PROCEEDINGS
OF

THE THIRD NATIONAL NUTRIENT DATA BANK CONFERENCE

April 17 and 18, 1978

Arlington, Virginia

INTRODUCTION

The Third National Nutrient Data Bank Conference was held April 17-18, 1978, at Stouffer's National Center Hotel in Arlington, Virginia. The purpose of the conference was to bring together the users of computerized nutrient data bases with the individuals involved in their preparation, and to encourage an exchange of ideas on the development and use of those data bases.

The program consisted of five sessions:

Nutrient Data--nutrient data sources, the Government's role in developing nutrient data bases, and reliability of available data;

Uses of Nutrient Data--applications in research, hospitals, food service, and industry;

Computer Applications--mini computers and USDA computer applications;

Survey Report--nutrient data base survey, which was initiated at the second conference;

Concluding Session--history, objectives, and possible future of this nutrient data bank users' group.

The conference was organized by Robert Rizek, Frank Hepburn, and Betty Perloff of the U.S. Department of Agriculture's Consumer and Food Economics Institute. Tony Fisher, U.S. Army TRIMIS Agency, assisted in planning the program.

Betty P. Perloff
Proceedings Editor

TABLE OF CONTENTS

Monday morning, April 17, 1978

8:30 a.m. Registration

9:00 a.m. Welcome Robert L. Rizek, Chairman
Consumer and Food Economics Institute

NUTRIENT DATA

Moderator - Robert L. Rizek

1. The Food and Drug Administration's Interest in the Nutrient Data Bank

   John E. Vanderveen, Acting Director
   Division of Nutrition
   Food and Drug Administration
   Washington, DC

2. Reliability of Methods for Nutrient Analyses

   Kent K. Stewart, Chief
   Nutrient Composition Laboratory
   Nutrition Institute, USDA
   Beltsville, MD

   BREAK

3. Procedures and Status of USDA's Nutrient Data Bank

   Betty Perloff
   Nutrition Analyst
   Consumer and Food Economics Institute, USDA
   Hyattsville, MD

4. Food Composition Data Sets Available from USDA

   Brucy C. Gray, Leader
   Survey Statistics Group
   Consumer and Food Economics Institute, USDA
   Hyattsville, MD

5. Sources of Data Other than USDA

   Tony Fisher, Chief
   Food Service Team
   U.S. Army TRIMIS Agency
   Walter Reed Army Medical Center
   Washington, DC

Monday afternoon, April 17, 1978

1:15 p.m. USES OF NUTRIENT DATA

Moderator - Bonita W. Wyse
Associate Professor
Utah State University
Logan, UT

1. Diet Appraisal

   Peggy M. Veres
   Dietitian
   Human Nutrition Laboratory, USDA
   Grand Forks, ND

2. USDA's Food Consumption Survey

   Eleanor M. Pao
   Home Economist
   Consumer and Food Economics Institute, USDA
   Hyattsville, MD

3. Food Service

   Richard Bresnahan, Project Manager
   Army Hospital Food Service System
   U.S. Army
   Walter Reed Army Medical Center
   Washington, DC

   BREAK

4. Diet Recall, Coding, and Processing

   P. Victor Grambsch, Director, and
   Naseem Kassim, Nutritionist
   Nutrition Coding Center
   Minneapolis, MN

5. Diet, Nutrition, and Cancer Program

   Arlene Howard
   Nutritionist
   Enviro Control, Inc.
   Rockville, MD

6. Industrial Applications

   Arvid W. Munson
   Managing Director
   Raltech Scientific Services
   Ralston Purina Company
   St. Louis, MO

Tuesday morning, April 18, 1978

8:30 p.m. COMPUTER APPLICATIONS

Moderator - Frank N. Hepburn
Leader, Nutrient Data Research Group
Consumer and Food Economics Institute

1. Mini-computer application

   Donald E. Annala
   Computer Specialist
   U.S. Army
   Frederick, MD

2. SEA In-house Computer Applications

   Sandra L. Strauss, Computer Specialist
   Science and Education Administration, USDA
   Beltsville, MD
   and
   Richard E. Cooper, Chief
   Numerical Analysis Branch
   Science and Education Administration, USDA
   Beltsville, MD

   BREAK

3. Programs for USDA's Food Composition Data Sets

   Brucy C. Gray

4. Direct Access to a Nutrient Data Base

   Jan Janiczek, Computer Systems Analyst
   Survey Statistics Group
   Consumer and Food Economics Institute, USDA
   Hyattsville, MD

Tuesday afternoon, April 18, 1978

1:15 p.m. OTHER SYSTEMS AND SERVICES

Moderator - Tony Fisher

1. Report on Survey Questionnaire
2. Discussion

2:30 p.m. CONCLUDING SESSION

Moderator - Joan M. Karkeck
Director of Nutrition Services
Harborview Medical Center
Seattle, WA

1. Future Opportunities for the Nutrient Data Bank Conference
2. Discussion

3:30 p.m. Adjourn

Opening Remarks

by Robert L. Rizek

Two years ago a small group of people who were using computerized nutrient data bases decided to get together to share with each other some of the experiences they were having with their work. They met that year in Seattle, Washington, and again last year in Logan, Utah. I was invited to attend those meetings since our Institute is responsible for providing the food composition tables that form the core of most of the various nutrient data bases used in this country.

Both meetings were rewarding experiences and have served to enhance communications between our Institute and some of the primary users of one of our main products. I am pleased that we are able to host the third meeting.

For decades, the Department of Agriculture has been gathering nutrient data and tabulating them to produce handbooks of food composition. We have been providing these handbooks in machine readable form for about 10 years. Every year more requests are received for these data sets.

A few years ago we began a venture with the Food and Drug Administration and the food industry to develop a computerized system to aid us in the revision of Agriculture Handbook No. 8, our standard reference handbook of food composition. This venture has resulted in the Nutrient Data Bank. We realize that this Data Bank is only the initial step in providing adequate nutrient data, and we are continuing to work to improve it to better suit our needs.

Nutrient data bases are going to be used by more and more people for more and more purposes. We hope this conference will encourage an exchange of ideas and information about the development and use of nutrient data bases, and that it will help to make each of you more aware of the benefits, and the drawbacks, of using computerized nutrient data.

The Food and Drug Administration's Interest in the Nutrient Data Bank

by John Vanderveen

Following the White House Conference on Nutrition, the Departments of Health, Education, and Welfare and Agriculture began to try to establish a cooperative computer based nutrient data system. This system is now a reality and is operated at the Department of Agriculture. I would like to review some of the roles of the Food and Drug Administration in nutrition so that you may have a greater appreciation of our interest in and our use of nutrient data.

The FDA's mission includes four distinct areas of nutrition.

1. To maintain and improve the nutritional quality of the food supply.

2. To provide consumers with needed or wanted nutrition information through food labeling.

3. To foster the application of sound nutrition practices in the dietary management of injuries or errors of metabolism, primarily through foods for special dietary use and medical foods.

4. To protect the consumer from fraudulent or misleading nutrition information.

The Department of Agriculture has the same types of responsibilities for meat and poultry, but FDA is responsible for the rest of the food supply.

A few tools that the FDA uses to carry out its role are:

Standards of identity, which for years have been the most fundamental means of dealing with staples in the food supply, such as bread, or flour. All manufacturers in the country must follow the standard of identity if they manufacture foods and use the names for which these standards exist;

Common or usual name regulations establish a desirable nutrition profile for products which are known by a common name, for example, peanut butter, vegetable protein meat substitutes, etc.;

Nutritional quality guidelines which establish a desirable nutrition content for a class of foods such as ready-to-eat breakfast cereals, cooked breakfast cereals, and frozen meals;

General principles for addition of nutrients, which have been proposed to try to slow the addition of more and more nutrients to foods; and

Regulations for special dietary foods such as low calorie, reduced calorie, and low salt.

All of these mechanisms require a definitive existing nutrition profile for a recognized food or a desirable nutrition profile based on public health needs.

FDA uses nutrient data in various ways to monitor the food supply. There is a total diet program where our field offices develop diets based on the 1965 household food consumption survey data. These diets are analyzed every year for about eight nutrients. There are also special studies to determine the nutrient composition of particular foods. A recent study to establish the nutritional profile for ice cream is an example.

Trend data on food composition are studied to determine significant changes in the nutrient composition of our food supply, and also to determine long range impact of our regulatory actions. Major changes in staple items in the food supply might necessitate fortification changes or changes in processing procedures to restore the food's nutrient value. After such corrective action has been initiated, trend data must be obtained to determine if the corrective action reached desired goals.

Nutrient data are also utilized to develop provisional U.S. RDA's, where they are needed for regulatory purposes; to determine whether there is a need to increase or decrease a nutrient in the food supply; and to determine how to define the "low" and "high" for individual nutrients, for example, "what is a low cholesterol food?"

When deciding whether or not foods should be fortified, survey data, together with nutrient data, are examined to determine which foods reach the target population and to determine what the impact of adding a particular nutrient to a particular food would be.

Nutrient data are also used in reviewing the adequacy of our nutrient labeling program. By reviewing the variability of data, assessment of the appropriateness of compliance requirements can be made. FDA has a policy whereby data from the Nutrient Data Bank are used only for their implication as to whether or not regulations are adequate, and not for surveillance or compliance purposes.

Our current nutrient data are invaluable but there are a number of areas where nutrient data banks should be improved. They should have ready access and be continuously updated, and different data bases should use a common language and food code. We need to continue to devote our efforts in trying to make nutrient data bases more useful to a variety of necessary functions in our society.

Nutrient Analyses - How Good Are the Data?

by Kent K. Stewart

The usefulness of nutrient data is dependent upon how precisely the data describe the actual nutrient content of the food under consideration. The quality of the nutrient composition data produced by any analytical laboratory is dependent upon the methodology used for the extraction of the nutrient from the food, the analysis method, the analyst, the sample selection and the number of samples analyzed. To meet the needs of today's users, nutrient data base systems need to have a means of evaluating data obtained from various laboratories. This paper presents some suggested guidelines for this evaluation.

An assessment of the state of the methodologies for the analysis of nutrients is given in Table 1. If the analyst uses the appropriate methodology in proper fashion, then the probability of the correct value being obtained is given in the table.

The newer developments in human nutrition have brought about some changes in the requirements for nutrient data. For example:

(1) Originally the analytical values for classes of compounds such as total fat, total carbohydrates, and ash were considered to be adequate. Recent developments in nutrition have brought the realization that composition data are required for the individual sugars, fatty acids, and the inorganic elements.

(2) Historically most nutrients were assayed by biological means, usually with microbiological methods. These methods are usually very sensitive and quite selective. However, experience has shown that they are expensive, slow, and subject to interferences from other compounds.

(3) A number of chemical assay systems have been developed, but many of these systems lack the required sensitivity and selectivity. Hopefully, research on the development of modern chromotography systems will provide better methods.

(4) Most fatty acid data have been obtained from qualitative gas-liquid chromatography. Recently it has been demonstrated that this means of calculating fatty acid data introduces systematic errors into the results. To date, there has not been an acceptable method for calculating quantitative data from the qualitative data. The only way to get accurate data is to do quantitative analyses for fatty acids. It is probable that the same situation exists in other nutrient analyses.

(5) The use of certified standards and Standard Reference Materials are an excellent means of validating methodology and

individual assay values. If available, these certified materials should always be used to validate nutrient data. Proper use of these materials is an excellent means of reducing interlaboratory variation. Unfortunately, there are not any certified standards for many nutrients. The National Bureau of Standards is aware of the problem and action is being taken to provide these standards.

(6) The selection of the proper sample of food for nutrient analyses is extremely important in obtaining high quality nutrient data. Considerable care should be taken to insure that the sampling scheme is not biased.

We at the Nutrient Composition Laboratory are leaning toward a statistically designed nationwide retail store sampling plan. Care must also be taken that proper numbers of samples are taken. As a first step, we at the Nutrient Composition Laboratory have arbitrarily decided that sufficient samples should be taken on a nationwide basis to insure that the observed mean is within ± 10%, the true mean at a 0.95 confidence level. The number of samples required to reach mean values vary with the food and nutrients, but we estimate that a minimum of 20-30 random samples will be needed for most foods and nutrients. In any case, the sampling procedures require as much documentation as the analyses procedures for reliable data.

Finally, I would like to suggest that it is time to try to establish reliability indexes for nutrient data. Factors such as method, validation, precision, and sampling schemes should be included in any such index. Probably other factors will also be important. It is crucial that such factors be established before we get so much data that it is unmanageable. One hundred wrong values should not have more weight than five correct values; but until such a reliability index is established, that is exactly what will happen.

Table 1.--State of Development of Methodology for the Analysis of Nutrients in Foods

	Sufficient	Substantial	Conflicting	Fragmentary	Little to none
CARBOHYDRATES			Fiber Starch	Individual sugars	
LIPIDS		Cholesterol Fatty acids	Other sterols Total fat	Trans-fatty acids	
MINERALS & TRACE ELEMENTS	Calcium Copper Magnesium Phosphorus Potassium Sodium Sulfur Zinc	Iron Selenium	Chromium Fluorine Iodine Manganese	Molybdenum	Cobalt Silicon Tin Vanadium
PROTEIN		Most amino acids	Total protein Some amino acids		
VITAMINS		Vitamin C Niacin Riboflavin Thiamin	Vitamins A B_6 B_{12} D E Folacin Pantothenic acid	Biotin Choline Vitamin K	

KEY

Factors	Sufficient	Substantial	Conflicting	Fragmentary	Little to none
Probability of Correct Value	Excellent	Good-excellent	Fair	Poor	Zero to poor
Speed of Analysis	Fast	Slow	Slow-fast	Slow	Very slow
Cost of Analysis	Low	High	Low-high	Very high	Very high

Procedures and Status of USDA's Nutrient Data Bank

by Betty P. Perloff

The Nutrient Data Bank is a computer-based system for storing data on the nutrient composition of foods and for processing those data into meaningful average or representative values. Presently, this system is being used to revise Agriculture Handbook No. 8, Composition of Foods--Raw, Processed, Prepared. Data are processed by food groups, and the revision is published in sections as each food group is completed.

This data bank is operated by the Consumer and Food Economics Institute, Science and Education Administration, U.S. Department of Agriculture, in Hyattsville, Maryland. Within the Institute, the Nutrient Data Research Group provides the subject area knowledge, and the Survey Statistics Group provides the computer system and statistical support (Fig. 1).

Major sources of data are published research, the food industry, USDA's Nutrient Composition Laboratory, special USDA projects which include nutrient analyses, and contracted research. Specialists in foods and nutrition search out possible sources of data for their respective areas of responsibility. They carefully evaluate and qualify all information, monitor the flow of data within the system, and after analysis of the final summarized nutrient values, release them to the public (Fig. 2).

Before data entry, each item is qualified to reflect its unique characteristics. An illustration of the qualifying process is presented in Figure 3. The food classification is potato, Kennebec. The descriptive information represents successively more detailed levels of qualification that are coded and entered into the system with the food classification code. Is it raw or cooked? Peeled or unpeeled? Where was it grown? Freshly harvested or stored? The types of qualifying detail vary with different foods, but the more information known about the sample, the more detailed the coding.

The main stages in the Data Bank System are diagramed in Figure 4. They are:

The recycle file - the initial stage where editing and corrections take place;

Data Base I - The individual nutrient values;

Data Base II - A summary of identical food items from Base I, including averages, number of samples, standard deviations and ranges. Many items exist on Base II which are used in our analysis of nutrient data, but which are not needed by most users of

Handbook No. 8, e.g., different entries may exist for different cultivars of a vegetable; and

Data Base III - A smaller, more useable file, created by combining items from Base II. Where possible, combinations are made by weighting the different foods according to their relative commercial importance. Entries include average nutrient values and standard errors. These values are published in the Handbook revision and are available on magnetic tape.

Nutrients listed below are included in Data Base III unless data for them are unavailable. Copper was not included in the first two revised food groups, but will be included in baby foods and other food groups where the data exist. Fatty acids and amino acids are still being processed outside the system but are incorporated into Data Base III.

In Data Base III, Revised Handbook 8, and File 456	In Data Base III and Revised Handbook 8, but not File 456
Water	Magnesium
Energy	Zinc
Protein	Copper
Fat	Pantothenic acid
Carbohydrate	Vitamin B-6
Fiber	Vitamin B-12
Ash	Folacin
Calcium	Monounsaturated fatty acid
Phosphorus	Polyunsaturated fatty acid
Iron	Additional fatty acids
Sodium	Amino acids
Potassium	
Vitamin A	
Thiamin	
Riboflavin	
Niacin	
Ascorbic acid	
Saturated fatty acid	
Oleic acid	
Linoleic acid	
Cholesterol	

Although new data are released by food groups, we do realize that most users need a complete, across-the-board, data file. Therefore, our Systems Group has developed an approach to provide a file of our most current data for all foods which we hope to make available by direct access. For this file, data from Agriculture Handbook 456 were reformatted into Data Base III format. The reformatted file will be revised as each food group is updated, replacing the older data with the new. Jan Janiczek will discuss this file in more detail during his presentation.

Figures 5 and 6 indicate the status of the first 12 food groups. Dairy and Egg Products and Spices and Herbs were processed before the system was complete, but their final summarized values were placed in Data Base III. Food groups in earlier stages are: beef, cereal grains, bakery products, nuts and seeds, sugars and candies, beverages, and mixed dishes. All groups should be complete by 1982.

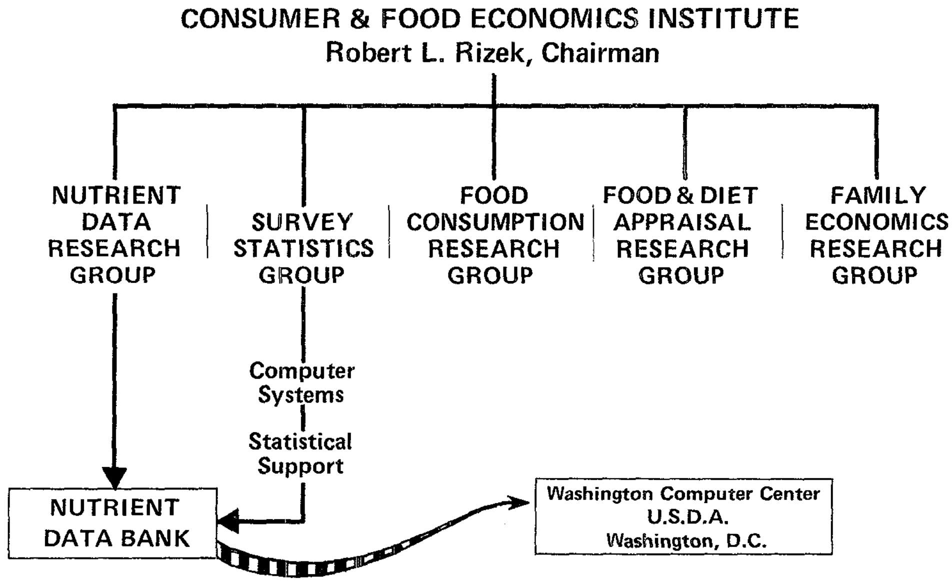
CONSUMER & FOOD ECONOMICS INSTITUTE
Robert L. Rizek, Chairman
NUTRIENT DATA RESEARCH GROUP
SURVEY STATISTICS GROUP
FOOD CONSUMPTION RESEARCH GROUP
FOOD & DIET APPRAISAL RESEARCH GROUP
FAMILY ECONOMICS RESEARCH GROUP
Computer Systems
Statistical Support
NUTRIENT DATA BANK
Washington Computer Center
U.S.D.A.
Washington, D.C.

Fig. 1

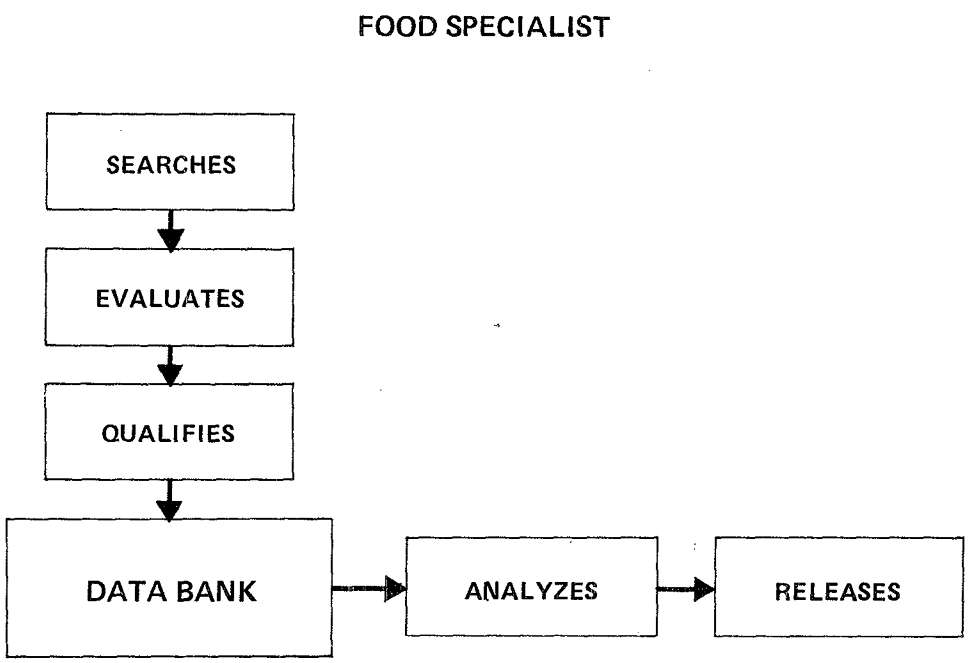
FOOD SPECIALIST
SEARCHES
EVALUATES
QUALIFIES
DATA BANK
ANALYZES
RELEASES

Fig. 2

QUALIFY

Potato, Kennebec

Potato, Kennebec, Raw

Potato, Kennebec, Raw, Without Peel

Potato, Kennebec, Raw, Without Peel, Maine

Potato, Kennebec, Raw, Without Peel, Maine, Stored 3 months.

Fig. 3

NUTRIENT DATA BANK

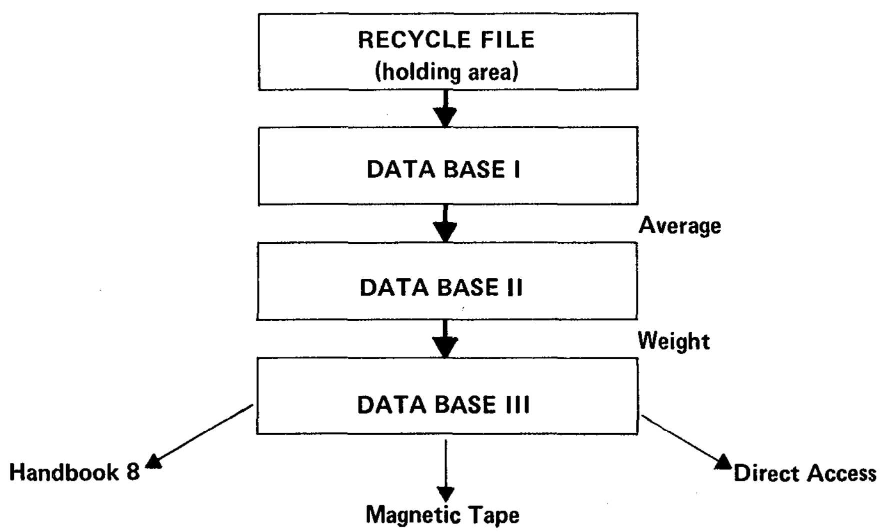

Fig. 4

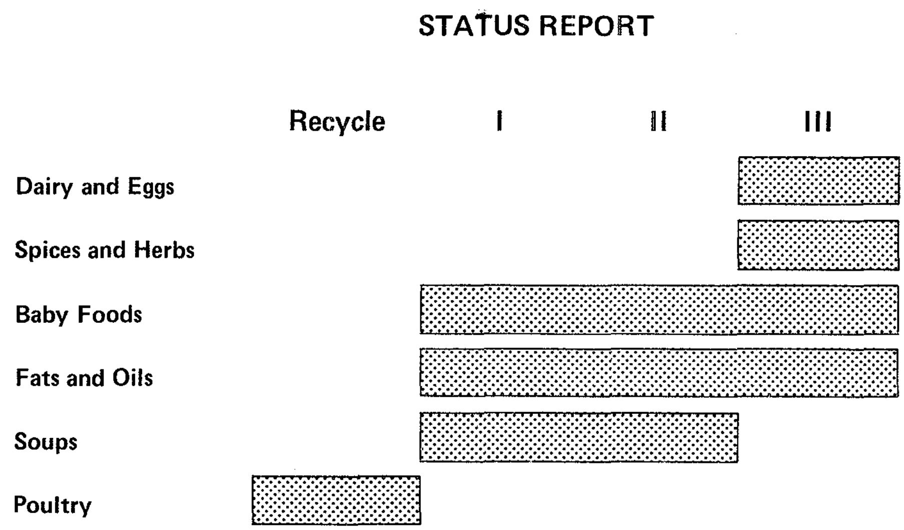
STATUS REPORT
Recycle
I
II
III
Dairy and Eggs
Spices and Herbs
Baby Foods
Fats and Oils
Soups
Poultry

Fig. 5

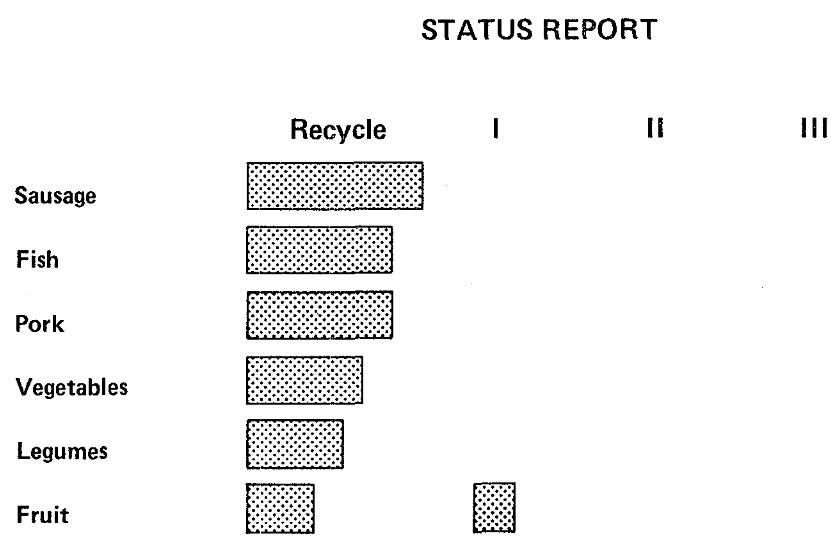
STATUS REPORT
Recycle
I
II
III
Sausage
Fish
Pork
Vegetables
Legumes
Fruit

Fig. 6

Food Composition Data Sets Available From USDA

by Brucy C. Gray

Several food composition data sets that have their origin in USDA's Consumer and Food Economics Institute are available to the public in machine readable form. A few of the more recent data sets are described below.

Data Set 456-3

This file contains food composition data which were used to prepare tables 1 and 2 of Agriculture Handbook No. 456, Nutritive Value of American Foods in Common Units, issued 1975. Twenty-one composition values are included: percent water, food energy, protein, fat, carbohydrate, fiber, ash, calcium, phosphorus, iron, sodium, potassium, vitamin A, thiamin, riboflavin, niacin, ascorbic acid, saturated fatty acid, oleic acid, linoleic acid, and cholesterol. Quantities are given in terms of 100 grams edible portion. A 20-character description is included for each food. An accompanying booklet contains expanded descriptions of the foods.

Data Set 456-2

This file is a companion file to 456-3 and contains gram weights for the units of measure used in Handbook 456 for each food item. By taking the product of the nutritive values per 100 grams contained in 456-3 and the corresponding quantities contained in this file (adjusted for refuse), one can create a file comparable to tables 1 and 2 of Handbook 456.

Data Set 72-1

This file contains food composition data as published in table 2 of Home and Garden Bulletin No. 72, Nutritive Value of Foods revised 1977. Values for food items are described in terms of household measures for the food and are provided for the weight of the household measure, percent water, food energy, protein, fat, saturated fatty acid, oleic acid, linoleic acid, carbohydrate, calcium, phosphorus, iron, potassium, vitamin A value, thiamin, riboflavin, niacin, and ascorbic acid. There are 730 food items included. A three-digit food code has been sequentially assigned to each food item after the items have been placed into food groups. A 24-character description of the food exists on each of the 87 character records.

The following two data sets are derived from the current revision of Agriculture Handbook No. 8.

Data Set 8-1, Dairy and Egg Products, 144 food items
Data Set 8-2, Spices and Herbs, 43 food items

Average nutritive values expressed in 100 grams edible portion, standard errors and number of samples are reported. Nutritive values are also reported for three other accepted units of measure for each food item. A unique 3-digit code identifies each nutrient, and 20 or more nutrients should be included for each food. No food descriptions exist on these files. Users will need copies of the publication.

For a complete listing of food composition data sets available in machine readable form, including costs and details for ordering, call USDA's Consumer and Food Economics Institute, 301-436-8507.

Sources of Data Other Than USDA

by Tony Fisher

Last year at the second conference in Logan, Utah, an ad-hoc committee was established to survey the holders of nutrient data banks. We developed a questionnaire to query the users of nutrient data banks and now those survey results are available. Today I will identify who those people are with nutrient data bases. Tomorrow we will go into the details of the survey.

Twenty institutions were identified as likely candidates to receive the questionnaire. We received 15 responses, of which 13 actually have a nutrient data base in one form or another. The 13 institutions are listed in alphabetical order below, with the names of the respondents.

1.	Case Western Reserve University Cleveland, Ohio	Harold Houser
2.	Golden West College Hunting Beach, California	Stanley Winter
3.	Harborview Medical Center Seattle, Washington	Joan Karkeck
4.	Kansas City Dental School Kansas City, Missouri	George Young Lois Cook
5.	Little Falls Hospital Little Falls, New York	Mary Kilby
6.	Louisiana State University New Orleans, Louisiana	Margaret Moore
7.	Nutrition Coding Center Minneapolis, Minnesota	Naseem Kassim
8.	Nutrition, Computer and Statistical Services, Inc. Great Neck, New York	Ruth Carol
9.	University of Colorado Denver, Colorado	Arlene Ernest
10.	University of Missouri Columbia, Missouri	Loretta Hoover
11.	USDA-SEA-Human Nutrition Laboratory Grand Forks, North Dakota	Peggy Veres

12. Utah State University — Mary Farley
Logan, Utah

13. Virginia Polytechnic Institute — Jane Wentworth
Blacksburg, Virginia

These data bases are used for a variety of applications. Most of them seem geared to research and teaching. They go far beyond just the nutrition classes. The list of respondents include departments of biometry, dentistry, pediatrics, pathology, as well as nutrition, food science, and home economics.

We have also seen that there are commercial applications for nutrient data banks, and that there are organizations making nutrient data and nutritional analysis applications available in a commercial environment. These applications may include the bookwork part of institutional food service or hospital dietetic management. After analyzing recipes, one can analyze menus, or a list of menu items served to a particular group, for example, a hospital patient on a particular type of diet.

Taking the menu application even one step further, there's a market for determining specific consumer intake, either hospital patients or individual food item breakdowns for super market shoppers, or cafeteria patrons. There are people who want to know nutrition information, and they're finding that computers can be a very valuable aid in getting that information.

We have a considerable amount of information about each of these systems, but we have not decided exactly what we will do with this information. What we do with this data really depends on the recommendations that are going to be made here at this conference.

Dietary Appraisal

by Peggy M. Veres

Dietary appraisals are time consuming without a computerized data base. A well-guided dietary history interview takes approximately two hours to complete, and collects the numerical and subjective data used in the appraisal. Our GRAND system is designed to process the data collected through a series of eight master files in a very short period of time. The files contain food numbers, names, and household measures; nutrient information; activity tables; RDA tables; and summary data. The final result of the files is a SUBJECT INTAKE REPORT listing subject identification, energy balance data, and nutrient summary data. The report is designed to adapt to CAP II or SAS for any special statistical reports not printed in the summary. These summaries can include either individual or group data and can also be correlated with biochemical and physical data to produce a detailed Human Nutrition Status summary. These Nutrition Status summaries can be used by epidemiologists, physicians, and nutritionists for assessing a patient's nutrition status.

USDA Food Consumption Surveys

by Eleanor M. Pao

Trends and variations in U.S. food consumption have been and are measured and analyzed by means of the USDA nationwide household food consumption surveys. The six surveys in this series have been made about once every 10 years since 1936-37, with two small surveys carried out in the 1940's. Fieldwork is being completed in the latest survey--the 1977-78 Nationwide Food Consumption Survey (NFCS). In the 1965-66 and 1977-78 surveys, dietary intakes of individuals were obtained as well as household food use.

The 1977-78 survey period extended from April 1, 1977, to March 31, 1978, and NFCS is the largest of the nationwide surveys undertaken. The basic sample was planned to include 15,000 households in the contiguous 48 states (about the same sample size as in 1965-66). About 17,000 additional households are expected to participate in the six supplemental surveys--special samples of the elderly and low-income; samples in Puerto Rico, Alaska, and Hawaii; and a bridging sample to assess effects attributable to changes in methodology used in 1965-66 and in 1977-78 surveys. The basic and elderly surveys span the full year and provide seasonal data. The low-income and Puerto Rican surveys cover 6 months and the others cover one season. Food intake records for about 34,000 individuals are expected from the basic survey and for about 45,500 from the supplemental surveys...almost 80,000 in all. The NFCS is the first USDA nationwide survey of individual food intakes to extend over all four seasons. All family members were surveyed concurrently in the supplemental surveys and in the spring of the basic survey. For the other three seasons of the basic survey, only half of the individuals over 18 years of age were systematically included.

To obtain information about food consumption in different regions of the country and for various subpopulation groups, USDA household food consumption survey data are used. Quantities of foods are reported "as purchased" or as brought into the kitchen and used in the household during the week surveyed. Information about food eaten away from home is not obtained but adjustment is made for number of meals members eat away and for guests eating meals in the household. Factors are used to adjust quantities for reasonable refuse before energy and nutrient values are calculated. An adjustment is also made for losses of vitamins in cooking. Losses due to spoilage, waste, and discard are not known. Money value of food is computed, as well as average consumption per person. However, consumption by individuals of the household is not available from these data.

To obtain data about food consumption of sex-age groups, surveys of food intake of individuals are necessary. The quantities of food are for "edible portion" or as ingested and include food as eaten both at home and away. Average food and nutrient intakes per person per day were calculated for the various sex-age groups based on the 24-hour recalls obtained for the first time on a nationwide representative sample in the 1965-66 survey.

USDA food consumption data were collected during a visit to the home by trained interviewers. At least 7 days in advance, an appointment was made with a person in the household (usually the homemaker) who was knowledgeable about the household's food management.

The list-recall questionnaire was used to obtain detailed information about the kinds, quantities, and prices of foods used in the household during the previous week. The precoded 54-page list-recall form doubled as a memory aid to help the homemaker recall food used in the home. For example, if fish or seafood were used, the interviewer read from the 21 categories of seafood on the fish page until the proper group was reached. Then the more detailed kinds of fish items were read until the exact item was mentioned. Each of the 20 food categories was handled similarly. Leftovers from the presurvey period were added and leftovers still to be used were deducted to measure only food used during the survey period. After completing the list-recall portion of the questionnaire, information about home food production and preservation and income and use of food stamps was obtained. At the beginning of the interview, demographic, household composition, and food practices information was obtained. This portion of the NFCS interview averaged about 1-1/2 hours.

The interviewer then proceeded with the portion of the survey to obtain food intake of eligible individuals in the household. The basic method to cover 3 consecutive days was comprised of a 24-hour recall and a self-administered 2-day diary record. The interviewer attempted to complete the 24-hour recall form for each individual present in the household. If a child was under 12 years or a person was unable to give information or was not present, someone having knowledge about the individual's food intake could answer. Otherwise, the form was left for absent members to complete. The interviewer then gave instructions for filling in the diary record. A set of measuring cups and spoons and a 6-inch plastic ruler were given to each household to assist in making more accurate estimates of portion sizes eaten. A four-page leaflet of instructions was left with the 2-day diary form to tell participants how to describe foods and report amounts--information necessary to properly code the foods eaten. After the 2 days had passed, the interviewer returned to the household to pick up the diaries. Before leaving the home, the forms were reviewed for completeness and clarity of information.

Food intake information of individuals is coded and units are standardized by coders at the contractor's central office in Philadelphia. Technical decisions are made at USDA-CFEI. A food coding manual developed at USDA is used.

Food codes are 7-digit numbers. The first digit identifies one of nine food groups. Most of the nine food groups are based on basic agricultural commodities (milk and milk products; meat, poultry, and fish; eggs; legumes, nuts, and seeds; grain products; fruits; vegetables; fats and oils; and sugars and beverages). Major and minor subgroups are indicated by the second and third digits. The last 4 digits are used to describe characteristics of the particular minor subgroup and unique items. The fourth digit is sometimes needed to further subdivide an especially large group of foods. Classification of subgroups is based on a common characteristic.

Quantities of food eaten are reported in several ways, e.g., cups, dimensions, or raw weights. Such measures must be converted to a common unit, grams, in the survey of food intake of individuals, before quantities can be aggregated and summarized. (The yield bulletin, USDA Handbook No. 102, and the common measures bulletin, USDA Handbook No. 456, are the two most frequently used sources of information). To obtain suitable measures for new products it is often necessary to conduct store checks or call fast-food chains or food firms, or experimentally determine measure-to-weight equivalents, sometimes by making a recipe in the laboratory.

For portions specified inadequately or not at all, a portion size is provided by USDA in the coding manual. Each usage of this generalized size is documented.

Providing accurate conversions of common measures to gram-weight equivalents for all food items reported in the survey is one of the most time-consuming and difficult tasks in processing the dietary information. It now appears that we will process over 12,000 requests from the contractor for gram-weight equivalents of measures for the intakes of individuals alone. The manual has been updated every few months.

Decisions to create a new code are made when no existing code is suitable or when an item is reported frequently. When detailed information is lacking, an "unknown" or a "not further specified" item code is created. For food mixtures such as salads, sandwiches, frozen meals, and recipes, there are the alternatives of separating them into component parts having existing codes in the manual, or assigning a new code to represent the total recipe. If the recipe is reported repeatedly, it is usually given a code of its own. Guidelines have been developed to help maintain consistency in coding decisions.

Questions requiring subjective judgment have been handled at USDA, where the item is researched, consensus reached among nutritionists, and the reasons for the decisions documented.

Each food item assigned a unique code in the coding manual must be assigned energy and nutrient values per 100 grams of edible portion by the food composition experts. Tabulations are currently planned for energy and fourteen nutrients: Protein, fat, carbohydrate, calcium, phosphorus, magnesium, iron, vitamin A value, B1, B2, B6, B12, C, and niacin. Handbook No. 8 with revisions is the basis for nutrient values on the nutrient data tape being developed for processsing the food reported as consumed in the current survey. Not all foods being reported appear in Handbook No. 8. These include items adequately described but not currently in Handbook No. 8 and items inadequately described.

New products and recipes adequately described are assigned nutrient values which are the most appropriate based on currently available information. Such estimates will be noted as "tentative" if information was not sufficient. Estimates based on ingredients or similar products may be assigned for use in the survey.

Occasionally, decisions have been made to enter unique codes for several items assigned the same nutrient values to meet certain requirements for the data, or to provide opportunity for use of more specific nutrient data later. One example is the detailed codes for kinds of fish being used as food, which is of interest to the National Marine Fisheries Administration.

Items which are inadequately described are coded separately from adequately described items and assigned nutrient values based on the form of the food most commonly used, or a composite value may be developed based on several frequently used forms. Mixtures and recipes which may vary with each household or restaurant or brand are a problem. Ethnic dishes are particularly troublesome. Nutrient values are often based on recipes from the most popular cookbooks.

Researchers and Government officials often use data from several different surveys in order to gather as much information as possible bearing on a problem before making decisions. However, most surveys are not easily compared because of differences in data collection and processing procedures, including differences in the nutrient data base used to calculate nutrient content of food consumed. There is a great need for developing standardized procedures where possible--such as manuals for measure-to-weight conversions, recipe calculation and yields, and sharing of guidelines for handling problems of unknowns and other assumptions that must be made. Development of these materials would facilitate carrying out future surveys and contribute to better comparisons among surveys.

Nutritional Analysis as a Part of A Computerized Food Service Management Information System

by Richard Bresnahan

In the majority of food service operations, nutritional analysis is something we would like to do more of. However, we have not because of the lack of nutritional data and/or the lack of time to perform the analysis. We now have the data that we need available to us not only in printed form but also in a form usable by a computer.

Now that we have the data, what are we going to do with it? We still are faced with the problem that it takes an enormous amount of personnel time to perform nutritional analysis. To solve this problem of time, and to make optimum use of the computerized data, we need a computer system which can use the data to perform the time consuming tasks of calculating the nutritional analysis of various recipes and menus.

In an institutional food service environment the opportunity exists to design such a system as a part of a comprehensive computerized food service management information system. I have developed a model that I use to demonstrate the capabilities of the computer when applied to an institutional food service environment.

The basic design structure contains three computerized files. The inventory file includes the name of every ingredient used in the operation, with purchasing and nutrient data. The nutrient data has been extracted from USDA's data tape and reformatted to be compatible with our food service system. The recipe file contains all recipes used at the institution, the ingredients with their required amounts, and production instructions. The third file is a menu file which contains a list of all menu items, with popularity factors for calculating the number of servings needed on a given day.

With these three files, and information on the number of people to be fed on a given day, a system can prepare a number of reports which will be extremely useful in a food service operation. A few such reports are:

- Menus which can be distributed to patients for item selection;

- Menu summaries which indicate the frequency with which items appear on the menu;

- Recipe indexes with nutrient or cost information per serving;

- Nutritional analysis reports;
- Cost analysis reports which include daily costs for individual recipes, meals, and menus, as well as cost per customer per meal;
- Worksheets for production and purchasing; and
- Inventory reports.

Such an approach gives us the ability, not only to computerize the tasks associated with nutritional analysis, but also other food service tasks such as menu planning, recipe extension, purchasing, inventory control, and cost accounting.

Recall Coding and Processing Using the NHLBI Dietary Recall System

by P. Victor Grambsch and Naseem Kassim

The NHLBI Dietary Recall System was developed for the Lipid Research Clinics and the Multiple Risk Factor Intervention Trial studies funded by the National Heart, Lung and Blood Institute. Major aspects of the system are outlined below.

I. NHLBI Dietary Recall System

A. Developed under aegis of and with funding from the National Heart, Lung and Blood Institute (NHLBI).

B. Joint venture of Lipid Research Clinics (LRC) and Multiple Risk Factor Intervention Trial (MRFIT) research projects funded by NHLBI.

C. Principal goals:

1. Collect dietary recalls in LRC and MRFIT under a common protocol so that the resultant data sets can be pooled for joint analysis.

2. Establish a data collection method which is useful to the wider medical research community.

II. Nutrition Coding Center (NCC)

A. Code Dietary Recalls collected according to the NHLBI protocol.

B. Maintain a database of nutrition information for use in coding, calculation, and counseling.

C. Maintain, produce, and distribute the NHLBI Codebook.

D. Maintain, produce, and distribute the NHLBI Food Table used in recall calculation by LRC and MRFIT.

E. Train field nutritionists in the NHLBI dietary recall data collection method.

F. Conduct research into nutrition data collection methods.

III. NCC Database

A. <u>Food Table</u>

1. Identification

a. Food code
b. Status
c. Type
d. Name
e. Reference
f. Cross references
g. Food groups
h. Codebook classifications
i. Entry, Coding and Inactive dates

2. Editing and Calculation

a. Food units and conversions
b. Allowable PREP Codes
c. Principal fats (ACOM, BCOM, CCOM, HOME)
d. Maximum serving

3. Nutrients

a. Total Calories
b. Protein
c. Total Fat
   1) SFA
   2) PFA
   3) MFA
   4) Oleic
   5) Linoleic-Linolenic
   6) CIS-CIS
d. Total CHO
   1) Sucrose
   2) Starch
   3) Other CHO
e. Alcohol
f. Cholesterol
g. Calcium
h. Phosphorus
i. Iron
j. Vitamin A
k. Thiamin
l. Riboflavin
m. Niacin
n. Vitamin E
o. Water
p. Fiber (crude fiber)
q. Ash
r. Sodium (excluding added salt)
s. Potassium
t. Caffeine
u. Folic Acid

B. <u>Recipe File</u>

1. Identification

a. Reference
b. Comments

2. Ingredient List

a. Ingredient (Food Code)
b. Amount
c. Unit

3. All recipes are items in the Food Table. Nutrients are calculated from the ingredient list and posted to the nutrient fields in the Food Table.

4. All ingredients are themselves items in the Food Table.

C. <u>Manufacturer's File (Product Information Form)</u>

1. Identification

   a. Product type/classification
   b. Product name
   c. Manufacturer/distributor name and address
   d. Date information typed
   e. Revision number

2. Nutrient Composition

   a. Unit of analysis
   b. Date of analysis/date information received
   c. Calories
   d. Protein
   e. Cholesterol
   f. Total Fat
      1) SFA
      2) MFA
      3) PFA
   g. Total CHO
      1) Sucrose
      2) Starch
      3) Other CHO
   h. Other nutrients if available

3. Notes and Comments

   a. Ingredients
   b. Geographic distribution
   c. Variety of similar products by same company
   d. Size of market units available

4. Sources and References

   a. Analytical data
   b. Calculated data

D. Codebook Format and Content

1. Instructions

2. Reference Material
   a. Recipe Index
   b. List of Food Models

3. Food Item and Coding Rule List

4. Guides

IV. Innovations to Collect Data on Fats

A. Rationale

LRC and MRFIT are vitally interested in fat consumption, especially the kind of fat consumed. The usual recall methods were not sensitive enough to assess the types of fat consumed, so extensions to collect more detailed information on fat were made by NHLBI.

B. Innovations

1. Guides - a variety of guides which classify foods by amount and/or kind of fat were developed and are used to assign Food Codes in coding.

2. APF Recipes - recipes which contain a significant amount of fat are coded in such a way that the kind of fat is identified and hence its particular fatty acid profile reflected in nutrient calculation of the recall. For example, a cookie made with butter will be coded differently than an otherwise similiar cookie made with margarine.

3. PREP and FAT Codes - these codes are used to add specific amounts and kinds of fat to foods that are prepared with fat. For example, the fat absorbed in frying meat or used in seasoning vegetables is coded in this manner.

V. Codebook Guides

A. Brand Name Guides

These guides are used for selection of appropriate code. Examples are:
1. Margarine Guide
2. Cracker Guide
3. Cheese Guide

B. <u>Food Characteristics Guides</u>

These guides are also used specifically for food code selection. Examples are:

1. Beef Guide
2. Pork Guide
3. Veal Guide

C. <u>Calculation Guides</u>

These guides are an aid to estimating frequency in terms of NHLBI servings. These help to facilitate calculation while maintaining consistency and accuracy. Examples are:

1. Common Measurements
2. Math Formulae
3. Meat Guide

D. <u>Coding Rule Guides</u>

These are miscellaneous rules to direct coding in case of unknowns or ambiguous situations. These rules help to maintain consistency in coding. Examples are:

1. Miscellaneous Meat Guide
2. Salad Dressing Guide
3. Restaurant Rules Guide

VI. PREP and FAT Codes Mentioned in the Presentation

A. <u>PREP Codes</u>

1. Used to indicate the amount of fat to be added to the food consumed.

2. Examples
   a. EGF - egg, fried; computerized rule (1 teaspoon per serving)

   b. APF - add principal fat; computer will add calculated amount of designated fat to recipe or commercial items that are pre-pared with fat.

B. <u>FAT Codes</u>

1. Used to indicate the kind of fat to be added to the food consumed.

2. Examples
   a. LARD - lard
   b. BCOM - Unknown commercial fat (varies with food and PREP Code)
   c. CORN - Corn oil
   d. FMGS - Margarine, stick or soft, P/S 0.6 - 0.9

Diet, Nutrition, and Cancer Program

by Arlene Howard

The purpose of the Diet, Nutrition, and Cancer Program (DNCP) is to develop and disseminate information on the interrelationships between diet, nutrition, cancer's etiology, and the therapy and subsequent rehabilitation of the cancer patient. The program is managed by the National Cancer Institute. Enviro Control, under contract, is responsible for the technical management and acts as the dietary clinical evaluation center for the nutrient data bases.

The primary structure of the DNCP emphasizes etiology and therapy. Research in etiology is being conducted in the following areas: evolution, dietary excesses and deficiences, development of methods for testing nutritional status, and epidemiological and dietary surveys.

Therapy is oriented toward the role of the metabolic and dietary processes in the development of cancer and the use of dietary and nutritional supplementation in the support of traditional cancer treatments. The possibility of utilizing diet and nutrition as a bureaucratic regimen is also being evaluated. Various methods of increasing the food intake of cancer patients, both adults and children, are being investigated. The expected results to be derived from this element include the definition of dietary recommendations for optimal nutritional support, the development of suggested dietary intervention techniques to increase nutrient intake, the development of direct nutritional therapeutic solutions, and the development of cancer screening methods based on changes in metabolic processes. The overall improvement of cancer patients' quality of life is the major goal of this research element.

The DNCP has developed two handbooks for the lay public. One is a resource for parents of children with cancer, and the second one provides diet and nutritional support during cancer therapy for adults. The DNCP projects include human and animal studies.

There are six types of clinical studies in the DNCP which are collecting dietary information.

Two studies are looking at the effect of total parenteral nutrition (TPN). One study is concerned with children and the effect that TPN has on weight maintenance and improvement of the nutritional status of therapy treated patients. There is a similar study for adult patients which looks at the effect TPN has on tumor growth, tolerance to the type of therapy treatment, and the post-tumor response.

A third type of study is concerned with anorexia in pediatric and adult cancer patients, and examines the effects of both cancer and the therapy on anorexia.

The fourth study is controlling the amount of dietary amino acids to study the effect on brain tumor growth. Some brain tumors have specific need for certain amino acids. It is also known that a host has a preferential uptake of amino acids. A logical question is what happens if you starve the tumor but allow adequate intake for the host.

The fifth study is comparing the vitamin intake of women with positive pap smears to the vitamin intake of women with negative pap smears. The sixth study looks at dietary patterns, nutritional status, and cancer incidence in vegetarian and non-vegetarian populations.

A very important step in designing these studies is to use a single nutrient data base. We use the data base from the USDA GRAND system, but have included additional data on vitamins, minerals, and nutritional supplements from MRFIT, food manufacturers, and the physicians' desk reference. Some of the software capabilities in our system were adapted from the GRAND, others were developed by our programing staff.

We have also developed a food coding manual designed to be used by dietary technicians. It contains a detailed description of each food. There are 18 food group categories. We have coding rules for combining items, such as the amount of sugar to include for sweetened fruit. All dietitians from around the country who are part of the study attended a workshop on the principles of coding and use of the manual. We may collect and process data in household measures or in gram weights. We include default categories to use when detail provided by a patient is incomplete.

Coded dietary information is sent to the Dietary Evaluation Center, validated, and put into the computer. Nutrient profiles are developed for each subject and merged with other data from the study.

We are still collecting dietary information. Hopefully, we will soon begin to answer the questions which are being asked by the Diet, Nutrition, and Cancer Program.

Industrial Applications for Nutrient Data Base

by Arvid W. Munson

The Ralston-Purina Company has been accumulating nutrient data from its own laboratory since 1926. We analyze not only the products which we manufacture, but also the individual ingredients purchased to go into the products. These data comprise our computerized nutrient data base. The existing data base is used as a reference for new analytical results, since it is very important to have a good indication of the level of a nutrient before beginning the analytical procedure. As new analyses are run, the resulting data are added to the base. The nutrient data are used by our laboratory in our quality assurance program and also to support our research on new products and processing techniques.

Data are stored in the data base in such a way as to be able to examine them by variety, year, and area of production. Information about conditions of storage and transportation and the different types of processing that the foods or ingredients have been subjected to is also included.

From these data it is possible to study the effects that various conditions have on the nutrient levels of foods. We look at relationships between nutrients and watch how these change over time. For example, as moisture decreases during storage, what direction do the other nutrients go? By looking at trends in nutrient composition, we are able to predict how products will be affected by various conditions. We also examine different processing techniques to see how they affect the final products. Since we gather data from all of our different plants, we are also able to compare products from different areas.

New ingredients are evaluated from a nutritional standpoint, and we are able to predict how a particular product will be affected by an ingredient substitute or a change in formulation. Animal foods can be formulated to meet the nutrient needs of specific animal species.

We monitor the quality of ingredients purchased from different suppliers by comparing the nutrient analyses results with data from the data base, which allows us, over a period of time, to judge the realibility of the suppliers.

We also use our nutritional data base as a marketing tool when we include nutritional information in advertising. It may also be used as an educational tool, since we are willing to make the nutrient data available to others who can use them.

Mini-Computer Application

by Donald E. Annala

In recent years nutritionists and food service managers have become more sophisticated about the benefits and potential of data processing. At the same time, large organizations find it very costly to develop a computerized food service system and have it installed in a reasonable time. Small organizations with limited resources are often not able to afford the specialized people who have technical data processing knowledge. New advances in electronic technology have been assimilated by cost conscious managers and the use of mini-computers and micro-computers is growing astronomically. Small computers do have limitations but people who are planning to use a computer with a nutrient data base should consider a mini or micro-computer.

Mini-computers are compact computers. They operate through programing, have at least 4K memory, versital input/output capability, and low cost, usually less than $25,000. One brand has been advertised for under $600.

For those considering a mini-computer, the software probably will be the major cost area. Software is the programs needed to run the job. While great strides have been made in the development of low cost, high performance hardware, the cost of software has not decreased. It has increased. The software systems are essentially handcrafted. Great care must be taken to define the job precisely before one begins. Most program difficulties stem from the lack of definition at initiation.

A user may purchase a mini-computer with software designed to his specifications. The vendor has no clear responsibilities outside of the equipment maintenance contract once the system has been installed. If the user requires software changes, the vendor supplies them for a price. However, the user should understand the workload capacity of the equipment and be able to assess the impact of future workload expansion on the system.

Another type of service is similar to that offered by a facility management company. The company maintains ownership of the equipment and the programs and charges a fixed monthly rate plus a fee for each transaction processed. If a change in service (hardware or software) is required, the two parties negotiate a price and the facility manager does whatever is necessary to make the change.

Some of the advantages and disadvantages of mini- and micro-computers are:

Advantages

- Low in cost
- Simple to operate
- Small, can fit into working environment
- Operated by user, no formal data processing staff is required
- System can be custom designed to a specific application
- If the user knows exactly what he wants, there is no need to over buy

Disadvantages

- Vulnerability - There may be problems with service and hardware, or Brand X may not be in existence when problems arise
- Limited use, for example, a system bought for one purpose is not always adaptable to other purposes

For someone about to use a computer for the first time, a good place to begin would be with a nutritional analysis program. I would like to bring to your attention such a program described in a recent article. "The Micro Diet: Better Health Through Electronics." ROM Vol. 1, December 1977, p. 36.

SEA In-House Computer Applications

by Richard E. Cooper and Sandra L. Strauss

It is the responsibility of the Communications and Data Services Division (CDSD) to provide data processing services to the Science and Education Administration of USDA. These services may take the form of systems analysis and design; consulting; statistical analyses; user services; laboratory automation; programing, testing and debugging; data entry; and production to name a few. Two of these services are discussed below.

Statistical Evaluation of Research Data

The Numerical Analysis Branch (NAB) provides data processing consultation and assistance in the statistical evaluation of research data. Certain factors may affect the nutrient composition of foods. Some of these include processing methods, processors, environment (location), cultural practices, product age (shelf life), cooking methods, variety, cultivar, breed, and certainly others. Along with other CDSD staff personnel, NAB intends to provide assistance in the collection, data processing, and evaluation of nutrient data, as a prelude to publication of research articles.

Production Activities in SEA Nutrition Applications

After a system has been approved as a final product by both the user who has requested it and the data processing personnel who have implemented it, it is judged to be operational and ready for production. At that point in time the primary responsibility for maintaining the system shifts to the user.

Often he is completely unprepared for the assumption of this burden. He can neither prepare sufficient input to feed the system, not does he have sufficient time to analyze the output from it. Not only may he be poorly equipped to detect potential errors in the system and/or his data, but he also may be unable to intitiate affirmative action to correct these ills.

These problems can be overcome and a painless transfer of the system to the user can be effected by careful planning and resource allocation, and through close cooperation between the user and those providing the ADP services. For example, written system documentation must be identified; and these personnel must then be trained to interact with the hardware and the software.

These elements have been provided for in both the Grand Forks Analysis on Nutrition Data (GRAND) system, a project carried out by the staff at the Human Nutrition Lab in Grand Forks and the personnel at CDSD; and the Dietary Lipid and Blood Pressure Study which has been developed as a cooperative effort between the staff from the Lipid Nutrition Lab and our personnel.

It is hoped and expected that these provisions will guarantee success for the life of the systems in both nutrition applications.

A Computer System for Diet Analyses

by Brucy C. Gray

A computer system has been developed to calculate the total nutrients obtained from foods in an eating period (originally set to be one day), the average nutrients provided over several of these eating periods (originally intended to be one week), and at the option of the user, the percent of the Recommended Dietary Allowances (RDA's) contained in the foods consumed in these eating periods. The input consists of a code indicating the age and sex of the person eating the food, the item number of each food, and the quantity consumed of the respective food item. The user may select eating periods different from one day and a set of eating periods different from one week and may eliminate the calculation of the RDA's if so desired.

The output consists of a table showing, for each food item in the eating period, the input food code and the input quantity along with the description of the food and the amounts for 20 food composition values contained in the food item. At the end of each eating period, the totals for the 20 food composition values for the eating period are given. Following the printing of the total nutrients for the last eating period in the week, the daily average is printed for each nutrient along with the percent of the RDA's if that option has been selected.

The data needed in this system are data set 456-3, which is placed in a direct access file with the food item code as the key, and a set of RDA's defined for the sex-age groups. The RDA's currently in use are from Recommended Dietary Allowances, published in 1974.

A procedure manual which describes the operating procedure for the programs and gives the source listings is available on request.

Direct Access to a Nutrient Data Base

by Jan Janiczek

As many of you are well aware, we have worked with Computer Sciences Corporation to establish an online data base that you, the users, can query interactively. Since our initial contract with CSC, the Federal Government, through the General Services Administration, has initiated a new Teleprocessing Services Procurement (TSP) program. The TSP proscribes a formal procedure for vendor selection, and controls our activities at CFEI, from sending out a Request for Proposal (RFP) through the awarding of a contract. Vendor selection is based on the least cost to the Government. The contracting procedure is not complete at this time, so we cannot name the new vendor, but we hope to be operational with the new vendor before October 1, 1978.*

For obvious reasons the exact structure of the new, or next, system is not known. However, we can make some generalizations about the types of ad hoc queries that can be performed. Before continuing let me explain the data base itself.

The initial data base will contain Handbook 456 in 100 gram edible portions. Sections of the new Handbook 8 will be added as they become available. As each section is added to the data base, the corresponding entries from 456 will be purged.

Each food record in the data base can be identified in two ways. The first and quickest is by the unique number assigned to each entry. This unique number is either a modified version of the 456 item number or the revised Handbook 8 item number.

Without modification of the 456 number, uniqueness cannot be guaranteed. For example, the 456 item number 1001 is for figs, raw, while in Handbook 8-1 the item number represents butter, regular. To eliminate potential confusion, and to insure uniqueness of the item numbers, the 456 numbers have been adjusted. Those 456 items that have a suffix digit, such as 439-1 and 439-2, have the number 70,000 added to them so that they become 74391 and 74392, respectively. For those 456 foods without a suffix such as Figs, raw (item number 1001), the item number is multiplied by 10 and then added to 70,000. The Figs, raw item number now becomes 80010.

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* USDA's formal agreement with Computer Sciences Corporation ended September 30, 1978, and a new contract was not awarded. CSC continues to maintain the USDA data base as described in this presentation and interested parties should contact CSC's Infonet Division directly.

The second method of food identification is via food codes and qualifiers. Each food in the data base will have a food code and a set of qualifiers that are unique to the data base. These food codes and qualifiers are the same ones used for food classification in our other data bases. Today's handouts include a listing of the updated item numbers, the food code and descriptions used in this data base.

Nutrients in the data base are also identified by an ID number, and all nutrients are stored in common units such as all solids are in grams, and calcium is stored in milligrams. The current system allows for over 300 nutrients, but most foods will have fewer nutrients available. When considering results of a query, one must remember that only nutrients for which data are available will be in the file. A value of zero indicates that a measurement was taken and reported as zero. No value implies that the nutrient may occur in the food, but no measure ments have been taken.

The interactive online data base will be able to report code definitions and nutrient data. Queries can report foods that have nutrient values with a specified range, or specified combinations of nutrients in foods. Other queries can report food with a specified qualifier or group of qualifiers. It will also be possible to contract with the vendor to have parameter driven standardized queries.

Until the new contract is let, you, the users, will have the option of using the current vendor, Computer Sciences Corporation, or you may purchase the data tapes from Action Data and perform your own processing. The programs presented by Mr. Gray are free and the listings are available for your use. For those who wish to work with the data interactively, Mr. Gray's programs can be modified easily to meet your needs.

We have a terminal here today for demonstration purposes. For those of you who wish to try this application, or have more detailed questions about conversion from batch to interactive use of our programs, the terminal and I are available from the end of this session until the afternoon session begins.

At the close of the session on computer applications, conference participants who had services to offer were given an opportunity to describe those services and were asked to remain after the session to receive questions from interested individuals.

The following participants spoke:	Services:
Ruth Carol Nutrition Computer and Statistical Services, Inc. 15 Linden Street Great Neck, New York 11021 516-466-8162	Nutrient data base and generalized software for nutrient analysis of dietary intake
Arden Forrey, spoke for Harborview Medical Center 325 Ninth Avenue Seattle, Washington 98104	Nutrient data base and software for dietary assessment
Harold Houser Case Western Reserve University Cleveland, Ohio 44106 216-444-3491	Nutrient data base and software for dietary assessment
Donna Lloyd Management Science Associates, Inc. 5100 Centre Avenue Pittsburgh, Pennsylvania 15232 412-683-5933	Marketing and management research with particular emphasis in areas of marketing analysis and management oriented computer applications
Margaret Moore Louisiana State University 1542 Tulane Avenue New Orleans, Louisiana 70112	Nutrient data base and software for dietary assessment
Aileen Sprague Computer Horizons, Inc. 7101 Wisconsin Avenue Washington, D.C. 20014 301-657-3165	Science and technology research ranging from statistical modeling of research systems to the publication of directories of research activities
Stan Weinstein Computer Sciences Corporation 8130 Boone Boulevard Vienna, Virginia 22180 703-821-2272	An independent software company implementing the food system for TRIMIS project at Walter Reed Medical Center

Report on Survey Questionnaire

by Tony Fisher

As I discussed in my presentation yesterday, a committee was established last year to conduct a survey of nutrient data bases. We developed a sample questionnaire, circulated it to participants of last year's conference for comments, refined it, and finally mailed it to institutions which we thought operated nutrient data banks. Joan Karkeck had queried the industry with announcements in professional journals to develop a list of likely candidates to receive our questionnaire.

We mailed the form to 20 institutions, received 15 responses. Of those respondents, 13 actually had nutrient data bases. I identified those institutions yesterday. Since then, Nancy Mulholand has completed a questionnaire for Ohio State University to bring the total respondents to 14. I have also been informed of a number of additional institutions who are thought to have data bases, and I plan to send questionnaires to them.

Today I would like to discuss the results of the survey, and ask for recommendations about how we should proceed from here. When we originally mailed out the form, we stated only that the results would be discussed at this year's conference. The questions and answers follow. Responses of individual institutions are not identified.

- What type of computer do you use?

  IBM dominated, primarily 360 or 370. There were a variety of sizes; two mini-computers, and one programable calculator.

- In-house? 11 Timesharing? 3

- Programing Language?
  There were a variety, but FORTRAN seemed to dominate.

- Do you provide on-line support? 10 yes

- How many food items are in your data base?
  Ranged from 500 to 6,000.

- How many nutrients do you keep track of?
  Ranged up to 144.

- Do you have a method of identifying data sources for each item in your data base?
  9 yes (1 did not break down to nutrient level)
  5 no (2 keep information, but not on the computer file)

- Do you have a technique for flagging questionable nutrient values?
  1 is under development
  1 had mechanism but no data to support it
  11 no (some screen data and eliminate all questionable values)

- What is the basis for quantities of food items in your data base?
  3 household measures
  11 100 grams

- Is there a technique for converting between household measures and 100 grams?
  10 yes
  4 no

- Do your food items represent edible portion, as consumed, or as purchased?
  11 edible portion
  3 edible portion and as consumed

- Do you flag for food allergy?
  3 yes, 11 no

- Do you have a means for indicating food drug interactions?
  1 yes, 13 no

- Do you have a food group code for individual foods?
  10 yes (6 are part of I.D. number; 4 separate from I.D.)
  4 no

- Is your nutrient data file linked to other data bases (recipe file, menu file, etc)?

  6 yes

Other questions asked, but not summarized for this presentation were:

What is the source of your programs?
What is the source of your data base?
Are you associated with laboratory performing assays of food composition?
Do you have a regular method for updating your data bank?
Special features?
Specific nutrients?

Summary of Discussion Following Report on Survey Questionnaire

The discussion was led by Tony Fisher, who asked for recommendations regarding what should be done with the survey results. The main response favored publishing the information if the respondents agreed and if they had an opportunity to review the material before publication.

Twelve of the 14 respondents were present during the discussion. They were polled and all 12 agreed to publication of the results. The other two respondents were to be contacted.

Recommendations were made for additional information which might be obtained from respondents:

Have the data been compared to laboratory analyses?
What is the logic behind food codes?
Other potential applications for programs?
Copies of formats?

Concern was expressed about the reliability of the systems. One suggestion was made to have meals analyzed and the results checked against the data bases; another suggestion was to develop a baseline for checking computer logic. These suggestions were discussed, but no action was taken.

Conferences on Computer Applications in Nutrition:
Where From Here.

by Joan Karkeck

History

When Loretta Hoover reviewed the progress of computer applications in nutrition and dietetics for our first conference in 1976, she graphically demonstrated the progress of a few, isolated groups working towards rather similar goals, but with little contact or cooperative effort.

Basically, USDA, with the extensive work of Bernice Watt, was creating a large data base of nutrient values of food. Their original base forms a core for almost all nutrient data bases being used and their work towards expanding, and refining this base into the complex tool we now see has been a center for the work being done by other groups: Mary Helen Goodloe and Margaret Moore in Louisiana and Miagene Worrick at Ohio State were developing both brand name identified data base extensions and therapeutic application programs. Others, including Loretta's group in Missouri were working extensively on administrative dietetic applications while still others were working on research and teaching oriented applications including the graphics and teaching capabilities demonstrated to us last year at Utah State.

It was apparent, however, that 12 or 15 groups working in isolation were, to use a favored computer terminology, reinventing the same wheels. In addition, USDA, with its rather central relationship to all groups working in nutrition and computers, was not regularly communicating with these regular users of their nutrition analyses or data bases.

When, in 1974, our Seattle Consortium initiated a rather modest program designed to make computer applications in nutrition available to a wide variety of small health care providers, we found that other people with experience and expertise in the area were hard to find.

We were disappointed with the completeness and accuracy of our data base, amazed at the cost of developing application tools, and dismayed with the lack of obvious resources for information, data and programs. Even the literature offered limited help.

In our thrashing about, we discovered that Dr. Donough O'Brien at the University of Colorado represented a similar interest. He was chairing a committee of the Academy of Pediatrics expressly charged with developing information links which would allow the dissemination of nutrition data to those programs studying the nutrition problems of children. A brief meeting with Dr. O'Brien initiated, in a cataclysmic fashion, the drive toward drawing together interested parties for a meeting which the American Dietetic Association and the Academy of Pediatrics co-sponsored. In April 1976 close to 50 participants, physicians, dietitians, and computer programmers met in Seattle to discuss common problems, projects and, perhaps most importantly, to express our common interest in the Nutribank project to Dr. Rizek and his staff, who were kind enough to be the "target" of the day since it became obvious that the problem most frequently held in common was the need for expanded nutrient data from a reliable source.

Dr. O'Brien in a summary, defined a relationship which he felt could help all persons interested in nutrition applications. At this time, we looked to the sponsorship of a parent organization and ADA was suggested. In pursuing this thought, I found that ADA's current policy does not include the broad scope of membership required for such an organization.

In April 1977, Utah State hosted a second conference with Ann Sorenson and Bonita Wyse doing a great deal to expand the horizon of our thinking and helping us to clarify a set of objectives.

Subsequent to this meeting, such projects as the ones by Tony Fisher and Loretta Hoover have been at least partially completed. In addition I was asked to create a list of objectives for our loose knit, nameless organization.

Objectives

Part of our original efforts to organize a conference included sending a questionnaire to all people we could find with expressed interest in computer applications in nutrition and dietetics. Originally 35 groups were represented on this list.

The response was excellent and quite informative. Among the objectives found in these responses were those listed for the first meeting:

1. To discuss common modes of reporting nutrient analyses and creating nutrient data bases in order to allow greater sharing of information.

2. To discuss the dietitian-nutritionist's needs for specific types of information applicable to daily functions such as extending nutrition assessment capability.

3. To share our current research in applications of the nutrient data base with hopes of interfacing some of these applications.

4. To establish a communications network which would facilitate exchange of computer applications and data.

The following year, I wrote a second set of objectives based on these perceived problems and events.

> In recent years the proliferation of nutrient data base users has revealed some common problems which make extended use of computer applications in nutrition difficult. Even with the limited data bases that exist, a number of programs have been developed which potentially have great impact. Current uses of computerized nutrient data include:
>
> 1. Nutrition and medical research with great emphasis being placed on nutrition factors in epidemiologic studies of heart disease and cancer.
>
> 2. Nutrition education from primary grades through health science students in universities (including medicine).
>
> 3. Nutrition education for the public.
>
> 4. Food purchasing education for consumers.
>
> 5. Therapeutic applications in health care settings.
>
> 6. Preventive medicine screening programs (especially for the very young and the elderly).
>
> The primary goal of this group is to extend and improve these important applications through:
>
> 1. Communications with concerned federal agencies such as USDA and FDA, and food industry representatives sharing specific needs for nutrient analysis data and common conventions for reporting and disseminating and collecting that data.
>
> 2. Setting up a system of communications which will expedite the sharing of important nutrient data in the most cost-effective way.
>
> 3. Providing information and guiding the definition of the procedures used in processing and inter-

preting food and nutrient data to allow all potential users of computerized nutrition services an open and effective exchange of information about developing computer applications in nutrition and the direct sharing of programs and data. This will promote the spread of their use through development of complementary applications.

4. Providing a forum for presentation of information about collecting, coding, and validating the accuracy of processed nutrient data.

This year, I have had the feeling, and the attendance here demonstrates its accuracy, that the interests in computers and nutrition seem to have hit a fever pitch rather simultaneously. With this inspiration, I recognize an extended set of objectives that I would like to share with you.

1. To act as a resource for gathering and disseminating information about computer applications in nutrition:

   a. Sources of nutrition data bases and further nutrient data.

   b. Possible sources of programs, help with program planning, etc.

   c. Information about cost sharing arrangements for multiple units and other possible business arrangements.

   d. Current and proposed uses of the computer in health care facilities, private practice, teaching, etc.

   e. Information about computer technology.

2. To act as a resource for federal agencies such as USDA and FDA who are funding and gathering nutrient data.

   a. To share with them the concensus of needs for new data, data subsets, application programs, etc.

   b. To share concerns about developing codes, reliability of data, standardization of food grouping, etc.

   c. To utilize their facility as a central clearing house for food analysis.

3. To act as a central clearing house and a resource for commercial food processors.

4. To act as a central resource for those persons developing computer applications in nutrition:

   a. To share and interface research into new applications, new programing methods, etc.

   b. To share sources of data, advances in management, funding, etc.

   c. To standardize methodologies including coding, measurement of accuracy, common modes of reporting analyses, etc.

5. To organize periodic meetings which will facilitate the exhcange of information and resources. To establish a communications network.

I would like to present this set of objectives to you for consideration.

The future

I recognize some obvious inclination towards organizing, legalizing and nominating. I hasten to assure you I also recognize in myself, and I'm sure in others here, a natural inclination to throw up my hands in horror and run away from another organization, more work, more responsibility, etc.

It is my hope that we can discuss this question at this time with your considered comments and suggestions. I know that some persons here wish to propose positive steps be taken now. I believe that we need to know, first, if it is the considered opinion of many of you that organizing can be of lasting value.

Summary of Group Discussion During Concluding Session

Joan Karkeck led the group discussion, which centered around the possibilities for a permanent organization and the form that such an organization should take.

Appearing at the request of Arden Forrey, Ted O'Neil, Veteran's Administration, spoke about his experience with standardization of systems and applications software and discussed the benefits of standardization. He recommended that the group adopt a constitution or set of by-laws to set forth procedures for reaching a concensus, which would be necessary before any standards could be established. A synopsis of a proposed constitution for a permanent organization had been distributed prior to the concluding session by Arden Forrey.

Opinions differed about the proposed constitution and whether such an organization should be independent, or under the sponsorship of a larger, existing organization, such as the Public Health Service. Bob Rizek, USDA, felt that the constitution as proposed would prohibit the participation of USDA and, possibly, private industry.

Agreement was reached within the group regarding the following:

1. That a permanent organization was desirable.

2. That objectives of an organization should be broader in scope than just to set standards, and that a set of objectives similar to those outlined by Ms. Karkeck during her presentation would be desirable.

A motion was passed that Ms. Karkeck have power to appoint, and give direction to, a steering committee representing the following groups: Government, academia, health industries, food processing industry, and computer services. This committee would explore the possibilities for forming a permanent organization.

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