completed the Post-Test Questionnaire on the day that their monthly blood tests were drawn. This experimental design is diagrammed in Figure 2.

	Week 1 Pre-Test	Weeks 2 and 3 CAI Program Used	Week 5 Post-Test
Treatment Group	RO_1X_a	X_b	O_2
Comparison Group	RO_1X_a		O_2

R = Random Assignment
X_a = Standard Education
X_b = Computer Assisted Instruction
O = Dependent Variables Measured

Figure 2. Experimental Design

Data Analysis

Responses to the questionnaires were scored on a five point adjective scale. Questions regarding attitude (7 questions), subjective norms (5 questions), perceived control (2 questions), and intention (4 questions) were scored using the bi-polar scale, "-2, -1, 0, +1, +2" with the favored response being scored as "+2". The question regarding self-reported consumption behavior was scored using a five point adjective scale of "1, 2, 3, 4, 5", with "1" indicating frequent consumption, and "5" no consumption. Means and differences scores were calculated for each of these behavior-related dependent variables for each participant from the Pre-Test and Post-Test. Means and differences

scores for serum phosphorus lab results were calculated for each study group from monthly lab results after the Pre-Test and Post-Test.

Statistical calculations were made with Microsoft's Excel Software Data Analysis (version 5.0, 1993, Microsoft Corporation). An alpha level of 0.05 was used for all statistical tests. Descriptive statistics (means, standard deviation, range, and percentages) were computed. Comparisons of the Treatment and Comparison Groups were made with *t*-Tests Assuming Equal Variances ($p = .05$) to measure:

(a) dependent variables' pre-test means (between Groups),

(b) dependent variable's means, pre-test to post-test (within each Group),

(c) dependent variable's difference means (between Groups),

For ease of calculation the behavioral variable's pre-test scores were subtracted from the post-test scores. To determine the differences between pre-test and post-test serum phosphorus lab results, the post-test means were subtracted from the pre-test means for ease of calculation (Frankel & Wallen, 1993; Sommer & Sommer, 1991). The number of serum phosphorus lab results greater than 6.0 mg/dL, and equal to or less than 6.0 mg/dL, were analyzed by Chi-Square for significance at Pre-Test and Post-Test.

CHAPTER 4

RESULTS

The results of this study of supplementary education for End Stage Renal Disease (ESRD) patients in a chronic dialysis clinic are shown below. Descriptive analysis, *t*-tests, and chi-square tests were used to examine attrition rate, dependent variables scores, and questions regarding acceptance of CAI.

Analysis of Attrition

Fifty-eight patients (73%) of the clinic's population were eligible to participate in the study. Fifty-one patients (88%) participated in the study. Forty-two subjects (82%) of this sample completed the study. Co-morbidities, hospitalizations, and the size of the computer screen prevented nine subjects from completing the study.

In the Treatment Group, four subjects (one male and three females) were unable to complete the study. In the Comparison, Group five subjects (two males and three females) were unable to complete the study. Descriptive statistics examining demographic factors for these subjects and those finishing the study are shown in Table 4. The only demographic factor found significantly different was education. Subjects not completing the study had less education (m = 8.9 years) than those completing the study (m = 11.5 years), $t = 2.49$, $df = 1$, $p = .02$.

Table 4

Descriptive Analysis of Attrition

Demographic Factors	Subjects Not Completing Study n = 9	Subjects Completing Study n = 42
AGE (years)		
Mean ± S.D.	61.7 ± 17.12	60.0 ± 11.6
Range	31 - 79	34 - 79
GENDER		
Male	3 (33.3%)	20 (47.6%)
Female	6 (66.7%)	22 (52.4%)
ETHNICITY		
African-American	7 (77.8%)	39 (92.9%)
Caucasian	2 (22.2%)	3 (7.1%)
EDUCATION COMPLETED		
Mean (years) ± S. D.	8.9 ± 3.4	11.5 ± 2.8
Range (years)	2 - 13	6 - 18

Dependent Behavioral Variables

Analysis Comparing Pre-Test Scores

The dependent behavior variables' Pre-Test, Post-Test, and difference mean scores are shown in Table 5. Comparison of Pre-Test mean scores between study groups of the five behavioral variables showed significant differences for three: Attitude, Subjective Norm and Intention. Attitudes of the Treatment Group were closer (m = 0.86 ± 0.68) to the desirable score of "+2" than those of the Comparison Group (m = .29 ± 1.04), t = 2.08, df = 40, p = .04. Comparison Group Subjective Norms were closer (m = 0.52 ± 0.87) to the desirable score of "+2" than the Treatment Group (m = -0.14 ± 1.03), t = 2.22, df = 40, p = .03. Treatment Group Intentions were closer to the desirable

Table 5

Pre-Test and Post-Test Differences of Dependent Variable's Means

	Comparison Group n = 20			Treatment Group n = 22		
Dependent Variables	Pre-Test	Post-Test	Difference	Pre-Test	Post-Test	Difference
Attitude	0.29 ± 1.04	0.61 ± 0.95	0.32	0.86 ± 0.68	1.23 ± 0.64	0.38
Subjective Norm	0.52 ± 0.87	0.89 ± 0.84	0.37	-0.14 ± 1.03	0.44 ± 0.76	0.58
Perceived Control	0.63 ± 0.84	1.23 ± 0.80	0.6	0.89 ± 0.52	1.48 ± 0.73	0.59
Intention	0.01 ± 0.96	0.71 ± 0.97	0.7	0.81 ± 1.00	1.41 ± 0.61	0.6
Reported Behavior	3.65 ± 1.35	4.35 ± 0.81	0.7	4.14 ± 0.99	4.77 ± 0.43	0.64
Serum Phosphorus* Lab Result (mg/dL)	6.50 ± 2.55	6.56 ± 2.54	0.06	6.03 ± 1.31	5.28 ± 1.38	0.74

Note: Means are calculated at Confidence level of 95%.

^ Responses to the first four behavioral variables were ranked on the bi-polar scale of "+2" (most desirable score) to "-2" (least desirable score). Reported behavior was calculated on a scale of "1 to 5;" "5" is the most desirable score.

*Serum Phosphorus lab results greater than 6.0 mg/dL are considered undesirable (U.S. E.S.R.D., 1995).

score of "+2" (m = 0.81 ± 1.00) than the Comparison Group (m = 0.01 ± 0.96), $t = 2.62$, $df = 40$, $p = 0.01$.

Analysis of Within Group Change

Comparisons of Pre-Test to Post-Test differences were conducted within study groups by paired *t*-tests. The Treatment Group showed a significant increase toward "+2" for Subjective Norms (difference = 0.58) $t = 2.95$, $df = 21$, $p = .01$; Perceived Control (difference = 0.59) $t = 3.33$, $df = 21$, $p = .003$; Intentions (difference = 0.60), $t = 2.27$, $df = 21$, $p = .03$; and Behavior (difference = 0.64), $t = 2.73$, $df = 21$, $p = .01$. The Comparison Group showed a significant increase toward "+2" for Perceived Control (difference = 0.60), $t = 2.42$, $df = 19$, $p = .03$; Intentions (difference = 0.70), $t = 2.44$,

$df = 19$, p = .02; and Behavior (difference = 0.70), $t = 2.21$, $df = 19$, $p = .04$. In both groups, Pre-Post Test differences for Attitude were not significant.

Analysis of Between Group Differences

Difference scores of the five behavioral dependent variables for the Treatment and the Comparison Groups were compared by independent *t*-tests. No significant differences were found between the groups on any of the five variables.

Serum Phosphorus Lab Results

Analysis Comparing Pre-Test Lab Results

Pre-Test, Post-Test, and difference mean scores of the serum phosphorus lab results are shown in Table 5. No significant differences were found on Pre-Test mean scores between groups.

Analysis Comparing Within and Between Group Differences

Within Groups. Mean scores for the Comparison Group showed a non-significant worsening of serum phosphorus lab results from Pre-Test to Post-Test. The Treatment Group showed a significant improvement of phosphorus lab results from Pre-Test to Post-Test by paired *t*-test ($t = 2.42$, $df = 21$, $p = .02$).

Between Groups. No significant differences were found between groups on serum phosphorus difference scores ($t = 1.79$, $df = 40$, $p = .08$).

Analysis of Pre-Test and Post-Test Collapsed Lab Results

Table 6 shows Pre-Test and Post-Test subjects with acceptable (6.0 mg/dL and less) and unacceptable serum phosphorus lab results (greater than 6.0 mg/dL). No

Table 6.

Subjects' Phosphorus Lab Results by Group.

	Treatment Group (n = 22)		Comparison Group (n = 20)	
Phosphorus Lab Results	Pre-Test	Post Test	Pre-Test	Post-Test
Equal to and greater than 6.1 mg/dL	12 (54.5%)	7 (31.8%)	11 (55.0%)	11 (55.0%)
Less than 6.0 mg/dL	10 (45.5%)	15 (68.2%)	9 (45.0%)	9 (45.0%)

significant differences were found between the number of subjects with acceptable and unacceptable serum phosphorus lab results at Pre-Test. At Post-Test, more Treatment Group subjects (68.2%) had acceptable serum phosphorus lab results (n = 15) than Comparison Group subjects (45.0%) (n = 9). These data were not significant when compared by a chi square test ($x^2 = 2.30$, $df = 1$, $p = .08$).

CAI Acceptance

Treatment Group subjects evaluated the CAI at Post-Test for their satisfaction with its format, ease of use, and willingness for future use of the CAI program. The results are shown in Table 7. The means for each question (Opinion = 1.41 ± 0.96; Ease of Use = 1.36 ± 0.95; Re-use = 1.64 ± 0.95) reflect high positive opinions of the CAI for all three measures. No significant differences were found on these measures across age and gender categories.

Table 7.

Mean Scores of Treatment Group Subjects' CAI Use by Age and Gender.

n = 22	Opinion	Ease of Use	Re-Use
Group Mean	1.41 ± 0.96 (90.91%)	1.36 ± 0.95 (90.91%)	1.64 ± 0.95 (90.91%)
Age (years)			
30 - 59 n = 10	1.50 ± 1.30	1.40 ± 1.26	1.50 ± 1.27
60 - 79 n = 12	1.33 ± 0.65	1.33 ± 0.07	1.75 ± 0.62
Gender			
Male n = 13	1.46 ± 1.13	1.15 ± 1.07	1.62 ± 1.21
Female n = 9	1.33 ± 0.71	1.67 ± 0.71	1.67 ± 0.71

Note: Responses to the questions were ranked on a bi-polar scale of "+2" (most desirable score) to " -2" (the least desirable score).

CHAPTER 5

DISCUSSION AND CONCLUSIONS

This pilot study examined the use of computer aided instruction (CAI) as a supplemental teaching instrument for End Stage Renal Disease (ESRD) chronic dialysis patients. A CAI prototype delivering instruction for dietary phosphorus control was developed using Gagne's Model of Instructional Design (Price, 1991). The CAI delivered phosphorus education to a treatment group of 22 patients. Twenty patients who did not receive the CAI were the comparison group. Statistical analysis found significant changes over time on three of the behavior variables for the Control subjects and for differences for the Treatment subjects. Results approaching significance were found on monthly serum phosphorus lab results for Treatment subjects. Perceived satisfaction with the CAI by Treatment Group subjects was reported as high. Statistically significant differences were not demonstrated between groups for any of the behavioral variables. A difference approaching significance was observed for the Treatment Group's phosphorus lab results, compared to the Comparison Group's phosphorus lab results.

Characteristics of Subjects

The subjects for this study were solicited from a convenience population at a chronic hemodialysis clinic in northeastern Florida. The patients at the clinic are from the

surrounding community. The demographic statistics describe this population as predominantly elderly, African-American and female. When compared to the United States ESRD population in 1995 (U.S. E.S.R.D., 1996), this sample is unique for its predominance of African-Americans and females. The mean age of this clinic population (61.8 years) and of the U.S. ESRD population (59.4 years) are comparable. No studies were found in the literature that tested a CAI within a similar population.

Behavioral Dependent Variables

Group Differences at Pre-Test

The Comparison Group's Pre-Test scores for the dependent behavioral variables were nearly neutral on the scale of "-2 to +2." The Treatment Group's scores for the same variables are were higher (nearly "1") at Pre-Test except for Subjective Norms. The more positive behavioral scores may have had a "ceiling effect" by limiting the room for improvement among Treatment subjects on most behavioral measures.

Comparison of Pre-Test and Post-Test Results Within Groups

Comparisons of the five dependent behavioral variables, Pre-Test to Post-Test, showed significant differences for three variables in both study groups (Perceived Control, Intentions, and Behavior.) In addition, there was a significant difference in Subjective Norms for the Treatment Group. This improvement is important since previous researchers (Ajzen & Fishbein, 1980; Blue, 1995; Fluery, 1992) have linked subjective norms to actual behavior.

Serum Phosphorus Lab Scores

The serum phosphorus lab results approached significance Pre- to Post-Test for the Treatment Group. Although each group began with comparable serum phosphorus lab results, Treatment Group subjects' scores had greater improvement over time. When compared between groups, the range of change at was better for those in the Treatment Group. A greater proportion of those receiving the CAI were found to have an improved serum phosphorus level, compared to the control subjects. These results reflect improved control of consumption of phosphorus-rich foods. The clinical implications are that a reduction of the serum phosphorus lab reduces renal osteoporosis, and thus improves bone health and mobility of the patient. This study suggests that the CAI may hold promise in helping reduce serum phosphorus among selected patients.

CAI Acceptance

The use of interactive computer-based learning is reported as useful in influencing health-related behavior (Kinzie, Schorling, &Kinzie; Suitor & Garner, 1992). It has been demonstrated that older adults do successfully learn using the CAI, do increase their knowledge and practice of health behavior, and do accept the technology (McNeeley, 1988; Rachal, 1993; Rippy et al., 1987). Treatment subjects rated the CAI highly for acceptance of the medium, ease of use, and willingness to re-use.

Subjects also verbalized their opinion of the CAI. One subject, a 67 year old male, requested similar instruction for other areas of patient education. Another subject, a 50

year old male, found the instruction to be "too simple" until he recorded his last phosphorus lab result. He admitted embarrassment when he did this, since his lab result was greater than 6.0 mg/dL. Another subject, a 37 year old female, was delighted to realize she was able to successfully use the computer "without breaking it, and learn helpful information, too, just like my little boy." The technology was acceptable to these subjects. Four subjects verbalized the desire to continue to receive personal instruction by nutrition staff and physicians as well as the CAI. These comments are similar to those reported by Luker and Carress (1991, 1992) who used a CAI as the principal education tool in their studies with chronic dialysis patients.

Study Limitations

The statistical power of this pilot study was limited by the size of the study sample and the brevity of the intervention. Ideally, a minimum sample of fifty subjects would have been used in each group (Robinson & Neutens, p. 91, 1987). The length of this pilot study was limited to five weeks. Future studies should examine extended interventions and longitudinal outcomes of at least six months.

Subjects converse among themselves while waiting to begin, and while receiving, their dialysis treatments. They often share ideas for appropriate food choices as well as encourage each other to improve their monthly labs results. Conversation about, and after, the use of the CAI may have contaminated the scores of those in the Comparison Group even though they did not receive it. Future studies should control for circumstantial contamination by using multiple sites.

Serum phosphorus lab results are influenced by consumption of phosphorus-rich foods, as well as by consumption of protein foods (meat, poultry, fish, and eggs). The greater the consumption of protein foods without medical phosphorus binders, the higher the serum phosphorus lab. This study was limited only to comparison of CAI education and the phosphorus lab results. It did not compare the subject's phosphorus lab with protein consumption and use of medical phosphorus binders

Advantages and Disadvantages of CAI

This CAI was written for a specific population having a mean education level of the tenth grade. The inherent ability to custom design the software will allow the CAI to be used with other populations of varying literacy. Modifications for those less literate would include less text, additional, appropriate graphics and a larger font software. For those with a greater level of literacy, additional explanations of the disease process would be appropriate.

The CAI is a personal learning system, allowing use at the patient's discretion, personal learning pace, and with repetition as desired. The patient is not totally dependent on the health professional for nutrition education.

The use of the CAI as a teaching tool is limited by time and cost to develop the CAI programs. As CAI development systems and appropriate hardware become more readily available, the cost of producing a CAI program may be expected to decrease.

The size of the lap-top computer screen delivering the CAI prevented its use by two subjects in this study. One fourth of the clinic population were unable to participate

in the study due to blindness or inability to see sufficiently to read. Written materials have this same limitation. The technology to include an audio presentation and response format for the CAI is available, and would be appropriate to this visually challenged population. In addition, screen enlargers would be a useful tool when using the CAI in a desk top application. Several styles are available and can be considered for use with the CAI.

Recommendations

The recommendations emerging from this pilot study are:

1. To continue development of the CAI program for ESRD patients. Future versions of this CAI education will include additional graphics, larger font, and a cumulative score for the subject at the end of each session.

2. To replicate this study using several dialysis centers and a larger sample. A study sample similar to the average U.S. ESRD population would allow extrapolation to that population. Studies examining elderly, African-American subjects should also continue because they are less likely to receive innovative education.

3. To expand the CAI programs to supplement standard teaching by the Registered Dietitian for control of potassium, sodium, fluids, calories, and proteins, each a facet of the complex renal diet prescription.

4. To communicate these findings at conferences with other nephrology specialists, and submit them for peer review and professional publication.

Conclusions

This study did not demonstrate a statistically significant difference in attitude, perceived control, intention, and reported behavior between patients who received, and those who did not receive the CAI program. A significant difference was found on subjective norms for Treatment subjects. Serum phosphorus labs for Treatment subjects were found to be nearing significance. In addition, satisfaction with the CAI was rated highly among users. This method for interactive nutrition education warrants further study as a method for changing eating behaviors among ESRD patients.

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JOYCE J. DAUGHERTY R.D./L.D.
GRADUATE STUDENT
COLLEGE OF HEALTH
UNIVERSITY OF NORTH FLORIDA
JACKSONVILLE, FLORIDA

PHOSPHORUS EDUCATION STUDY

Permission is granted to Joyce J. Daugherty, R.D./L.D. to conduct a study of Phosphorus Education for patients at the North Jacksonville Renal Care Center, Jacksonville, Florida. The study will compare interactive computer aided instruction with the normal and usual education methods provided by Registered Dietitians to chronic dialysis patients. Subjects will complete permission forms allowing access to their monthly phosphorus laboratory results and will provided demographic data about themselves. In order to assure privacy, subjects will be identified only by code number. Their names or identifying characteristics will not appear in the prepared report.

5/13/96
Date

Signature deleted

Ira Harmon, M.D.,
Medical Co-Director
North Jacksonville Renal Care Center
Jacksonville, Florida

Signature deleted

Osami Ashouri, M.D.,
Medical Co-Director
North Jacksonville Renal Care Center
Jacksonville, Florida

JOYCE J. DAUGHERTY R.D./L.D.
GRADUATE STUDENT
COLLEGE OF HEALTH
UNIVERSITY OF NORTH FLORIDA
JACKSONVILLE, FLORIDA

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Permission is granted to Joyce J. Daugherty, R.D./L.D. to conduct a study of Phosphorus Education for patients at the North Jacksonville Renal Care Center, Jacksonville, Florida. The study will supplement the normal and usual education methods provided by Registered Dietitians to chronic dialysis patients with interactive computer aided instruction . Subjects will complete consent forms allowing access to their monthly serum phosphorus laboratory results and will provide demographic data about themselves. In order to assure privacy, subjects will be identified only by code number. Their names or identifying characteristics will not appear in the prepared report.

5/13/96
Date

Signature deleted

Mary Cisko, MBA, R.N.
Area Administrator
BMA
Jacksonville, Florida

APPENDIX A3

PHOSPHORUS EDUCATION STUDY

JOYCE J. DAUGHERTY, R.D., L.D.
GRADUATE STUDENT
COLLEGE OF HEALTH
UNIVERSITY OF NORTH FLORIDA

INFORMED CONSENT

Date:_____

I, _____, (please print), a patient receiving dialysis, agree to participate in a study of phosphorus education directed by Joyce Daugherty, R.D./L.D., Registered Dietitian.

In addition, so that a report about the phosphorus education can be made, I agree to provide information about myself (age, sex, length of time on dialysis, and amount of education completed) and my phosphorus lab results during the period of the study. My name, or identifying characteristics, will be kept confidential and not appear in any way in the prepared report.

The study has been explained to me. I understand that I will continue to receive phosphorus education during the length of the study. I understand that I may stop participation in the study at any time.

(Signed)_____

UNIVERSITY OF NORTH FLORIDA
4567 St. Johns Bluff Road, South
Jacksonville, Florida 32224-2645
(904) 646-2455 FAX (904) 646-2457

ACADEMIC AFFAIRS
Division of Sponsored Research and Training

April 26, 1996

MEMORANDUM

TO: Ms. Joyce J. Daugherty

FROM: Joseph A. Butler, Chairman J.A.B
Institutional Review Board for Protection of Human Subjects

SUBJECT: Review by Institutional Review Board

This is to advise you that your project, "Pilot study of the feasibility of computer aided instruction as a supplemental teaching instrument for dialysis patients" has been declared exempt from further review.

A copy of the certification of review is attached. Please telephone Mr. David Slusher or Ms. Rosalyn Gilbert in the Division of Sponsored Research and Training at 646-2455 if you have questions. Thank you.

JAB/reg

Attachment

c: Mr. David Slusher, DSRT

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APPENDIX B1

COMPUTER AIDED INSTRUCTION:
Evaluation of a Supplementary Nutrition Education Tool

INSTRUCTIONS: After you have reviewed the computer lesson, PHOSPHORUS, please rate the program for adequacy in each of the following areas.

Instructional Adequacy	Poor	Fair	Average	Good	Excellent
Directions clearly stated					
Instructional sequence?					
Clarity of text					
Meaningful student-lesson interaction					
Personalization of instruction					
Appropriate learner control					
Motivation					
Appropriate lesson control options					
Cosmetic Adequacy	Poor	Fair	Average	Good	Excellent
Effective screen use					
Consistent screen format					
Uncluttered screens					
Appropriate use of color and graphics					
Lesson appeal					
Freedom from text errors					
Program Adequacy	Poor	Fair	Average	Good	Excellent
Accurate program execution					
Freedom from program errors					
Efficient program operation					
Accurate display of information					
Appropriate response to learner input					
Curriculum Adequacy	Poor	Fair	Average	Good	Excellent
Consistency with related lessons					
Timelessness					
Appropriateness of time to complete lesson					
Flexibility					
EVALUATION SUMMARY Summarize your evaluation of each topic					
Instructional adequacy					
Cosmetic adequacy					
Program adequacy					
Curriculum adequacy					

Please answer the following questions as fully as possible.

1. Have any important points relevant to the topic of Phosphorus been omitted?
   If yes, please describe them.

2. Are the recommendations made here appropriate for the chronic dialysis population?

3. List anything in the lesson that might be offensive to the chronic dialysis population.

4. List what you *like* about the lesson.

5. List what you *dislike* about the lesson.

6. How responsive do you think the chronic dialysis population will be to the message in the lesson?
   _____ very responsive
   _____ not very responsive
   _____ unresponsive

7 How could the message in this lesson be improved?

Please make any additional comments regarding this lesson and its application to the chronic dialysis patient populations that would improve this computer aided instruction program.

THANK YOU FOR TAKING TIME TO COMPLETE THIS QUESTIONNAIRE.

Please return completed questionnaire to J. Daugherty, R.D.

Adapted from:

Office of Disease Prevention and Health Promotion, USPHS. Making Health Communication Programs Work: A Planner's Guide. U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health. NIH Publication No. 92-1493, April, 1992.

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APPENDIX B2

PHOSPHORUS EDUCATION STUDY

FOCUS GROUP QUESTIONS

1. What is your most recent phosphorus level?

   What is your opinion about how important phosphorus is to your health?

   How much does diet influence your phosphorus level?

   How much does the phosphorus level influence what you eat?

2. What are some of the dietary changes a person could make to lower phosphorus levels?

   kinds and amounts of food
   changes in shopping for food
   changes in what is eaten in restaurants

3. What kinds of instructions have you received about changing your diet?

   a. How many have tried to make the changes suggested?

   b. Were the changes easy or difficult to make?

   c. What would have helped you to make changes like these?

   d. Is there anything you can think of that would help you stick with a change once you've made it?

4. Regarding this new method of diet instruction,

   a. Did this kind of approach work for you?

   b. What do you like about this approach?

   c. What do you like least about this approach?

   d. What would you change about this approach?

   e. Would this approach be useful for other aspects of the renal diet?

Adapted from: Islzler J., Crockett S., Lytle L., Elmer P., Finnegan J., Luepier R., & Laing B. (1995). Formative evaluation for planning a nutrition intervention: Results from focus groups. Journal of Nutrition Education, 27 (3), 127-132.

APPENDIX C1

PHOSPHORUS EDUCATION STUDY: *PRE-TEST*

ID NUMBER _____ Date of Birth _____

The following questions ask you about your eating habits. There are no right or wrong answers! These are your answers and your opinions. Your answers will help the dietitians plan education activities to help YOU stay with the diet you doctor ordered.
Please answer the questions by circling the answer that is the most correct for you.
When you answer question 1 please circle the food you eat most often.
Questions? Ask the Dietitian

1. That I intend to eat macaroni and cheese, black-eyed peas or peanut butter in the next month is:

VERY LIKELY	SOMEWHAT LIKELY	NEITHER/ UNSURE	SOMEWHAT UNLIKELY	VERY UNLIKELY

2. My eating macaroni and cheese, black-eyed peas or peanut butter in the next month is:

VERY BENEFICIAL	BENEFICIAL	NEITHER/ UNSURE	FOOLISH	VERY FOOLISH

3. My eating macaroni and cheese, black-eyed peas, or peanut butter in the next month is:

VERY WISE	WISE	NEITHER/ UNSURE	SOMEWHAT FOOLISH	VERY FOOLISH

4. My eating macaroni and cheese, black-eyed peas, or peanut butter in the next month would be:

VERY ENJOYABLE	ENJOYABLE	NEITHER/ UNSURE	UNPLEASANT	VERY UNPLEASANT

5. My eating macaroni and cheese, black-eyed peas, or peanut butter in the next month is:

VERY GOOD	GOOD	NEITHER/ UNSURE	BAD	VERY BAD

---

6. My dietitian and doctor think that I . . .

DEFINITELY SHOULD	SHOULD	NEITHER/ UNSURE	SHOULD NOT	DEFINITELY SHOULD NOT

. . . eat foods such as macaroni and cheese, black-eyed peas, or peanut butter in the next month.

---

7. When it comes to eating macaroni and cheese, black-eyed peas, or peanut butter in the next month, I want to do what my spouse or other family members want me to do.

AGREE	SOMEWHAT AGREE	NEITHER/ UNSURE	SOMEWHAT DISAGREE	DISAGREE

---

8. For me, eating macaroni and cheese, black-eyed peas, or peanut butter in the next month would be:

VERY EASY	SOMEWHAT EASY	NEITHER/ UNSURE	SOMEWHAT DIFFICULT	VERY DIFFICULT

---

9. My friends and family members think that I . . .

DEFINITELY SHOULD	SHOULD	NEITHER/ UNSURE	SHOULD NOT	ABSOLUTELY SHOULD NOT

. . . . .eat foods such as macaroni and cheese, black-eyed peas, or peanut butter in the next month.

---

10. How much control do you have over eating macaroni and cheese, black-eyed peas, or peanut butter in the next month?

COMPLETE CONTROL	SOME CONTROL	NEITHER/ UNSURE	LITTLE CONTROL	ABSOLUTELY NO CONTROL

---

11. In the next month I will eat macaroni and cheese, black-eyed peas, or peanut butter

6 TO 8 TIMES	3 TO 4 TIMES	1 TO 2 TIMES	ONCE	WILL NOT EAT

12. That I intend to eat macaroni and cheese, black-eyed peas, or peanut butter in the next month. is:

VERY LIKELY	SOMEWHAT LIKELY	NEITHER/ UNSURE	SOMEWHAT UNLIKELY	VERY UNLIKELY

13. That I will try to eat macaroni and cheese, black-eyed peas, or peanut butter in the next month is:

VERY LIKELY	SOMEWHAT LIKELY	NEITHER/ UNSURE	SOMEWHAT UNLIKELY	VERY UNLIKELY

14. When it comes to eating macaroni and cheese, black-eyed peas, or peanut butter in the next month, I want to do what most people who are important to me want me to do. I . . . .

AGREE	SOMEWHAT AGREE	NEITHER/ UNSURE	SOMEWHAT DISAGREE	DISAGREE

15. I will make an effort to eat macaroni and cheese, black-eyed peas, or peanut butter in the next month.

DEFINITELY TRUE	SOMEWHAT TRUE	NEITHER/ UNSURE	SOMEWHAT FALSE	DEFINITELY FALSE

16. It is likely that I will eat macaroni and cheese, black-eyed peas, or peanut butter in the next 6 months at a special occasion or holiday.

AGREE	SOMEWHAT AGREE	NEITHER/ UNSURE	SOMEWHAT DISAGREE	DISAGREE

17. I have eaten macaroni and cheese, black-eyed peas, or peanut butter in the last month

6 TO 8 TIMES	3 TO 4 TIMES	1 TO 2 TIMES	ONCE	DID NOT EAT

18. I . . .

DEFINITELY CAN	CAN	NEITHER/ UNSURE	CANNOT	DEFINITELY CANNOT

. . . eat foods such as macaroni and cheese, black-eyed peas, or peanut butter in the next month.

19 What is your sex? _____ **1. male** _____ **2. female**

20 What is your age? _____ **years**

21 What is the highest grade or year of regular school you have ever completed? (Check one).

_____ 1. Grade 8.

_____ 2. Some high school

_____ 3 High School graduate or GED

_____ 4. Technical or vocational or community college

_____ 5. College

_____ 6. Post-graduate

23. How long have you received dialysis treatments? _____

24. How often do you use a computer?

_____ Never

_____ 1 or 2 times a year

_____ 1 or 2 times a month

_____ 1 or 2 times per week

_____ Every day

Thank you for answering these questions. Your answers will be used to create materials to help you follow your doctor's diet prescription.

APPENDIX C2

PHOSPHORUS EDUCATION STUDY: POST TEST

ID NUMBER _____ **Date of Birth** _____

The following questions ask you about your eating habits. There are no right or wrong answers! These are your answers and your opinions. Your answers will help the dietitians plan education activities to help YOU stay with the diet you doctor ordered.
Please answer the following questions by circling the answer that is the most correct for you.
When you answer question 1 please circle the food you eat most often.
Questions? Ask the Dietitian

1. That I intend to eat macaroni and cheese, black-eyed peas or peanut butter in the next month is:

VERY LIKELY	SOMEWHAT LIKELY	NEITHER/ UNSURE	SOMEWHAT UNLIKELY	VERY UNLIKELY

2. My eating macaroni and cheese, black-eyed peas or peanut butter in the next month is:

VERY BENEFICIAL	BENEFICIAL	NEITHER/ UNSURE	FOOLISH	VERY FOOLISH

3. My eating macaroni and cheese, black-eyed peas, or peanut butter in the next month is:

VERY WISE	WISE	NEITHER/ UNSURE	SOMEWHAT FOOLISH	VERY FOOLISH

4. My eating macaroni and cheese, black-eyed peas, or peanut butter in the next month would be:

VERY ENJOYABLE	ENJOYABLE	NEITHER/ UNSURE	UNPLEASANT	VERY UNPLEASANT

5. My eating macaroni and cheese, black-eyed peas, or peanut butter in the next month is:

VERY GOOD	GOOD	NEITHER/ UNSURE	BAD	VERY BAD

6. My dietitian and doctor think that I . . .

DEFINITELY SHOULD	SHOULD	NEITHER/ UNSURE	SHOULD NOT	DEFINITELY SHOULD NOT

. . . eat foods such as macaroni and cheese, black-eyed peas, or peanut butter in the next month.

7. When it comes to eating macaroni and cheese, black-eyed peas, or peanut butter in the next month, I want to do what my spouse or other family members want me to do. I . . . . .

AGREE	SOMEWHAT AGREE	NEITHER/ UNSURE	SOMEWHAT DISAGREE	DISAGREE

8. For me, eating macaroni and cheese, black-eyed peas, or peanut butter in the next month would be:

VERY EASY	SOMEWHAT EASY	NEITHER/ UNSURE	SOMEWHAT DIFFICULT	VERY DIFFICULT

9. My friends and family members think that I . . .

DEFINITELY SHOULD	SHOULD	NEITHER/ UNSURE	SHOULD NOT	ABSOLUTELY SHOULD NOT

. . . . .eat foods such as macaroni and cheese, black-eyed peas, or peanut butter in the next month.

10. How much control do you have over eating macaroni and cheese, black-eyed peas, or peanut butter in the next month?

COMPLETE CONTROL	SOME CONTROL	NEITHER/ UNSURE	LITTLE CONTROL	ABSOLUTELY NO CONTROL

11. In the next month I will eat macaroni and cheese, black-eyed peas, or peanut butter

6 TO 8 TIMES	3 TO 4 TIMES	1 TO 2 TIMES	ONLY ONCE	WILL NOT EAT

12. That I intend to eat macaroni and cheese, black-eyed peas, or peanut butter in the next month is:

VERY LIKELY	SOMEWHAT LIKELY	NEITHER/ UNSURE	SOMEWHAT UNLIKELY	VERY UNLIKELY

13. I will try to eat macaroni and cheese, black-eyed peas, or peanut butter in the next month.

VERY LIKELY	SOMEWHAT LIKELY	NEITHER/ UNSURE	SOMEWHAT UNLIKELY	VERY UNLIKELY

14. When it comes to eating macaroni and cheese, black-eyed peas, or peanut butter in the next month, I want to do what most people who are important to me want me to do. I . . . .

AGREE	SOMEWHAT AGREE	NEITHER/ UNSURE	SOMEWHAT DISAGREE	DISAGREE

15. I will make an effort to eat macaroni and cheese, black-eyed peas, or peanut butter in the next month. This is . . . .

DEFINITELY TRUE	SOMEWHAT TRUE	NEITHER/ UNSURE	SOMEWHAT FALSE	DEFINITELY FALSE

16. **It is likely that I will eat macaroni and cheese, black-eyed peas, or peanut butter in the next 6 months at a special occasion or holiday. I . . . . .**

AGREE	SOMEWHAT AGREE	NEITHER/ UNSURE	SOMEWHAT DISAGREE	DISAGREE

17. I have eaten macaroni and cheese, black-eyed peas, or peanut butter in the last month

6 TO 8 TIMES	3 TO 4 TIMES	1 TO 2 TIMES	ONCE	DID NOT EAT

---

18. I . . .

DEFINITELY CAN	CAN	NEITHER/ UNSURE	CANNOT	DEFINITELY CANNOT

. . . eat foods such as macaroni and cheese, black-eyed peas, or peanut butter in the next month.

---

19. How often do you use a computer?

_____ Never

_____ 1 or 2 times a year

_____ 1 or 2 times a month

_____ 1 or 2 times per week

_____ Every day

---

20. What is your sex? _____ **1. male** _____ **2. female**

21. What is your age? _____ **years**

22. What is the highest grade or year of regular school you have ever completed? (Check one.)

_____ 1. Grade 8.

_____ 2. Some high school

_____ 3 High School graduate or GED

_____ 4. Technical or vocational or community college

_____ 5. College

_____ 6. Post-graduate

23. My use of the computer for phosphorus education was

VERY GOOD	GOOD	NEITHER/ UNSURE	BAD	VERY BAD

24. My use of the computer for phosphorus education was

VERY EASY	EASY	NEITHER/ UNSURE	DIFFICULT	VERY DIFFICULT

25. I would . . .

AGREE	SOMEWHAT AGREE	NEITHER/ UNSURE	SOMEWHAT DISAGREE	DISAGREE

. . . . to using the computer again to learn more about dialysis.

Adapted from: Chapman, et al. (1995). Applying behavioral models to dietary education of elderly diabetic patients. Journal of Nutrition Education, 27(2), 75-79.

VITA

JOYCE DAUGHERTY, M.S.H., R.D., L.D.

PROFESSIONAL EXPERIENCE

Current Employment

Renal Dietitian, Dialysis Clinic, Jacksonville, Fl.

Dietitian, Mayo Home Health Agency, Jacksonville, FL,

Teaches medical nutrition therapy and nutrition maintenance skills.

Previous Employment

Adjunct Faculty, College of Health, University of North Florida, (UNF), developed curriculum, instructed "Foundations of Food Production;"

Graduate Assistant to Associate Dean, College of Health, UNF, co-authored periodic reports for longitudinal drug-abuse rehabilitation studies;

Dietitian, St. Louis Regional Medical Center, Ambulatory Care Center, taught medical nutrition therapy for adult and pediatric patients;

Dietitian, Washington University Clinical Research Center, N.I.H., provided medical nutrition therapy for adult and pediatric patients per clinical investigators' protocol.

EDUCATION

M.S.H., University of North Florida, 1996.

Dietetic Internship Program, Washington University, St. Louis, Mo, 1967;

B.S., Oklahoma State University, Foods and Nutrition, 1966;

SCHOLASTIC ACHIEVEMENTS

The Honor Society of Phi Kappa Phi,

Omicron Nu, National Home Economics Honor Society,

Talbot Award for Outstanding Home Economics Student,

Oklahoma State University.

PROFESSIONAL ASSOCIATIONS

American Dietetic Association,

National Kidney Foundation,

Florida Council on Renal Nutrition.

PUBLICATIONS

Co-authored monographs of progress reports for drug rehabilitation studies, June, 1994 to January, 1995.

Pilot Study of the Feasibility of Computer Aided Instruction as a Supplemental Teaching Tool for Chronic Hemodialysis Patients. Poster session presented at The National Kidney Foundation, New Orleans, LA., October, 1996.

Pilot Study of the Feasibility of Computer Aided Instruction as a Supplemental Teaching Tool for Chronic Hemodialysis Patients. Journal of Renal Nutrition, October, 1996, (abstract).

PERSONAL HISTORY

Born in , .