COMPUTERIZED 24-HOUR DIETARY RECALL DATA COLLECTION FOR NHANES III

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The National Health and Nutrition Examination Survey (NHANES) is conducted by the National Center for Health Statistics (NCHS) to monitor the health and nutrition status of the nation's population and to gather data for further study of the relationships between diet and disease. The collection of 24-hour dietary recalls is a major component of the NHANES program. In past surveys, the recalls were conducted by trained dietary interviewers who documented the reported foods and food quantities on dietary intake forms. To prepare these recalls for analysis by a nutrient analysis system, all food and quantity descriptions were manually translated into appropriate food codes and quantity measurements by the dietary interviewers in the field.

A sophisticated system of computer hardware available in the Mobile Examination Centers for NHANES III makes possible the automation of these labor intensive procedures for collecting and preparing the dietary data for nutrient analysis. Furthermore, as demands increase for more detailed data on national food consumption, a computerized 24-hour recall system becomes essential to ensure standardized collection of the most complete and detailed dietary data possible within the thirty minutes allotted to the dietary interview portion of the survey.

The Dietary Data Collection (DDC) system, under development at the Nutrition Coordinating Center (NCC), University of Minnesota, has been selected for collection of the 24-hour dietary recall data for NHANES III. The DDC system, which runs on an IBM-AT or compatible microcomputer, is designed to guide a trained interviewer through a 24-hour dietary recall. The system collects the dietary information as described by the survey participant and automatically translates this descriptive information into food codes and quantities for subsequent analysis by a nutrient analysis system.

The specific goals of the DDC system for use in NHANES III are:

- to standardize procedures for collecting the 24-hour recall data.
- ensure specificity of the dietary intake data.
- to simplify the collection of food descriptions and quantities as reported by the survey participant.
- to improve the efficiency of collection, preparation and timely release of the dietary data.

The DDC system design and functions are described below as they relate to each of the stated goals.

1) Standardize procedures for collecting the 24-hour recall data

The DDC system obtains standardization in data collection by requesting all of the information required to precisely define each food item consumed by the survey participant during the 24-hour recall period. This information includes description of the food, specification of recipe ingredients and cooking methods used in preparing the food, and description of the amount of food consumed. The food data are collected interactively through a series of menu selection

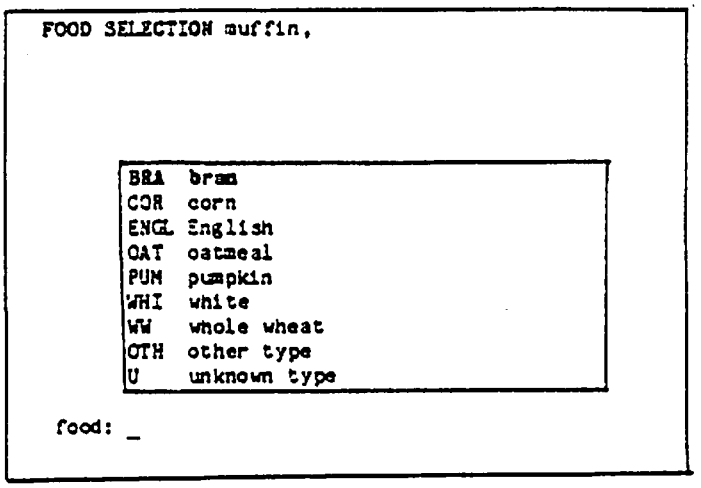

Figure 1a DDC system screen menu of choices for description of type of muffin.

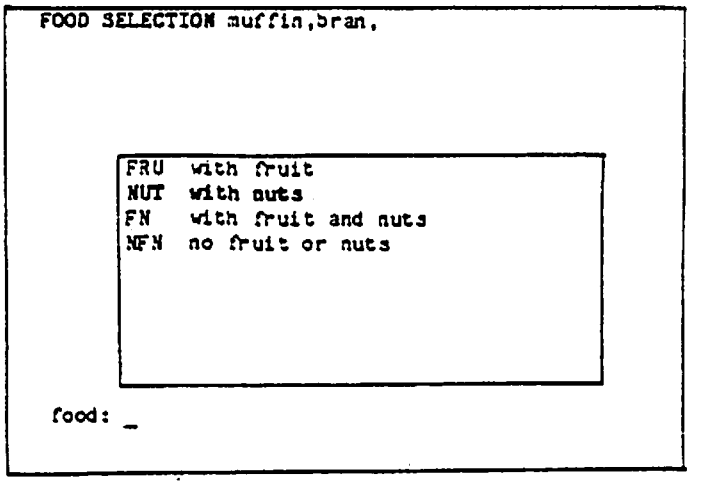

Figure 1b DDC system screen of choices for detailed descriptin of a bran muffin.

screens.

Collection of food data is begun by entry of the primary name of the food reported by the survey participant. This entry initializes a pathway of system-generated menus of progressively detailed food descriptions. The interviewer selects one description from each menu. For example, if the interviewer enters "muffin", the system responds with a menu containing choices to describe the type of muffin, as illustrated in figure 1a. If a bran muffin in specified, another menu is displayed with further description choices for bran muffins with fruit or nuts, as illustrated in figure 1b. Selection of "with nuts" completes the food description selection process. The muffin is then identified in the recall by its list of food descriptions, "muffin, bran, with nuts".

Once a food has been precisely identified by its list of descriptions, the DDC system continues to present menu selection screens to solicit the information required to specify recipe ingredients, cooking methods, and food items used during preparation. The system also displays screens with choices of food quantity measurements for estimating the amount of food consumed by the survey participant.

Further standardization of data collection is achieved with the inclusion of "unknown" choices in system menu screens when the participant or proxy may not be able to provide the level of food detail requested. For example, the muffin descriptions presented above include a choice of "unknown type". The DDC system assigns the white flour muffin data to this selection, while retaining the "unknown type" description. By providing defaults for unknown selections, the system standardizes the assignment of data to incomplete food descriptions. If the food descriptions displayed on the DDC system menu screens are not adequate to describe a food reported by the survey participant, a "Missing Food" mechanism is available for capturing descriptive and quantitative information about the food item. For example, if a chocolate chip muffin were reported by the survey participant, the interviewer would enter a description of the muffin including its brand name, ingredients, and size. To standardize processing of these data for NHANES III, all "Missing Food" descriptions will be sent to a central location. If required, new food descriptions may be added to the DDC system to accommodate collection of the new food item in future 24-hour recalls.

2) Ensure specificity of the dietary intake data

To obtain specificity of food description, the DDC system menus include such details as the source of the food (home prepared or commercially prepared fried chicken; fresh, canned, or frozen packaged vegetables), major ingredients (white, whole wheat, or spinach pasta; condensed soup prepared with milk or water), and special food labels (reduced sugar jelly; low sodium canned tomatoes; vitamin C fortified juice). Food descriptions require maximum detail for specifying dietary fat and sodium.

For many foods, variation in recipe ingredients may affect the type of fat or the level of fat or sodium in the food item. The DDC system identifies these key ingredients and requests the interviewer to determine the recipe ingredients used in the food consumed by the survey participant. The mayonnaise or salad dressing in egg salad, the salt in scrambled eggs, and the margarine, butter, oil, or shortening in a muffin are examples of key ingredients.

The ingredient specification screen for a bran muffin is illustrated in figure 2. If the participant reports that the muffin was made with margarine, the system generates menu selection screens to obtain the brand name or further description of the ingredient margarine. If the participant is not familiar with the recipe ingredients in the food consumed, the DDC system provides "unknown" choices and will assign a default ingredient. The default is often based upon whether the food was prepared at home or by a commercial establishment.

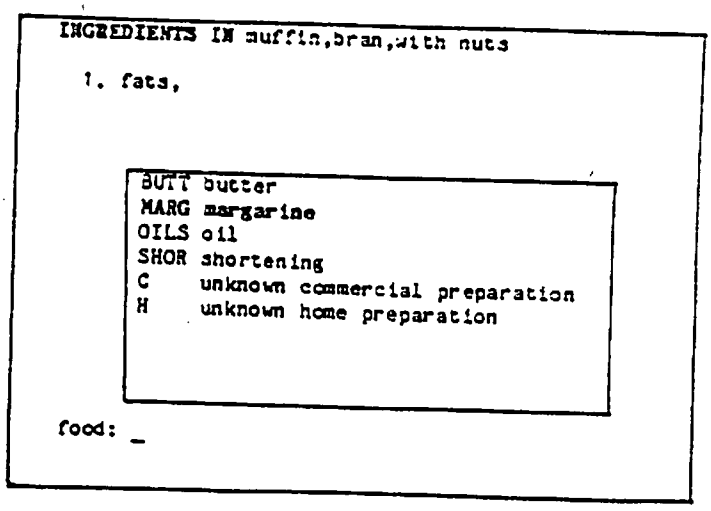

Figure 2. DDC system menu of choices for type of ingredient fat in a bran muffin

For further specification of fat and sodium intake, the DDC system displays a menu of cooking methods for meat, fish, poultry, and vegetable food items. If the participant indicates that the food consumed was prepared using one of the methods listed on the screen, further specification is requested for the type of cooking fat and whether or not salt was used in preparation.

Figures 3a and 3b illustrate the system menu screens for selection of a breaded and fried preparation for chicken. Selection of this preparation generates additional menu screens for specification of the frying fat and the use of salt, as illustrated in figure 3c. The DDC system includes "unknown" choices to describe the fat and salt if the participant is unable to provide the detailed information. The amounts of fat and salt added in preparation are calculated by the system using algorithms based upon the amount of food consumed.

The DDC system obtains additional specificity of dietary intake data by permitting the

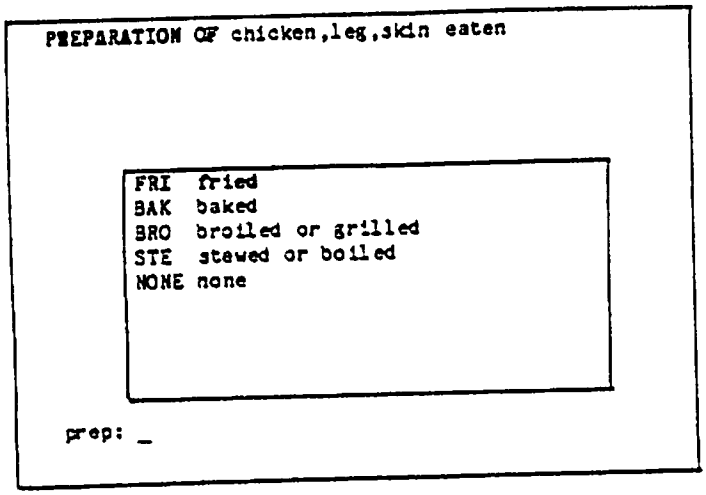

Figure 3a DDC system screen menu of choices for preparation of chicken.

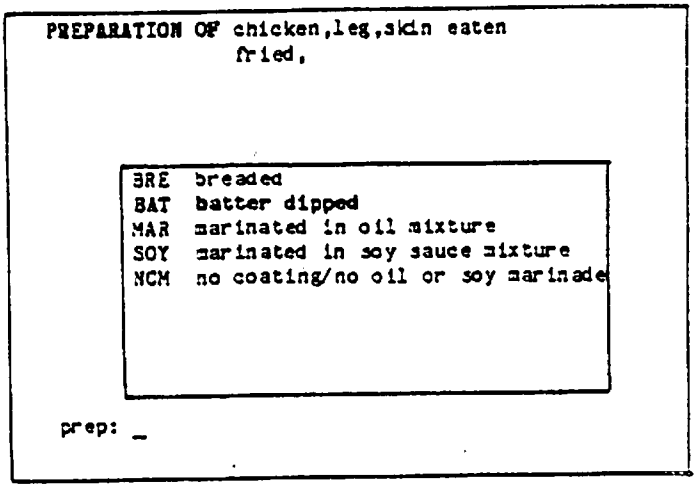

Figure 3b DDC system screen menu of choices for type of fried chicken.

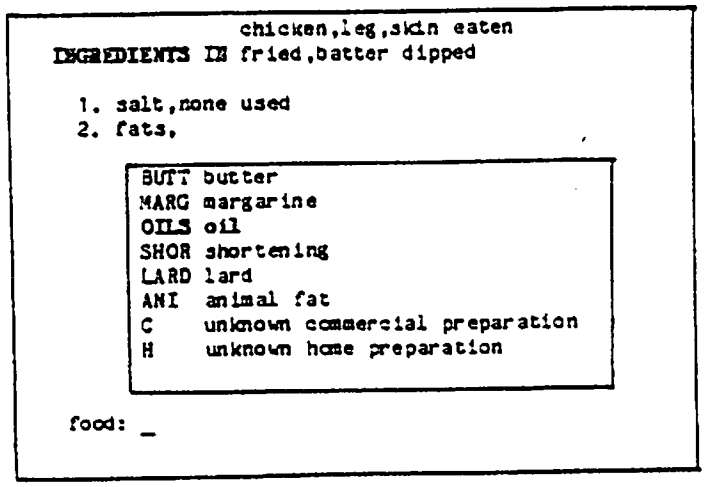

Figure 3c DDC system screen menu of choices for type of fat used to fry chicken.

interviewer to group foods eaten together as a single item. For example, if the survey participant reports a ham and cheese sandwich, the interviewer can proceed to enter a detailed description and precise quantity for each individual item. The DDC system retains the "ham and cheese sandwich" description reported by the participant and links the individual foods into one multi-component food item.

3) **Simplify the collection of food descriptions and quantities as reported by the survey participant**

At the beginning of the dietary interview, the survey participant is urged to briefly report all of the foods and beverages consumed during the previous 24-hour period. The DDC system provides a blank "Quick List" screen on which the interviewer may list the foods, meals, and eating times as initially described. An example of this screen is illustrated in figure 4. The

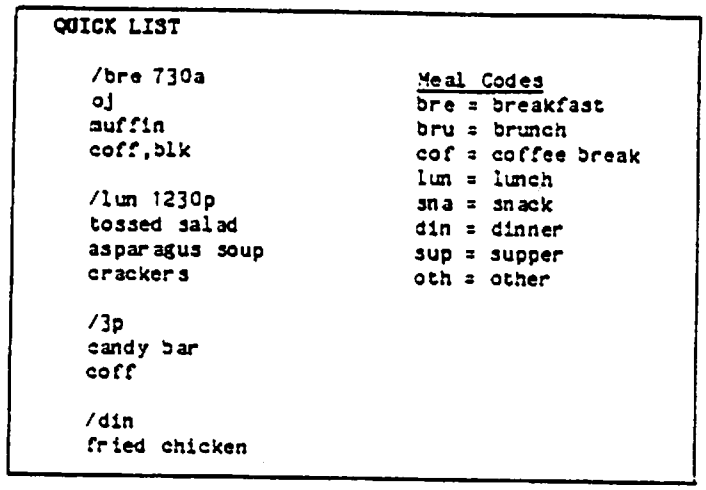

Figure 4. DDC system screen for notation of all meals and foods in a 24-hour recall.

information may be entered using any convenient shorthand notation. This mechanism allows the interviewer to capture eating occasions and general descriptions of food intake without distracting the participant with detailed questions about a particular food item. After completion of this "Quick List", the system prompts the interviewer for detailed information on each of the foods reported.

To simplify the process of selecting the food descriptions for each food reported in the 24-hour recall, the DDC system includes common food terms, brand names of commercial products, and names of fast food restaurant chains in its menu choices of food descriptions. For example, salad dressing may be identified as "Featherweight Imitation French - low calorie", and a fast food ice cream sundae may be described as "Dairy Queen, sundae, chocolate".

In addition, foods are grouped into categories which may be used as initial entries for food description. These categories are structured from a consumer viewpoint of foods, and a food may appear in multiple categories. For example, orange juice is classified in both the fruit and beverage categories. The food description process may begin with the interviewer entry of either one of these general category descriptions, or the interviewer can enter a more specific food name. If "orange" is the initial entry, a subsequent system menu will contain, juice" as one it its choices of descriptions. If "juice" is the initial entry, the next system menu will contain "orange" as one of its choices of descriptions. Either pathway would generate additional system menus with the descriptions "canned or bottled" and "unsweetened" to complete description of the orange juice.

The DDC system simplifies quantity measurement by accepting a variety of methods for estimating the amount of food consumed by the survey participant. A quantity may be expressed in terms of a weight or household volume, and for some foods, a pre-cooked weight or volume or a weight with refuse may be used. When necessary, the DDC system requests the form of the food (solid, grated, cubed, etc.) in the household volume measurement. Food volumes may also be described using dimensions of common shapes. For foods with standard thickness, such as crackers or pita bread, only the surface dimensions of the food are required. For many foods, quantities may also be expressed in terms of food-specific portions, such as a "stalk" of celery, a "medium" sized shrimp, or a "piece" of pie. A maximum serving size is associated with each food item; quantities which exceed the maximum serving size must be verified by the interviewer.

4) Improve the efficiency of collection, preparation and timeliness of release of the dietary data

The DDC system improves the efficiency of dietary data collection by replacing manual collection of the 24-hour recall data with computerized data collection on interactive menu screens. At the end of the dietary interview, the system generates a printed report of the foods and quantities in the 24-hour recall to replace the hand-written document. Figure 5 is an illustration of a 24-hour recall report.

The most significant improvement in efficiency is realized in preparing the data for nutrient analysis. The DDC system automatically translates the food and quantity descriptions collected during the 24-hour recall into food codes and gram weights of the edible portions of the foods as consumed. The output data file of food codes and amounts is suitable for processing by a nutrient analysis system. This automated preparation of the 24-hour dietary recall data is expected to result in a substantial time savings for nutrient calculation and data analysis in NHANES III.

The DDC system is designed to accommodate food coding for multiple nutrient databases. Currently, the system is equipped to produce food codes from the database of the USDA Continuing Survey of Foods for Individual Intake (CSFII), release 2, and the NCC Nutrient Database, version 13.

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breakfast              7:30 A

muffin,bran,with nuts
1 each (2" diam X 2 1/2" high)

    I: fat,unknown commercial preparation

coffee,regular caffeinated,instant
1 cup

lunch                  12:30 P

COMBO: tossed salad

       lettuce,iceberg
       1.5 cups

       tomato,red,raw
       3 slices  (2 1/2" diam)

       dressing for salads,[Featherweight Imitation French - low calorie]
       2 tablespoons

       cheddar cheese,unknown if natural or processed
       0.25 cups  grated volume

soup,asparagus - cream of,prepared from condensed can,diluted with milk
1.5 cups

crackers,whole wheat,low sodium
4 circle shape-2" diam

coffee break           3:00 P

MISS:  candy,candy bar without chocolate,

       candy bar with crisp rice, peanut butter type filling, and candy
       coating; candy bar is new on the market - brand name unknown

       consumed one bar 4" long, 1" wide, 1/2" thick

dinner                 7:15 P

chicken,leg,skin eaten
5.5 ounces   weight with refuse before cooking

    P: fried,batter dipped
       I: oil,[Wesson]
       I: salt,none used
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Key of Abbreviations	
I	ingredient used in recipe or during food preparation
P	preparation or cooking method
COMBO	combination of foods eaten together
MISS	food which could not be accurately described with the available DDC system food descriptions

Figure 5. Sample print-out from a DDC 24-hour recall.