

USING A NUTRIENT DATABASE IN A HOME HEALTH CARE ENVIRONMENT

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INTRODUCTION

The Hermann Health Connection (HHC) is a project funded by the Hermann Trust within the Hermann Institute for Futuristic Health Care Delivery. The project was designed to evaluate the effectiveness of using an interactive on-line computer system between users and health care givers. The project provides a new format for delivering educational information and monitoring behaviors of patients who have previously been followed by traditional methods. Although a health education and monitoring network is a new application of technology, computer-assisted instruction (CAI) has been available for many years and has proven successful in a number of different environments. Some of the benefits of CAI mentioned in the literature are: increased motivation, instruction individualized to the user's needs and level, reinforcement of learning through immediate feedback (1), increased confidence, diminished fear of testing, and improved learning (2). In addition to the expected benefits of using computers for instruction, using a computer also offers participants an opportunity to take greater responsibility for their own health care. In this study, the subjects are able to report behaviors and measures, monitor progress, ask questions of health professionals and access information when it is needed. Family members are also able to access information and to ask questions although their health data will not be analyzed for this study.

SPECIFIC AIMS

The overall goal of the project is to improve the quality of life via a communications vehicle rather than through a therapeutic modality. The specific objective will be to characterize two study populations with pre and post measures over one year in the following areas: biochemical, anthropometric, psychological, behavioral, and cognitive.

SIGNIFICANCE

A review of the literature shows no other interactive health network such as this has been implemented. Health and general information networks such as the American Medical Association's MINET (3) and the CompuServe network (4) are available to subscribers but they do not include the kind of interactive communications between lay users and health professionals used in this study. A limited amount of research has been done on the use of computers to monitor health status in: blood glucose reporting (5,6), insulin adjustment (7), recording dietary intake (8,9) and emergency care (4). However, such monitoring has not been integrated with a health information network. The significance of the Hermann Health Connection project is that it will be the first effort to offer a comprehensive network for education, monitoring and analysis. Additionally, the project offers an opportunity to study compliance from a new perspective.

SAMPLE POPULATIONS

Two populations were selected for inclusion, a chronically ill group and a healthy group. The chronically ill group are people with insulin dependent diabetes. The other a healthy group of post-menopausal women.

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Diabetic Population

Participants are 50 persons with insulin-dependent diabetes who are patients in The University of Texas Medical School Pediatric or Adult Diabetes Clinics. Persons with diabetes were chosen as the study population because: (1) patients are available through the UT clinics; (2) the required health behaviors are relatively straightforward and measurable: checking blood glucose levels, adhering to a prescribed diet, exercising, administering medications; and (3) compliance with a specific regimen is vitally important for control of the disease and prevention of complications. Yet, compliance has been difficult to obtain (10,11).

Inclusion Criteria: insulin dependent, at least eighth grade reading level, English-speaking, interest in own diabetes, willingness to participate, established record of regular office physician visits or telephone calls.

Exclusion Criteria: severe retinopathy, pregnancy, less than eighth grade reading level, non English-speaking.

Healthy Population

Participants are 80 women who had their last menstrual period within the last two years. These subjects were recruited from the Houston area through public announcements and communications with women's groups or other likely sources. Post-menopausal women were chosen as the second study population because there was an interest in investigating a group which is basically healthy but undergoing a normal life change, in contrast to the first study population, persons with a chronic disease. However, women in this group are at high risk for osteoporosis, (12), and the project provides an opportunity to examine whether providing information about drugs, diet, exercise, stress management, general health and the monitoring of health behaviors will affect physiological and psychological well-being.

Inclusion Criteria: Caucasian, last menstrual period no earlier than June 1, 1984 and not later than June 1, 1986, eighth grade reading level, English-speaking, at least one live delivery, willingness to participate.

Exclusion Criteria: non-Caucasian, last menstrual period before June 1, 1984 or after June 1, 1986, prior hysterectomy, prior reproductive tract malignancy, congenital lipid disorder, history of kidney stones, hyperparathyroidism, hyperthyroidism, history of disease known to cause secondary osteoporosis or osteomalacia, illness developed during recovery from a broken bone, nonambulatory, past or current therapy for osteoporosis, less than eighth grade reading level, non English-speaking.

METHODOLOGY

Once a subject was determined by telephone queries to meet the study inclusion criteria, appointments for various pre-tests and a training/orientation session using the computer were scheduled. Subjects took loaned terminals and monitors home at the completion of the training.

Pre and Post Measures

Diabetic Patients

- Fasting a.m. samples of blood and urine
 - Glycosolated hemoglobin
 - SMAK-15
 - HDL
 - Blood glucose
 - Urine protein
- Percent body fat - sum of 4 skin folds

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Frame determination - wrist measure
Vital signs
Diary of 24-hour food intake
Zung Self-Rating Anxiety Scale
Rosenberg Self-Esteem Scale
Multidimensional Health Locus of Control
Diabetes Self-Efficacy Scale
Cognitive tests:
 Nutrition
 Exercise
 Drugs
 Stress Management
 General Health

Post Menopausal Women

Fasting a.m. samples of blood and urine
 SMAK-15
 HDL
 FSH
 Estradiol, estrone, estriol
 Hematocrit, if low, hemoglobin and serum iron also performed
 Cyclic AMP 3-hr. urine
 Calcium 3-hr. urine
 Creatinine 3-hr. urine
 Phosphorus 3-hr. urine
 Hydroxyproline 24-hr. urine (preceded by 3-day modified diet)
Bone Density - heel scan using single photon osteoanalyzer
Exercise tolerance test
Muscle group testing
Percent body fat - sum of four skinfolds
Frame determination - wrist measure
Vital signs
Pap Smear
Diary of 24-hr. food intake
Zung Self-Rating Anxiety Scale
Rosenberg Self-Esteem Scale
Multidimensional Health Locus of Control
Self-Efficacy Scale
Cognitive tests:
 Nutrition
 Exercise
 Drugs
 Stress Management
 General Health

INTERACTIVE HEALTH NETWORK

The subject of this paper is to describe the nutrient data available to subjects in their homes. However, other services and information were made available along with the nutrient data. Services provided are: Electronic Mail, Weekly Health Letter, Health Encyclopedia Resource,

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Glossary, Personal Health Record and Analysis of Health Data. Nutrient data and analyses of foods can be accessed from the "Contents" menu in two ways. It is available through the Health Encyclopedia Resource and the Personal Health Record.

The nutrient database was purchased from Ohio State University because it offered a large number of fields and nutrients and other food constituents, has a large number of items, is a credible source, is useful for researchers, clinicians, and home users, and can be modified easily. Criteria for the HHC with respect to hardware and software were that the system be easy to use, visually pleasing and colorful, no previous computer experience needed by users, no typing ability needed, interactive and easy to access *only* the desired information quickly.

FEATURES OF HHC SOFTWARE FOR NUTRIENT DATABASE

The Hermann Health Connection is presented in full color graphics using the NAPLPS standard for graphics. Desired information is accessed through a series of menus by using key letters. Users may move directly to desired information by entering up to 26 key letters. The nutrient database is accessible through the Personal Health Record and the Health Encyclopedia Resource. In the Health Record, a menu option for Personal Health Diary contains all the health logs: food intake, exercise, medications and monitoring, illness and absence log, and stress management techniques. Other menu options under Health Record are for setting personal health goals, up to 27, and for analysis of health data.

The Food Log provides for immediate feedback with regard to recommended Kilocalories and ideal body weight (IBW). The user has the option to reject the recommended IBW and enter another weight choice, whereupon the Kcal are recalculated. Each user's record contains height, frame size, sex, age, and usual activity level which are used to calculate IBW and recommended Kcal. Users also get immediate feedback as they record foods regarding cumulative total Kcal and cumulative Kcal from fat.

After selecting "Data Entry" the user is offered either the full nutrient database with all food items or a condensed database complete for 16 nutrients. The latter option may require some substitutions of food items, however, there will be no missing data for the food item. This has appeal to researchers and users who either plan meals in advance or who are knowledgeable in making food substitutions. If the full list is chosen, in the nutrient summaries an asterisk will appear if any of the data were missing for a particular nutrient.

Food items are located by entering a letter or several letters of a word in a desired category. The data base is arranged in an index by first words and second words. For example, 2% fat cow's milk would first be accessed by typing in "M". Then selecting milk as the desired category. The user is then presented with a group of 2nd word choices, all the various kinds of milk. For this example, the choice is cow, where upon a "C" can be typed in and the user receives choices of various kinds of cow's milk. The user may scroll until 2% cow's milk is found and either step through the list or choose directly by entering the food item's code number. After the specific food item is selected, the user is prompted to give time of day the food was eaten, and size of serving in decimals. The item is then recorded above the scrolling window and individual and cumulative total Kcal and Kcal from fat are shown. At any point the user may stop data entry and analyze while still in the food log for the energy nutrients and alcohol and for the RDA. Users like this feature because they can look at the nutrient content of single foods or single meals. They may also switch to the other food list or select a previous day's record.

In the analysis option accessed through the Health Record menu, a user may analyze food hourly, daily, weekly or monthly. For analysis exceeding one day, if data is missing, an interpolation of the actual recorded days is plotted for the missing data. Up to seven variables can be selected by key letters from a scrolling window below the graph. Variables other than

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nutrients may also be plotted. This is particularly useful for looking at trends regarding Kcal consumed versus Kcal expended for exercise, or such variables as units of insulin taken versus various energy nutrients consumed. A selection of "Profiles" will offer the user a combination of nutrients.

The profiles and nutrients in each are:

Energy: Carbohydrates, Total fat, Alcohol, Crude fiber

Lipids: Total fat, Polyunsaturated fat, Oleic, Monounsaturated fat, Saturated fat, Cholesterol, Linoleic, P/S Fat Ratio

Trace Minerals: Copper, Fluoride, Selenium, Cobalt, Total Iron, Nonheme Iron, Manganese, Chromium, Molybdenum, Zinc, Heme Iron

Osteo: Calcium, Magnesium, Vitamin D, Dietary fiber, P/Ca Ratio, Phosphorus, Fluoride, Caffeine, Crude fiber

Carbohydrates: Dietary fiber, Crude fiber, Carbohydrates, Glucose, Fructose, Lactose, Maltose, Sucrose

Water/Electrolytes: Water, Sodium, Potassium, Chlorine

Amino Acids: Tryptophan, Isoleucine, Lysine, Cystine, Tyrosine, Histidine, Threonine, Leucine, Methionine, Phenylalanine, Valine

RDA: Food Energy, Total Fat, Carbohydrates, Vitamin A (RE), Vitamin A (IU), Vitamin D, Vitamin E, Vitamin C, Thiamin, Riboflavin, Niacin, Vitamin B6, Folic Acid, Vitamin B12, Calcium, Phosphorus, Iodine, Magnesium, Zinc, Total iron, Protein

Allergies: Gluten, Lactose

A selection of "Daily Energy" will show in bar graph format the user's energy intake compared to the recommended for height, weight, sex and activity level, or the distribution of calories from the energy nutrients. "Total Daily Nutrients" shows in percents the nutrient intake compared to the RDA in bar graph format. The line graphs show actual amounts of nutrients as well as the individual's RDA.

The nutrient database may also be accessed through the Health Encyclopedia Resource. Users who wish to browse in the data base for foods which are high or low in specific nutrients and/or compare them to the RDA or to other standards may do so under the menu choice, "What's in my Food and Drink?". Users enjoy this feature because they can compare foods in the same category or check on specific nutrients in items they have eaten or plan to eat. For example, checking fatty acid content of various oils is a practical use of the browse function. The profiles offered under the analysis choice of the Personal Health Record are also available in the browse function.

Other uses for the nutrient database are in the educational modules of the nutrition section of the Health Encyclopedia Resource. In this section typical modules or mini books under development include "Meal Planning Primer", "The Label Puzzle" and "Recipe Analysis". There are currently 75 modules which have been written in the nutrition category and others under development.

SUMMARY

The Hermann Health Connection is the first comprehensive system to offer health information, health monitoring and the capacity for on-line expert response to queries in the areas of Nutrition, Stress Management, Drugs, Exercise and General Health. This innovative, real time service using the NAPLPS standard for videotext has wide consumer appeal for a number of markets: users with chronic illnesses, institutional facilities, and individuals who are interested in improving their own health status.

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