Problems and Issues Related to Calculating Recipes in Several Settings

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A recipe is a written direction for combining two or more foods and it includes preparation and serving instructions. It could also be defined as a list of assembled components and preparation procedures for making a mixed dish or menu item. Recipes are received for nutrient analysis from many sources and from a variety of settings:

Dietary records

Surveys of free-living persons

-usually with no follow-up

-much unclear information

Clinical encounters

-metabolic, in-patient, weighed, measured

-24-hour recalls

-diet diaries with or without follow-up

-dietary intervention planning

Food service

Standardized recipes

-within institutions–schools, hospitals, etc.

-fast foods

-some restaurants

Non-standardized recipes

-institutions

-restaurants

Cookbooks, media, consumers

The quality of recipe information received ranges from very high, with all required information at hand, to very low, with only main ingredients reported. The issue of quality becomes important when considering the significance of the nutrient analysis in the a specific setting. This presentation is a review of a workshop organized by the National Center for Health Statistics (NCHS) to discuss the issues related to coding of non-commercial mixture recipes reported in the National Health and Nutrition Examination Survey III (NHANES III) now in progress.

Goals for the workshop were:

1. To explore approaches for coding non-commercial food mixtures which include school lunch and restaurant foods that are not in the coding data base.

2. To apply coding decision approaches to examples of NHANES III mixture examples.

3. To develop coding guidelines for mixtures that can be used by The National Center for Health Statistics and by The Human Nutrition and Information Service, USDA.

The National Center for Health Statistics invited participants who have had experience in dealing with these issues and problems in a variety of settings:

Janet Ditter-Johnson, University of Minnesota
Roberta Zeug, University of Minnesota
Dierdre Douglas, University of Texas
Monica Yamamoto, University of Pittsburgh
Fran Jones, University of Pittsburgh
Linda Ingwerson, Human Nutrition Information Service, USDA
Grace Petot, Workshop Chair, Case Western Reserve University

Significance of the Problems in NHANES III

Quality of information retrieved:

Dietary recalls may be classified as being of two types. One is the recall in which all foods reported are traditional and/or labeled commercial foods. This type of recall is easily coded and provides more accurate and precise nutrient analyses. The second type of recall is one in which many or most of the food mixtures are home-made, restaurant or institutionally prepared. These recipes become difficult to code when recipe information is sparse. Thus, a final survey analysis combines nutrient analyses from both types of recalled reports. The amount of information retrieved varies from being very specific to very vague. The variability of the nutrient analyses due to coding assumptions made with incomplete information is unknown. To code recipe information and to obtain precise portion quantities, it is necessary to have the following:

1. A complete list of ingredients

2. Descriptive information for each ingredient, e.g., kind and cut of meat, dry or cooked noodles, kind of fat, etc.

3. A quantity for each ingredient

4. Preparation method

5. Total yield of the recipe

Nine soup recipes received during interviews in NHANES III were examined and a matrix (Table 1) was constructed to illustrate the adequacy of the information. It is readily observed that there is missing information for a number of recipes. The task at hand was to determine the best methods for using all of the available information for assigning food codes.

Resources:

There are limited resources for recipe testing and for creating computer algorithms to achieve consistency of assumptions. Missing foods must be reviewed for a decision to use a match in the data base, to code as components, or to code as ingredients. This is very time consuming, especially if several persons are consulted for consensus and documentation.

Survey goals:

NHANES survey goals require analysis results for nutrients and for foods as identification as sources of nutrients. Therefore, it is important that as much food ingredient specificity and quantity be retrieved and coded as is possible.

Recipe Collection During the NHANES Interview

The automated Dietary Data Collection (DDC) system, developed at the University of Minnesota Nutrition Coding Center, is being used in NHANES III for recording dietary recall interviews. This system greatly facilitates the recording of food mixtures but does have some limitations:

1. The level of specificity of a food description may be picked without using food codes. Vitamins A and C content may be captured in some combination foods, i.e., without vegetables or with dark green vegetables.

2. Portion size may be quantified or a food shape recorded.

3. Variable ingredients may be selected, i.e., type of frosting, type of fat used in frosting, but these are limited.

4. Probes for type of fat and for salt may be used.

5. Recipes in data base are not visible to interviewer, e.g., the recipe ingredients linked to a recipe name cannot be viewed on the screen.

6. A recipe cannot be modified by the interviewer, i.e., the recipe ingredients are not in the system which the interviewers use.

7. Two types of generic mixed dishes are included in the food data base. They are combination or mixed dishes with no specific name such as beef with gravy, or are frequently used mixtures defined by common names such as lasagna, chicken chow mein, etc. These recipes have been obtained from popular cookbooks. Soups are defined by the main ingredient, i.e., chicken. If a homemade soup is named, it is being linked currently to a commercial product code.

8. Notes may be recorded within the interview record if different or unique ingredients are named. These must be examined later by NCHS staff and considered for coding, or for editing of the recall and a rerun of the analysis.

It is possible during the interview to capture all of the information provided by the respondent, but the coding becomes imprecise when unique or different ingredients are used in a commonly described recipe. If a homemade soup appears in a recall, the item is linked to a commercial soup code. It is not now possible to code for different ingredients; however, if nutrient information becomes available for "generic" homemade recipes, it may be possible to rerun the recalls later.

Family members who consume the same foods may not be interviewed at the same time, therefore there may be varying levels of specificity for mixed dish information for the same recipe. Each family member may describe the same food differently. The system has fixed combinations for recipe foods which cannot be changed at the time of the interview. There may be as many different recipes for the same soup or muffin or stew as there are families in the survey.

Workshop Participants' Experiences

Participants in the workshop described their experiences in retrieving food mixture information. In clinical settings and clinical studies, training of patients and subjects with continuing contact provides the maximum amount of information and an opportunity for investigators to evaluate quality. In surveys, where there is limited or no follow-up, the information available must be used with the best judgements and decisions made by the investigators.

Using a debriefing question, USDA collected information from interviewers about the easiest and the most difficult foods to describe. They ranked them for level of difficulty from easy to difficult:

Salad - EASY
Omelet
Vegetable combination
Stew
Homemade soup
Ethnic foods, e.g., Chinese, Mexican - VERY DIFFICULT

Criteria are needed for deciding 1) which recipes must be added to the data base, perhaps based on frequency of appearance and 2) which recipes may be matched to an existing food mixture in the data base. Consideration should be given to:

-significant nutrient contributions of the recipes ingredients
-ranges and variability of the nutrient values for similar recipes
-food ingredients of importance

When is an existing food code not a good choice and what assumptions can be made in the face of inadequate information?

What are Mixtures That Pose Problems?

Approximately fifteen per cent of NHANES recalls have "missing foods". About forty per cent of these are food mixtures which require decisions by NCHS staff. To retrieve information for mixtures, the respondent's knowledge and memory are important and the fact remains that for many food mixtures, the most discerning and knowledgeable respondents simply cannot provide the level of detail required. In any case, there is a need to use the amount of detail that is provided. For soups, it is necessary to know if they are homemade, prepared in a restaurant or commercial

products. The term 'homemade' must be clarified. Is it from a can? take-out? recipe? from canned or frozen? If a recipe is provided, it takes time to code for each component. It may be necessary to write standards or guidelines for restaurant or take-out foods since most respondents have difficulty describing mixtures.

Soup and cornbread recipes collected during NHANES III were presented for discussion as examples of food mixtures with the same names but with different ingredients and various levels of detailed information. Thirteen soup recipes, all called "chicken soup" or "Mexican chicken soup", were collected in the southwestern United States. The following is a summary of how the ingredients differ in these recipes:

10 recipes with whole chicken parts served in a portion
10 recipes with potatoes
10 recipes with carrots
8 recipes with tomatoes
8 recipes with onions
2 recipes with cabbage
7 recipes with rice

Nine different cornbread recipes were made with a variety of combinations of ingredients:

cornmeal, water, egg
cornmeal, wheat flour, buttermilk, egg
self-rising cornmeal, water, mayonnaise, non-fat dry milk
cornmeal, buttermilk, baking powder, baking soda
cornmeal, milk, egg, margarine
self-rising cornmeal water, egg, wheat flour, non-fat dry milk, oil
cornmeal egg, buttermilk, wheat flour, non-fat dry milk
cornmeal egg, buttermilk, wheat flour - fried in oil
cornmeal, water, onion

Questions were raised about the quality of the cornbread recipes since many appeared to have missing ingredients. However, it was recognized that baked or fried cornmeal mixtures called "cornbread" may be made with few or many ingredients in different combinations. There is an apparent need to investigate regional and ethnic differences. "Typical" regional or ethnic recipes can be added to the data base or more specific guidelines may be written. Existing recipes can be examined and compared for variability in nutrient content. Using cornbreads and soups as models, it may be possible to develop composite recipes as "typical" or representative. Some recipe ingredient information is provided most of the time and portion sizes consumed are given about seventy per cent of the time. It was concluded that several different basic recipes must be added to the data base; however, if uncommon or non-traditional ingredients are used, it may be necessary to continue to code by ingredients.

To facilitate the coding of reported food mixtures, a decision tree was constructed by workshop participants:

DECISION TREE

Review recipe
All ingredients and amounts?

Yes
Match in data base?

No
Main ingredients
No amounts or

portions

Close NDB match?

Yes
Edit record
Use base code
Use guidelines
for partition
codes

No?
Modify for close
NDB match?

No
Enter all
ingredients
ingredients

Save file
Consider
adding to database

Yes
Modify and
edit

No
Use guidelines for
important

or multi-component
food

Which recipes are most important? Which nutrients are to be priorities while keeping the number of data base additions to a minimum? A suggestion was made to collect all recipes for mixtures received as missing foods during the entire survey, and to review all similar mixture recipes for calculated nutrient ranges and variability. This information is necessary to make decisions about whether to code a mixture food recipe or to add a composite, representative recipe to the data base.

The outcome of the participants' discussions produced two primary considerations as guidelines for coding decisions are made. They are

1) Identification of the nutrients of importance to the survey and

2) Identification of food mixtures within food groups.

It was agreed that the decision tree with guidelines, which are yet to be written for each decision point, should be used for the following types of recipe mixtures:

- Meat mixtures with ANY amount of meat
  - Entrees, soups, salads
- Green, yellow and white vegetables
- Milk mixtures
  - Alternates for types milk and cheese
  - Entrees
  - Salads
  - Desserts
  - Beverages
- Cereals and grain mixtures
  - Entrees
  - Salads
  - Baked products, sweet and non-sweet
    - Breads
    - Cakes, cookies, desserts
    - Pastries
    - Stuffings

This workshop was intended to address the primary question "What do we do with the information we get?". A summary of the final discussions produced the following questions and comments:

1. What is the magnitude of the problem?
2. At what point do we stop the decision-making process?
3. What are the resources? There is a limit to time and effort.
4. What constitutes a significant amount of an ingredient in a mixture?
5. A significant amount of ingredient in a recipe may not necessarily be the main ingredient. Evaluate significance in the meal AND in the amount consumed.
6. What should be the form and content of guidelines?
7. What elements in a partial recipe lead to a decision to pursue coding individual ingredients?
8. It does not seem to be a problem to consider fat and sugar unless quantities are changed. It is possible to select alternate fats and milks, but it is not possible to reduce or increase quantity.
9. There is a need to capture as much FOOD detail as possible because this survey is considering both foods AND nutrients.

10. How much burden can we expect to put upon respondents?

11. A lot of questions are asked of the respondents; they may volunteer erroneous information.

12. Develop a method with which the interviewer can evaluate the quality of the information recalled and the respondent's ability and capability to recall; then train interviewers to use it.

13. If information is captured, use it if at all possible.

Research Needed

All mixture reports and decisions should be documented. When they have been accumulated at the end of the survey, examine frequencies and commonalities, calculate variabilities in nutrient content and then consider creation of typical, representative recipes.

Examination of the soup and cornbread recipes collected in NHANES III provided evidence that a more systematic review and analysis is needed of all food mixtures collected during the survey. Data accumulated for the following factors will assist in writing coding guidelines and for deciding what food mixtures are representative:

1. Frequencies of reporting:

    Food descriptions

    Quantity measurements

        Ingredients

        Yields

    Preparation procedures

    Preparation procedures

    Preparation times

    Quantity prepared at one time

    Standing, storage time and conditions

2. Ranges and variabilities of nutrient values

3. Frequencies of consumption