

NHANES III Update

Robert J. Kuczmarksi, Ph.D., R.D.
Margaret McDowell, M.P.H., R.D.
National Center for Health Statistics
Hyattsville, Maryland

INTRODUCTION

The National Center for Health Statistics (NCHS) is an agency of the U.S. Public Health Service and is one of the Centers of the Centers for Disease Control (CDC). The primary mission of the NCHS is the collection and dissemination of health statistics for the nation. The NCHS produces a wide range of data that are used for health research, administration, planning, and education. There are a number of data collection systems within the NCHS. The National Health and Nutrition Examination Survey (NHANES) is only one of the data collection systems, but is unique in that it collects data on the health and nutritional status of Americans through interviews and direct physical examinations.

Operating from a Mobile Examination Center (MEC), a set of four interconnected and specially designed and equipped trailers, the NHANES staff travels across the country to reach people selected to participate in the survey, and they administer standardized examination and laboratory tests. Before visiting a community, the examination team is preceded by an interview team that visits individual households to select sample persons as part of the complex sample survey design for this nationally representative survey. The interviewers administer health and nutrition questionnaires to the subjects prior to inviting them to the MEC, which is subsequently brought into the local community.

BACKGROUND

As a brief background, from 1959-84, the NCHS conducted six separate health examination surveys (Table 1). The first National Health Examination Survey (NHES I) focused on the prevalence of selected chronic diseases in civilian, noninstitutionalized adults. The NHES II and NHES III were devoted to growth

and development of children and adolescents. In 1969, the Department of Health, Education, and Welfare established within the NCHS a continuing activity to measure the nutritional status of the U.S. population, and to monitor changes in nutritional status over time. An NCHS task force decided to combine the nutrition component with the NHES to permit relating nutritional variables to health measures that were already being collected. Thus, the first National Health and Nutrition Examination Survey (NHANES) was created. The most recently completed, nationally representative NHANES was conducted from 1976-80. The Hispanic HANES (HHANES), conducted from 1982-84, was a special survey of three selected subgroups of the population in selected areas of the U.S. rather than a national probability sample. The NHANES III began data collection in October 1988 and will continue until the fall of 1994. Persons are included in the NHANES III beginning at two months of age and for the first time in the NHANES, there is no upper age limit for participation in the survey.

Table 1. National Health and Nutrition Examination Surveys.

<u>Surveys</u>	<u>Dates</u>	<u>Ages</u>
NHES I	1960-62	18-79 years
NHES II	1963-65	6-11 years
NHES III	1966-70	12-17 years
NHANES I	1971-75	1-74 years
NHANES II	1976-80	6 mo.-74 years
HHANES	1982-84	6 mo.-74 years
NHANES I Follow-up	1982-	25-74 years
NHANES III	1988-94	2 mo.+

NHANES III CHARACTERISTICS

Sampling Issues

The sample for the NHANES III consists of large samples of Black, Hispanic, and other groups. Approximately 30 percent of the sample will be Black, 30 percent Mexican American, and 40 percent of the sample will include White persons among other subgroups of the U.S. population. The sampling scheme consists of 81 counties in 26 states for a total of 88 locations that will be visited. The survey consists of two National samples that will be conducted in successive 3-year cycles. The first cycle will be completed in the fall of 1991 and the second cycle will run from 1991 through 1994. Approximately 40,000 persons will be interviewed and approximately 30,000 persons will be examined. While the NHANES III continues to exclude military and Native American reservations, nursing homes, long-term care hospitals, and prisons, it is of interest to note that Hawaii and Alaska are included in the sampling frame. Hawaii was included in the NHANES II (1), and Alaska will be visited in the second phase of the NHANES III.

Structure

The NHANES III household interview consists of four parts (Table 2) and it is here that detailed questionnaires obtain information on items such as family relationships, basic demographic information, participation in income assistance programs, and health status. Relevant to the nutrition component, participation in the Food Stamp Program and the WIC Program is assessed, as are the use of vitamin and mineral supplements. Infant feeding practices, such as breast feeding, the introduction of solid foods, and similar questions, are also asked. Interview questions assess alcohol intake in the past 12 months, the frequency of eating breakfast, quantity of tap water consumed in a day, type and frequency of salt use, availability of food or money to buy food, and a food frequency that is discussed in more detail below.

The focus of the examination component is on measures associated with chronic diseases, many of which are known to have relationships with diet and eventually can be analyzed in that connection. In

Table 2. 4-Part Household Interview

1. Household screener questionnaire
2. Family questionnaire
3. Household questionnaire
Age 2 mo.-16 yrs.
Age 17+ yrs.
4. 3 seated blood pressures

addition, a comprehensive nutritional assessment is completed.

Nutritional Assessment

The nutritional assessment component includes an extensive array of anthropometric measurements that will be used primarily to assess underweight, overweight, and obesity and the inter-relationships among these conditions and a number of other risk factors and chronic conditions and diseases. Body measurements are also used to assess growth in children and adolescents. In fact, it is intended that measures from the NHANES III will be used to update the NCHS growth charts. The nutritional biochemistry measurements from the laboratory analyses use blood and urine specimens to assess an extensive list of lipids, vitamins, minerals, and other factors related to nutritional status (2).

Dietary Intake

Dietary intake is a vital part of nutritional status assessment and was considered at length and very carefully during the planning phase that preceded the NHANES III. In 1986, prior to the start of the survey, a workshop was held in which comments and opinions were considered from a wide range of experts from the nutrition community. It was decided that a single dietary methodology could not meet the needs of all the major nutritional objectives planned for the survey. A decision was made to administer at least one 24-hour dietary recall to provide detailed quantitative food and nutrient intake data for the U.S. population and selected subgroups of the population. In addition, it was decided that a qualitative food frequency instrument would be used to assess food items and food groups that were used in the previous 30 day period. For the purpose of monitoring trends over time, a food-frequency list that could be linked with data from the previous HANES surveys was developed. The food frequency targets dietary sources of nutrients that are believed to be associated with selected chronic conditions. Furthermore, foods reported by selected ethnic groups in previous HANES surveys were also included to make the instrument appropriate for population subgroups. As shown in Table 3, the food frequency is administered in the MEC for persons aged 2-11 months and 12-16 years. Persons aged 1-11 years do not receive the food frequency questionnaire, and for sample persons aged 17 years or more, the food frequency is administered as part of the household interview. The latter is important in that it will yield dietary intake data for the subgroup of persons who do not come to the MEC.

Table 3. Administration of the NHANES III Food Frequency.

<u>Age group</u>	<u>Place</u>	<u>Respondent</u>
1-11 mo.	MEC	Proxy
1-11 yr.	MEC	-----
12-16 yr.	MEC	Self
17+ yr.	Household	Self

24-hour dietary recall

A 24-hour recall is collected in the MEC for all examined persons using an automated dietary data collection and interview system that was developed with support from several government agencies by the NCHS and the Nutrition Coordinating Center (NCC) at the University of Minnesota. This data collection system, known as the NHANES III Dietary Data Collection (DDC) System was described in detail at the 1989 National Nutrient Data Bank Conference held in Iowa City, Iowa and was published in the proceedings of that meeting and elsewhere in the scientific literature (3-4). For each sample person, a trained bilingual dietary interviewer records the quantity of every item of food or drink consumed during the 24-hour period prior to midnight before the day of the interview, enabling estimates to be made of macro- and micro-nutrients and energy. The dietary interviewers conduct open-ended interviews using structured probes to ensure standardized data collection. Data are collected on brand name products, ingredients, cooking methods, and the use of fat and sodium in food preparation. Information is also collected on the time of day the food was consumed, the name of the meal or snack, and the place where the food was consumed. In addition to the characteristics of the DDC shown in Table 4, abstract geometric food models and household measures along with the ability to edit dietary recalls both during and after the dietary interview, and the ability to record information during the actual interview about foods that are not currently in the system, constitute part of a system that provides, as one of its most important

Table 4. Automated 24-hour dietary recall features

- Detailed description of foods/beverages consumed
- Portion sizes/use of food models
- Time of day/name of meal, snack, etc.
- "Where consumed"
- Salt/fat added in preparation
- Links foods eaten together as a multicomponent food

features, automatic coding of foods to the USDA database.

At this time, data from the NHANES III, including the 24-hour recall data, are not yet available for analysis and it is unlikely that the first results will be available for review prior to the fall of 1992 when the data tape for the sampling weights of the sites included in the first half of the survey is scheduled to be completed. The only statistics that are currently available for any of the components are on the response rates of survey participants. Response rates for the dietary recall component are high. Approximately 98 percent of the examinees completed the dietary interview component of the MEC exam. For the first 36 survey sites of the NHANES III, 12,435 24-hour recalls have been completed. The response rates by age are shown in Table 5. From this table, it can be seen that a small decrease in the response rate appears to be associated with increasing age.

As shown in Table 6, the 24-hour recall is administered for the youngest sample persons through proxy respondents, usually the mother or another caretaker who is familiar with what the child has eaten. As mentioned, all sample persons who visit the MEC are asked to complete the dietary recall.

Telephone Recall

In addition to the single 24-hour dietary recall obtained in the MEC, supplementary funding has been received from the National Institute on Aging to conduct a special dietary study on persons aged 50 years

Table 5. 24-hour dietary recall response rates by age

<u>Age group</u>	<u># completed</u>	<u>% completed</u>
2 mos.-5 yrs.	3316	98.9
6-11 yrs.	1375	98.6
12-19 yrs.	1235	97.7
20-39 yrs.	2641	97.9
40-59 yrs.	1739	97.2
60-74 yrs.	1341	96.5
75 + yrs.	788	95.4

Source: NCHS, NHANES III (Stands 1-36)

Table 6. Administration of the NHANES III 24-hour dietary recall

<u>Age group</u>	<u>Place</u>	<u>Respondent</u>
2 mos.-5 yrs.	MEC	Proxy
6-11 yrs.	MEC	Proxy/self
12-49 yrs.	MEC	Self
50 + yrs.	MEC	Self
	Telephone	Self

and older. Two additional 24-hour recalls are collected by telephone at 8 and 16 months after the initial MEC visit. This initiative is known as the Supplementary Nutrition Survey of Older Americans (SNS). Data collection is performed under contract by the Westat Corporation. Among the major objectives for this special study is the collection of additional days of dietary intake data to improve the quantitative estimates of the usual intakes of the target population.

The same NHANES III DDC interview that is used in the MEC is administered by trained, bilingual telephone interviewers. A food model booklet containing 2-dimensional drawings of the abstract food models and measurement aids used in the MEC is mailed to SNS respondents prior to each contact for use during the telephone interview. The average 24-hour telephone recall is completed in approximately 20 to 30 minutes, similar to the time required for the MEC in-person interview. Interview questions on self-reported health status, food sufficiency, special diets, and other items that were asked in the initial interview are repeated in the telephone interview.

Response rates for the first and second telephone 24-hour recall in the NHANES III SNS are shown in Table 7. As of March 1991, participants from the first 18 survey sites had been recontacted for at least the first telephone interview at eight months after the MEC visit. From the 1,479 persons eligible for this interview, recalls were completed by 1,152 sample persons, indicating a response rate of 78%. Among the 10 stands for which the first and second telephone recalls were conducted at 8 and 16 months respectively, the response rate for the first interview was 77%, and for the second interview, 70%. Examples of reasons for nonresponse include not having a telephone, subject deceased, subject refusal, unable to contact subject or subject away from residence for prolonged period of time, and inability to locate proxy respondents. Data from the SNS will be processed along with the rest of the NHANES III dietary data sets.

Special Features of the NHANES III

The telephone data collection is one of a number of special features of the NHANES III. Some of other features that are new to the NHANES III are also noteworthy. For the first time, the NHANES has a longitudinal component built into it to provide a better understanding of disease etiology and the natural history of disease. Present efforts focus on tracking current addresses of the sample persons by mail and reviewing the NCHS National Death Index, as the primary means of mortality follow-up. In the future, contingent upon appropriate funding, it is anticipated that sample persons may be reinterviewed by telephone and may even receive a modified home examination at a later time.

The precedent for a home examination has been developed and implemented as a part of the NHANES III. Persons who cannot or will not come to the MEC for a complete examination are offered the option of having a health technician visit them in their place of residence. This modified home examination is designed to improve the response rates on selected components of the survey, especially for the very young and the very old, and includes anthropometry, spirometry, cognitive and physical function, and a venipuncture (5). The home exam has helped to improve the overall response rates as shown in Table 8. To date, for the first 36 sites that have been surveyed, approximately 86 percent of the persons selected to participate in the survey have been successfully interviewed in their households. Those sample persons were then invited to the MEC for an examination and as indicated, 77 percent of those originally selected to participate have been examined in the MEC. The addition of the modified home examination has increased the examination response rate by approximately 1.3 percent, with 203 persons having been examined in their homes. When compared with the NHANES II and the HHANES, there has been an

Table 7. Response rates at 8 and 16 months for the SNS

	Number	Percent
Stands 1-18		
Eligible (8 mo.)	1479	
Completed (8 mo.)	1152	78
Stands 1-10		
Completed (8 mo.)		77
Completed (16 mo.)		70

Source: NCHS, NHANES III

Table 8. HANES interview and exam rates

Survey	Number selected	Inter-viewed percent	MEC Exam percent	MEC+ Home Exam percent
NHANES II	27,805	91.0	73.1	
HHANES	15,931	86.3	73.3	
NHANES III*	16,572	86.2	77.0	78.3

Source: NCHS, (*Stands 1-36)

increase in the overall response rate of approximately 4 percent, even when the home examination is not taken into account. Table 9 shows the percentage of persons examined thus far in each age and sex group. From this table, it becomes apparent that the MEC response rates decrease progressively with age, and that for the hardest to reach age group (75 + years), the home exam approach has increased the response rate by 8.1 percent.

Table 9. NHANES III examination response rates

	Male		Female	
	MEC <u>exam</u>	MEC + <u>home</u>	MEC <u>exam</u>	MEC + <u>home</u>
2 mos.-5 yrs.	86.5	87.9	88.8	89.6
6-19 yrs.	87.6	87.7	84.2	84.2
20-44 yrs.	74.5	74.7	80.7	80.9
45-59 yrs.	69.5	70.1	72.8	73.3
60-74 yrs.	69.3	71.4	65.3	67.5
75 + yrs.	58.8	66.9	53.7	61.8

Source: NCHS, NHANES III (Standards 1-36)

Another special feature of the NHANES III is the complete automation of the MEC which will help to facilitate more accurate data collection and more rapid data release. In addition to the microcomputer that runs the automated dietary recall, we have several other microcomputers on board, as well as a VAX minicomputer. Data collection in the MEC is completed online with daily back-ups, edit checks, and built-in quality control procedures. Data are sent to the NCHS and to contractors in machine readable format. This approach allows for built-in edit checks and assists in controlling the quality of the data.

The NHANES III was designed to have both a descriptive and an analytic orientation. With regard to nutrient intakes, descriptive data will be available for population subgroups by age, race, and sex, and other demographic variables as in previous HANES surveys. In addition, the analytic datasets will allow the study of associations among nutrient intakes and a variety of chronic conditions. The associations between nutrient intakes and clinical indicators of cardiovascular disease are prime candidates to be studied. Related to this, dietary data from the NHANES III are anxiously awaited to evaluate public education activities such as the National Cholesterol Education Program. For the first time, the NHANES is attempting to assess risk factors for osteoporosis of the hip by measuring bone density at the hip. The food frequency, 24-hour recall,

and other specialized interview questions on the historical intake of dairy products at various stages of the life cycle will provide further insight into the risk factors associated with this condition. Beyond nutrition and chronic disease, data from the NHANES make a vital contribution to nutrition status monitoring, allowing the study of vitamin and mineral deficiencies and toxicities for example, as well as the impact of other dietary factors on health outcomes. For example, there will be data on growth in children and overweight and obesity in all age groups that may be analyzed in relation to the dietary intake of energy and selected macronutrients.

Behind the Scenes

Finally, for persons who have not had the opportunity to participate in the current NHANES III, a behind the scenes look at the major components included in this survey will provide an idea of the types of data that may be anticipated for future analysis in the connection between diet, nutrient intake, and health outcomes.

There is a physicians' examination in which, among other assessments, three seated blood pressure measurements are recorded. As indicated previously, the home interviewers are also trained to record 3 seated blood pressure measurements in the home for a total of six readings that can be averaged and analyzed. There is still interest in the connection between sodium as a nutrient and blood pressure levels. The automated dietary interview system does collect information on fat and sodium in food preparation, and this will be available in addition to the detailed data from the survey nutrient data bank on nutrients from the food items that are consumed.

A certified ultrasonographer scans the gallbladder for gallstones. A recent report has suggested an association between the increased consumption of total calories, fat, and sugar, as well as the decreased consumption of high-grain fiber, and gallbladder disease (6).

A dentist conducts a complete dental exam, looking for caries, periodontal status, tooth loss, soft tissue lesions, baby bottle caries in preschool children, and similar conditions.

The health technicians are licensed X-ray technicians and take x-rays of the hand/wrist and knee of older persons in the search for signs of rheumatoid arthritis and osteoarthritis of the joints.

Because heart disease is still a major source of morbidity and mortality in the United States, a complete electrocardiogram provides information on cardiovascular disease and cardiac irregularities includ-

ing silent myocardial infarctions.

An allergy test consists of the application of 12 standardized food, insect, animal, and mold allergens.

Diabetic retinopathy, characterized by hemorrhaging blood vessels in the retina of the eye, is the leading cause of new cases of blindness in adults. The fundus photography procedure provides a picture of the retina that can be interpreted for this condition.

With the oversampling and emphasis on elderly persons in the NHANES III, an addition to this survey is the physical function test for persons aged 60 years or older. Exercises such as the time it takes to accomplish the everyday task of opening a door lock or walk a short distance are quantified.

While a major use of the food and nutrient intake data will be, for example, to help measure progress toward the Year 2000 Health Objectives for the Nation (7), it is hoped that other researchers interested in exploring the connections between nutrient intakes and the health outcomes measured in the NHANES III will begin to formulate research hypotheses or at least remember the sorts of data that will eventually become available for analysis through the public release data tapes.

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