# Fourth National Nutrient Databank Conference

# April 23-24, 1979

# Cleveland, Ohio

- Task Force 4 - Alfred C. Meyer, Leader
    - Uses and Applications of Nutrient Data Bases

Business Meeting

The Fourth National Nutrient Data Bank Conference was sponsored by the Departments of Biometry and Nutrition, Case Western Reserve University School of Medicine. The conference was supported in part by General Mills Foundation and the Campbell Soup Company.

Conference Program Planning Committee

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# PREFACE

These Proceedings of the Fourth Annual Nutrient Bank Conference are presented in their entirety rather than in abstract or summary form because we feel it important to have on the record the issues that have continued to be present since they were defined at the first conference in 1976. While the second conference also addressed the issues, the third conference was primarily a progress report on the USDA nutrient data base development and an overview of applications of computerized nutrient data bases. The program of the fifth conference to be held at Michigan State University in April, 1980 suggests that applications will again be the major thrust.

In these Proceedings, the question and answer sections after the formal presentations and the panel discussions point out user concerns with the present state of the art of nutrient data bases and the four task force reports define with clarity the issues that need to be approached and resolved in an orderly organized fashion. Until this occurs, the sixth conference will very likely be defining the same set of issues.

Cleveland, Ohio
March 1, 1980

Grace Petot
Harold B. Houser

## Review of First Annual Conference

Joan Karkeck

The first of these annual meetings was in Seattle in 1976. It came about because we had been presented a data base and two programs. We began to use the programs instead of looking carefully at what we had and where we were going. We realized that we needed to communicate with some other people who were doing similar things. We were frustrated by the fact that we felt we had an imperfect tool and we were quite sure that other people must have much more perfect ones, so we started trying to communicate with people using the computer in nutrition around the country. By some chance we encountered Donough O'Brien who had been appointed by the Academy of Pediatrics to a committee that was supposed to look into trying to develop better computer applications in nutrition for pediatric applications. The two of us together decided that we should have a meeting in Seattle. It happened to be in April and subsequent meetings have been in April ever since.

The Seattle meeting gathered 45 or 46 people together including the representatives from USDA and Dr. Rizek. We began with a somewhat simplistic idea of where we were going and what we wanted to do. Our original purposes were very much focused on the problems of all who were applying computing to nutrition - the data bases were really very incomplete and quite difficult to use. In the process of meeting we developed a much more complex idea about having an organization that would communicate about nutrition and computer applications and would share between members some of the programming techniques and some of the problems that all of us were encountering. My ideas, I suppose, were representative of at least the dietitians in the group. I don't know how represientive they were of the others, but I want to mention them to you because they show the flow of direction at the time.

First, I wanted to complain about data bases, then I began to see that we needed to be much more specific in our needs in nutrition applications. We recognized that there was obviously a strong need for an international cooperation. We needed an international data base that has comparable data collections that will allow studies done in Cleveland or studies done in Seattle or studies done in Utah or Washington to be comparable. We began to recognize, however, that there were some other problems that were really very important and one of them is something obvious to all of you who worked in nutrition and that is that before you can use the data base you've got to come up with diet information from people and our diet history methodologies are rudimentary. We have done some sharing of information about how we gathered our dietary history and we need to have more information and more sharing about coding procedures as well.

Certainly in the last few years, we've began to recognize that there is a great deal of danger in computer applications and nutrition and that the interpretation of results can be very very important. We have a very powerful tool and perhaps people who are closely aligned with computers get swallowed up and forget how powerful it is. Each year we should remind ourselves that this is indeed a tool that can be used badly as well as used well.

I think we need to deal with questions about programs and data bases - How do you share these things, how do you pay for them? How do you protect the rights of the author and the rights of ownership? How do you make sure that the programs you have are used in an appropriate way? I think we strongly feel the need to assure ourselves that the people who develop programs have the right to direct the way that they are used so that they are not misused and I don't have to remind any of you that nutrition not only is a volatile subject but that it is open to be gathered up and taken in by professionals and non-professionals alike and it can be applied poorly as well as well and it is possibly very dangerous. We are sometimes turning over a very powerful tool to people who do not have the right to use that tool. Ideas and thoughts about what we were doing as a group began to evolve and they started basically in that first program. Suddenly your simplistic ideas became not very simplistic. I began to focus each year on a group of objectives for an organization and each year my objectives changed and by last year I had really quite a complex group of objectives. This year I feel much less complex about objectives. I am all the way back to the original idea - what we really need to do is to produce a common set of conventions about nutrition data bases and to define the way they should be used. I realize that what we really need to do is to say to ourselves what are our priorities and what can we do realistically within a reasonable period of time. Where are our really high point needs and who are the greatest number of people who are going to use data so that we can define nutrition data needs and the highest user group.

We need to be much more specific. We also need to look at our own applications to be very aware of the fact that other people cannot make us come up with reasonable coding procedures, cannot assure our accuracy, cannot force us to use these tools in an appropriate manner and that we in the field of nutrition and dietetics and in medicine who are using these programs need to gather a group of conventions among ourselves and not push this off onto other people. I have come to this complete evolution from thinking what we needed here was a very grandiose organization that needed to do 10 thousands fantastic things and I've gotten back to what we need is an organization that concentrates very much on nutrition data and how to use it.

This basically is our review of the original ideas and the history of our developing ideas about what we're doing here today.

## Review of Second Annual Conference

Ann Sorenson

As Joan Karkeck mentioned, people at Utah State University hosted the second annual nutrient data bank conference. Though at that conference there were no formal plans made for further meetings after 1976, our conference was a logical outgrowth of the first data bank conference held in Seattle. There was interest expressed at the Seattle conference in continuing some kine of data bank group so I and two of my colleagues, Dr. R. Gaurth Hansen and Dr. Bonita W. Wyse of Utah State University offered to host the second conference at Utah State campus. Endorsement for the conference was obtained from the original data bank conference organizers and the plans were laid with the help of Joan Karkeck, Harborview Medical Center, Seattle, Washington and Dr. Donough O'Brien, Univerisity of Colorado. The conference was co-sponsored by the American Dietetic Association and the Academy of Pediatrics as was the first conference. The 1977 National data bank conference was a two-day working meeting where nutrition data users and compilers discussed ways of sharing, expanding and better utilizing the existing computerized nutrient data.

We refined our goals and objectives from some of the grandiose expectations that emerged from the first data bank conference and tried again as Joan has indicated to focus on ideas that were practical and projects that we could reasonably expect to accomplish. The meetings were held April 28, and 29, 1977 on the Utah State campus. We provided participants an opportunity to hear talks on the current state of nutrient data banks and current use being made of them. Small task force meetings and open discussions within the general assembly of participants were designed to let each participant contribute his unique expertise and to recommend solutions to the many problems related to the computerized nutrient programs. Each person was also asked to communicate their own individual needs (or their program needs) related to specific applications of nutrient information. It was hoped that the participants would get immediate feedback from their colleagues with similar problems or from persons who may have information on how to solve some of these problems. The participants represented a broad spectrum of data bank users and contributors and included representatives of basic research, epidemiology, dietetics, food service managers, nutritionists, educators, clinical-health care providers, the armed forces, private computer services (food industries), and various government agencies. However, the majority of the participants at our conference were directly concerned with health research or health care delivery. Based on the discussions of the 1976 conference the following objectives were identified for the 1977 data base conference:

1. To discuss the ways in which nutrition data on computer files can be shared or expanded.
2. To review the progress made in nutrition data banks (since the 1976 data bank conference) and review their accessibility to users.
3. To discuss ways users can increase input into the design and use the data bases being compiled.
4. To identify actual and potential users of nutrient data banks and assess their needs.
5. Identify those sources which can add new data or new output format.
6. To show the versatility of computerized nutrition analyses in clinical and institutional settings.
7. To review the current research requiring a nutrition data bank.
8. To explore the sources for financial aid to improve data bases.
9. To formulate methods of information and for sharing procedures.
10. To find ways to standardize data bases so that data from research studies or clinical computer analyses can be compared.
11. To discuss new techniques in computer science that can be applied to the construction of nutrition data bases and their application.

Our agenda was divided into two parts. There were formal addresses with question periods and separate sections for group discussion. There was time provided for summaries of the section meetings and open discussions among the participants. I'm not going to go through the program but speakers included representatives of industry, basic research, clinical studies and various segments of the nutrition community involved with computerized data. Each participant selected membership in one of the following task forces. The task forces are:

1st task force: the expansion of research and clinically oriented nutrition data.
2nd task force: users of computerized nutrition data.
3rd task force: methods for funding and administering nutrient data bases.
4th task force: methods of data sharing and standardization.

The Second Annual Conference produced several resolutions and actions. The proceedings of the second national nutrient data bank conference was published and distributed to all conference participants and to interested persons who wrote and requested copies. There was also a resolve to continue an organization of data bank users and organizers and as this commitment emerged a committee was organized to do the following things:

1. To identify users and compilers whom may wish to join our group.
2. To develop, distribute, and analyze the data from a questionnaire that was designed to provide information on existing data bases. The questions attempted to determine where data bases were located and the types available to other users and to determine the specific nutrients and foods and sources of data contained in these data bases. The questionnaire also ascertained the organization storage capacity, retrieval techniques of the data bases as well as the types of software programs developed to utilize the data bases.
3. A decision was made to hold a third national nutrient data bank conference. Dr. Robert Rizek accepted the responsibility on behalf of USDA to organize that conference which was subsequently held in Washington, D.C. in April of 1978.

## Review of Third Annual Conference and USDA Update

Robert Rizek

I would like to thank Dr. Houser and Mrs. Petot for arranging this conference, and for giving me and my staff an opportunity to meet with you.

My topic today includes an overview of the Third Nutrient Data Bank Conference. We hosted the Third Conference for two reasons. First, Joan Karkeck, Ann Sorenson, and others who had been instrumental in organizing the first two meetings requested us to host and plan a third meeting. Secondly, we recognized the importance of continuing the information exchange which had begun with the Seattle meeting.

The Third Conference attracted over a hundred participants. Not only experienced users of computerized nutrient data, but also people who were just beginning to consider the possibilities of automating their nutrient data operations, were encouraged to attend. We notified the food companies who were among our major data suppliers about the meeting, and a number of them sent representatives. Also, representatives of the computer service industry who were interested in offering services to nutritionists and dietitians were welcomed.

We chose a format different from the first two meetings. Instead of asking participants to form specialized task forces, we presented a roster of speakers who would provide background information about the development of USDA's data bases, and also the operation of a variety of specific computer systems utilizing nutrient data.

One session of the program covered the role of the Government in providing nutrient data - the operation of our Nutrient Data Bank, how the nutrient data sets are developed, how one may obtain the data sets, the FDA's interest in the data bank, and the reliability of nutrient data. Another session was devoted to specific uses of nutrient data bases. Presentations were given which pertained to hospital, food service, industry, and research applications. The specific research areas discussed were the USDA Food Consumption Survey, the use of a nutrient data base in the Diet, Cancer, and Nutrition Program, and the data base and computer system developed for the Mr. Fit and Lipid Research Clinics projects funded by the National Heart, Lung, and Blood Institute.

There have been a number of changes at USDA since last year, so I would like to take a moment to explain how our Institute fits into the new organization of the Department. We are in the USDA's Science and Education Administration (SEA). Within SEA, we are a part of the recently created Human Nutrition Center, which operates under the administration of Dr. D. Mark Hegsted. The Nutrition Institute of Beltsville, Maryland, the Human Nutrition Laboratory in Grand Forks, North Dakota, and the new labs at Tufts University and Baylor are also a part of this new Center.

Within the Consumer and Food Economics Institute (CFEI), the Nutrient Data Research group operates the Nutrient Data Bank and produces Handbook 8. The Survey Statistics Group provides the computer system and statistical support for the Data Bank and also prepares the magnetic tapes of the food composition data sets which are available for purchase.

CFEI is also responsible for the Nationwide Food Consumption Surveys which come under the Food Consumption Research Group. We have one other group, the Food and Diet Appraisal Research Group, which is responsible for a variety of nutrition related projects, such as developing dietary guidance materials, providing food plans at different cost levels, estimating the nutrients available in the nation's food supply, and evaluating the effectiveness of various intervention programs.

I won't go into the operation of the Nutrient Data Bank since it was described in detail last year. The top priority, however, is to update Handbook 8, which is released in sections by food group. Tapes of the sections are available through a private company. We have a leaflet which describes how to order copies of the Handbooks, and a brochure which describes all our dietary guidance materials, providing food plans at different cost levels, estimating which describes how to order copies of the Handbook and a brochure which describes all our data sets that are available on magnetic tape.

Since last year, the section on Baby Foods has been released. There has been a delay making the tape for this section available because we are trying to provide estimates where gaps appear in the data, but it should be available for purchase within 2 months.

We are in the last stages of preparing sections for publication of three additional food groups: fats and oils; poultry; soups, sauces, and gravies. We are also preparing Data Base II (the intermediate level) summaries for pork and vegetables. We have also prepared a provisional table of the nutrient content of 24 frozen and canned vegetables. These data are average values generated from the nutrient data which are presently contained in our data base. Most of the data were supplied to us by the food industry, who ran the analyses for nutritional labeling purposes. Copies of this table are also available here today. For those who are using data sets created from Handbook 8 or Handbook 456 and would like to update their tapes from this table, we have included the item numbers from the Handbooks.

When the current revision of Handbook 8 is complete, we expect it to contain over 4,000 items. We are including over 60 nutrients in this revision whenever relevant and when the data are available. In addition to the proximate composition, energy, vitamins, minerals, amino acids, and fatty acids that we report in Handbook 8, we are receiving requests for data on sugars, starches, and complex carbohydrates. I do not have to tell you that there are critical gaps in existing nutrient composition data. While we do not have our own laboratory, we work closely with the Nutrient Composition Laboratory in the Nutrition Institute. We also have limited funds to support outside research. But laboratory analysis of foods is expensive, and we clearly do not have the resources to analyze every food, for every nutrient.

In conjunction with the Nutrient Composition Laboratory, we have drafted for consideration a set of guidelines for setting priorities in nutrient composition research. They cover priorities for development of representative nutrient data, as well as research on methods. Because of the limited time I cannot go into these priorities in detail, but we have prepared a summary which outlines how priorities would be set. This summary is available and we would appreciate your written comments.

Insofar as possible, we are sponsoring research to help fill major gaps. Over the last 3 years, we have sponsored a project on the folacin content of foods. These results will be incorporated into the sections of Handbook 8 as they are released.

We currently have a project underway which covers vitamins, minerals, and proximate components of seven vegetables. The products are being sampled three times during one season, and analyses are run before and after cooking, canning, and freezing. The canned and frozen products are also analyzed after preparation for the table. The results of this research will allow us to compare the effects of cooking methods on nutrient retention levels and yields of the foods, and to study the effects of canning and freezing. We plan to sponsor similar research on other foods in the future.

We are also working with Giant Food Stores, the United Fresh Fruit and Vegetable Association, the FDA, and the Land Grant University system to develop and carry out plans for analyzing fresh fruits and vegetables.

We also encourage other research institutions to study nutrient composition of foods, and our staff is available to give advice on needed research (for both foods and nutrients), analytical procedures, and sampling plans.

Since last year, we have developed for our own purposes a program on a mini-computer to analyze diets for seven nutrients, using data from Home and Garden Bulletin No. 72. It computes daily and weekly intakes and the percent of RDA based on the average daily intake. We can provide a listing of our program, and the information needed to run it, to anyone who has a minicomputer or who is thinking about using one.

Because of the time it will take to complete the revision of Handbook 8, we are investigating ways that we can provide information from the updated sections in a format that would be more easily utilized by those of you who are now using tapes of 456. In addition to those materials which were already mentioned, we have for distribution a list of publications prepared in our Institute and instructions for ordering them. We also have a listing of articles containing nutrient data prepared by staff of the Nutrient Data Research Group and published during the last few years in the ADA journal.

For those of you who are just beginning to consider going to an automated system, we will be happy to provide you with information about our available data sets. We have programs in use at our Institute for dietary analysis, and listings and procedures manuals for these programs are available upon request.

To conclude, we do realize your needs, as well as ours, for nutrient data. We are doing everything possible within our staffing and funding limitations to update Handbook 8. We realize that in the meantime you may need to develop your data bases from other sources. I must caution you not to use data blindly. Just because a food has been analyzed somewhere, at some time, and a value exists, does not necessarily mean that the value is within an acceptable range. The topic of nutrient data reliablity was addressed last year, and I urge you to go back and review the statement which summarizes that presentation in the Proceedings of last year's conference.

Again, I would like to thank Dr. Houser and his staff for their efforts in hosting this conference. May we have many more, where my staff, I, and others as data generators, have an opportunity to meet with those of you who are the data users.

# Nutrient Data Base Survey Update

Tony Fisher

I am glad to be here, and I feel rather proud to be a part of this organization thats gone as far as it has, representing the interest of a large number of people throughout the country. The topic of my report is Nutrient Data Base Survey Update. You might be wondering what it is that I'm updating. I'll do a brief recap of where my subject has been over the last four years. The first meeting in Seattle allowed us to get to know one another and come to some common agreement on where we wanted to start heading as an interested group of professionals in this particular area. We set some pretty ambitious objectives that year and the following year in Logan, Utah. It was in Utah where we came up with the idea to do a survey of nutrient data bases. One of the objectives of this group of individuals represented here today has been to strive toward some mechanism of standardization or means of sharing data. We thought a good first step in that area would be to document what was being done right now. That was the basic objective of the survey. We developed a manual form designed to collect as much data as we possibly could. The seven page questionnaire went to as many people at that time that we knew about who might be doing something in this area. Last year, at our conference in Washington, D.C. sponsored by USDA, we presented the initial results of this survey. We'd collected information from twenty-two institutions throughout the country. Since last year's conference we've collected information from fifteen other institutions. We've also identified twelve more institutions which have some type of system. So we've identified a rather large population which would ultimately be involved in the final survey.

Information from thirty-seven respondents has been entered into a computer so that we could keep track of it better, have a simple mechanism for updating it, and, perhaps most importantly, be able to cross-reference the various surveys. As an example, if we kept track of the types of computers that each one of our institutions was running its system on, then we could come up with cross-reference listing which would tell us what kind of computers are being used. A subset of persons using IBM 370 computers, for example, could share information on programming. An even more important question, and one that's been posed to me several times in the interest of those doing research, "Who has information on what nutrient?". People might want to know who has information on some of the various amino acids. Having all this information documented in a machine readable form was to be the answer to those areas of concern. Using the computer and its retrieval capabilities, we could provide this information in a published format on demand. These were some of the goals that we established for ourselves last year. We've developed a report format. I don't have samples of the format with me but some draft copies of it have been circulated to a few of the individuals here. It was my intention to distribute copies here but my baggage did not arrive with me today. The Proceedings of last years conference contains a report of the first survey which shows the type of information collected.

Our objective, which we have not reached yet, is to revise the questionnaire. Hindsight always being 20-20 vision, we thought after we collected the information from three dozen institutions that "wouldn't it have been nice to ask this question, or we should have reworded this second question to make it a little more explicit-based on the types of responses we got we could see that it wasn't asked in the proper way because we were getting misleading answers". The revised questionnaire will be sent to the people that have already responded and to those institutions which had not participated in the original survey. We have had four basic objectives: automate the questionnaire, revise it, resubmit it and then publish the results. We have achieved the first objective which, looking at it now, I believe was monumental. The information we've collected is computerized and we have the mechanism for easily updating it and adding more information to it. In the meantime we have learned of other similar surveys. Ida Jacqua from Los Angeles Valley College published a rather extensive survey containing basically the same type of information that we were collecting. A couple dozen institutions were surveyed by her. Darlene Myers for the University of Washington also published a survey of some hospitals related nutrition analysis systems.

The recommendation that I would make to this group today would be that these efforts be completed. I recommend that they be completed under the official auspices of this group whatever this group ends up being at the end of this conference. I suggest that a committee or a task force be comprised of all those individuals who have been working on these surveys up to this point. Information from each of the surveys could be entered into the computer system I have described. There is still a handful of institutions which have not responded to any of the three surveys. The three surveys are not redundant. Some institutions responded to all three but that is not the majority case. I think it is in the interest of all of to put these three exercises together and come up with one conclusive document.

The information collected up to this point will be made available not only to all those who provided it but to all participants in this conference.

# NUTRIENT DATA BANKS - THE STATE OF THE ART

## Introduction

Harold B. Houser

The state of the art of computerized nutrient data banks will be put into focus by presenting problems and issues related to one specific computerized nutrient data base. It may be presumptuous to confine observations of the state-of-the-art to only one of the 15 to 20 data bases developed in the United States, however, the current status of the HVH-CWRU Nutrient Data Base and its historical development probably reflect the problems and issues related to other computerized nutrient data bases. To insure a non-parochial view, the reactor panel this afternoon will discuss the state-of-the-art in the broader context of computerized nutrient data banks in general.

I will review briefly the history of the HVH-CWRU Nutrient Data Base, since I believe the current status is better understood if one knows how it was arrived at. Our first need for a nutrient data base arose in 1960 when we were studying persons with chronic illness. A large proportion of people admitted to Highland View Hospital had evidence for nutritional deficiency at the time of admission. In order to study chronically ill persons before they came into the hospital, we selected for study a group of people with multiple sclerosis who were living at home. We planned to determine their usual diet over a year and then translate what they ate into nutrients. It became apparent that if we could do the former, we could not do the latter. A suitable nutrient data base was not available in hard copy, let alone a computerized version. If we were to do the study we had to develop a nutrient data base and, because of the large numbers of individuals that we were studying over a year's time, we had to use a computer.

Starting with USDA Handbook 8, we searched the literature, checked with manufacturers and even set up our own kitchen laboratory in order to measure and weigh food; eventually we compiled a nutrient data base which met our needs. This early work and initial development of the data base was done by Ardyce Sorensen who, having worked with Bertha Burke, found that the analysis of 36 days of recorded intake from a lot of individuals was quite different from analyzing a long diet history from one individual.

Once we had suitable nutrient data, the next step was to organize it through a food identification code that would make the life of coders not too difficult and would also make some sense to computer systems and applications programmers and to the users of the analyzed data-nutritionists, statisticians and epidemiologists. Again we found we were on our own since we could not identify a ready source of information to help us. Next, under the direction of Arthur Littell, we developed computer programming that enabled us to enter food consumption data, access the computer stored nutrient data base, calculate and sum individual nutrients and percent RDAs, and print out the nutrient data in a useful format. While each person had a primary responsibility in the development, the total system was the result of input into all phases of development by a multidisciplinary team whose interests were the use of the data generated as well as generation and processing of data. This point is emphasized since we feel this approach is necessary to develop a flexible system responsive to the users.

The success of our initial efforts enabled us to do nutrient analyses on over 5,000 daily diet records from free-living persons without having to limit our analysis to short food lists or to substitutions or exchanges. A problem then, however, and still a problem but less so, was the limited number of nutrients about which we had information. Our first food table had information on only 8 nutrients in addition to calories, protein, fat, and carbohydrates. We did gain useful additional information by identifying protein, fat, and carbohydrates in all food items by animal or plant source. This proved useful in our studies of the relation of usual diet and fatty acid composition of subcutaneous tissue. Then, as now, information about the fatty acid composition of food was limited. Other early developers of food tables such as Margaret Moore, Mary Ellen Goodloe, and the Heart Disease Control Program, Bureau of State Services, USPHS, had the same problem. We solved the problem by assigning iodine numbers to our food groups and, owing to the computer, were able to assign an iodine index to a person's annual dietary intake.

By the middle 1960's we had developed a useful system which could be applied to the studies in diet and atherosclerotic heart disease, of high interest at that time. We tried to identify others with nutrient data bases in order to exchange information and to develop consensus on content and structure. Variability in results of studies should not be from differing methods of analyzing dietary data. In 1967 the Heart Disease Control Program, supporting many of the dietary studies, recognized this and asked us to develop a contract proposal for a National Food Table.

In a statement that now seems simplistic, we proposed to:

"develop a food list that will identify and classify all known food items used by the United States population. A suitable code for the food list will be developed along with an outline or model of the nutrient table. A comprehensive food list and code suitable for study of diet by cardiovascular disease researchers and other related research groups is not now available. Such a list and code with the necessary subsequent development of an accompanying nutrient table will provide a basis of comparability between studies that is presently impossible with the several different lists in nutrient tables now in use. A systematic numerical scheme will be devised to group foods into major categories and sub-groups assigned a code number for each food item to permit addition of new market foods. Sources of information will include existing food lists, food composition tables, research reports and commercial statements. A committee will be appointed to advise regarding the development of the food list and code and the size and structure of the nutrient table which would be used with the code."

The contract, approved and due to start on August 1, 1968, was cancelled on June 30, 1968. The Heart Disease Control Program now had a new director and he had decided that developing a nutrient data base or food table was of very low priority.

Where would we be today if the work had been carried out? Probably not here discussing the above issues. The cancellation presaged the next several years of difficulty in obtaining federal or other support for continued maintenance and development of our food table. The problem of financing was pointed out earlier today by Joan Karkeck and was a prominent part of the agenda for the first Nutrient Data Bank Conference.

During this period there was little exchange of information, or even awareness, among the several persons in the United States working at the common problem. This is illustrated by a letter I received from Arden Forrey in July, 1973. It turned out that we had been in competition for a sub-contract from the CAPO (Computer Aided Physician's Office Practice) project to develop a computerized method for diet instruction of patients. He inquired who were we?, what were we doing?, and suggested that it was time to develop a national working conference to provide exchange of information. Although the first such conference did not occur for another three years, I believe our exchange of correspondence and the identification of others with similar problems were the initiating factors in planning the first conference.

In the meantime, we needed to develop an extensive food table in relation to a proposal for the National Exercise and Heart Disease Study. Our original table was outdated. Somewhat pessimistically we again searched for a suitable table. Unable to identify any that suited our purpose we started over.

Although the dietary part of the National Exercise Study was not funded, we had gotten well along in development of the new food table and decided to complete it; surely funding sources would see the need for working nutrient data bases. When the Diet and Cancer program came along it gave us renewed hope. However, we were not successful in obtaining federal funding for development of the food table itself. One review came back suggesting that the applicants were "just trying to play with a computer". As a result our data base was not developed with federal support, and I think this is probably true of most of the "private" nutrient data bases. They were developed to meet a specific need and their utility has become apparent to many other users. Interest and demand has heightened along with a certain reluctance to pay the developers for more than the reproduction cost.

In summary, the past nineteen years of our experience is probably mirrored by all developers of computerized nutrient data bases. First, the definition of a need; then the disappointing search for somebody else's answer to the need; the long and difficult development of the computerized system in a lonely environment; the erosion of interest and support for the development; the dogged persistence in the belief that sometime, somewhere the need for what you had developed would become apparent; and finally finding that there is interest in a forum to discuss the problems and issues relative to computerized nutrient data bases.

## Food Composition and Nutrient Data Sources

Grace J. Petot

Virginia McMasters, in her comprehensive review of the history of food composition tables of the world, published in 1963, stated that "human knowledge is often accepted and used with little thought of its origins". I would like to paraphrase that statement to say that computerized food and dietary nutrient analyses are often accepted with little thought of the origins of the information provided. This discussion will first review and describe the process of accumulation and identification of the sources of food composition data in the HVH-CWRU Nutrient Data Base and secondly, identify some problems and issues which must be considered by those who are maintaining nutrient data bases, and by the various users of nutrient data bases.

All nutrient data bases in the United States are based on one or more versions of food composition tables compiled by USDA. The procedures, status and food composition data sets available from USDA were reviewed at last year's conference. In the meantime, Handbook 8-3, Composition of Baby Foods, has been published. Dr. Rizek brought us up to date in this morning's discussion. The USDA Food Composition Tables continue to be the best sources of information for conventional, relatively unprocessed foods, especially for meats, most dairy products, fruits, vegetables and many cereal grain products. Much information is still needed for these groups of foods. The situation has not changed appreciably since these needs were reviewed by Watt and Murphy in their article published in Food Technology in 1970. Therefore, in order to meet the ever increasing demands for food composition and dietary data by researchers, clinical practitioners, food service management and government rulemaking agencies, other sources of data are used. These sources may be one or more of the following:

1. USDA data reported in widely read journals

2. Composition data for foods or groups of foods for one or more nutrients published in a wide variety of journals

3. Directly from the food manufacturers and/or industry associations

4. Tables published in a number of books, for example, Bowes and Church, and the Geigy Tables

5. Other independently compiled nutrient data bases

6. From nutrition lables on food products

7. One's own laboratory analyses of one or more samples for one or more nutrients

8. Calculated values, especially for recipes, based on one or more sources

9. Imputed values based on varying criteria

With only a few minutes of thought devoted to this list, it does not take long for one to realize that there are numerous questions to be asked about the sources and that there are many problems associated with evaluating, interpreting and comparing output from the various nutrient data bases. These questions and problems are not new. There is just a more widespread awareness of them because the computer has made so much more information available, so much quicker and at much less cost to more diversified groups of people. Therefore, it is axiomatic that the user of any data have access to knowledge of the data sources so that he or she may be able to evaluate that data relative to a specific use.

The original use of the HVH-CWRU Nutrient Data Base was in conjunction with a diet diary method of data collection from free-living subjects as part of several research studies in the Cleveland area. Continuous development has resulted in the inclusion of more than 2300 food, recipe and therapeutic product items as a result of processing several thousand 24 hour intake records of free-living and hospitalized persons from many areas of the United States. Efforts have been maintained to accumulate as much reliable information as is possible about frequently consumed foods.

The major sources of nutrient data are USDA Handbooks 8, 456, 8-1, and 8-2. Handbook 8-3 data will be incorporated as soon as the tape becomes available, as will subsequent sections as they are published. Another major source, but one which is becoming outdated, is Bowes and Church, 12th Edition, which in the past served as one of the few tables which included food manufacturers' data. However, with better availability of this information directly from food manufacturers, it is becoming a less significant source. These sources, USDA, Bowes and Church and food manufacturers, because they provide in all cases, values for the major nutrients, are identified in the data base with a 7 character alpha-numeric major source code. For example, USDA item number 01-077 in Handbook 8-1, Milk, whole, 3.3% fat, fluid, has a source identification code in our food table of UD01077. The name of a food manufacturer is also indexed with an alpha-numeric code and the source identification for a single food item includes the code number for the manufacturer. Original source materials are then filed for easy reference.

Space is also allowed within the data base for recording a source identification for each single nutrient. An alpha-numeric code is assigned to the source of data which may be one of the major sources, a journal article, government regulation, etc. These indexed materials are then filed for easy reference. A bibliography of references is included in the code manual. Insofar as is possible, primary sources of information are used. A few frequently used recipes, precalculated, are included. However, it has been our experience that when one ingredient in a recipe may be substituted for another by the cook, such as butter for margarine for example, it is preferable to obtain recipes or ingredient information and use these individual recipe ingredient items within a dietary or recipe analysis as needed. It is also possible to create an associated recipe file which accesses the ingredients in the Data Base, thereby always using the most current nutrient data.

Needless to day, with a rapidly changing food supply and with the many variations in life-styles and dietary patterns among individuals and groups, it is necessary to continually revise the list of food items included in the Data Base. Indeed, it is possible to respond almost immediately to the frantic dietitian who must have nutrient values included for a new product or an unusual food, provided we can obtain the composition data. Values for individual nutrients are added as they become available and as they are judged to be reliable. Thus, the nutrient data base is dynamic in nature.

Food items for which USDA values are used are described in the code manual as they are listed by USDA. Brand names are used for commercial products. All nutrient data are stored in the Data Base for 100 grams of product. Volumetric household and metric measure equivalent weight factors are included for conversion in the computer.

There are several problems associated with using food compostion data from many different sources. I would like to elaborate on just a few.

1. The reporting of data by food manufacturers.

Most of us who are maintaining data bases use values per 100 grams of food. We are finding that many manufacturers, especially those who have had analyses made for nutrition labeling, are cooperative in providing data in this manner. However, in many cases, we do not receive volumetric equivalent weights or portion size with weight which are more frequently used in recording intakes and for recipes. Analyses for many fluid products are customarily reported for a volume measure such as milligrams of nutrient/liter or quart. Specific gravity or another volume/weight equivalent is necessary to convert to gram weights. U.S. RDA values are not satisfactory and are not consistent with the accuracy of other values being used. The percentages of U.S. RDA's are rounded for use on nutrition labels.

Careful evaluations must be made for calculated food compostion values which are distributed by some manufacturers. Depending on the food product and its subsequent preparation for serving, these values may or may not be appropriately used in a data base.

It has been estimated that there are some 10,000 food products in the markets. Keeping up to date with just those which have been analyzed for nutrition labeling is a formidable task. For many products, it may be far into the future before analyses for all nutrients and other components are made. If interest and need is demonstrated, this task may need to be undertaken by a government agency.

We must admit that, at times, we are pesty and nagging in our requests for data, although many manufacturers are cooperative. Some have even been known to supply it quickly when a large institutional order is being considered on the basis of availability of nutrient information. We here today might make a plea for a centralized collection system and brand name identification in USDA tables.

2. Composition values from different sources for a single food item.

USDA handbooks do not provide lactose data. We know that lactose is present in milk and many milk products. In our search for lactose content information, we discovered that for many milk products, the lactose values reported in the literature did not report total carbohydrate for the same samples. These lactose values in many cases were greater than or much less than total carbohydrate values for the same products in USDA Handbook 8-1. Perhaps access to USDA Data Base II could help resolve this problem or we could suggest to USDA that this issue should be placed high on their priority list for publication.

A similar situation exists with fatty acids in the tables published in series in the Journal of the American Dietetic Association. For many food items, total lipid values do not match those in Handbooks 8 and 456. Therefore, when we include values for individual fatty acids, their sum may be greater or less than Handbook 8 total lipid values. Individual fatty acid values can be scaled to total lipid, but is this an acceptable procedure?

The HVH-CWRU Nutrient Data Base does include several table checking programs which allow us to sum components so that they may be compared with a reported total. For example, total water, carbohydrate, protein, fat and ash may be added. If they do not add up to 100 grams, a message is received and errors may be traced. The same check may be performed for other breakdowns of nutrients.

3. Values for nutrients which have low priority for analysis in some foods and groups of foods.

As dietitians we make generalized assumptions that some nutrients and food components are either not present or are present in only trace quantities in some foods and groups of foods. For example, we generally assume that cholesterol is present in animal foods only. The identification of sterols in plant materials is currently being reported. Cholesterol may be present in only trace amounts or not at all. Instead of designating cholesterol content as being unknown because an analysis has not been or may not be made, can we agree that a zero or trace value may be assigned to these foods. Similar cases may be illustrated for several other nutrients such as sucrose in meats, lactose and B12 in plant foods. Chemical analyses are expensive and may indeed be unnecessary for some groups of foods.

4. Separate identification of nutrients naturally present in a food and the same nutrients added to the food.

In some studies it is desirable to separately identify the quantity of a substance which has been added. For example, with increasing use of fructose and lactose as food ingredients in foods which already contain the same substance. The first occurance of the substance should be identified as one which occurs naturally; the second could be identified as a refined sugar. At the present time, we do not have adequate quantitative information to identify these or enrichment and fortification nutrients separately.

5. Calculations of nutrients in recipes with consideration of nutrient losses in preparation.

Increasing use is being made of nutrient data bases for calculating nutrients in recipes for home or institutional use. Allowances for nutrient loss in preparation may or may not be considered. Resolution of this issue depends on the state of our knowledge of nutrient losses and agreement on the use of common factors for specific nutrients and preparation methods.

This discussion has briefly reviewed the origins of food composition and nutrient information in nutrient data bases and has discussed only a few problems associated with using data which is acquired from a variety of sources. Evaluation, interpretation and acceptance of the data and information processed by nutrient data bases requires close, ongoing communication among all of us here today and among all who contribute to, maintain, use and evaluate nutrient data bases.

Questions and Answers:

Q: Do you make an attempt to fill in blank spaces with nutrient values? As you said, we know, for instance, that "trace" is used to indicate a detectable quantity, but do you use zeros if you can assume that none of the nutrient is present?

A: If we can determine, and sometimes we can from an ingredient list, that the value is zero, then, yes, we do put a zero in. However, if there is any doubt we leave it as "unknown. Who is interested in chemically analyzing meats for sucrose, for instance? It is very low on a priority list. Yet we retain sucrose as "unknown" on our list of nutrients in the calculations for meats.

Q: How do you handle manufacturer's data which are based on nutrient label claims instead of analysis?

A: We do not use nutrient label information which is expressed as per cent of U.S.RDA. If the manufacturer will supply us with an analysis per 100 grams of product, we do use it.

Q: You mentioned a number that you have which corresponds to the item number in Handbook 8. Does this number link together the information about certain parts of the identification, the process?

A: Yes. This number is used as a source code and consists of alpha-numerics. For example, UDA0258 refers to a Handbook 8 number for a food item.

Data Storage and Organization

Alan Whitney

This talk will address the basic organization of a nutrient data base using examples from the HVH-CWRU Nutrient Data Base. Techniques for increasing the flexibility of the data base and application programs will also be discussed.

The primary thing one is interested in when using a nutrient data base is a set of nutrient values for a set of food items. The data base can therefore be modeled as an array of nutrient values. There are other things that are useful in the data file. The first is the food item identifier and a description of the item. It is useful to include encoded quantity information to allow scaling of values in the data base to other convenient units. For example, nutrient values in the data base may be for some standard amount of food, like a 100 gram portion. It is more convenient for the user to access the data in a more usual measurement such as a volumetric or descriptive measure. Additionally, several other data items can be used for documentation of sources and revisions and other coded information relating to the food item. This leads to the storage structure shown in Figure 1.

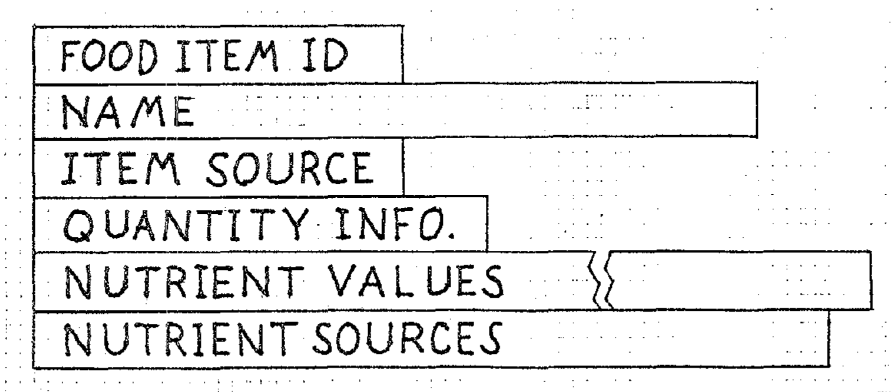


Figure 1.

Structure of a Food Table Record.

If the key into the data base, the food item identifier, is a number in the range one to the number of items in the data base, this number can be used as an index into the data file. If the item identifier is more complicated, it is convenient to have a separate index file that gives the identifier and the index into the data file for each item. Note that space can be saved in the index file if the data file is stored sequentially. In this case, the index is just the position in the index file of the index record.

A partially implemented feature of our system is a distinct recipe file which describes a recipe item as a combination of food items. This file is structured similarly to the nutrient data file except that instead of having the stored nutrient data, there is a list of food item identifiers and a factor which represents the proportion of that item in the recipe item. This organization does not allow for different cooking losses for different nutrients, but it does insure that the most current nutrient data are used.

A drawback to the data organization described is that it does not take advantage of the fact that many unknown nutrient values are present in the data base. Currently, unknown values and trace values are represented by an impossible data value. It would be possible to save storage space by including with each data value a nutrient code which indicates the nutrient represented by this particular value. Unknown values would then be represented by the absence of a value. One advantage to this organization is that the set of nutrients to be considered could easily be expanded. A drawback is that this would necessitate using variable-length records or multiple fixed-length records and would complicate the access to the data. When a record of this form is read, it could be translated to a simpler form.

Another desirable goal would be to parameterize the structure of the data records so that a single program could access multiple data bases in different formats without modification. This could be implemented using an additional file that describes the location and size of the data fields of interest. For example, Figure 2 might be a description of the HVH-CWRU Nutrient Data Base. The first line of the description gives the name of the nutrient data file. The next line gives the size in bytes of each record in the file. The third line gives the location, size and format of the item identifier. In this example it is indicated to be at byte offset 0 and consist of two binary integers. The fourth line gives the location and length of the descriptive information for the item. The fifth line gives the number of nutrient values in the data record and the remaining lines describe each nutrient data field. A nutrient data field can be described as the position and format of the data and a set of descriptive information that can be printed on output reports. The descriptive information given in the example is the nutrient name, an optional shortened form of the name and an abbreviation for the units nutrient values are reported in. There are tradeoffs in this representation. Quantity codes are difficult to represent and assumptions about their specific interpretation may

```
/usr/hvh/data/ftab.n
464
0 2bi
4 60c
71
98:Water:Gm
102:Kilocalories,KCal:
106:Total Protein,T-Pro:Gm
110:Animal Protein,A-Pro:Gm
114:Plant Protein,P-Pro:Gm
118:Total Fat,T-Fat:Gm
122:Animal Fat,A-Fat:Gm
126:Plant Fat,P-Fat:Gm
130:Total Carbohydrate,T-CHO:Gm

        . . .

370:Selenium,Selen:mg
374:Sulphur,Sulph:mg
378:Zinc:mg
```

Figure 2.

Sample Data Description File.

have to be made. An interpreter of the description file must be added to the application programs. Added complexity in the data file structure would lead to more complexity in the file description and the interpreter. The compressed data file structure discussed previously would be very difficult to describe concisely.

Increased flexibility could be achieved using a general purpose data base management system (DBMS). These systems usually allow data file formats to be redefined without much difficulty. The tradeoff in this approach is the additional storage that will be required and the increased access time. Use of a DBMS may also limit the choice of an application programming language.

Another area where a parameterization approach might prove useful is for computing nutrient standards. It would be straightforward to set up a nutrient standard file that describes a nutrient standard as a percentage of some constant value. Figure 3 shows a description of the percentage of U.S. RDA for the HVH-CWRU Nutrient Data Base. The first line gives the title of the standard and indicates that it is to be calculated as a percentage. Succeeding lines then give the nutrient number to be considered and the constant value to be compared with. The last

```
%USRDA
3 65      Protein
47 5000 Vitamin A
37 60     Vitamin C
38 1.5    Thiamine
40 1.7    Riboflavin
39 20     Niacin
57 1000 Ca
56 18     Fe
53 400    Vitamin D
50 30     Vitamin E
41 2000 Vitamin B6
43 .4     Folic Acid
42 6      Vitamin B12
58 1000 P
61 .15    I
62 400    Mg
71 15     Zn
66 2      Cu
44 300    Biotin
46 10     Pantothenic Acid
```

Figure 3.

Sample Nutrient Standard File.

item on the line indicates the nutrient under consideration. This representation works well in this example, but would not be applicable to RDA's based on functions of sex, age, weight and other nutrient values. Consider the RDA for niacin as defined by the text of the 1974 RDA. This standard is a function of age, sex, niacin intake and other nutrient intakes. It would be possible to define a representation that would work, but the complexity of creating the files and the interpreter for them would be much greater than hard-coding the formulas.

Questions and Answers:

Q: What application programming languages do you use?

A: Our primary programming language is Fortran and we do some programming in a language called C which is a more modern language.

Q: What percentage of fields in your data base are unfilled?

A: It really depends on the field. There are some fields for which we have values for almost everything, every item that is. Examples are calories, total fat, total carbohydrate and total protein. There are others where there's almost no information. Examples, iodine, I believe there's not a whole lot of B6 information, and things like that. Some of these are nutrients which are in the U.S. RDA and the RDA's and I really can't come up with an estimate of altogether how many fields are vacant or unknown, but we have been thinking about actually quantitifying that.

Q: How many structures do you provide and how do you relate them to the available government tapes?

A: The linkage between the item identifier and the government tapes is through the field in the item record which is the item source. Item source is encoded to be the same number as the government tape numbers or the publication numbers and there's also some alphabetic information that indicates whether it's publication or food manufacturer's data or from USDA. Food item ID is structured as a six character numeric ID the first two characters of which are a food group identifier. And that's represented in the actual file as two binary integers rather than as character information.

Q: What are the other four characters?

A: The other four characters are just a number. We do separate some food groups into food subgroups, so the first character or two of that can indicate that. But otherwise it's just some unique identifying number. Usually with space between sequential items.

Q: I'd just like to ask about your food groups. You've indicated the first two characters were food group identifiers. I think Ohio State is using a four character identifier which brought o t a more detailed breakdown of foods. What system do you provide?

A: I don't know if I'm really qualified to answer that question. I really didn't have anything to do with constructing the food groupings and things like that but we have found that some don't work real well. There are certain things that are difficult to classify.

Q: What about items that have multiple groups that they might be a part of?

A: That's the basic problem. How to classify those. It's difficult to come up with some consistent way of doing it.

Q: Do you make any attempt to assign a scientific name if it's a fruit or a vegetable?

A: No, not really, however through the ID number, if it's a USDA item I believe that you can go back to that information and find out scientific names. But that's not normally part of our descriptive information.

Q: Alan, I'D like to suggest for foods that are cross-referenced, for example, catsup you might think is that a condiment or is it a tomato product? In the coding manual, under tomato, you may say, "Catsup, see condiments".

A: That's right, I forgot about that. We put together a special coding manual to go with the system and it sometimes indicates cross-references so that from one section of the manual it might be referenced to some other section.

Q: But that means you're imposing kind of an arbitrary structure on your coding and that's one of the logical dilemmas that we have in making the data useful to the user.

A: I think it would be difficult to come up with some convenient, consistent system of doing that. I don't know though.

Q: I was wondering about your nutrient sources code. Do you have identified in that code the actual food item identifier that's identical to the one in Handbook 8 or USDA?

A: The item source identifier indicates whether the item was actually taken from USDA publications.

Q: In other words, you can't overlay your tape with USDA's.

A: Not really, not directly. If the item is identified as a USDA item, there are alpha-numeric codes that tell you which particular nutrients were taken from USDA sources. If additional data were taken from other places, that's indicated also.

Q: Is your source code printed out on hard copies or are these codes part of the record?

A: We don't typically print those out on the actual dietary analysis and things like that. If questions come up we can ference them and ...

Q: I'm speaking of the hard copy of the data base.

A: Yes, we have hard copies of the meanings of the codes and things like that.

Q: ... printed out with the hard copy?

A: No, you just print out the code itself and then you can reference another sheet to find out where it came from.

Q: What about the components of the last 4 digits of the identification?

A: They're just four numeric digits. Sometimes they indicate some subgrouping within a major food group.

Q: Then how many digits do you use to actually identify the different foods within the subgroups or groups?

A: We use all four of them. It's sort of a sparse identification. In other words, you can have spaces inbetween the numbers. For example, the first food item number in the table is 01- which indicates a beverage, and then 0010 which indicates some particular food item within that group. It doesn't give you any indication whether it's the first or last item, except that if it were 0001, then it would have to be first.

Q: When a record is processed, do you store that information for use later on?

A: No we don't. You mean, for example, a dietary or something like that, store the accumulated values or something like that? No, we don't do that, we consider that it isn't that difficult to re-run it if need be. Especially since you may want to make changes in the input or the output.

Q: If you wanted data say on 100 foods in your data bank, could you print it out in a matter of a few minutes?

A: I expect so.

Q: In terms of the nutritional values for them?

A: Yes.

# Success In a Hospital Setting

Roberta V. Uhrich

This presentation is entitled "Success in a Hospital Setting" because we, the development team, feel that together we have implemented a practical system for processing daily nutrient intakes rapidly and efficiently. Some of this story has been told by the other members of our team - Grace Petot, our nutrient data base expert, Janet Farrell, our therapeutic specialist, and Alan Whitney, our programmer. This episode reflects the view of the systems dietitian.

University Hospitals of Cleveland is a 1000 bed teaching hospital with dietetic, medical, nursing and a wide variety of other students. There are seven therapeutic units housed in several buildings throughout this massive medical complex. The pediatric, maternity, and psychiatric hospitals are actually three separate buildings. The department of dietetics employs more than 30 dietitians, and serves more than 8000 meals per day.

A comprehensive computerized materials management system was planned for the department of dietetics about 10 years ago. This master plan (Figure 1) having four distinct phases is just being fully implemented this year. Implementation began in 1970 with the inventory and cost control quadrant because of its relative simplicity and financial benefits. Then, recipe standardization and ingredient control were established simultaneously. Computerized nutrient analysis of our recipes, menus and food intakes is the final and long awaited phase.

About two years ago, we seriously began investigating methods of implementing an automated nutrient analysis system within the hospital. Originally hoping to maintain our own nutrient data base, we soon discovered the merits of using the existing nutrient data base maintained by Case Western Reserve University. A skilled specialist at the University has direct responsibility for the content, validity and accuracy of the data base while hospital dietitians can make recommendations for new products as needed. For example, low sodium milk and infant formulas were added to the data base to accomodate hospital diets. With such an arrangement,there is no duplication of effort or cost. At that time, the department of Biometry was primarily processing diet records (Figure 2) for free living individuals. The diet record included name, age, sex, height, and weight of the individual in addition to the quantities and types of food

UNIVERSITY HOSPITALS OF CLEVELAND DEPARTMENT OF DIETETICS

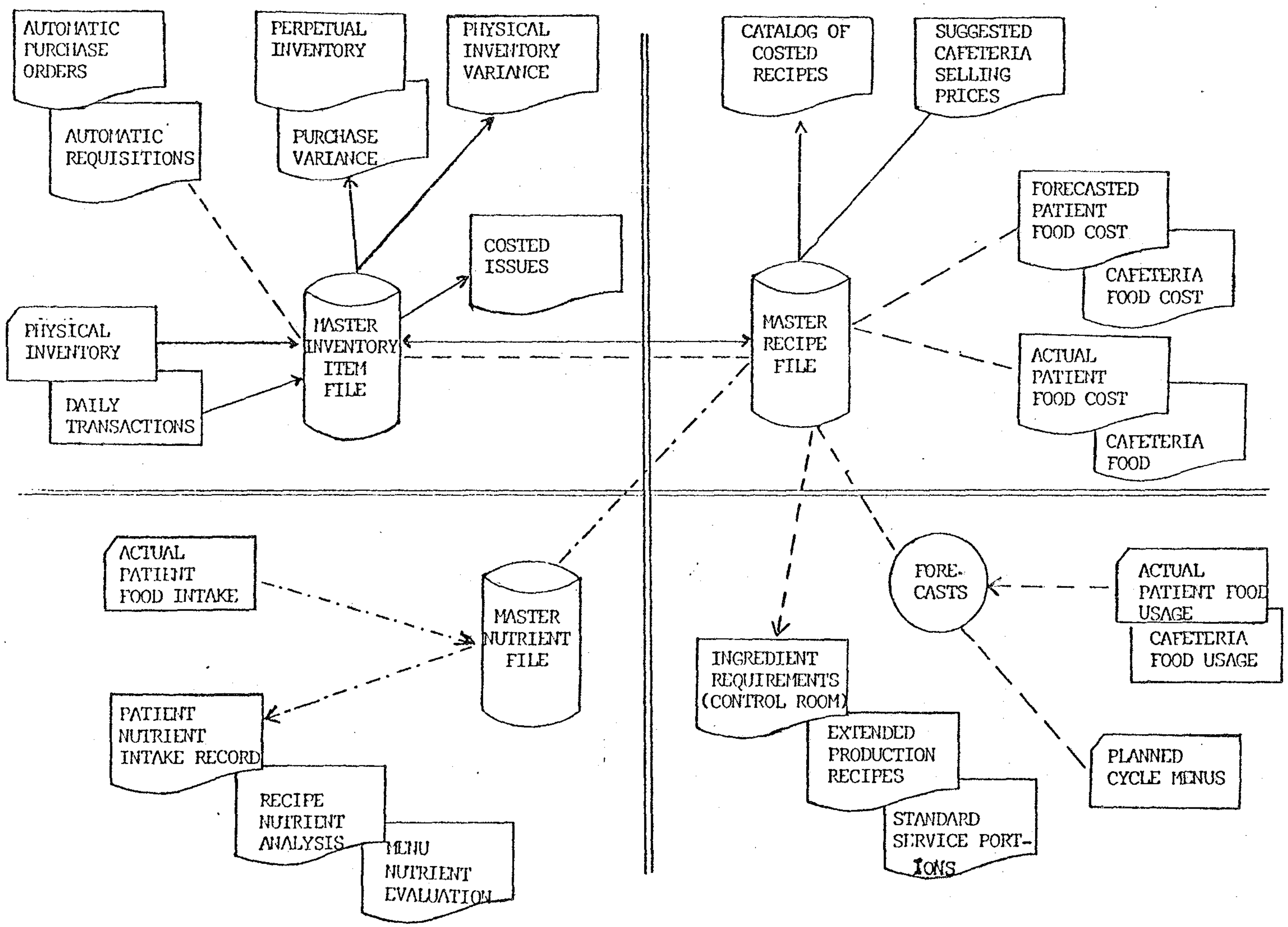


FIGURE 1

## DIET RECORD

BREAKFAST 7:10 AM

6 OZ. ORANGE JUICE
1/2 CUP OATMEAL
1/4 CUP MILK
2 TSP. SUGAR
1 SLICE TOAST, WHITE
1 TSP. MARGARINE
1 CUP COFFEE

LUNCH 12:15 PM

1 CUP PEA SOUP
1 LEAF LETTUCE
1 EACH PEACH HALF
1/2 CUP COTTAGE CHEESE
1 EACH CORN MUFFIN
1 TSP. MARGARINE
1/2 CUP CUSTARD
1 CUP MILK
1 EACH APPLE

DINNER 6:30 PM

ETC..............

NAME________AGE______SEX______WEIGHT______HEIGHT________

FIGURE 2. TYPICAL DIET RECORD

being eaten. The foods were translated into the appropriate item code, measure code and amount and transferred to a coding sheet (Figure 3). In order to complete the coding sheet, a six digit code representing the appropriate food item was selected from the HVH-CWRU coding manual (Figure 4). The first two digits of the item code represent the category of food, thus in looking for sugar, one might look in category 70-Sugars, Syrups and Dessert Sauces. Within this category is the unique number 70-0040 which identifies Sugar, Granulated, White. Each item has one or more volumetric and/or descriptive units of measure plus several expressions of weight (Figure 5). Some examples of acceptable measures are a large, medium or small egg, a can of beer, a chunk of pineapple, a leaf of lettuce, a package of mustard, a sprig of parsley, or a wedge of lemon. The acceptable measure codes for sugar are all weights plus 01-08 and 35. Teaspoon is 06, thus 2 teaspoons of sugar are coded 2 (06) 70-0040. The flexibility built into the original features of the nutrient data base is impressive.

Some errors are easily located and rejected by computer. An item code that does not appear on file is rejected as an invalid entry. An unacceptable or impossible measure, such as slice of water, or a leaf of soup, is also rejected as an invalid entry. These errors are easily corrected before the nutrient values are computed. Other errors are found by manually proof reading the printout of nutrient analysis.

The printout (Figure 6) lists the quantity and description of intake followed by a long list of up to 71 nutrient values plus comparison with R.D.A. and % Calorie distribution when applicable. This is essentially the original method of recording and processing nutrient intakes. The major problem with transferring this application to the hospital setting is the time required for coding the input documents. The existing staff was unable to look up measure and item code numbers for potentially 10% of the hospital population, i.e. from 80-100 food intakes per day. The differences between our in-patient population and the free living research or clinic population are numerous (Figure 7).

First, hospitalized subjects are a captive audience whose food intakes can be monitored by observing their trays three or more times per day. Often the patients are on special diets requiring dietetic or therapeutic products and restricted amounts of food. The in-patient rarely gets seconds! This controlled environment also includes a computerized materials management system which helps to insure quantity control throughout the kitchen. The hospital food supply is controlled by purchasing specifications, standardized recipes, ingredient control room procedures, cycle menus and limited portion sizes.

In comparison, the situation for free living individuals is varied and unrestricted. It is much more difficult to guarantee that the intake information recorded by free living intividuals

HVH-CWRU NUTRIENT DATA BASE

Coding Sheet for On Line

Alpha Center Code NTN (1)

Patient I.D. Number 3 4 3 (2)

Record Number 0 1 (3)

Date 1 1/0 1/7 8 (4)

| (5) MEAL | (6) TIME | (7) QUANTITY | (8) MEASURE CODE | (9) FOOD ITEM NUMBER |
|---|---|---|---|---|
| BREAKFAST | 7:10 | | | |
| | | 6 | 01 | 4511250 |
| | | .5 | 02 | 552210 |
| | | .25 | 02 | 090340 |
| | | 2 | 06 | 700040 ← |
| | | 1 | 44 | 570490 |
| | | 1 | 06 | 500080 |
| | | .75 | 02 | 010040 |
| LUNCH | 12:15 | | | |
| | | 1 | 02 | 400880 |
| | | 1 | 11 | 481090 |
| | | 1 | 30 | 464040 |
| | | .5 | 02 | 140135 |
| | | 1 | 16 | 571670 |
| | | 1 | 06 | 500080 |
| | | .5 | 02 | 680200 |
| | | 1 | 02 | 090340 |
| | | 1 | 11 | 463010 |
| DINNER | 18:30 | | | |
| | | 1 | 10 | 251080 |
| | | .75 | 02 | 470610 |
| | | .5 | 02 | 480570 |
| | | .25 | 06 | 500080 |
| | | 3 | 46 | 484500 |
| | | 1 | 44 | 570480 |
| | | 1 | 06 | 500080 |
| | | 1 | 60 | 640310 |
| | | 6 | 01 | 030120 |
| | | | | |
| | | | | |
| | | | | |

FIGURE 3

Sugar & Sugar Substitutes

| ITEM | ITEM NAME<br>QUANTITY | GRAM WT | MEAS |
|---|---|---|---|
| | DEXTROSE,USP (SEE GROUP 95) | | |
| 70-0010 | SUGAR BROWN | | |
| | Tablespoon | | 01-08 |
| 70-0040 | SUGAR GRANULATED WHITE | | |
| | Tablespoon | | 01-08 |
| | Package | 4.3 Gm | 35 |
| 70-0050 | SUGAR GRANULATED WHITE, LUMP | | |
| | Medium | 7.0 Gm | 11 |
| 70-0080 | SUGAR POWDERED | | |
| | Tablespoon | | 01-08 |
| 70-0150 | SUGAR SUBSTITUTE, ADOLPH'S | | |
| | Tablespoon | | 01-08 |
| 70-0170 | SUGAR SUBSTITUTE, DIAMOND | | |
| | Tablespoon | | 01-08 |
| | Package | 0.4 Gm | 35 |
| 70-0190 | SUGAR SUBSTITUTE, SUCARYL LIQUID | | |
| | Tablespoon | | 01-08 |
| 70-0210 | SUGAR SUBSTITUTE, SPRINKLE SWEET, PILLSBURY | | |
| | Teaspoon | | 01-08 |
| 70-0250 | SUGAR SUBSTITUTE, SWEET'N LOW | | |
| | Package | 1.0 Gm | 35 |

Jams, Jellies, Syrups & Sundae Toppings

| | | | |
|---|---|---|---|
| 70-2000 | APPLE BUTTER | | |
| | Tablespoon | | 01-08 |
| 70-2030 | JAM, ASSORTED | | |
| | Tablespoon | | 01-08 |
| 70-2050 | JAM, RED CHERRY/STRAWBERRY | | |
| | Tablespoon | | 01-08 |
| 70-2080 | JELLY, ASSORTED | | |
| | Tablespoon | | 01-08 |
| | Package | 14.1 Gm | 35 |
| 70-2110 | JELLY, RED CHERRY/STRAWBERRY | | |
| | Tablespoon | | 01-08 |
| | Package | 14.1 Gm | 35 |
| 70-2150 | JAM/JELLY LOW CALORIE, SMUCKER | | |
| | Tablespoon | | 01-08 |
| 70-2200 | JAM/JELLY ART SW, SMUCKER | | |
| | Tablespoon | | 01-08 |
| 70-2250 | MARMALADE, ASSORTED | | |
| | Tablespoon | | 01-08 |
| 70-2500 | HONEY | | |
| | Tablespoon | | 01-08 |
| 70-2530 | MOLASSES | | |
| | Tablespoon | | 01-08 |
| 70-2550 | MOLASSES, BLACKSTRAP | | |
| | Tablespoon | | 01-08 |

FIGURE 4. HVH-CWRU CODING MANUAL

HVH - CWRU NUTRIENT DATA BASE

## MEASURE CODES

### VOLUME

01 FLUID OUNCE
02 CUP ( 8 OUNCE )
03 PINT ( 16 OUNCE)
04 QUART( 32 OUNCE)
05 TABLESPOON ( 3 TSP)
06 TEASPOON
07 MILLILITER
08 100 MILLILITERS

### SIZE

10 SMALL
11 MEDIUM
12 LARGE

### SCOOP

13 ICE CREAM/SHERBET
14 OTHER ITEMS

### FORM

16 AVERAGE
17 BALL
18 BOTTLE/CAN
19 CARTON
20 CHUNK
21 CUBE
22 CAN
23 BOTTLE
24 GLASS
25 LEAF
26 JIGGER
27 COCKTAIL

### FORM (CONTINUED)

28 FLOWER
29 JAR
30 NUMBER
35 PACKAGE
36 PAT
37 PATTY
38 PIECE
40 RING
42 SERVING
43 SECTION
44 SLICE
45 SPRIG
46 STALK
47 STICK
48 STRIP
55 TIDBIT
60 WEDGE

### WEIGHT

68 GRAM
69 100 GRAMS
70 OUNCE(WEIGHT)
71 1/4 POUND
72 1/2 POUND
73 3/4 POUND
74 ONE POUND

FIGURE 5. HVH-CWRU MEASURE CODES

Breakfast

| | |
|---|---|
| 6 Vol Oz | ORANGE JUICE UNSW, FROZEN CONC. DILUTED W 3 PARTS WATER |
| .5 Cup | OATMEAL OR ROLLED OATS, REGULAR & INSTANT COOKING, COOKED |
| .25 Cup | WHOLE MILK, 3.3% FAT |
| 2 Teasp | SUGAR GRANULATED WHITE |
| 1 Slice | WHITE TOAST ENRICHED |
| 1 Teasp | MARGARINE REGULAR, BLUE BONNET |
| .75 Cup | COFFEE, INSTANT BEVERAGE |

Lunch

| | |
|---|---|
| 1 Cup | SPLIT PEA SOUP, CANNED DILUTED W/EQUAL VOLUME WATER |
| 1 Medium | LETTUCE ICEBERG RAW, LEAF |
| 1 Number | PEACH HALVES CANNED, SOLIDS & LIQUID, HEAVY SIRUP |
| .5 Cup | COTTAGE CHEESE, CREAMED LARGE CURD |
| 1 Avg | CORN MEAL MUFFIN |
| 1 Teasp | MARGARINE REGULAR, BLUE BONNET |
| .5 Cup | CUSTARD, BAKED |
| 1 Cup | WHOLE MILK, 3.3% FAT |
| 1 Medium | APPLE W/SKIN RAW, FRESHLY HARVESTED OR STORED, EP |

Dinner

| | |
|---|---|
| 1 Small | CHICKEN (FRYER) BREAST HALF FRIED IN VEGETABLE FAT |
| .75 Cup | POTATO MASHED, MILK AND MARGARINE ADDED |
| .5 Cup | CARROT SLICES COOKED, BOILED DRAINED |

| Nutrient Summary | | % RDA | % CAL |
|---|---|---|---|
| Water | 1888 Gm * | | |
| Kilocalories | 2047 | 100 % | |
| Total Protein | 76.9 Gm | 166 % | 15 % |
| Animal Protein | 53.4 Gm | | |
| Plant Protein | 23.4 Gm | | |
| Total Fat | 69.2 Gm | | 30 % |
| Animal Fat | 29.1 Gm | | |
| Plant Fat | 40.1 Gm | | |
| Total Carbohydrate | 255.4 Gm | | 50 % |
| Refined Carbohydrate | 50.3 Gm * | | |
| Natural Carbohydrate | 184.5 Gm * | | |
| Alcohol | 17.6 Gm * | | 3 % |
| Histidine | 739.5 mg * | | |
| Leucine | 3567 mg * | | |
| Lysine | 2547 mg * | | |
| Methionine | 894.8 mg * | | |
| Phenylalanine | 1962 mg * | | |
| Valine | 2315 mg * | | |
| Sucrose | 8.36 Gm * | | |
| Fructose | Gm * | | |
| Glucose | Gm * | | |
| Lactose | Gm * | | |
| Maltose | Gm * | | |
| Reducing Sugars | .64 Gm * | | |
| Cholesterol | 262 mg * | | |
| Linoleic | 5.481 Gm * | | |
| Oleic | 22.83 Gm * | | |
| Total Polyunsat FA | 3.878 Gm * | | |
| Total Saturated FA | 27.49 Gm * | | |
| Cysteine | mg * | | |
| Cystine | 222 mg * | | |
| Isoleucine | 2134 mg * | | |
| Threonine | 1620 mg * | | |
| Tryptophan | 457.2 mg * | | |
| Tyrosine | 1266 mg * | | |
| Fiber | 5.864 Gm * | | |
| Ascorbic Acid | 135.5 mg * | 301 % | |

FIGURE 6. SAMPLE HVH-CWRU NUTRIENT ANALYSIS PRINTOUT

NUTRIENT ANALYSIS

| | IN-PATIENT HOSPITAL | OUT-PATIENT CLINIC RESEARCH |
|---|---|---|
| **I N P U T** | | |
| POPULATION | CAPTIVE | FREE LIVING |
| DIET | RESTRICTED | UNRESTRICTED |
| FOOD SUPPLY | CONSISTENT/SPECS | VARIED |
| MENU | PLANNED CYCLE | VARIED |
| RECIPES | STANDARD/INGREDIENT | VARIED |
| PORTION | ROOM<br>LIMITED/MEASURED | UNLIMITED |
| INTAKE | OBSERVED | QUESTIONABLE |
| **P R O C E S S I N G** | | |
| TIMING | RIGID<br>DAILY (2-4 HRS) | FLEXIBLE<br>WEEKLY(2-4 DAYS) |
| METHOD | ON-LINE TERMINAL | BATCH-KEYPUNCH |
| VOLUME | CONSISTENT (10%) | VARIABLE |
| COST | CONTAINMENT | NEGOTIABLE |
| REQUIREMENTS | ↓ KEYSTROKES<br>HANDLING<br>ERRORS<br>↑ TRAINING ↑ | |
| **O U T P U T** | | |
| PRINTOUTS | CONCISE<br>ONLY PERTINENT DATA<br>8.5x11 FOR CHART | LENGTHY<br>ALL OPTIONS<br>11x14 |
| USE | EASY TO READ<br>NO MYSTERIOUS CODES | TECHNICAL |

FIGURE 7. COMPARISON OF IN-HOSPTIAL VERSUS RESEARCH APPLICATION

is correct. The recipes, menus and portions vary widely from family to family and within each family. Eating in restaurants and at the home of friends further complicate the ability to identify and quantify foods accurately. Thus, there is a notable difference in input constraints.

Processing differences also exist. An acute care facility requires access to the data base 7 days per week with a maximum delay of a few hours processing time. Since the average patient stay is less than a week , today's nutrient information is needed to influence tomorrow's menu and/or intake. It is imperative to have a rigid time schedule and reliable equipment while keeping keystrokes, handling and errors in processing down to a minimum. Research projects may have a more flexible time schedule. Information may be batch processed several times each week or month. There is usually more time available to verify and correct errors. Many aspects of processing are negotiable depending on funding and purpose.

Output needs are extremely important in a hospital setting. The printout must be clear, concise and correct. We wanted a document that would fit in the patient chart, i.e. one sheet of 8-1/2 by 11 inches. Since the nutrient analysis report might be seen by many health professionals, students and patients, it must be easy to read and understand.

Conversely, research printouts might have a more limited and technically sophisticated audience. Such printouts might be lengthy and filled with special codes and jargon. The size of the paper may be of little concern. In summary, input, processing and output requirements vary considerably and play an important role in the design of our approach to nutrient analysis.

The overview of the system (Figure 8) that evolved during the past year shows three major data bases. As mentioned earlier, the nutrient data base is maintained by the departments of Nutrition and Biometry at Case Western Reserve University. The cycle menu file is maintained by the hospital and contains the 21 day cycle plus holiday menus. The third is a hospital recipe file of some 200 selected standardized recipes that have no suitable counterpart in the existing nutrient data base. Most of the hospital's 1000 recipes have counterparts, for example, hard cooked egg, gelatin, sugar cookie, cooked broccoli, etc. The 200 selected recipes are primarily unsalted products, unsweetened products, special formulae, and mixed dishes that are unique to our institution. A recipe is entered into the file via an interactive program on a computer terminal. Heading information includes recipe number, recipe name, coder initials, servings per recipe, weight per serving, and alternate quantity with measure per serving. The ingredient information includes the corresponding HVH-CWRU food code, raw weight in pounds and ounces, and preparation, cooked, and edible portion yield factors. With this information a recipe printout is produced (Figure 9). The cooked gram weight of each ingredient is computed automatically from

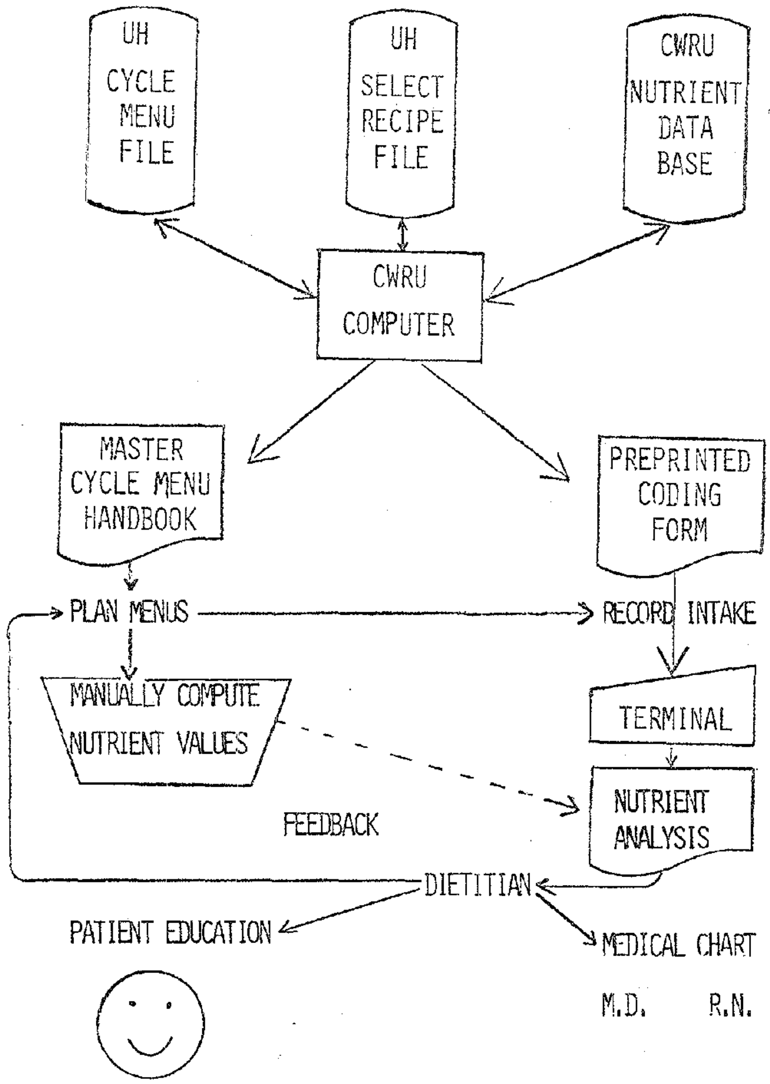


FIGURE 8. OVERVIEW OF NUTRIENT ANALYSIS SYSTEM

UNIVERSITY HOSPITALS OF CLEVELAND

STANDARDIZED RECIPE FILE

07-6290 VIENNA LOAF
Coded by MAN

| Servings | Weight/svg | Quantity | Measure |
|---|---|---|---|
| 160 | | 60. | 68 Gram |

| No | Ingred | Desc | Lbs | Ounces | pr | ck | ep | Grams |
|---|---|---|---|---|---|---|---|---|
| 1 | 24-4040 | VEAL ROUND, LMF COOKED, GROUND | 16 | 0. | 100 | 59 | 100 | 4281.91 |
| 2 | 22-3070 | PORK GROUND LMF COOKED | 5 | 0. | 100 | 71 | 100 | 1610.25 |
| 3 | 48-4880 | ONION (DRY YELLOW) BOILED DRAI | 1 | 0. | 100 | 85 | 100 | 385.553 |
| 4 | 48-1330 | PARSLEY RAW, CHOPPED | 0 | 2. | 100 | 100 | 100 | 56.699 |
| 5 | 16-0070 | EGG WHOLE, HARD-COOKED | 1 | 8. | 100 | 100 | 100 | 680.388 |
| 6 | 75-3950 | SALT, TABLE | 0 | 5. | 100 | 100 | 100 | 141.747 |
| 7 | 75-3730 | PEPPER, WHITE | 0 | .5 | 100 | 100 | 100 | 14.1748 |
| 8 | 75-3510 | NUTMEG, GROUND | 0 | .04 | 100 | 100 | 100 | 1.13398 |
| 9 | 57-0480 | WHITE BREAD ENRICHED | 0 | 8. | 100 | 100 | 100 | 226.796 |
| 10 | 09-0220 | NONFAT DRY MILK POWDER, INSTAN | 0 | 12. | 100 | 100 | 100 | 340.194 |
| 11 | 01-0010 | WATER, CITY OF CLEVELAND | 2 | 0. | 100 | 100 | 100 | 907.184 |

FIGURE 9

input data. The nutrient value of the recipe is computed anew each time a recipe code number is requested. This allows for dynamic updating of recipe nutrient values (Figure 10). Using our own standardized recipes and having current nutrient information has produced greater confidence in the system and better communications between the production and patient service staff.

From the sample analysis of Vienna Loaf, one can see that one portion provides 20% of the protein required by reference man plus 396 mg. sodium and 22 mg. potassium. During the process of recipe standardization, it may be desirable to alter the quantity and type of ingredients to produce a product with different nutrient values, e.g. lower sodium. It may also be revealing to find recipes with unexpected nutrient values, e.g. some regular products were lower in sodium than expected and surprisingly appropriate for some low sodium diets.

With these three data bases, it is possible to print two key documents for the patient service staff. One is the Master Menu Handbook (Figure 11) which is a 70 page reference manual for the Department of Dietetics. It is our own customized handbook organized according to each meal of the menu cycle. Each page lists the food items being served at that particular meal, the portion size served by the kitchen and the corresponding selected nutrient values for that item. It is useful for planning menus and computing intakes manually. One needs only to refer to the

Name: Reference Man
Vienna Loaf Portion: 60 grams

Averaged over 80

| | | Kcal | T-Pro Gm | Na mg | K mg |
|---|---|---|---|---|---|
| 2140 Gram | VEAL ROUND, LMF COOKED, GROUND | 58 | 7.3 | 21 | 134 |
| 805 Gram | PORK GROUND LMF COOKED | 38 | 2.3 | 7 | 39 |
| 193 Gram | ONION (DRY YELLOW) BOILED DRAINED | 1 | 0.0 | 0 | 3 |
| 28 Gram | PARSLEY RAW, CHOPPED | 0 | 0.0 | 0 | 3 |
| 340 Gram | EGG WHOLE, HARD-COOKED | 7 | 0.5 | 6 | 6 |
| 70.9 Gram | SALT, TABLE | 0 | 0.0 | 343 | 0 |
| 7 Gram | PEPPER, WHITE | 0 | 0.0 | 0 | 0 |
| .6 Gram | NUTMEG, GROUND | 0 | 0.0 | 0 | 0 |
| 113 Gram | WHITE BREAD ENRICHED | 4 | 0.1 | 7 | 1 |
| 170 Gram | NONFAT DRY MILK POWDER, INSTANTIZED | 8 | 0.7 | 12 | 36 |
| 454 Gram | WATER, CITY OF CLEVELAND | 0 | 0.0 | 0 | 0 |

| | Kcal | T-Pro Gm | Na mg | K mg |
|---|---|---|---|---|
| Total | 115 | 11.0 | 396 | 222 |
| % RDA | 4 % | 20 % | | |
| % Cal | | 38 % | | |

ID: UHC 001 02
Date: Fri, 20 Apr 1979
Name: Reference Man 23 Yr Male Ht: 175 cm Wt: 70. Kg
Vienna Loaf Portion: 60 grams

FIGURE 10. NUTRIENT ANALYSIS OF STANDARDIZED HOSPITAL RECIPE

appropriate breakfast, lunch, dinner and snack pages to determine Calories, protein, fat, carbohydrates, cholesterol, iron, sodium and potassium values. It serves as an ideal manual backup system for computerized nutrient analysis.

The second key document is the food intake summary form. It is produced by combining two pages of the Master Menu Handbook and eliminating nutrient information. A master copy of the food intake summary form is generated for each day of the menu cycle with all lunch items on one side of the page and all dinner items on the reverse side. The master forms are photocopied and used by the patient service staff to record food intake information for subsequent computer analysis. Non-professionals can record intake data by circling the appropriate quantity, measure code

University Hospitals of Cleveland
Master Menu Handbook
Name: DINNER #1-ALL DIETS          Date: Sun, 25 Mar 1979   ID:   PG 001.03

| Quan | Meas | Code | Item # | Description | Kcal | T-Pro Gm | T-Fat Gm | T-CHO Gm | Chol mg | Iron mg | Na mg | K mg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 180 | cc | (07) | 07-0363 | TOMATO CONSOMME/STRAINED VEGETABLE SOUP | 15 | 1.3 | 0.2 | 2.5 | 0 | 0.33 | 1231 | 212 |
| 180 | cc | (07) | 07-0384 | TOMATO CONSOMME UNSALTED/STRAVEG SOUP | 61 | 2.7 | 1.6 | 9.9 | 0 | 1.42 | 14 | 406 |
| 180 | cc | (07) | 40-0170 | CHICKEN CONSOMME | 16 | 2.6 | Trace | 1.5 | | 0.91 | 550 | 99 |
| 120 | cc | (07) | 45-2030 | APPLE JUICE | 59 | 0.1 | Trace | 15.0 | | 0.75 | 1 | 127 |
| 120 | cc | (07) | 45-1250 | ORANGE JUICE UNSWEETENED | 62 | 0.9 | 0.1 | 14.6 | 0 | 0.13 | 1 | 255 |
| 60 | Gram | (68) | 07-5151 | ROAST/MINCED BEEF AU JUS | 122 | 17.1 | 5.3 | 0.3 | 52 | 2.15 | 126 | 225 |
| 60 | Gram | (68) | 07-5152 | ROAST/MINCED BEEF AU JUS/UNSALTED | 143 | 17.1 | 7.0 | 1.9 | 52 | 2.15 | 36 | 212 |
| 90 | Gram | (68) | 07-7150 | ORANGE GLAZED DUCK (NO BONE) | 297 | 35.0 | 12.2 | 10.1 | 0 | 5.63 | 91 | 268 |
| 90 | Gram | (68) | 07-5830 | ROAST DUCKLING (PLAIN/UNSALTED) NO BONE | 267 | 34.9 | 12.2 | 2.6 | | 5.61 | 70 | 242 |
| 1 | Large | (12) | 07-6437 | POACHED EGG (REG/UNSALTED) | 89 | 6.9 | 6.3 | 0.7 | 310 | 1.18 | 78 | 74 |
| 1 | Slice | (44) | 57-0490 | WHITE TOAST ENRICHED | 69 | 2.2 | 0.8 | 12.9 | 0 | 0.64 | 130 | 27 |
| 90 | Gram | (66) | 27-1118 | FRANKFURTER/WIENER COOKED, SERVING WT | 274 | 11.2 | 24.5 | 1.4 | 56 | 1.35 | 976 | 195 |
| 1 | Vol Oz | (01) | 75-0060 | BARBECUE SAUCE | 28 | 0.5 | 2.2 | 2.5 | 0 | 0.25 | 254 | 54 |
| 2 | Tbsp | (05) | 07-7019 | BEEF GRAVY | 23 | 0.3 | 1.9 | 1.2 | 0 | 0.06 | 226 | 19 |
| 2 | Tbsp | (05) | 07-7085 | BEEF GRAVY UNSALTED | 36 | 0.9 | 2.4 | 2.6 | 0 | 0.07 | 3 | 3 |
| 1 | Avg | (16) | 47-0030 | POTATO BAKED IN SKIN | 145 | 4.0 | 0.2 | 32.8 | | 1.09 | 6 | 782 |
| .5 | Cup | (02) | 07-9503 | POTATOES AU GRATIN | 158 | 7.1 | 8.0 | 14.7 | 15 | 0.53 | 363 | 284 |
| .5 | Cup | (02) | 07-9570 | POTATOES AU GRATIN UNSALTED | 150 | 6.2 | 7.4 | 14.9 | 1 | 0.46 | 35 | 279 |
| .5 | Cup | (02) | 48-4120 | BEANS WAX FROZEN, BOILED | 18 | 1.1 | 0.1 | 4.2 | | 0.47 | 1 | 111 |
| .5 | Cup | (02) | 07-9462 | WAX BEANS WITH BACON BITS | 57 | 3.1 | 3.1 | 5.2 | 0 | 0.76 | 349 | 147 |
| .5 | Cup | (02) | 48-0510 | BROCCOLI CHOPPED FROZEN, BOILED | 24 | 2.9 | 0.2 | 4.3 | | 0.65 | 11 | 204 |
| 1 | Tbsp | (05) | 07-7130 | MOCK HOLLANDAISE SAUCE | 27 | 1.0 | 1.7 | 2.2 | 2 | 0.04 | 35 | 45 |
| .5 | Cup | (02) | 07-9481 | STRAINED WAX BEANS(REG/UNSALTED) | 17 | 1.1 | 0.1 | 3.9 | | 0.44 | 1 | 103 |
| 1 | Cup | (02) | 48-1080 | LETTUCE ICEBERG RAW, CHUNKS | 10 | 0.7 | 0.1 | 2.2 | | 0.38 | 7 | 131 |
| .5 | Cup | (02) | 07-8235 | GINGERALE FRUIT MOLD | 98 | 3.4 | 0.0 | 22.1 | 0 | 0.14 | 8 | 52 |
| .5 | Cup | (02) | 07-8279 | UNSWEET FRUIT COCKTAIL IN LEMON GELATIN | 26 | 5.0 | 0.0 | 1.8 | 0 | 0.08 | 10 | 31 |
| 1 | Leaf | (25) | 48-0960 | ENDIVE (CURLY AND ESCAROLE) RAW | 1 | 0.1 | 0.0 | 0.3 | | 0.11 | 1 | 18 |
| 2 | Tbsp | (05) | 50-3110 | FRENCH DRESSING | 123 | 0.2 | 11.7 | 5.3 | | 0.12 | 411 | 24 |
| 2 | Tbsp | (05) | 07-7322 | FRENCH DRESSING UNSALTED | 59 | 0.2 | 4.2 | 5.6 | 0 | 0.27 | 1 | 68 |
| 1 | Pkg | (35) | 50-5280 | MAYONNAISE | 102 | 0.2 | 11.3 | 0.3 | 10 | 0.07 | 85 | 5 |
| 2 | Tbsp | (05) | 07-7352 | MAYONNAISE UNSALTED | 219 | 0.5 | 24.5 | 0.2 | 42 | 0.16 | 1 | 6 |
| 1 | Wedge | (60) | 64-0010 | APPLE PIE | 302 | 2.6 | 13.1 | 45.0 | 0 | 0.83 | 356 | 95 |
| .5 | Cup | (02) | 66-0120 | VANILLA ICE CREAM | 134 | 2.4 | 7.2 | 15.9 | 30 | 0.06 | 58 | 128 |
| 2 | Tbsp | (05) | 70-2850 | SUNDAE TOPPING CHERRY, RASPBERRY | 106 | 0.2 | 0.1 | 27.2 | 0 | 0.92 | 14 | 304 |
| .5 | Cup | (02) | 46-4050 | PEACH SLICES CANNED, HEAVY SIRUP | 100 | 0.5 | 0.1 | 25.7 | | 0.38 | 3 | 166 |
| .5 | Cup | (02) | 46-4030 | PEACH HALVES CANNED, WATER PACK | 38 | 0.5 | 0.1 | 9.9 | | 0.37 | 2 | 167 |
| .5 | Cup | (02) | 68-0290 | GELATIN LOW CALORIE, D-ZERTA | 8 | 1.6 | 0.0 | 0.0 | | 0.00 | 34 | |
| .33 | Cup | (02) | 07-8070 | FRESH FRUIT CUP | 46 | 0.5 | 0.1 | 11.8 | | 0.27 | 1 | 148 |

Portion   codes   --DINNER #1--

FIGURE 11. MASTER MENU HANDBOOK

and item code. Preprinted quantities can be crossed out and rewritten to reflect ingestion of partial portions. This method eliminates errors resulting from transposition of numbers, invalid item codes, invalid measure codes and poor penmanship. Professional time is reserved for reviewing printouts and taking appropriate followup action, rather than collecting, recording and computing intakes.

Let us use the intake of Sally Smith as an example (Figure 12). Two forms are needed for one day's intake. The preprinted lunch and dinner form plus the cover sheet with patient information and preprinted breakfast. At lunch, Sally ate all the soup, asparagus, lettuce, dressing, blueberry crumb cake and sauce, but ate only half of the Vienna loaf and gravy. All items are circled and the preprinted quantities that do not reflect intake are crossed out so that actual quantities consumed can be written next to the appropriate food. Dinner is recorded in the same fashion on the reverse side of the form. Breakfast is recorded similarly on the reverse side of the cover sheet. The top of the cover sheet (Figure 13) contains heading information, write-ins and summarized standards. Heading information includes location or place, date of intake, patient name and diet order. Age is expressed in month or year by circling M or Y. Sally is 25 Y. A six month old infant would be 6 M. Sex is expressed by circling M,F,P, or L to represent male, female, pregnant or lactating. Sally is pregnant, so P is circled. Height is recorded in centimeters and weight in kilograms. If intake information is incomplete, INCOM is circled. This triggers an appropriate message on the printout. The nutrient detail and summary line may be left blank to obtain a routine predetermined printout. If other nutrient values are desired for a special purpose, the appropriate nutrient code numbers may be entered to change the content of the printout.

Standard breads and beverages are summarized for the entire day to reduce the number of keystrokes. Thus 240 ml. of milk consumed four times per day are entered once as 960 ml. Many times, patients will receive treats from home or the snack shop, so there is space for write-ins ... an inevitable part of any system. Here, of course, the item and measure codes must be found in the Master Menu Handbook and recorded on the cover sheet.

These sheets are sent to the Department of Dietetics computer terminal operator who enters the data onto magnetic tape. When several intakes are on tape, the terminal is connected to the Department of Biometry computer via telephone. Errors are detected and corrected and the printout is ready within minutes. The routine daily printout (Figure 14) lists the quantity and type of food eaten with corresponding nutrient values for calories, protein, fats, carbohydrate, sodium and potassium, with daily totals and comparison to RDA and percent calorie distribution where applicable. It should be noted that any other six nutrients can be substituted for those mentioned above. In

University Hospitals of Cleveland
Food Intake Summary
Menu: LUNCH #16 - ALL DIETS
Name: SALLY SMITH Place: MAC 504

| Quan Meas | Code | Item # | Description |
|---|---|---|---|
| 180 cc | (07) | 40-0220 | CHICKEN NOODLE SOUP |
| 180 cc | (07) | 40-0170 | CHICKEN CONSOMME |
| 180 cc | (07) | 07-0377 | BROTH SOUP UNSALTED WITH NOODLES/RICE |
| 180 cc | (07) | 40-0860 | GREEN PEA SOUP(REG/STR) |
| 120 cc | (07) | 07-1240 | PINEAPPLE-GRAPEFRUIT JUICE |
| 120 cc | (07) | 45-2400 | PINEAPPLE JUICE UNSWEETENED |
| | | | |
| 60 Gram | (68) | 07-6290 | VIENNA LOAF |
| 2 Tbsp | (05) | 07-7055 | MUSHROOM GRAVY |
| | | | |
| | | | CHEF'S SANDWICH SPECIAL |
| 60 Gram | (68) | 14-0010 | AMERICAN CHEESE, PASTEURIZED PROCESS |
| 2 Medium | (11) | 48-2070 | TOMATO RAW, SLICE/WEDGE |
| 1 Slice | (44) | 50-2010 | BACON (ANY) COOKED |
| 1 Slice | (44) | 57-0490 | WHITE TOAST ENRICHED |
| | | | |
| | | | GRILLED CHEESE SANDWICH(REG/UNSALTED) |
| 60 Gram | (68) | 14-0010 | AMERICAN CHEESE, PASTEURIZED PROCESS |
| 60 Gram | (68) | 14-1120 | LOW SODIUM COLBY CHEESE, CELLU |
| 2 Slice | (44) | 57-0490 | WHITE TOAST ENRICHED |
| 2 Slice | (44) | 57-0600 | LOW SODIUM BREAD, WHITE/WHOLE WHEAT |
| 2 Pat | (36) | 50-0060 | MARGARINE REGULAR, (ANY) |
| 2 Pat | (36) | 50-0310 | MARGARINE LOW SODIUM |
| | | | |
| 2 Large | (12) | 07-6438 | SCRAMBLED EGGS (REG/UNSALTED) |
| 1 Slice | (44) | 50-2010 | BACON (ANY) COOKED |
| 60 Gram | (68) | 07-5153 | ROAST BEEF(MINCED/STRAINED) |
| 2 Tbsp | (05) | 07-7019 | BEEF GRAVY |
| 2 Tbsp | (05) | 07-7085 | BEEF GRAVY UNSALTED |
| 60 Gram | (68) | 24-4040 | VEAL ROUND, LMF COOKED, GROUND |
| 1 Pkg | (35) | 75-0110 | CATSUP REGULAR |
| | | | |
| 1 Avg | (16) | 47-0030 | POTATO BAKED IN SKIN |
| 1 Pat | (36) | 50-0015 | BUTTER REGULAR |
| 1 Pat | (36) | 50-0035 | BUTTER UNSALTED |
| 1 Tbsp | (45) | 64-6200 | CREAM, SOUR CREAM |
| .5 Cup | (02) | 48-0030 | ASPARAGUS (GREEN) FROZEN CKD, WHOLE |
| .5 Cup | (02) | 48-4240 | BEETS RED CANNED, SLICED OR DICED |
| .5 Cup | (02) | 90-0500 | PEAS, STRAINED, GERBER |
| .5 Cup | (02) | 90-0508 | GARDEN VEGETABLES, STRAINED, GERBER |

| Quan Meas | Code | Item # | Description |
|---|---|---|---|
| 1 Cup | (02) | 48-1080 | LETTUCE ICEBERG RAW, CHUNKS |
| 2 Tbsp | (05) | 50-3110 | FRENCH DRESSING |
| 2 Tbsp | (05) | 07-7322 | FRENCH DRESSING UNSALTED |
| .5 Cup | (02) | 07-8071 | FRUIT SALAD WITH CREAMY DRESSING |
| .33 Cup | (02) | 07-8070 | FRESH FRUIT CUP |
| .5 Cup | (02) | 46-3650 | FRUIT COCKTAIL CANNED, HEAVY SIRUP |
| | | | |
| | | | APRICOT HALVES w/COTTAGE CHEESE |
| 4 Number | (30) | 46-3120 | APRICOT HALVES CANNED, WATER PACK |
| .25 Cup | (02) | 14-0130 | COTTAGE CHEESE, CREAMED SMALL CURD |
| 1 Leaf | (25) | 48-0960 | ENDIVE (CURLY AND ESCAROLE) RAW |
| | | | |
| | | | CELERY & CARROT STICKS |
| .25 Stalk | (46) | 48-4500 | CELERY RAW STICKS |
| 3 Stick | (47) | 48-0540 | CARROT RAW, EP |
| 1 Leaf | (25) | 48-0960 | ENDIVE (CURLY AND ESCAROLE) RAW |
| | | | |
| .5 Cup | (02) | 68-0230 | GELATIN SWEETENED PLAIN |
| .5 Cup | (02) | 68-0290 | GELATIN LOW CALORIE, D-ZERTA |
| 1 Tbsp | (45) | 64-6040 | CREAM, HALF & HALF (MILK & CREAM), FLUID |
| 1 Piece | (38) | 07-4615 | BLUEBERRY CRUMB CAKE |
| .25 Cup | (02) | 70-3120 | SAUCE LEMON |
| 1 Wedge | (60) | 64-1310 | PEACH PIE |
| .5 Cup | (02) | 46-3130 | APRICOT HALVES CANNED, HEAVY SIRUP |
| .5 Cup | (02) | 46-4030 | PEACH HALVES CANNED, WATER PACK |
| .5 Cup | (02) | 66-0102 | STRAWBERRY ICE CREAM |

--LUNCH #16--

FIGURE 12. SAMPLE FOOD INTAKE SUMMARY FORM

FOOD INTAKE SUMMARY

P[]MAC504 [|R[]DD [|D[] 04/15/79 (r) N[] SALLY SMITH (r)
PLACE:bldg/room/bed DATE:mon/day/yr NAME: patient's first & last(MAX 25 LETTERS)

D[] BASIC PRENATAL (r)
DIET: order, allergies, notes (MAX 59 CHARACTERS)

A[] 25 M Ⓨ [|S[] M F Ⓟ L [|H[] 165 [|W[] 49.__ (r) I 68 INCOM(r)
AGE:Month/Year SEX:Male/Fem/Preg/Lac HEIGHT: cm WEIGHT: kilograms *INTAKE INCOMPLETE ?

WEIGHT RANGE
F 50-69 KG
M 60-83 KG

NUTR[]D[] _[]_ _[]_ _[]_ _[]_ _[]_ (r) NUTR[]S[] (r)
*NUTRIENT:detail:specify up to 6 codes *NUTRIENT:summary:specify up to 71 codes

| QUANTITY | MEAS | ITEM # | BREAK | LUNCH | DINNER | SNACK | MEAS | ITEM DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 120. | 07 | 452360 | | | | 120 | cc | PEAR NECTAR |
| 60. | 68 | 075950 | | | | 60 | GM | TURKEY |
| 1. | 16 | 571040 | | | | 1 | AV | BUN |
| 1. | 35 | 503280 | | | | 1 | PK | MAYO |
| 1. | 11 | 463010 | | | | 1 | Med | APPLE |

| QUANTITY | MEAS | ITEM # | BREAK | LUNCH | DINNER | SNACK | MEAS | ITEM DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| . | 07 | 09-0340 | | | | | 240cc | MILK WHOLE |
| 960 | 07 | 09-0080 | 240 | 240 | 240 | 240 | 240cc | MILK LOWFAT 2% |
| . | 07 | 09-0240 | | | | | 240cc | MILK SKIM |
| . | 07 | 09-0020 | | | | | 240cc | MILK BUTTER |
| . | 07 | 09-2060 | | | | | 240cc | MILK CHOCOLATE |
| . | 07 | 09-0400 | | | | | 240cc | MILK LOW SODIUM |
| . | 07 | 01-0040 | | | | | 240cc | COFFEE-INSTANT |
| . | 07 | 01-0050 | | | | | 240cc | COFFEE-BREWED |
| . | 07 | 01-0060 | | | | | 240cc | COFFEE-DECAF |
| . | 07 | 01-0080 | | | | | 240cc | TEA |
| 240. | 07 | 09-4016 | 240 | | | | 240cc | HOT COCOA w/water |
| . | 35 | 15-1150 | | | | | 1 pkg | LEMON JUICE |
| . | 35 | 09-6080 | | | | | 1 pkg | CREAM half/half |
| . | 35 | 09-6060 | | | | | 1 pkg | COFFEE WHITENER-non-dairy |
| . | 44 | 57-0480 | | | | | 1 sl | BREAD-white |
| . | 44 | 57-0440 | | | | | 1 sl | BREAD-whole wheat |
| . | 44 | 57-0320 | | | | | 1 sl | BREAD-rye |
| . | 44 | 57-0600 | | | | | 1 sl | BREAD-LO NA white |
| . | 44 | 57-0600 | | | | | 1 sl | BREAD-LO NA wheat |
| . | 44 | 57-0610 | | | | | 1 sl | BREAD LOW PROTEIN |
| . | 30 | 82-0300 | | | | | 2 ea | MELBA TOAST |
| . | 30 | 82-0700 | | | | | 2 ea | *MELBA/ZWEIBACK |
| . | 35 | 82-0560 | | | | | 2 ea | SALTINE CRACKERS |
| . | 35 | 82-0570 | | | | | 1 pk | UNSALTED CRACKERS |
| 1. | 36 | 50-0015 | | 1 | | | 1 pat | BUTTER-regular |
| . | 36 | 50-0035 | | | | | 1 pat | BUTTER-unsalted |
| . | 36 | 50-0060 | | | | | 1 pat | MARGARINE-regular |
| . | 36 | 50-0290 | | | | | 1 pat | MARGARINE-unsalted |
| 2. | 35 | 75-3950 | | 1 | 1 | | 1 pkg | SALT |
| 2. | 35 | 75-3670 | | 1 | 1 | | 1 pkg | PEPPER |
| . | 35 | 70-0040 | | | | | 1 pkg | SUGAR |
| . | 35 | 70-0170 | | | | | 1 pk | SUGAR SUBSTITUTE |

FIGURE 13. SAMPLE COVER SHEET OF FOOD INTAKE SUMMARY

Name: DIET MANUAL EVALUATION Date: Sun, 15 Apr 1979 ID: MAC 504 DD
Diet: BASIC PRENATAL

| Amount | Food | Kcal | T-Pro Gm | T-Fat Gm | T-CHO Gm | Na mg | K mg |
|---|---|---|---|---|---|---|---|
| 960 cc | LOWFAT MILK, 2% FAT | 495 | 33.0 | 19.0 | 47.5 | 495 | 1524 |
| 240 cc | CARNATION INSTANT HOT COCOA BEVERAGE MADE W/WATER | 112 | 4.1 | 3.0 | 20.3 | 156 | 179 |
| 1 Pat | BUTTER REGULAR | 36 | 0.0 | 4.1 | 0.0 | 41 | 1 |
| 2 Pkg | SALT, TABLE | 0 | 0.0 | 0.0 | 0.0 | 930 | 0 |
| 2 Pkg | PEPPER, BLACK | 1 | 0.0 | 0.0 | 0.2 | 0 | 5 |
| 120 cc | PEAR NECTAR, (40% FRUIT), CANNED | 66 | 0.4 | 0.3 | 16.7 | 1 | 49 |
| 60 Gram | ROAST TURKEY(REGULAR/UNSALTED) | 107 | 17.8 | 3.5 | 0.0 | 51 | 229 |
| 1 Avg | HAMBURGER BUN | 119 | 3.3 | 2.2 | 21.2 | 202 | 38 |
| 1 Pkg | MAYONNAISE | 102 | 0.2 | 11.3 | 0.3 | 85 | 5 |
| 1 Medium | APPLE W/SKIN RAW, FRESHLY HARVESTED OR STORED, EP | 80 | 0.3 | 0.8 | 20.0 | 1 | 152 |
| 120 cc | ORANGE JUICE UNSW, FROZEN CONC, DILUTED W/ 3 PARTS WATER | 62 | 0.9 | 0.1 | 14.6 | 1 | 255 |
| 1 Svg | SPECIAL K, KELLOGG'S | 110 | 6.0 | 0.0 | 21.0 | 216 | 57 |
| 1 Pat | BUTTER REGULAR | 36 | 0.0 | 4.1 | 0.0 | 41 | 1 |
| 1 Medium | SWEET ROLL (ANY) | 174 | 4.7 | 5.0 | 27.1 | 214 | 68 |
| 120 cc | CHICKEN NOODLE SOUP, CANNED DILUTED W/EQUAL VOLUME WATER | 33 | 1.8 | 1.0 | 4.4 | 499 | 24 |
| 60 Gram | VIENNA LOAF | 115 | 11.0 | 6.6 | 2.1 | 396 | 222 |
| 2 Tbsp | MUSHROOM GRAVY | 43 | 0.6 | 3.5 | 2.1 | 309 | 28 |
| .5 Cup | ASPARAGUS (GREEN) FROZEN CKD, WHOLE STALKS BOILED DRAINED | 22 | 3.0 | 0.2 | 3.6 | 1 | 226 |
| 1 Cup | LETTUCE ICEBERG RAW, CHUNKS | 10 | 0.7 | 0.1 | 2.2 | 7 | 131 |
| 2 Tbsp | FRENCH DRESSING | 123 | 0.2 | 11.7 | 5.3 | 411 | 24 |
| 1 Piece | BLUEBERRY CRUMB CAKE | 333 | 2.9 | 11.3 | 56.2 | 174 | 52 |
| 25 Cup | SAUCE LEMON | 133 | 0.1 | 2.8 | 27.8 | | |
| 20 cc | APPLE JUICE, CANNED OR BOTTLED | 59 | 0.1 | Trace | 15.0 | 1 | 127 |
| .5 Medium | CORNISH HEN ROASTED, WHOLE | 158 | 27.6 | 4.4 | 0.0 | 77 | 318 |
| .5 Cup | CHICKEN FLAVOUR'D RICE COOKED W/O BUTTER, UNCLE BEN'S | 100 | 2.6 | 0.9 | 20.5 | 416 | 71 |
| .5 Cup | CARROTS DICED COOKED, BOILED DRAINED | 22 | 0.7 | 0.1 | 5.1 | 24 | 161 |
| 1 Cup | SPINACH RAW, CHOPPED | 14 | 1.8 | 0.2 | 2.4 | 39 | 259 |
| 2 Tbsp | HOT BACON DRESSING | 31 | 0.8 | 1.2 | 4.4 | 128 | 14 |
| 1 Piece | CHOCOLATE BROWNIES W/NUTS | 310 | 3.5 | 15.8 | 41.8 | 114 | 97 |

| | Kcal | T-Pro Gm | T-Fat Gm | T-CHO Gm | Na mg | K mg |
|---|---|---|---|---|---|---|
| Total | 3004 | 127.9 | 113.1 | 381.9 | 5033 | 4317 |
| % RDA | 113 % | 145 % | | | | |
| % Cal | | 17 % | 34 % | 51 % | | |

SALLY SMITH
ID: MAC 504 DD
Date: Sun, 15 Apr 1979
Name: DIET MANUAL EVALUATION 25 yr preg F Ht: 165 cm Wt: 68. Kg
Diet: BASIC PRENATAL

FIGURE 14. ROUTINE DAILY NUTRIENT ANALYSIS PRINTOUT (SHORT FORM)

addition, a long form with up to 71 nutrient values can be requested without re-entering the original intake information. The sample long form (Figure 15) shows four values below 50% RDA. Another printout can be requested with more information regarding the four nutrients in question (Figure 16). Sometimes the printout shows blank values indicating that the value is unknown. This may show that the diet may not be inadequate, but that our knowledge of the nutrient values is inadequate. This type of

UNIVERSITY HOSPITALS OF CLEVELAND

| Nutrient Summary | | % RDA | % CAL |
|---|---|---|---|
| Kilocalories | 3004 | 113 % | |
| Total Protein | 127.9 Gm | 145 % | 17 % |
| Total Fat | 113.1 Gm | | 34 % |
| Total Carbohydrate | 381.9 Gm | | 51 % |
| Ascorbic Acid | 177.1 mg * | 295 % | |
| Thiamin | 1.806 mg * | 120 % | |
| Niacin | 33.6 mg * | 308 % | |
| Riboflavin | 3.486 mg * | 193 % | |
| Pyridoxal B6 | 1429 ug * | 57 % | |
| Vitamin B12 | 4.251 ug * | 106 % | |
| Folic Acid | .425 mg * | 53 % | |
| Biotin | 11.63 ug * | | |
| Choline | 19.19 mg * | | |
| Pantothenic | 4.778 mg * | | |
| Total Vitamin A | 18049 IU * | 361 % | |
| Total Tocopherol | 15.96 mg * | 127 % | |
| Vitamin D | 455.2 IU * | 114 % | |
| Iron | 19.21 mg | 107 % | |
| Calcium | 1720 mg | 143 % | |
| Phosphorus | 2081 mg * | 173 % | |
| Sodium | 5033 mg * | | |
| Potassium | 4317 mg * | | |
| Iodine | .0096 mg * | | |
| Magnesium | 358.1 mg * | 80 % | |
| Chlorine | 76.79 mg * | | |
| Chromium | 43.19 ug * | | |
| Cobalt | .0001 mg * | | |
| Copper | .4855 mg * | | |
| Manganese | 1.014 mg * | | |
| Molybdenum | mg * | | |
| Selenium | .0131 mg * | | |
| Sulphur | 51.66 mg * | | |
| Zinc | 13.33 mg * | 67 % | |

ID: MAC 504 DD
Date: Sun, 15 Apr 1979
Name: DIET MANUAL EVALUATION 25 yr preg F Ht: 165 cm Wt: 68. Kg
Diet: BASIC PRENATAL SALLY SMITH

FIGURE 15. STANDARD IN-DEPTH DAILY NUTRIENT ANALYSIS SUMMARY (LONG FORM)

in-depth analysis is the exception rather than the rule. Most often, one printing of the short routine form is adequate to evaluate and monitor daily activity. Multiple in-depth printouts are used primarily to evaluate the dietary operation for the good of groups, such as analysis of the diet manual, menus and recipes.

This is basically the successful system that is operational today at University Hospitals of Cleveland. The hard work of establishing the basic system is complete and now there is time to enjoy the information explosion that accompanies many computer applications. New ways of expressing the existing information

UNIVERSITY HOSPITALS OF CLEVELAND

Name: DIET MANUAL EVALUATION Date: Sun, 15 Apr 1979 ID: MAC 504 DD
Diet: BASIC PRENATAL

| Amount | Food | B6 ug | Folic mg | Magne mg | Zinc mg |
|---|---|---|---|---|---|
| 960 cc | LOWFAT MILK, 2% FAT | 425.7 | .0494 | 138.6 | 3.861 |
| 240 cc | CARNATION INSTANT HOT COCOA BEVERAGE MADE W/WATER | 30.43 | .0024 | 19.68 | .4663 |
| 1 Pat | BUTTER REGULAR | .15 | .0001 | .1 | .0025 |
| 2 Pkg | SALT, TABLE | — | — | 4 | — |
| 2 Pkg | PEPPER, BLACK | — | — | .7095 | .0051 |
| 120 cc | PEAR NECTAR, (40% FRUIT), CANNED | | | | |
| 60 Gram | ROAST TURKEY(REGULAR/UNSALTED) | — | .0033 | 15.86 | 1.841 |
| 1 Avg | HAMBURGER BUN | — | .0156 | — | .24 |
| 1 Pkg | MAYONNAISE | — | .0004 | .284 | .0227 |
| 1 Medium | APPLE W/SKIN RAW, FRESHLY HARVESTED OR STORED, EP | 41.4 | .0110 | 4.416 | .069 |
| 120 cc | ORANGE JUICE UNSW, FROZEN CONC, DILUTED W/ 3 PARTS WATER | — | .0694 | 13.01 | .0252 |
| 1 Svg | SPECIAL K, KELLOGG'S | 499.7 | .0999 | 16 | 3.745 |
| 1 Pat | BUTTER REGULAR | .15 | .0001 | .1 | .0025 |
| 1 Medium | SWEET ROLL (ANY) | 19.25 | — | 18 | — |
| 120 cc | CHICKEN NOODLE SOUP, CANNED DILUTED W/EQUAL VOLUME WATER | | | | |
| 60 Gram | VIENNA LOAF | 13.32 | .0054 | 12.24 | 1.422 |
| 2 Tbsp | MUSHROOM GRAVY | 1.219 | .0004 | .9097 | .0168 |
| .5 Cup | ASPARAGUS (GREEN) FROZEN CKD, WHOLE STALKS BOILED DRAINED | 101.7 | — | 13.3 | — |
| 1 Cup | LETTUCE ICEBERG RAW, CHUNKS | 41.25 | .0277 | 8.25 | .3 |
| 2 Tbsp | FRENCH DRESSING | — | — | 3 | .06 |
| 1 Piece | BLUEBERRY CRUMB CAKE | 6.846 | .0045 | 5.801 | .0407 |
| .25 Cup | SAUCE LEMON | | | | |
| 120 cc | APPLE JUICE, CANNED OR BOTTLED | 37.73 | .0002 | 5.031 | .1383 |
| .5 Medium | CORNISH HEN ROASTED, WHOLE | — | — | — | — |
| .5 Cup | CHICKEN FLAVOUR'D RICE COOKED W/O BUTTER, UNCLE BEN'S | — | — | 7.956 | — |
| .5 Cup | CARROTS DICED COOKED, BOILED DRAINED | — | .0174 | 4.495 | .2175 |
| 1 Cup | SPINACH RAW, CHOPPED | 154 | .1062 | 48.4 | .44 |
| 2 Tbsp | HOT BACON DRESSING | .0679 | 0 | .8229 | .0091 |
| 1 Piece | CHOCOLATE BROWNIES W/NUTS | 56.18 | .0110 | 16.99 | .4039 |

FIGURE 16

and new uses for the printouts are being discovered everyday.

One new printout is the nutrient ratio comparison (Figure 17) which is especially helpful for patients with metabolic disorders in our pediatric hospital. In this example, calories are compared with protein, thus the calorie to protein ratio is 48, meaning that for each gram of protein in a graham cracker, the patient will receive 48 calories. The reverse is stated as one calorie provides .0208 grams of protein. This, of course, is a limited application, but it is of great importance to the physicians and dietitians working with metabolic disorders. Such printouts will become more and more valuable as our nutrient information expands. Such a program is cost effective only because it is a byproduct of the basic system.

CASE WESTERN RESERVE UNIVERSITY NUTRIENT RATIO COMPUTATIONS

Name: CALORIE TO PROTEIN RATIO Date: Fri, 6 Apr 1979 ID: RBC 415 CC

| | | Kcal | T-Pro Gm | Kcal T-Pro | T-Pro Kcal |
|---|---|---|---|---|---|
| 10:00 Breakfast | | | | | |
| 2 Avg | GRAHAM CRACKER | 54 | 1.1 | 48 | .0208 |
| .5 Cup | COTTAGE CHEESE, CREAMED SMALL CURD | 108 | 13.1 | 8.247 | .1213 |
| 2 Medium | TOMATO RAW, SLICE/WEDGE | 9 | 0.5 | 20 | .05 |
| 1 Stalk | CELERY RAW | 7 | 0.4 | 18.89 | .0529 |
| .75 Cup | WHITE RICE COOKED W/O BUTTER OR SALT, UNCLE BEN'S CONVERTED | 136 | 2.6 | 52.77 | .0189 |
| .5 Cup | APRICOT HALVES CANNED, SOLIDS & LIQUID, WATER PACK | 47 | 0.9 | 54.29 | .0184 |
| 240 cc | SKIM MILK | 87 | 8.5 | 10.26 | .0974 |
| 1.8 Slice | WHOLE WHEAT BREAD | 101 | 4.3 | 23.14 | .0432 |
| 240 cc | ORANGE JUICE UNSW, FROZEN CONC. DILUTED W/ 3 PARTS WATER | 124 | 1.8 | 70 | .0142 |
| 120 cc | GRAPEFRUIT JUICE UNSW, CANNED | 51 | 0.6 | 82 | .0122 |
| 240 cc | APPLE JUICE, CANNED OR BOTTLED | 118 | 0.3 | 470 | .0021 |
| 1 Avg | GRAPEFRUIT HALF, WHITE TEXAS EP | 41 | 0.5 | 86 | .0116 |
| .5 Cup | PEAR HALVES CANNED, SOLIDS & LIQUID, WATER PACK | 39 | 0.2 | 160 | .0062 |
| 1 Cup | PUFFED WHEAT, QUAKER | 54 | 2.2 | 24.11 | .0414 |
| .5 Pat | BUTTER REGULAR | 18 | 0.0 | 843.5 | .0011 |
| 1 Pkg | JELLY, ASSORTED | 39 | 0.0 | 2730 | .0003 |
| 1 Large | EGG WHOLE, HARD-COOKED | 79 | 6.1 | 13.01 | .0768 |
| 1 Cup | COFFEE, BREWED BEVERAGE | 7 | 0.4 | 18.75 | .0533 |
| 90 Gram | COFFEE, INSTANT BEVERAGE | 1 | Trace | ***** | 0 |
| 2 Medium | TOMATO RAW, SLICE/WEDGE | 9 | 0.5 | 20 | .05 |
| .5 Stalk | CELERY RAW | 3 | 0.2 | 18.89 | .0529 |
| 2 Slice | DILL PICKLE, SLICED | 1 | 0.1 | 15.71 | .0636 |
| 1 Medium | LETTUCE ICEBERG RAW, LEAF | 3 | 0.2 | 14.44 | .0692 |

| | Kcal | T-Pro Gm | Kcal T-Pro | T-Pro Kcal |
|---|---|---|---|---|
| Total | 1135 | 44.3 | 25.63 | .0390 |
| % RDA | 42 % | 79 % | | |
| % Cal | | 16 % | | |

ID: RBC 415 CC
Date: Fri, 6 Apr 1979
Name: REFERENCE MAN 23 Yr Male Ht: 175 cm Wt: 70. Kg

FIGURE 17

Janet Farrell, our Assistant Director of Patient Service, would like to see more work done in customizing instructional materials. As part of our investigation into potential educational printouts, the FAVORITE FOODS LIST (Figure 18) was designed. Our bachelor Jones eats at McDonald's and Arthur Treacher's often. His diet order is to limit Calories, fat and sodium. Since many commercial and restaurant foods are included in the HVH-CWRU Nutrient Data Base, it was easy to generate a favorite foods list just for our bachelor Jones. Hopefully, he will be better informed and able to make wise choices as a result of this individualized list. The same list can be produced with only one nutrient (to avoid confusing a patient) or up to eight

UNIVERSITY HOSPITALS OF CLEVELAND

NUTRIENTS IN FAVORITE FOODS
Name: BACHELOR JONES Date: Sun, 15 Apr 1979 ID: LKS 200 01
Diet: LIMIT CALORIES, FAT, SODIUM

| | | Kcal | T*Pro Gm | T*Fat Gm | Na mg |
|---|---|---|---|---|---|
| 1 Cup | CHEERIOS, GENERAL MILLS | 89 | 3.0 | 1.6 | 256 |
| 1 Cup | RICE KRISPIES, KELLOGG'S | 110 | 2.0 | 0.0 | 254 |
| 1 Number | FRIED CHICKEN "TV" BRAND DINNER, SWANSON | 602 | 37.4 | 29.2 | 1173 |
| 1 Pkg | SPINACH SOUFFLE, STOUFFER'S | 436 | 16.7 | 27.6 | 1670 |
| 1 Cup | CHICKEN NOODLE SOUP, CANNED DILUTED W/EQUAL VOLUME WATER | 65 | 3.6 | 1.9 | 984 |
| 2 Tbsp | GREEN GODDESS DRESSING, KRAFT | 169 | 0.2 | 18.4 | 312 |
| 1 Number | MCDONALD'S APPLE PIE | 265 | 2.0 | 15.4 | 395 |
| 1 Number | MCDONALD'S BIG MAC | 558 | 26.2 | 31.9 | 1064 |
| 1 Pkg | MCDONALD'S FRENCH FRIES | 215 | 3.0 | 10.4 | 117 |
| 1 Piece | ARTHUR TREACHER'S FISH | 171 | 9.5 | 10.4 | 312 |
| 1 Svg | ARTHUR TREACHER'S COLE SLAW | 121 | 1.1 | 8.0 | 120 |
| 2 Wt Oz | SWISS CHEESE | 214 | 16.1 | 15.6 | 148 |
| 1 Number | TRISCUIT WAFER, NABISCO | 19 | 0.4 | 0.7 | 27 |
| 10 Number | PEANUTS ROASTED IN SHELL (WITH SKINS) | 105 | 4.7 | 8.8 | 1 |
| 1 Medium | TOOTSIE ROLL | 30 | 0.2 | 0.6 | 15 |
| 12 Vol Oz | GINGER ALE, PALE DRY/GOLDEN | 113 | 0.0 | 0.0 | 24 |
| 1 Bt/Can | BEER, 4.5% ALCOHOL BY VOLUME | 151 | 1.1 | 0.0 | 25 |
| 1 Glass | WINE (TABLE), 12.2% ALCOHOL BY VOLUME | 89 | 0.1 | 0.0 | 13 |

NUTRIENTS IN FAVORITE FOODS

ID: LKS 200 01
Date: Sun, 15 Apr 1979
Name: BACHELOR JONES 35 yr male Ht: 175 cm Wt: 70. Kg
Diet: LIMIT CALORIES, FAT, SODIUM

FIGURE 18

nutrients for special needs.

These are just two of the many ideas that our development team would like to try. We have just scratched the surface and feel the potential is great. The options seem to be endless.

Finally, I would like to share one potentially great idea with you. A survey has been sent to all hospitals and nursing homes in the area by the GREATER CLEVELAND HOSPITAL ASSOCIATION to see if there is interest in forming a city-wide shared nutrient analysis program. The response was overwhelmingly positive and encouraging. At this point, the proposal is sketchy, but it would involve sharing research and development as well as data base management costs. A feasibility study will be conducted this summer to determine the best way to establish such a service. Essentially, a recipe, menu, or intake record could be mailed in or transmitted by terminal to the central computer for analysis. The nutrient data base would be maintained by the CWRU Nutrition and Biometry department. This project would be especially helpful; to small users that may only wish to analyze their menus every year or two. I am sure there will be more to tell you about this project at the next national meeting.

In closing, I would like to thank everyone involved in making this project a success story. First, thanks to Dr. Houser and his staff for being so cooperative in modifying and creating programs for hospital use. Also, the contributions of many people such as Mary Pinchak and Maggie Davis, who have kept the Nutrient Data Base intact over the years are acknowledged and appreciated. Last, and most important, is the financial and moral support of our Director of Dietetics, Miss Pauline Hart. She and her staff have persevered in debugging and implementing the system thus bringing the ideas to reality.

Questions and Answers:

Q: What is the cost per diet analysis?

A: I don't have the exact figures, but roughly speaking, computer terminal rental and actual computer time run about $100.00 per month plus two hours of clerical time every day. There is no increase in clinical dietitians' time.

Q: What terminal do you use?

A: It is a Texas Instrument Model 733 which has a basic typewriter keyboard with printer using thermal sensitive paper and a cassette magnetic tape recorder. The clerk initially records food intake data on magnetic tape without being connected to the computer. She is free to answer the phone or take a break between intakes without spending computer connect time. Then when all intakes are recorded on tape, she dials the computer center and transmits the recorded data via telephone hook-up to the computer. Within minutes, the nutrient analyses are being printed by her terminal printer. Since this printer is relatively slow, she has the option of printing the output on the high speed printer in the computer center. In addition to speed, high speed printer output is required for long range projects because print on thermal sensitive paper tends to disappear with time.

This terminal is compact; comparable to having a large electric typewriter in the office. The only unusual feature is the dual cassette tape recorder mounted on the top.

Q: Do you print menus using the computer?

A: We haven't gotten into menu printing by computer yet. Presently our menus are duplicated by conventional means in the hospital print shop.

Q: Do you receive patient information from the computer?

A: We receive pressure sensitive labels from the computer center to affix to our pre-printed menus. The admitting department supplies the data shown on the labels, specifically, the patient's name, age, sex, room and bed number.

Q: How do you handle write-ins?

A: In addition to the 21 lunches and dinners in the Master Menu Handbook, we have a special section listing acceptable write-ins with pre-determined quantities and codes. An aide on the floor can look at the write-in list and add the appropriate code and measure to the pre-printed food intake forms.

Q: Since you have so many bits of information being transmitted, do you have any data verification to find out whether all things are being typed properly?

A: Both computer and manual editing are done. All the food item and measure code numbers are automatically checked by computer to be sure that they correspond to existing codes on file. The terminal operator visually scans the printouts as they are generated to insure accuracy. It is easy to spot a large error, e.g. 100 punched instead of 1 or an extremely high RDA of 999%. As in all systems it is the minute errors that are difficult to detect, e.g. a minor decimal error of .01 instead of 0.1 or an omission like 2 instead of 2.25 slices of bread. The dietitians on the floors also review the printouts carefully and may request a re-run when needed.

Q: Does any of this happen before the input data are transferred from magnetic tape to the computer?

A: Computer verification ocurrs as soon as the input on magnetic tape is read into the computer. An error report is sent back to our terminal immediately indicating which food item and measure code numbers are invalid. Error messages also flag input lines that are too long, too short, alphabetic instead of numeric, and those that are out of sequence. The terminal operator then has time to edit the files she has just created. She returns to the original food intake sheets, locates the error, enters the correction directly into the computer file and asks for the computer to verify the file again. When all errors are corrected, she commands the computer to analyze and print the nutrient analysis reports.

Q: This question has to do with judgements made about missing data. When you are looking at things on your menu, for example, that we all know are lacking information, do you have a systematic way of deciding how many or which items constitute simply a lack of information as opposed to something that would cause you to worry? How do you systematize that observation?

A: That is exactly what we are asking ourselves at this time. We have a Nutrition Assessment Committee that is formulating standards for the hospital. We also have our experts, Grace Petot, R.D. and Janet Farrell, R.D., to advise our clinical dietitians in interpreting the computer reports. We systematically analyze for calories, protein, fat, carbohydrate, sodium and potassium on a daily basis and rarely find any problem with missing or incorrect absolute values. Other nutrient values are frequently requested, some of which do cause concern. Basically, we don't aim for 100% of all RDAs for all patients every day. That's unrealistic! We look for certain key nutrients depending on dietary restriction and need and then aim for an acceptable range over several days of monitoring.

Q: Pertinent to the same question, the question of using data when there are missing values has come up for many, many years. What value do you find, for instance, in seeing a menu with an asterisk indicating there are missing data? What do you say? Ingnore it? Do you go back and see which foods are missing nutrient data? What value is it to know that there's missing data?

A: First, I don't call it missing data anymore. I call it the minimum value. I know the minimum amount of a given nutrient contained in a recipe or menu and the asterisk indicates that there may be more of the specific nutrient. The asterisk never indicates that there may be less of a specific nutrient. The comparison to RDA may show that the minimum value meets 50%, 70% or more of the RDA. If most of the RDA is met, even with "missing data", there would be little concern or follow-up on a daily basis. On the other hand, if the RDA % is extremely low, if the analysis is being conducted for research purposes or if it is a critical nutrient in a critical product such as Vitamin D in milk, then an investigation is in order.

First, we locate the specific food(s) with missing values. Then we check handbooks and product information manually to see if the given nutrient data is available. If the state of the art is such that no nutrient values for that or similar products are published anywhere, then the case is closed. However, if similar products show values, we proceed to update the Nutrient Data Base by working with Grace Petot, R.D.. Sometimes a phone call to the manufacturer will yield an answer. Sometimes an experts' educated opinion will be entered and flagged as such. For example, it may be assumed that there is no cholesterol in fruit juice.

Even though it serves to emphasize our lack of knowledge, there is value in showing an asterisk.

Q: Have you ever evaluated any of these figures by actual analysis to substantiate and quantitiate your error in calculations?

A: We have a Research Unit in the hospital that actually analyzes some foods. However we rely heavily on Grace Petot at CWRU to handle that aspect of Nutrient Data Base Management.

Our task is to be meticulous about matching the specifications of items in the data base to those actually prepared in the hospital kitchen. In creating the Master Menu Handbook, many hours were spent in verifying recipes and purchasing specifications. For example, is the meat lean, marbled, choice or utility? Again, it isn't perfect, but it is much more accurate than estimating using the exchanges. Perhaps someday we'll be able to analyze each shipment of food delivered or each batch of food prepared in the kitchen, just as they do in a strict research unit. Presently, it is financially impossible.

Q: When you calculate the % RDA, do you take into account the quality of protein or do you use 65 grams or 45 grams?

A: Grace Petot is our expert in that area, so she may wish to answer your question. Grace: Yes, it is calculated according to the text of the 1974 RDA book.

# The System

Harold B. Houser, M.D.

In the March-April, 1979 Newsletter of the Conference Board of the Mathematical Sciences (1) appeared the following brief paragraph entitled "Concept of Computer Proof Disturbs Philosophers".

"The changed conception of proof involved in the 1977 Appel-Haken proof-by-computer of the four-color theorem is disturbing some members of the professional community in philosophy, according to a review in the 20 February 1979 Chronicle of Higher Education of a paper scheduled to appear in the February 1979 Journal of Philosophy. The paper, 'The Four-Color Problem and Its Philosophical Significance' by Professor Thomas Tymoczko of Smith College, contends that a computer proof which no one actually sees in detail amounts to an appeal to authority rather than a demonstration. Professor Haken is quoted as commenting, 'Anyone, anywhere along the line can fill in the details and check them. The fact that the computer can run through more routine details in a few hours than a human could ever hope to do in a lifetime does not change the basic concept of the mathematical proof. What has changed is not the theory but the practice of mathematics.'"

I will paraphrase the last line - what has changed (with the development of computerized nutrient data bases) is not the theory but the practice of translating food consumption into its nutrient content.

The dietitian, who practiced her lonely art with a printed table of nutrients to translate dietary intake or to plan dietary intake, is still the same person with the same responsibility. But suddenly, or so it may seem to some, she or he is no longer lonely. She or he is involved with information specialists, systems programmers, application programmers, statisticians, epidemiologists, and others who, to a greater or lesser extent, are helping her discharge her responsibility. In many instances, these persons put limits, related to their own areas, on her ability to do what needs to be done. The printed table of nutrients now resides in something called a computer which may or may not be in the same building or in the same city but is likely to be completely invisible, reached either by a typewriter-like machine connected to a telephone or by putting information into an envelope. Information comes back in an envelope or rapidly printed out on a piece of paper. Suddenly the users, the generators of information and the interpreters of information, find themselves not in control of the information system which presumably was created for them. The loss of control started when the user was not considered a primary contributor to the design of the system.

Of course, the foregoing is exaggerated and applies to none of the computerized data bank systems developed by persons in the audience here. It is only those others to which my description applies.

Note, I used the phrase computerized data bank systems - not computerized data bank. A computerized data bank, by itself, is no more than the printed table placed in a machine which by its nature can perform table lookups and calculations with extreme speed and accuracy.

The use of the word system relates to the concept that the nutrient data bank is part of an information system. Borrowing from information theory, the goal of the information system, of which the nutrient data bank is part, is to improve the accuracy of the messages coming from the system by reducing the probability of transmission failure, distortion and accidental additions.

This relatively lengthy introduction to my part of the State of the Art using the HVH-CWRU nutrient data base as the model is to clarify for you my meaning of the topic of my presentation - The System. The computerized file of nutrient data is just that - a file - and the thing of interest is the information which is used to give form or character to what our lonely dietitian wants to know. So now we come to the system which for our purposes we will choose to define as the state or condition of harmonious, orderly interaction.

This interaction is among the user of information, the supplier of information, the persons responsible for generating and storing the data file, and those processing the input and output information. While we usually manage to keep the interactions orderly, per the definition, we at times have difficulty in keeping them harmonious.

The most critical person or persons in the interaction is the user of information. The most elegant system will not be used if it does not meet the needs of the user. We have tried to listen to our users and be responsive to their needs. (I believe the previous presentation by Mrs. Uhrich illustrates this.) The technicians must not be in control of the system.

Of course, one cannot create a new system for every user nor, as Dr. Goffman will point out this evening, can a single system meet the needs of users who have quite different applications such as research, education, and practice. If, however, the potential uses are kept in mind, then a basic system can be developed with sufficient flexibility to be able to respond effectively to a variety of users. This we have attempted to do and we have been able to respond to a variety of users.

The parts of our system are the instruction and coding manual, the programming for editing, error checking, nutrient analysis, and output formatting, and the nutrient data file. While primary responsibility for each part rests with an individual, overall responsibility for planning lies with a team of users, coding and data entry clerks, dietitian, nutritionist, systems programmers, and biometricians. Absent from this list is the supplier of the basic data in many uses - that is the subject or patient. Such persons did have input early on and certainly should be considered in development of the system.

In conclusion, the computerized Nutrient Data Bank is a data file. It should never be an end in itself. To borrow from Bell Telephone - the system is the solution. Without a telephone directory there would be no need for a system - but without the system the directory would just take up space - or could be used as a door stop - a use also for a printout of a 2400 item nutrient data bank.

## Reference

1. Newsletter, Conference Board of the Mathematical Sciences Vol. 14, No.2, p.20, March-April, 1979, Washington, D.C.

## Reactor panel and discussion

### Introduction

Grace J. Petot

In this fifth part of our presentation, we have gathered together some users. I think that all of us today have emphasized the fact that it is primarily those people who are using the data bases who are going to determine what they are and what they mean; and who are also, of course, going to be interpreting and ultimately evaluating all of the information. We have some people here who are users in various environments and for various purposes. Each person has been asked to speak for about ten minutes to react to what he or she heard this morning and to also explain how he or she is using a nutrient data base.

## Education

Robin Willard

My intention is to share the applications of a nutrient data base system in the area of education as we have established such applications at the Ohio State University. Computer technology has made several contributions to education in previous years including computerized scheduling, computerized data collection and computerized management. Education has also been able to utilize the unique diagnostic capabilities of the computer for actual instruction. Computer assisted instruction, CAI, is a learner operated educational tool which offers educators an easily accessible individualized mode of study. The purpose of the CAI network is to provide readily available, easily revised education materials to health professionals.

One CAI course offered through Ohio State consists of a data bank of 14 nutrient values for each of approximately 1000 food items. Referred to as "FOODS", the CAI program was designed to assist clinical dietitians, nurses, medical students and dietetic students in evaluating diets, food intake records and menus for their nutritive content. It also aids administrative dietitians when analyzing recipes and patients when learning to evaluate their diets.

The goal of "FOODS" is to perform the calculations and to provide the required data in the least amount of time from the most current sources. Presently, the program consists of four main parts: the nutrient data base, the teaching section, a reference book, and a computer program to retrieve data and perform calculations. I'll highlight each of the components and then if you have any questions please feel free to address them.

Data was collected from the large nutrient data base in the dietary department at the Ohio State University Hospitals for entry into the "FOODS" program. As was stated previously, "FOODS" is composed of approximately 1000 food items in 100 gram portions with corresponding values for 14 nutrients. In contrast, the nutrient data base in the dietary department has up to 63 nutrient values for the approximately 6000 food items presently on file. The food items and nutrients in the "FOODS" file were selected by dietitians representing the group who were originally responsible for the CAI program. The data base contains a household conversion code which allows the user to enter the quantity of the food selected by either approximate measure or by gram weight.

The teaching section is divided into three parts and is built into the program to teach the new user how to use the "FOODS" program. The unique feature of the teaching program is that it allows the user to practice each command as it is taught and prevents progression to the next step of the teaching section without successfully completing the previous one.

The reference book contains some reminder notes from the teaching sections as well as an alphabetized listing of the food items in the nutrient data bank which are further categorized by food group.

The computer program is written to allow the user to retrieve the nutrient data, to plan menus and to analyze nutrient intakes based on stored levels of nutrients in the data base. The user simply types on the teletypewriter, which is connected to the memory bank of the computer, the four-digit food item code which represents the item that the record shows as being consumed. The quantity of intake is entered as well. When all the desired food items and associated quantities have been entered, then the user may request the total value for all of the 14 nutrients or simply a select few.

If the user wishes to monitor the total value of nutrients he is calculating for a modified diet, the "FOODS" program will maintain a running total for up to four nutrients. If and when the user exceeds the established limit, the computer will inform him that the limit has been exceeded and will print the current value of the limited nutrient. For example, if the user was attempting to calculate a 1000 calorie diet he could enter the limitation as 1000 calories and would receive a warning if that level is exceeded. The user may then delete or replace a food item or quantity from the menu and the computer simply subtracts the nutritive values of the changed food item and adds the new nutrient values if the replacement is entered. The nutrient data base can also be used as a reference source to retrieve nutrient data in 100 gram portions for any of the food items on file.

"FOODS" is a component of other computerized educational programs that are used in the CAI network. The medical dietetic students are required to complete four computerized case studies which simulate hospitalized patients on modified diets. The students communicate with the patients, requesting a 24-hour recall of their food intake at home. They have files for laboratory values, for general progress notes, etc. When all sections of the case studies are completed, the students are instructed to compose a menu for the patient which is appropriate for his dietary restrictions. They then turn to the "FOODS" program to satisfy this requirement.

There are terminals for the CAI network both in the hospital and in the medical library. For use of the dietary department's nutrient data base there are four terminals within the department which the students are permitted to use.

Hospitals

Janet Farrell

I'd like to get away from the system and talk about the clinical applications. We orginially began using the system as a means of enhancing our nutritional assessment program in the hospital.

We wanted to obtain more information about what patients were eating in the hospital. Intakes are only a small portion of nutritional assessment, but certainly a very important one. Prior to the use of the Nutrient Data Base, we were relying on average values to calculate intakes. We have seven units within our hospital and in each unit dietitians were using different bases of information including Bowes and Church, Handbook 8, Handbook 456, etc. So the system initially provided us with a standardized base of information for use in calculating intakes. That was probably the most important initial outcome that we achieved. The system also allows us to do a greater number of intakes that are more accurate and certainly more consistent within the hospital. After this initial achievement, the possibilities became endless and as was alluded to this morning, the more we work with the system in the hospital, the more uses we envision.

In addition to the daily monitoring of intakes, one of the primary uses at the current time is in the analysis of diets in our diet manual. We are in the process of revising our diet manual and with a little modification, the system allows us to evaluate the nutrient composition of diets in a greater number, detail and for a wider range of patients than was previously possible. It allows us to evaluate the diets that we currently recommend and make changes as necessary. The major problem that we encounter in this type of in-depth evaluation is lack of data. We continually receive printouts that show deficiencies of the lesser known vitamins and trace minerals. However, the system can actually help to solve these problems because after we receive the nutrient summaries and comparison to the RDA, we generally request nutrient detail on each food item for each nutrient which is grossly deficient. In almost all cases, deficiencies are due to lack of data and generalities can be made based on known knowledge of other food composition. These evaluations have been an eye opener for us, but the analysis of both the quantity and detail would be difficult at best without the use of the Nutrient Data Base.

Other uses alluded to this morning include the evaluation of cycle menus, recipes and for patient education. Patient education offers a wide range of applications for the Nutrient Data Base and we have only begun to recognize and develop some of these applications. This is the major direction that we would like to take at the present time. The printout itself can show patients what they have consumed in the hospital, if it is adequate or inadequate, and if it is something useful for planning meals at home. Many patients in the hospital want to take their menus home to help them plan their diets. Giving them their menu, printout, or both can be a very helpful educational tool. Using a slight modification of our present system, we can also produce individualized instructional materials to answer patients' own questions about their own diets and food habits. Some of these patient education ideas have been used on a limited basis at the present time but the usefulness of this type of material and the imagination and creativity that it allows makes this type of development very appealing.

The intake system is very sound right now and it is ripe for further development. I think that we were very shortsighted when we first evaluated the use of the Nutrient Data Base in the hospital and we felt that it had limited use in the hospital setting. What you actually can do with a good data base in a hospital is phenomenal.

Questions and Answers:

Q: You were talking about working with the menu cycle. Can you call up a menu cycle for a given menu type and meal and process both the recipes and the menu cycle to give you a nutrient content for that meal, assuming that the entire meal was consumed, in order to give you a profile?

A: One of the problems that we have is that our recipe file and menu file is on one computer and the nutrient data base system is on another. The two systems don't access each other, but our entire menu cycle and a portion of the recipe file are included in the nutrient data system. This allows us to look at an individual patient's intake of a given menu which will also include those recipes that were added.

Q: What I'm thinking is to obviate the necessity for pulling the menu information out and having to get into another computer for nutrient analysis, in essence, take a menu for a given meal and do a nutrient analysis and file that analysis back in the computer for that meal so that whenever you want to look at a pattern throughout the day for a given menu type and cycle it displays the information?

A: It is extremely difficult to work on assumptions about intakes of hospitalized patients and even more difficult when a selective menu is being used.

Q: I realize that you have to make certain assumptions but it does give you certain capabilities for looking at patterns and doing this interacting, then, would allow you to do your menu planning in such a way to at least give you patterns.

A: We have about seven menus which are all selective menus. What we have done to establish patterns, for instance in our diet manual evaluation, is to allow patients who have had instruction in a given diet to select menus, and then take these menu selections and analyze them. Because we function in a very narrow setting, we can establish some eating patterns, however this is only useful in our individual hospital.

Q: You haven't yet been able to achieve the union of the various data bases so that you've got an integrated system for the dietitian?

A: No, but we would certainly like to get all of our systems functioning simultaneously and accessing one another.

## Food Industry

Audrey Sevald

I'm going to start out by addressing three main points today, those being, first of all the current uses that we have for our computer system, secondly, a special project that we did last fall utilizing market research data, and last of all some possible uses we may have for data bases in the future and some ideas on expansion.

Back to my first point, on some of our current uses of data bases, probably our primary use of it right now is in support of our nutrition labeling function. Other uses include calculating the nutrient content of recipes and menus, as well as intake studies.

Being a food producer, we're most interested in what people eat, what their food habits are, and what the net effect is on the total nutrient intake of the diet. Last fall, in response to a request from our cereal division, the marketing research department along with the nutrition department undertook a study to determine the impact that ready-to-eat cereals have on the total nutrient intake of children. In order to conduct the study, we needed dietary intake data, which we acquired from the Market Research Corp. of America. We used the most recent menu census which was conducted in 1975. We also needed a new data base that would be more complete than what we had at the time, so after evaluating several different ones, we chose Case Western's as being the most comprehensive and perhaps the best one for our particular use. The data from Market Research was collected over a two week period from a nationally selected random sampling of some 2000 households. This included approximately 1200 children in the age group from 2 to 12. The data that comes from MRCA lists the foods consumed only, so we had to go about determing the nutrient contribution from that data. Food records covered both in-home and out-of-home eating and altogether some 3500 different food items were consumed by the population studied. Then we had the task of coding the data which took about three weeks. Since there were not 3500 items in the data base, we were faced with the situation where there was not an appropriate code or a code that exactly matched what we wanted. So in those cases we would use a number of codes from the data base that were representative or would be the characterizing ingredients and components on a pe centage basis. Appropriate portion sizes were then assigned for each food item consumed in terms of either base dish or additive use; and base dish meaning they consumed it as a main dish and additive use whenever that food item was added to another. We tested out the system and when that checked out we ran the entire study. The two things that we were most interested in were, first, the daily nutrient intake of children ages 2 to 12 versus teenagers and adults and secondly, to see how the daily nutrient intake of children who consumed ready-to-eat cereal compared with those who did not. The results of the study proved interesting and useful to us. I won't go into detail on results, other than from what we can tell, the children among us seem to be eating better than the adults. It's probably because the adults channel all their well intentioned requests on the children who probably don't end up having alot of choice. And those of us who do have a choice, tend not to always exercise the best judgement, perhaps.

Although we did not really concentrate on the demographics of the group that we studied, I see a great potential for learning many different kinds of things by combining these types of data. For instance, in the future, we may be able to learn something about the nutrition knowledge of the American people by seeing the types of food choices they are making in light of increasing inflation and tightening economic conditions.

In terms of future uses for nutrient data bases, one direction we may be able to expand in is the area of nutrition labeling. Throughout the nutrition labeling hearings, several persons from industry have brought up the thought that perhaps Handbook data could be used in some cases for nutrition labeling. The most applicable area to that may be in the area of produce type items. This would be a great benefit, perhaps to many people, in that it would be an inexpensive way of expanding nutrition information, both from the standpoint of the consumer and the producer. I've heard it mentioned many times today that it would be desirable if we could increase the information available on a number of nutrients. I have one suggestion in that regard. If we can concentrate our effort on generic types of foods, we'll probably accomplish more. I think relative to the types of products put out by the food industry, they are very susceptible to change. Just about the time you think you have a handle on what's in a particular food it changes and I'm sure that's frustrating to you and it also makes it difficult for us in providing that information to you. We don't like giving out antiquated information either.

# Research

Arlene Redmond

I am very new to thinking about sorts of problems that we have been discussing this morning, and very new to the fields of nutrition and research. I have been working in my current position since December, and have been using the nutrient data base here at Case Western since January. I would like to tell you about the research we are doing at the Weight Control Unit, our Nutrient Data Base, and some of my reactions to the conference this morning.

The Weight Control Unit is the clinical arm of the Obesity Research Center at St. Luke's Hospital. Our orientation is to look at what our patients are eating, and at what they have been eating, and to assess how diet affects their health, ability to lose weight, weight history, body composition, blood chemistry, and cell morphology. We have been analyzing three day food records kept during their first week at the WCU. We request that patients maintain their usual eating habits for this week. Later, we analyze three day food records at 8 months in treatment, 16 months, and 24 months. We also test body composition, blood chemistry and several of the studies that we did originally. We are looking for correlations among biochemical, physiological, and behavior measures, and also, correlations between these measures and food intake. For example, there may be an association of caloric level with liver enzymes or thyroid hormones, or fat intake and blood lipids.

One specific protocol that we are doing is a fiber study. Patients are put on 10 weeks of a high fiber diet, followed by 10 weeks of an isocaloric diet. We are using the nutrient data bank to ascertain base-line fiber intakes, and fiber intake at the different levels of fiber specified by the protocol. A more complete fiber breakdown in the nutrient data bank would be a useful improvement.

The views that were discussed this morning about the accuracy and reliability of data bases are very much of concern to us. Making bio-chemical conclusions about how various intakes affect liver enzymes, for instance, is a difficult thing to do in view of all the uncertainties that were noted this morning. The best we can do is to look for general correlations first, and then later to do a more controlled study to assess trends which we preliminarily find. The addit onal errors which we face are those of patient recording. It has been noted for years that obese patients are not always 100% accurate with their food records. We do encourage our patients to be as accurate as possible. It is also very much of concern to us to know where the data base is complete and where it is incomplete. Even if a ball park estimate could be made for the percentage of missing data for a particular nutrient, we would know how good the data was upon which we based our conclusions.

One special area we are interested in looking at is meal patterning, the time of eating, place of eating, physical position while eating , mood while eating, degree of hunger, and possibly one or two other things. Accordingly, we would like to see this type of information programmed into a data base. Another problem is speed in receiving analyzed records. The process may be speeded up by a telephone hook-up or by a purchase of tapes from Case Western or some place else. As Ms. Uhrich said this morning, however, it's probably easier to leave the computer program in someone else's hands.

Another concern that we had was discussed this morning; that was the quality of information from food companies. If package size information is not complete, then we will be unable to accurately interpret what the patients have recorded for us. Finally, several uses of a nutrient data base which were mentioned this morning are very exciting possibilities. Nutrient density, and specifically calorie density would be useful for us to use in both research and patient education. Analysis of favorite foods for cholesterol, calorie density, saturated fat, sugars, and other nutrients would be particularly helpful in patient education.

# Nutrient Analysis Services

Ruth Carol

Dr. Houser mentioned this morning that there were two major areas that had to work together in order for computer analysis of dietary intake to work. One is the computer system and the other is the data bank. Our company has a very flexible computer system, therefore I'm not going to talk to that area because we can customize our service to suit almost anybody. So I am focusing, today on the nutrition data bank.

The first point I would like to speak to is the question of missing data. Many years ago when I had to do my first compilation of computerized food composition table, the first obstacle I encountered, which everyone had mentioned over and over today, is what does one do for missing data. And I had to make a decision. At that time there were some other organizations that were dealing with this problem, as is being done here at Case Western Reserve. They just said "Well, we acknowledge we have missing data and we in some way flag it and let you know, but otherwise we just go on and give you the results", and then of course you have to evaluate these results. I took another path, recognizing that it is very difficult to evaluate results with missing data. But today when I raised the question from the floor, the speaker said that in terms of their particular needs, it didn't seem to matter. What they were concerned with was that dietary intakes meet the RDA. As long as the RDAs were achieved, even with some missing data, they've met their objective. However, I think we've got to go beyond that.

If we're going to do some real research in terms of the relationship of nutrition and disease, we have to have nutritional data for the foods that we're considering. I'm not saying that we're going to do this overnight; we all know the pressures of money and so forth and so on. But what I am saying is that when we take a food composition table and decide on a certain number of nutrients, we should in some way fill up those holes. And this is what I've always done. For instance, we know there is not going to be any sucrose in meat; don't put down unknown, put down a zero. There are going to be errors. But I think a collective educated guess, and not just an educated guess on my part, or with each colleague doing it individually, is necessary. I am suggesting that this be one of the functions of our organization in the future. We should have a committee to make these educated guesses. Thus we would have the best minds in the country tackling the problem - people who have good experience in developing a standardized food composition table with no holes, hoping that we can fill them in with accurate data as quickly as possible. But until such time let's use these educated guesses. I think they are far superior to trying to figure out, well, just what does this mean. It has a asterisk, there are holes in it. Where are we going? I think that is where the thing would be very useful. That was the first point I wanted to speak to today.

The next thing I would like to do is sort of dream. We are all unsatisfied with the state we are in and I think that's why this organization was formed. To accomplish our purposes, we must move ahead. This doesn't mean it is going to happen tomorrow. But the way I like to work is to dream ahead so that we have some real ideal objective, but then take it step by step. So that by next year we'll have done this much toward that objective and the next year that much more toward our goals. The first part of my dream is that with the cooperation of members of this group we can have some kind of standardized computerized nutrient data bank that we all will be using. We already have a marvelous start with the nutrient data bank developed by the USDA and everyone uses that initially. But then instead of each of us going off in different directions for our own purposes, let's all pull together so we are using more of a standardized food composition table system. I haven't thought this through to the nth degree, but I'm just going to throw out some of the ideas that I have that we might work towards. I'm sure in the course of time it will be thought through, refined and may not even resemble what I'm thinking about. But perhaps we can aim towards it.

We have a nutrient data bank in the USDA. And today everyone takes that, and I think from what Dr. Rizek said this morning, he's responded very well to our initial request four years ago to fill in the holes. For instance, he mentioned that there was one table that he is not giving out yet because there are still holes. That was our first complaint - fill in the holes. So we know we are getting to that point. However, every time dietary data is coded, there are new food items to be added to an existing table and always some questions about foods that you don't know quite how to handle. Instead of each one of us using personal judgment, there should be a centralized source to make these decisions. Dietitians have fun doing this. I've heard dietitians say "Oh, its great fun deciding how to code a food item" and that sort of thing, which is really nice for the staff. But its not giving us the kind of data we want to use for research, educational and health purposes.

My proposal pertains to food items that are not in the USDA data bank. I am not talking about individual nutrients because that would have to be a laboratory analysis and we know this is coming as fast as everybody can give it. But I'm talking about recipes, versions of recipes, exotic foods. For example, one of you who is sitting here today sent me a letter about two weeks ago and said that someone authorized her to have my company calculate the items on their menu which was just out of this world with many exotic foods. I said "You know we must really set a price for this". They said just go do it. I could have done it and sent them the bill, but I don't think that's the way to approach this sort of thing. Instead, I went back and said we have a minimum cost because I could see that for me to simply get these foods onto our table would be a tremendous effort in terms of money. I could have done it easily but I don't think they understood that the computer is not a magic button you press, but you must have these foods in the food composition table. The point of this illustration is not only that each of us is individually duplicating efforts unnecessarily, this wasting time, energy and money, but that each one would do it in a way sufficiently different to end up with a wide range of nutrient values for these same menus even though each were to use the USDA nutrient data bank as the original reference source.

We certainly have the technology today to quickly give people the nutrient values for recipes and foods not currently in the USDA data bank. But our group should set up a procedure for systematically incorporating new foods into one standardized food composition table for the United States. New users could select portions of the table for their purposes and each user would request the addition of new items to be incorporated as needed. I am proposing that this be one of the achievements of this group, perhaps to be finally achieved ten years from now, but a standardized food composition table should be one of our main objectives.

## Computer Systems

Oguz Caglarcan

I'd like to say that I'm also new in the area of interest that we're addressing here today. My professional involvement basically centers on defining aspects of design and development of large computer systems. This work involves looking at user needs and user requirements in the early phases of system development in order to define system implications and evaluate different concepts.

Before I give my reaction to a couple of interesting points made this morning, I would like to say that I very much enjoyed the presentation that was given on the hospital information system that has been developed here at Case Western. I found the presentation extremely informative and very much down to earth, with strong emphasis on the basic issues of the system's objectives rather than the mechanics and the technical aspects of computer systems, per se.

Of the key points that were made this morning I would like to further emphasize the necessity to make sure that the user needs are well defined and that they drive the solutions - not the other way around. To put it another way, many times it is easy to describe needs in terms of specific system solutions that we already have in mind - specific hardware, software, what have you. I believe the key here is to describe and define the needs to the greatest possible extent. Thus, a user's particular needs can be translated into a complete set of user requirements, independent of any predefined system solutions.

Further, even after the user requirements have been defined, they should be reevaluated throughout all phases of systems development. Therefore, evaluation and reevaluation of the requirements is an integral part of the systems development process. The importance of this point is further emphasized by the fact that today's computer technology is so advanced in terms of what's available out there - in terms of hardware, in terms of software, in terms of data bases management languages of all different types. There's just an abundance of solutions in terms of combinations of different elements of systems that we can put together to respond to a set of needs.

The tendency to do this is one that we've somehow got to stay away from. Again, we must describe and define user needs independent of solutions, techniques and methods that we have in mind, and perform as much analysis as possible in the early phases of requirements definition. In addition, in the early phases, we must look at as many different system concepts as possible, and not just one preconceived solution. This ties in with another issue that I want to raise - the question of different solution methods, different concepts. How do they compare? I'm talking about cost-benefit analysis or effectiveness analysis or whatever you want to call it. To me, the biggest difference among systems lies in the extent that the solutions they provide are responsive to the user's requirements. Obviously, someone could ask, to what extent can we completely define requirements, needs? Or, simply, can we define them? Well, we can't.

And that is where the question of flexibility comes in. Everybody says we've got to develop a very flexible system. Well, how do we define flexibility? There are those who can carry this idea of wanting to develop a flexible system to its ridiculous extreme. They would like to design the most flexible system, whatever that means. In this extreme, the search for flexibility becomes a theoretical exercise, and the service objective is almost lost.

I believe we need a definition of, or some attempt to define and measure, degrees of flexibility. And again, I would like to tie this concept directly to requirements. If we were able to define what we need with 100 percent certainty, the question of flexibility would go away. There's only one solution to it; one system will do the job. Obviously, however, we can't do that. There is uncertainty about the requirements, the needs - even as we know them today. And this uncertainty is compounded by the fact that we're trying to anticipate the future needs. So the question of flexibility, the degree of flexibility to be incorporated into a system, must be answered by carefully assessing the uncertainty about the current requirements as well as by assessing the uncertainty of future requirements.

Another comment that I want to make, again, stems from the points that were made earlier today. One of those points was that the concept of the computer system is not limited to a data base per se. It's a total system, or a capability in terms of a number of system elements, to operate on data to generate information. I'd like to emphasize a distinction between these two terms: data versus information. What makes a difference in terms of the unique needs of different users is the manner in which we operate on data to generate different types of information.

A final comment that I want to make concerns Tony Fisher's discussion on the survey of the producers of products, packages, data bases and what have you in this field. I think conducting such a survey is valuable effort, and I think it's definitely one that all of us here would benefit from. However, as I listened to him, I started thinking, what about the user community? The data users, the product users, if you will. What about a parallel effort of some sort, where we try to come up with a set of generic requirements among different users?

We need some sort of a systematic way - not necessarily in a survey format, but in some structured format - to make a serious attempt to come up with articulations on the part of each user group to describe their areas of needs. In this manner, these needs can be looked at collectively with the idea of identifying common areas. I think today's afternoon task force sessions, for example, will be helpful for communicating and trying to come up with a baseline from which we can address this concern. And I strongly suggest that there be a written form of some sort through which different user groups can describe their areas of concern and interest.

## Panel Discussion

R. Carol: I was interested in our discussion of flexibility. You could develop one system but I think right now that flexibility is something we really have to talk about in terms of a system. I say this because I think as a person has to service all different kinds of projects with all different kinds of people that the key points of the system are developed. Let me give you an example. Mention was made today about food groups and I think someone said that one of the problems with the food groups was that it was difficult to decide into which group you would put a particular food, i.e. recipes. This could be a problem. For instance, if you decide you want to have a MILK group, where do you put pudding? We could also put it into a SWEET FOOD group because pudding has sugar in it. Flexibility is here in the sense that you can set up any food groups you want. So by definition you will decide what you need. For dentists it is very important to know which foods have sugar so that if that is your primary aim you would set up the food groups in these terms. So I think that the name of the game right now is flexibility.

Comment from audience: I would like to suggest that the Universal Product Code which is being used by the retail food industry be used a a basis for classification.

Comment from audience: I really wonder whether we should have educated or first class guesses fill gaps. Is it the solution? I would much rather leave gaps and try to fill them with gradually increasing knowledge. Guesses cannot be pulled together at the same time and place and be acceptable. I am an outsider to nutrition but am developing a medical data base. There is already an amino acid in seafood data base and other very specialized numerical data bases which are much more limited than what you are trying to develop. You are going to have less confidence in these limited data bases than in those developed which include biological and medical data. What is the point of having all these independent data bases? Why cannot one try to unify them as some people seem to desire? For instance, for all applications in hospital nutrition services, a local data base may be useful. Why cannot one have a joint data base developed, not necessarily in any one place, which includes every data base in existence for any one specific aspect. Then everybody will be able to understand what each is saying. But I find it rather disturbing that everybody has probably very similar ideas but that we have to bridge these slight differences.

R. Carol: In reaction to your first comment, let me give you an example why I stated that we shouldn't have any holes. For instance someone who is interested in the cholesterol content of foods has eaten turtle eggs. For a cholesterol value you have a blank because you don't have a value for turtle eggs. You then give someone this analysis. You say it is not complete; we've included every single food except turtle eggs. It turns out that turtle eggs are very, very high in cholesterol and this is the one item the person ate a great deal of. You are giving the person completely wrong information. But if you had a panel ahead of time which agreed if other eggs are rich in cholesterol with a consensus opinion, we should put some kind of value in for those turtle eggs. You probably would have given that person a better final answer than had you left it blank.

Comment from audience: I see the point you are making, but I would much rather not do it in a data base frame but as personal advice: "I think that this is so". The moment you put a guess into copied data, you are discrediting the copied data.

Comment from audience: In line with what you were saying earlier today, once you've got something hard-printed by computer, people take it as gospel. If you put it in as a guess, people are going to forget that it is a guess later on. But if it is an asterisk, or other symbol, you're going to always indicate "We think its this".

Comment from audience: One of the points that has come up in past conferences has been about a way of expressing the uncertainty of these kinds of values. I think an answer or guess is to try to develop an appropriate index to provide some guess, as Ruth Carol has suggested and, yet, to reflect the uncertainty and to allow you to extract the certainty part, if you so desire, as long as you have an idea of what the magnitude of the uncertainty is. The computer will allow you to do it several different ways. The technology is certainly there. Again it gets back to what was said about defining requirements and looking at flexibility. For a clinical system for estimation or an index it may not be worth the extra investment to provide sophisticated capabilities for correcting all uncertainties. On the other hand, in a university setting that may be perfectly improper.

Comment from audience: I tend to agree with Ruth Carol. It is quite easy, when you get the information to identify it, whether it is "guessed" information or whether it is a matter of converting information by regression equation which can be done. Then when you process the information, you put a * by it to indicate that it is substitute information. If some information comes in later that can take the place of that, you can replace it with hard data. It is very simple to identify this. I think it is productive to process as much information as you can. You can always identify it, pull it out, or handle it any way you like.

G. Petot: I'd like to close with something that I recall, and it's particularly apropos as to what Ruth had to say about data and information. Reading in Science magazine last Fall sometime, Loius Branscombe, who is Vice President and Chief Scientist at IBM Corporation, made the statement that "data and information and wisdom and knowledge are as different as they can be. But they are interwoven as the molecules of starch, and the bread, and the flour and the asthetic aroma of the croissant that is produced". There you are!

# Information Systems for Research, Practice and Education

William Goffman, Professor

The recent nuclear accident at Three Mile Island and the subsequent reaction concerning the efficacy of peaceful uses of nuclear power suggested to me an interesting parallel between the use of the atom for peaceful purposes and the use of computing machines for automated information storage and retrieval. Although this analogy on the surface would seem to be far-fetched, there are several intriguing similarities. For example, we all know that power is the basis of our modern industrial society, yet it has been said, and with some justification, that the greatest power source of all is information. In fact, the age in which we live has been characterized at various times as both the nuclear age and the information age. Both nuclear power and mechanized information systems came into being at about the same time as byproducts of World War II. In the former case, it was, of course, the atomic bomb which paved the way for the program of peaceful uses of atomic energy whereas in the latter case, it was the critical importance of military intelligence in the conduct of the war. Interestingly, Dr. Vannever Bush was associated with each activity as a member of the Manhattan project team and as author of the now famous article in the Atlantic Monthly in 1945 in which he warned of a coming crisis in scientific communication. Finally, both movements were thought to hold enormous promise for the future, it being predicted that the atom would in the next twenty-five years be the source of most of our peacetime energy needs and that mechanized information systems would not only serve the traditional mundane informational needs of society but would contribute to the creation of new knowledge in its own right by identifying and aiding in the solution of scientific problems.

Some 30 years later, however, we see that in both cases this promise has not been realized. Granted, there has been progress. We do have nuclear power plants and we do have large mechanized retrieval systems. However, nuclear energy provides only a very small percentage of our needs and in the wake of the Three Mile Island accident, has an unknown but precarious future. On the other hand some of the mundane informational needs of society such as airline ticketing, personnel filing and inventory seem to be well served by mechanized systems. Yet, the predicted nuclear and information revolutions have not come to pass. Before we condemn the atom and the computing machine and cast them aside, let us remember that both are still by far the most effective mechanisms for producing those products for which they were originally developed, namely bombs and computations. The peaceful use of atomic energy and large scale mechanized information systems, we must also remember, are secondary applications, and these have not been too successful. Why is this so? The obvious answer is that we do not yet know enough about the problems involved. In the case of nuclear energy this seems to be the effect of radiation. In the case of information systems, the reasons are a little more complex, and to address this issue, I believe it would be useful to take a brief retrospective look at the history of this movement.

As I previously mentioned, the origins of large scale mechanized information processing goes back to the war during which the efficient and knowledgeable handling of masses of information was so vital. Because these tasks were generally carried out by undermanned staffs of human beings, it was natural to believe that the solution to problems relating to information processing lay in the supply of necessary man power to carry ou a sequence of clerical tasks.

With the immediate post war proliferation of scientific publications which to no small degree resulted from the demonstration of the value of science in the war, it was no wonder that some scientists began to feel that an information explosion was taking place and that critical communication problems were arising in the scientific community as a result. Thus, the Bush article and the ensuing program.

Simultaneous with the attitude was the fact that digital computing machines were becoming accessible to the scientific community. Consequently, based on war time experiences, it was believed that solutions to problems created by the information explosion were obtainable by replacing large staffs of human processors by computing machines which could carry out the required clerical tasks more accurately and more efficiently. It was also natural that the major effort was directed at the scientific literature, a situation which has not substantially changed in the past thirty years. This is, of course, not inappropriate if we accept the notion expressed by Prof. J. Ziman, the eminent British Physicist, that results of research become completely scientific only when they are published, hence the only legitimate base of scientific information is the primary scientific literature. Discontent with the scientific literature by members of the scientific community is not a recent phenomenon and has been voiced by every generation. What is a modern phenomenon is the introduction of mechanization in achieving a systematic approach to the problem. The roots for such an approach precedes the war itself and was best expressed by the British Crystallographer J.D. Bernal in the thirties. "It is clearly no longer sufficient to see that every new observation and discovery is published. The problem has to be looked at from the other end; we need to be sure that every scientific worker receives just that information that can be of the greatest use to him in his work and no more". Bernal went on to say that "The problem is essentially a technical one of selecting units and arranging for their proper distribution and storage, a problem which is every day solved in large business houses and mail order stores. The kind of organization we wish to aim at is one in which all relevant information should be available to each research worker and in amplitude proportional to its degree of relevance". So based on Bernal's hypotheses and spawned by Bush's warning, a major effort was launched. For over a quarter of a century there has been a great deal of activity, supported mainly by the National Science Foundation, National Institutes of Health and the Department of Defense aimed at producing large scale, mechanized information systems, which it was believed would solve the problems in scientific communication posed by the vast amount of scientific literature.

This effort has produced many remarkable computerized data bases, most notably the MEDLINE system of the National Library of Medicine. Thus, modern technology has been applied successfully to gathering vast amounts of bibliographic material into sophisticated computerized data bases. However, the question is: Has this effort been effective? Although such data are very difficult to accumulate and assess, a recent report by Donald King entitled Statistical Indicators of Scientific and Technical Communication prepared for the National Science Foundation, indicates that only 0.9 percent of useful information retrieved by scientists was obtained via computerized systems. These data were based on a survey in which authors identified those channels they actually employed in obtaining articles which they cited and the frequency with which those channels were used. Furthermore, a National Library of Medicine study of its MEDLINE system showed that the percentage of physician and student use among all of its users declined from 1973 to 1975.

What are the reasons for the apparent lack of success of large scale computerized information systems? It certainly isn't due to lack of effort or lack of financial support. In my opinion, it is due to four basic flaws in the underlying assumptions upon which these systems are based.

The first flaw is the assumption that the problem is merely a technical one. This is clearly not the case, otherwise our superb modern technology would already have come to grips with the problem. The fact is it is an intellectual problem, and not a trivial one. That is, "to be sure that every scientific worker receives just that information which is of greatest use to him in his work and no more" cannot be accomplished by technical means alone. In no way can selecting and distributing relevant information among scientists, and selecting and distributing inventories of business houses be considered comparable, as Bernal suggests. In the former case, what constitutes relevance is a complex determination; in the latter, it is relatively simple. Clearly, those large scale mechanized information systems which are successful, e.g. airline ticketing, etc., are those for which the relevance problem is trivially solved, and can be handled by technical means alone. To program a computer in such a way that it can separate from the vast and continuously expanding universe of scientific information, the important and valuable contributions and match them to the interests of the individual scientific worker requires a much deeper understanding of the process of how information is stored and processed in the brain than we now have. Only with such knowledge can we reduce the process to a series of simple clerical tasks which a computer is capable of carrying out.

The second flaw relates to the fact that, as far as I know, all large scale mechanized information systems are quantity rather than quality based. That is, they do not have the capability of filtering out from among the vast quantity of information that which is of high quality. It has been estimated, for example, that any where from fifty to seventy-five percent of the scientific literature is of questionable value. The philosopher W.V. Quine has recently characterized this situation in a brief article aptly entitled "The Paradox of Plenty" which appeared in the journal Daedelus as follows: "The mass of professional journals is so indigestible and so little worth digesting that the good papers, though more numerous than ever, are increasingly in danger of being overlooked".

The physical problems are so vast that attention has been focused on the quantitative aspects of information to the detriment of an understanding of its qualitative aspects. So, although the present systems seem to have been reasonably successful in coping with the mass of bibliographic material, they have not been able - nor have they attempted - to cope with the qualitative aspects. But if establishing relevance is a difficult problem, filtering the relevant material for quality would seem to be even more elusive. For a quality based information system is one that will deliver the information needed, when it is needed, in only the quantity required, so that some judgement relative to reliability, accuracy, and so forth can be made. Is it possible that such a task can be delegated to a mechanical information system? If a system is expected to fulfill this function, and I feel that it should, then that system must encompass more than the technology. It must include the prime resource - the people who work with that technology, namely the users of the system. A purely quantity based mechanized information system will probably deliver more product to the user, but that product will usually contain much non-relevant material of low quality. Consequently, much of the user's time will be spent on unproductive activity.

The third flaw relates to the use of the literature as the primary input and output resource. Although there can be little argument that the literature is the most reliable information source despite its qualitative inconsistency, it is questionable whether the user of an information system is best served if the output of such systems is in the form of documents or, as is generally the case, only titles to documents. Even though these documents might contain the needed information, the user is required to first obtain them, then read them and assimilate the information which they contain. When we add to this the fact that most of the retrieved output will consist of documents of questionable relevance and quality, the figure of 0.9% usage of computerized information systems in the King report is not surprising.

The notion of document outputs, of course, reflects the orientation of such systems towards the researcher who in the natural course of his activity is involved with documents both as producer and consumer. It also reflects the fact that these types of outputs are relatively easy to generate. This leads us directly to the fourth flaw.

The community of users of scientific information can be roughly divided into three groups, namely researchers, practitioners, and students. Heretofore, mechanized information systems have almost exclusively been directed towards the researcher. Yet one may argue that of the three groups, the researcher is the least likely to have an information problem requiring the aid of a large scale computerized system. This would seem to follow from the fact that researchers are involved in the creation of new knowledge whereas the practitioner and the student are involved in the use of known knowledge. Thus, in most cases the researcher whose interests are narrow would have no need to consult a formal information system since in general he could only hope to learn what he already knows. This in general would not be the case for the practitioner or the student. Thus, it would seem to be those two segments of the user population that would derive the greatest benefit from formal information systems, yet very few have been designed with them in mind. Furthermore a document retrieval system would seem to be of secondary importance to practitioners and students although clearly of greater value to students. What these users need, in particular the practitioner, are fact retrieval systems with capabilities of providing intelligence as well as the raw facts. There is an amusing TV commercial for ITT showing a French physician examining a patient, looking puzzled, punching some buttons on a keyboard which we are told will put the physician in direct contact with the NLM which we are shown, from which the physician immediately receives the information needed to treat the patient, all thanks to ITT. We are not told, of course, that the only information the physician can receive is a list of bibliographic citations which under the circumstances would not have been immediately helpful.

Of course, the information fed into any fact retrieval system must be derived from the literature, but the documents themselves besides providing the raw data would only provide supplementary reading material which the user can avail himself of at leisure. Moreover, the relevance and quality problems would be much less severe for systems of this type since the system would not have to anticipate key work as would be the case for a researcher oriented system but need only assess that knowledge which has met the test of time; such as assessments being carried out by subject experts and university faculties.

In the past few years, I believe, there has been a slow but steady change in attitude. For example, there are more and more fact retrieval systems emerging of which the nutrient data base is one of the best examples. The NLM is experimenting with a prototype on-line system for hepatitis which is filtered for quality with capabilities of producing facts, data, and other sorts of intelligence which would seem to be useful to all three segments of user populations. Moreover, this system utilizes a panel of representative user experts whose responsibility it is to carry out the overall assessment of the information before it enters the system. At present, this prototype is expensive and cumbersome but shows that the NLM is beginning to move in the right direction.

The Rockefeller Foundation is greatly interested in promoting research activity relating to the quality issue and has already sponsored one conference and will hold two others later this year to focus on this issue. The WHO is also very interested in these issues particularly as they relate to Less Developed Countries.

Hence, there seems to be cause for cautious optimism and perhaps much of the unfulfilled promise for mechanized information systems will yet come to pass. As for the peaceful use of nuclear energy, who knows?

Report of Task Force 4
Uses and Application of Nutrient Data Bases

Alfred Meyer

The topic of Task Force 4 was the uses and applications of nutrient data bases. The areas of discussion were:

1) Nutrient Data Bases,
2) Data Input
3) The RDAs as a standard,
4) Data Output, and
5) The role of the USDA.

I can summarize much of our discussion with the statement that the uses and applications of nutrient data bases must be defined by the specific situations in which one wishes to use them. Accordingly, one must select an appropriate method for each specific use, then be careful to use the results in that same context.

Regarding Nutrient Data Bases, discussion touched upon the real-life variability of food nutrient composition, the "stength or firmness" of the nutrient values which are used for calculations, consideration of nutrient losses from factors such as cooking and storage, and what to do about unknown nutrient values for foods. When using a computerized diet analysis system, one typically assumes that there is one set of values for one particular food, when in fact, we know that there is variation in say, carrots, or other foods. One approach to the hardness of the data is to establish a nutrient reliability code such as the Army has done. This essentially is a way of judging, on a relative scale, how accurate or how firm you consider the information to be. The question of nutrient losses during processing, cooking and holding of foods was brought up. If both the input data and the nutrient composition data permit, these factors can be incorporated into the calculations. Nonetheless, by the very nature of the method, one has an estimate at best. Another problem encountered is what to do with a food item when its nutrient composition is not known. Various options are to estimate its composition based on judgement of its similarity to another food item of known composition, to omit the food item from the calculations, and to indicate in the output which of the above procedures was followed.

We then turned to the question of the nutrient data base size. Here again, it's going to be determined by your specific situation. There are many kinds of applications, such as surveys, screening of populations, nutrition counselling, calculation of menu cycles and individual therapeutic diets and research to establish correlations between diet and health. One's particular applications, then, will be a factor in determining what kind of nutrient data base should be used. We discussed the advantages of mini-bases, namely, the ease of coding, the lesser amount of data storage required and the fact that only clerical help need be used to implement these programs. These factors combine to help keep the costs low. However, there is a greater amount of error inherent in these simplified procedures.

Data input format will be defined in large part by the capabilities of one's system and the purposes for which it is being used. The accuracy of the input data will be influenced by the paricular format of collection, as well as by the respondent's abilities and use of them to provide a complete and accurate accounting of the diets involved. Exactness of amounts and clarity of description are the major variables.

We then talked about the RDA and how it is used in the context of these efforts. The question was brought up whether or not this is in fact a proper use of the RDAs. This point is addressed in the RDA report itself, where we are warned not to use the RDAs for purposes beyond the scope of their validity. There are a number of problems which one must consider in using them. It was pointed out that the RDAs are established for normal healthy individuals. How are we to deal with different situations, such as the hospital setting, where people are very likely not healthy? The longitudinal nature of studies raises the question of truncating excess nutrient values. Should a high intake of a nutrient be ignored or in some way carried over to the next day? And what about the time of ingestion, and also food combinations? How might these influence the validity of our results? Another point brought up is that the RDAs change over time.

It was suggested that when studies based on these methods are reported, the reports should include actual nutrient amounts as well as the percent of RDA. This will serve to facilitate comparison with other studies done using different RDA values. Nonetheless, we do feel that this is the most useable standard we have.

Data Output was our next topic of discussion. Output formats will be determined by the particular application. We did feel, though, that efforts should be made to keep the output readily understandable; that is, we don't want to create our own language just to foster ourselves as specialists. Secondly, it was noted that output should always be used along with the diet history input; we should not take the output and abstract it from the acutal foods ingested. Thirdly, it was suggested that perhaps a group such as the one gathered here today could establish a library of teaching output formats. There is a great deal of interest in using this kind of output for patients and individual instruction. A group such as this might serve as a focal point for collection and exchange of experiences and materials.

The USDA is clearly a focal point of data base formulation and maintenance. We would like to see more work done along the lines of accounting for nutrient losses such as those previously mentioned. Another topic which recieved a great deal of interest was the interim provision of new data. An idea was brought up that perhaps a newsletter format could be used, whereby USDA would send out new data as it becomes available. This would be in contrast to the present situation in which an individual must write to USDA and request specific information.

In conclusion, we felt that the uses of nutrient data bases for various applications can be very effective and reliable. It was noted that several studies have appeared in the literature which support this conclusion.

## BUSINESS MEETING
### Report of Committee A

Frank Hepburn, Chairman

Four charges were made for 1978-79. In summarized form these were:

a) Select an appropriate name.

b) Determine feasibility of establishing an interest group within an existing organization.

c) Present the feasibility of establishing an independent organization to exist, gain members, develop funds, and maintain communication.

d) Source of funding might be sought.

It was the concensus of the Committee that participation within existing organizations such as the American Public Health Association or the American Institute of Nutrition, although possible, would not benefit the broader interests of those who have attended the National Conferences.

Alternatively, it was deemed more feasible to organize as an independent organization. However, the Committee could not reach unanimity as to the structure and degree of organization most desirable and could not give unanimous endorsement to the plan prepared by Dr. Arden W. Forrey, the proposed By Laws of which have been distributed at this meeting. The Committee had no serious objection to the name, "Institute for the Advancement of Computer Use in Nutrition and Dietetics," proposed by Dr. Forrey, but it was observed that the absence of the words "Nutrient Data" in the name might cause ambiguity.

## Report of Committee B

Stan Weinstein, Chairman

The discussions of Committee B dealt with the question of what kind of results or objectives should this group achieve? Basically, we reached a conclusion that the most important thing for this kind of an organization is information exchange. Getting together once a year, or sometimes more than once a year, would give the opportunity to the people to tell others what they are doing and to learn from other people. We all agreed that the Case Western Reserve group did a magnificent job in hosting this group here and prepared an excellent program. But the question of where we are going from now appears. One of the goals is to make the next annual conference the best one yet. And how can we achieve it? Maybe one of the things is to decide how we can get better communication between people during the year in order to prepare for the next meeting. We all agree that we'd like to have an annual conference meeting.

One of the ways to communicate is by using newsletters. Assign the reponsibility to a task force or a group or an individual to come out with a newsletter that will tell the members of the organization what's going on. This will keep people up to date with information which is vital to the survival of this organization. In addition to a newsletter, there are a number of publications and references for educational material that will keep members up to date. Another means of communication is teleconferencing. Here we thought that we might have a little bit of a problem because this means of communication might cost a lot of money and right now the organization doesn't have it; I guess the budget is very little, almost zero. Also, we recognize the problem of lack of time. All of us, I assume, do have regular jobs and the priority of each one of us, is, first of all, to do their day-to-day job. To get involved too much with this organization can interfere with day-to-day routine and many times people will leave things to be done tomorrow or to next week, next month and before you know it, it's the end of the year. So we cannot achieve a lot. One of the problems that we discussed was the task forces. We heard the task forces' reports here and a lot of the topics dealt with identification of things to do. Who's going to do it? All of us, like I mentioned before have other responsibilities and this will take a lot of time and a lot of devotion and not everybody can afford it. Basically, all of us are volunteers and I have to thank everybody in the room for all of the effort that they did so far. But, somehow, we get stuck. We do something and then the next year we start many things from the beginning, like the task forces. The first conference meeting three years ago had task forces and the year after that there were task forces which addressed the same topics as the first year's. I heard from some people here that yesterday's task forces also repeated a lot of topics that were addressed previously. Basically, we raise problems, but we don't comewith the solutions, or we might come up with solutions, but don't implement them. We don't have the means to pursue and to solve and overcome the problems and come up with some projects or standards or prototypes. This raises the question--should we be organized? At the last conference we were discussing it and Committee A was supposed to come up with some recommendation about organization.Committee B didn't feel that this topic ought to be discussed within the Committee once it was the topic of Committee A.

The remainder of the business meeting consisted of a presentation of the purpose and structure of the organization, "Institute for the Advancement of Computer Use in Nutrition and Dietetics", referred to in the report of Committee A. This presentation by Tony Fisher was followed by lengthy discussion relative to whether or not the proposed organization was representative of the wishes of the conference attendees to have some organizational structure. No consensus was reached.