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National Health and Nutrition Examination Survey: Plan and Operations, 1999–2010

Vital and Health Statistics
Series 1, Number 56
August 2013

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Center for Health Statistics

Suggested citation

Zipf G, Chiappa M, Porter KS, et al. National Health and Nutrition Examination Survey: Plan and operations, 1999–2010. National Center for Health Statistics. Vital Health Stat 1(56). 2013.

Library of Congress Catalog Number 312'.0723s 80–607914

For sale by the U.S. Government Printing Office
Superintendent of Documents
Mail Stop: SSOP
Washington, DC 20402–9328
Printed on acid-free paper.

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Program and Collection Procedures

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Centers for Disease Control and Prevention
National Center for Health Statistics

Hyattsville, Maryland
August 2013
DHHS Publication No. 2013–1332

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Acknowledgments

Planning and implementing the National Health and Nutrition Examination Survey (NHANES) 1999–2010 involved numerous persons and organizations. To all who deserve mention in this report, the Centers for Disease Control and Prevention's National Center for Health Statistics, Division of Health and Nutrition Examination Surveys (DHANES), says, ''Thank you.'' Without your diligent efforts, the national resource represented by NHANES data would be significantly diminished in scope and quality.

NHANES collaborated with a number of federal agencies. Without their partnership, the survey could not have been completed. NHANES appreciates their support in the form of funding, staffing, and consultation. The following government organizations deserve mention.

Organizations within the U.S. Department of Health and Human Services:

- Centers for Disease Control and Prevention:
  - National Center on Birth Defects and Developmental Disabilities
  - National Center for Chronic Disease Prevention and Health Promotion
  - National Center for Environmental Health
  - National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention
  - National Center for Immunization and Respiratory Diseases
  - National Institute for Occupational Safety and Health
- Food and Drug Administration:
  - Center for Food Safety and Applied Nutrition
- National Institutes of Health:
  - National Cancer Institute
  - National Eye Institute
  - National Heart, Lung, and Blood Institute
  - National Institute on Aging
  - National Institute of Arthritis and Musculoskeletal and Skin Diseases
  - National Institute of Child Health and Human Development
  - National Institute on Deafness and Other Communication Disorders
  - National Institute of Dental and Craniofacial Research
  - National Institute of Diabetes and Digestive and Kidney Diseases
  - National Institute of Environmental Health Sciences
  - National Institute of Mental Health
  - Office of Behavioral and Social Sciences Research
  - Office of Dietary Supplements
- Office of the Assistant Secretary for Planning and Evaluation
- Office on Women's Health

Other federal organizations:

- U.S. Department of Agriculture:
  - Agricultural Research Service
  - Economic Research Service
- U.S. Department of Housing and Urban Development
- U.S. Environmental Protection Agency:
  - Office of Pesticide Programs
  - Office of Research and Development

DHANES also wishes to thank the many state and local health departments and community leaders for their expertise in determining locations for NHANES mobile examination centers and providing letters of endorsement that helped us establish credibility with those selected for the survey. We thank Westat, which performed the field data collection. We thank the contract diagnostic centers and laboratories and their staffs for their dedication to the project. Finally, we thank those who took part in the survey as participants. Their personal contribution of time and effort will help improve the health and nutritional status of all Americans.

Abstract

Background

Starting in 1999, the National Health and Nutrition Examination Survey (NHANES) became a continuous, ongoing annual survey of the noninstitutionalized civilian resident population of the United States. A continuous survey allowed content to change to meet emerging needs.

Objective

This report describes how NHANES for 1999–2010 was designed and implemented. NHANES is a national survey designed to provide national estimates on various health-related topics.

Methods

The survey used in-person face-to-face interviews and physical examinations for data collection. Approximately 5,000 people per year participated in NHANES. The 5,000 people surveyed each year are representative of the entire U.S. population.

Keywords: survey design • mobile examination center • field operations • NHANES

National Health and Nutrition Examination Survey: Plan and Operations, 1999–2010

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Introduction

This National Health and Nutrition Examination Survey (NHANES) 1999–2010 plan and operations report provides detailed information on how the Division of Health and Nutrition Examination Surveys (DHANES), within the Centers for Disease Control and Prevention's (CDC) National Center for Health Statistics (NCHS), planned, implemented, and conducted the 1999–2010 NHANES. Those who use the NHANES public-release data sets should find this report helpful in using the data sets properly. This report is structured by the order in which NHANES is planned and implemented. The first four sections describe the survey history and planning. The remaining sections describe the survey operations, data collection, and information technology. Additional information is found in the Appendix, which presents a glossary of terms used in this report.

History of NHANES

The National Health Survey Act of 1956 provided for a continuing survey and special studies " . . . to secure accurate and current statistical information on the amount, distribution, and effects of illness and disability in the United States . . . " and to provide methods and processes to secure this statistical information (1). In 1960, the U.S. Department of Health and Human Services (HHS) merged the National Office of Vital Statistics and the National Health Survey program to form NCHS (Appendix). NCHS has been located in a number of organizations within HHS. Since 1987, NCHS has been part of CDC (2). To achieve its mission of providing information to guide actions and policies that improve health, NCHS conducts a number of major data collection programs, including NHANES.

NHANES is unique in that it combines personal interviews with standardized physical examinations and laboratory tests. The interviews are conducted in the home and at a mobile examination center (MEC). The physical examinations and laboratory tests are conducted in the MEC. The purpose of NHANES is to collect data about the health, nutritional status, and health behaviors of the noninstitutionalized civilian resident population of the United States. From its establishment in 1959, the survey has been conducted in three separate eras: the National Health Examination Survey (NHES) era (1959–1970), the periodic and population-specific NHANES era (1971–1994), and the continuous NHANES era from 1999 forward (1).

In 1959, the first National Health Examination Survey (NHES I) was conducted and focused on selected chronic diseases, such as cardiovascular disease and diabetes (3). NHES I concluded in 1962. The second NHES (NHES II) was conducted during 1963–1965 and focused on the growth and development of children aged 6–11 years (4). The third NHES (NHES III)

Table A. National Health Examination Surveys, 1959–1970

Survey	Years conducted	Number of participants	Participant age (years)	Focus
NHES I	1959–1962	7,710 interviewed 6,672 examined	18–79	Chronic disease
NHES II	1963–1965	7,417 interviewed[1] 7,119 examined	6–11	Growth and development – children
NHES III	1966–1970	7,514 interviewed 6,768 examined	12–17	Growth and development – adolescents

[1]Represents those children whose parents or guardians responded to a telephone call from an interviewer who collected information on the ages of all children within that household.

NOTE: NHES is National Health Examination Survey.

Table B. Periodic and population-specific National Health and Nutrition Examination Surveys, 1971–1994

Survey	Years conducted	Number of participants	Participant age	Focus
NHANES I	1971–1974	28,043 interviewed 20,749 examined	1–74 years	Nutrition and health
NHANES II	1976–1980	25,286 interviewed 20,322 examined	6 months–74 years	Nutrition and health
HHANES	1982–1984	13,689 interviewed 11,653 examined[1]	6 months–74 years	Hispanic nutrition and health
NHANES III	1988–1994	33,994 interviewed 30,818 examined	2 months and over	Subpopulation nutrition and health

[1]Of those examined, participants' ethnicities were 7,462 Mexican-American, 1,357 Cuban-American, and 2,834 Puerto Rican persons.

NOTES: NHANES is National Health and Nutrition Examination Survey. HHANES is Hispanic Health and Nutrition Examination Survey.

was conducted during 1966–1970 and focused on the growth and development of adolescents aged 12–17 (5). Because the same basic survey design was used, nearly one-third of the children examined in NHES II were examined again in NHES III as adolescents. Table A provides further information on NHES I, II, and III.

In 1971, a nutrition component was added to the survey, and the survey name changed to the National Health and Nutrition Examination Survey. This began the periodic and population-specific era (1971–1994), during which four surveys were conducted. The first NHANES (NHANES I) was conducted for 1971–1974 (augmented for 1974–1975 by an additional national sample) and focused on the nutrition and health of participants aged 1–74. The Augmentation Survey included adults aged 25–74 and did not oversample any populations. For more information on the augmentation, see "Plan and Operation of the HANES I Augmentation Survey of Adults 25–74 Years: United States, 1974–1975" (6) at http://www.cdc.gov/nchs/data/series/sr_01/sr01_014.pdf.

The second NHANES (NHANES II) was conducted during 1976–1980 and focused on nutrition and health, but the age of eligible participants started at 6 months. The maximum age of sampled participants remained 74 years.

For 1982–1984, NHANES shifted to a population-specific survey. The Hispanic Health and Nutrition Examination Survey (HHANES) was conducted on the three largest Hispanic subgroups in the United States at the time: Mexican-American, Cuban-American, and Puerto Rican persons. HHANES aimed to produce estimates of nutrition and health status for these subgroups. HHANES was similar in design to NHANES II in that the ages of sampled participants were 6 months through 74 years.

In 1988–1994, a third NHANES (NHANES III) was conducted in which several population groups were oversampled, including children aged 2 months to 5 years, persons over age 60, Mexican-American persons, and non-Mexican-American black persons. Additionally, emphasis was placed on the effect of the environment on overall health, and, therefore, data were collected on environmental exposures (e.g., carbon monoxide, pesticides, and others). Table B provides further information on NHANES I, II, III, and HHANES.

Starting in 1999, NHANES became a continuous, ongoing annual survey of the noninstitutionalized civilian resident population of the United States. NHANES excluded all persons in supervised care or custody in institutional settings, all active-duty military personnel and active-duty family members living overseas, and any other U.S. citizens residing outside of the 50 states and the District of Columbia. Noninstitutional group quarters were included; for more information on group quarters, see Appendix. A continuous survey allowed content to change to meet emerging needs. The goals of the continuous NHANES were:

- To provide prevalence data on selected diseases and risk factors for the U.S. population.
- To monitor trends in selected diseases, behaviors, and environmental exposures.
- To explore emerging public health needs.

- To maintain a national probability sample of baseline information on health and nutritional status.

The design of the sample changed periodically as well. In the continuous NHANES, the participant age range was expanded to all ages. Data were released to the public in 2-year cycles. The sample size in a 12-month period was approximately 5,000 individuals from 15 different county locations selected from a sampling frame that included all 50 states and the District of Columbia. Oversampled subgroups for 1999–2006 included non-Hispanic black persons, Mexican-American persons, low-income white persons (beginning in 2000), adolescents aged 12–19, and persons aged 70 and over. During 1999–2006, a supplemental sample of pregnant women was included. Oversampled subgroups for 2007–2010 included all Hispanic persons, non-Hispanic black persons, low-income white persons, and persons aged 80 and over. Table C provides information on the number of participants interviewed and examined during the continuous NHANES. This report hereafter addresses only the continuous NHANES era for 1999–2010. For more information on the history of NHANES, see "The NHANES Story" at http://www.cdc.gov/nchs/video/nhanes50th_ppf/intro/ppf_intro.htm.

Table C. National Health and Nutrition Examination Survey, 1999–2010

NHANES 2-year cycle	Number of participants
1999–2000	9,965 interviewed
	9,282 examined
2001–2002	11,039 interviewed
	10,477 examined
2003–2004	10,122 interviewed
	9,643 examined
2005–2006	10,348 interviewed
	9,950 examined
2007–2008	10,149 interviewed
	9,762 examined
2009–2010	10,537 interviewed
	10,253 examined

NOTE: NHANES is National Health and Nutrition Examination Survey.

Survey Planning and Sample Design

A major advantage of continuous NHANES data collection is the ability to address emerging public health issues and provide objective data on health conditions for the U.S. population in a timely manner. For 1999–2010, NHANES content was modified biannually as components were added, changed, or removed. Changes were also made to target new age groups, modify data collection methods, and update technologies. Prior to biannual changes, NHANES conducted pilot tests of new or revised survey material as part of the ongoing data collection.

Planning Process

The NHANES program solicited new content proposals in the mid-1990s for the launch of the continuous survey, and biannually after the survey began. Broad oversight for planning and content was provided through consultation with stakeholders, collaborating agencies, and other research partners. These parties, as well as those on an NHANES mailing list, were informed every 2 years of deadlines and guidelines for proposals for the upcoming 2-year survey cycle. This information was also posted on the NHANES website. The research proposal solicitation process required that all persons interested in adding content to NHANES submit a letter of intent and a full proposal.

Letters of intent were reviewed by the DHANES Planning Branch to determine if the proposed content was safe, feasible, and of sufficient public health significance to include in NHANES. If the letter of intent was acceptable, the proposer was asked to submit a full research proposal. A full proposal included details about the public health significance and data collection methodology. Proposals were evaluated based on public health significance; appropriateness and feasibility given the NHANES design and sample; ethical issues; participant burden; and financial considerations. If accepted, the protocol was fully developed and prepared for field-testing prior to use in NHANES. If required, cognitive testing and translation activities were completed prior to field implementation. Similarly, laboratory methods were tested and deemed reliable and valid prior to their inclusion in NHANES. Accepted proposals for new content and content modifications were summarized in an information clearance request (ICR) submitted to the Office of Management and Budget (OMB). An ICR was submitted to OMB every 2 years or when amendments were necessary. OMB approved and provided clearance for NHANES to begin data collection. All protocols were also reviewed and approved by the NCHS Research Ethics Review Board (ERB) prior to implementation in NHANES; for more information on ERB, see the "Ethical, Privacy, and Confidentiality Considerations" section.

Sample Design

NHANES was designed to assess the health and nutritional status of the civilian noninstitutionalized U.S. population. NHANES data were not obtained using a simple random sample. Rather, a complex, multistage probability sampling design was used to select a sample representative of the civilian noninstitutionalized household population of the United States.

Sample selection for NHANES followed these stages, in order:

1. Selection of primary sampling units (PSUs), which are counties or small groups of contiguous counties.
2. Selection of segments within PSUs that constitute a block or group of blocks containing a cluster of households.
3. Selection of specific households within segments.
4. Selection of individuals within a household; see the "Household Interview" section for more information on sample person selection.

About 12,000 persons per 2-year cycle were asked to participate in

NHANES. Response rates varied by year, but an average of 10,500 persons out of the initial 12,000 agreed to complete a household interview. Of these, about 10,000 then participated in data collection at the MEC. These persons are located in counties across the country. About 30 selected counties were visited during a 2-year survey cycle out of approximately 3,000 counties in the United States. Each of the four regions of the United States and metropolitan and nonmetropolitan areas are represented each year.

Demographic Domains and Oversampling

For certain subgroups of particular public health interest, the proportion of individuals in the NHANES sample was larger than the corresponding proportion in the U.S. population. This oversampling increased the reliability and precision of estimates of health status indicators for these population subgroups. Weighting schemes allowed estimates from these subgroups to be combined to obtain a national estimate that reflected the relative proportions of these groups in the population as a whole. Oversampled subgroups in the survey were:

For 1999–2006:

- Non-Hispanic black persons
- Mexican-American persons
- Low-income white persons (beginning in 2000)
- Persons aged 70 and over
- Adolescents aged 12–19

For 2007–2010:

- Non-Hispanic black persons
- Hispanic persons
- Low-income white persons
- Persons aged 80 and over

During 1999–2006, a supplemental sample of pregnant women was also included.

Sample Weights

The weighting of sample data permitted analysts to produce estimates of statistics they would have obtained if the entire sampling frame had been surveyed. A sample weight was assigned to each sample person. Sample weights were considered measures of the number of people represented by the particular sample person. When a sample was weighted in NHANES, it was representative of the U.S. civilian noninstitutionalized population. Weighting took into account several features of the survey: the differential probabilities of selection for the individual domains; nonresponse to survey instruments; and differences between the final sample and the total population. Weights were adjusted for nonresponse to the in-home interview when creating the interview weights, and further adjusted for nonresponse to the MEC examination when creating the examination weights.

Each single year and any combination of consecutive years comprised a nationally representative sample of the population. However, because NHANES went to only a small number of PSUs each year, estimates for single-year data were relatively unstable (large variance estimates). In addition, releasing only 1 year of data increased the possibility of disclosure of a sample person's identity. As a result, data were publicly released in 2-year cycles. In general, any 2-year data cycle in NHANES can be combined with adjacent 2-year data cycles to create analytic data files based on 4 or more years of data, to produce estimates with greater precision and smaller sampling error. For further details on the NHANES sample design, see the National Health and Nutrition Examination Survey reports on sample design for 1999–2006 (7) and 2007–2010 (8).

Ethical, Privacy, and Confidentiality Considerations

The NHANES protocol was developed and reviewed to be in compliance with the HHS Policy for Protection of Human Research Subjects (45 CFR part 46), available from http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.html. It was approved by the NCHS Research ERB and underwent annual review. Three federal laws protected all data:

- Privacy Act of 1974 (5 U.S.C. 552a)
- Section 308(d) of the Public Health Service Act (42 U.S.C. 242m)
- Confidential Information Protection and Statistical Efficiency Act (CIPSEA) (PL107–347)

The Public Health Service Act stipulates that " . . . no information may be used for any purpose other than the purpose for which it was supplied unless . . . [a] person consented to its use for such other purpose, and further that it cannot be released or published in a form that the particular . . . person supplying the information or described in it is identifiable unless such . . . person has consented . . . " (9). These strict prohibitions, forbidding even unintentional unauthorized disclosures, guided the behavior of all NCHS staff and all contractor staff.

To prevent disclosing information to unauthorized persons, all government and contractor staff working on NHANES read and signed a nondisclosure affidavit, and viewed the "NCHS Confidentiality Practices for Federal Employees and Contractors" video. Each person working on the study was aware of his or her responsibility to safeguard the rights of all NHANES participants. Employees were instructed never to divulge names or any other information about sample participants (those sample persons who take part in the survey). They refrained from any discussions about sample participants, inside or outside of the MEC, which could be overheard by people not on the NHANES staff. Information kept on interviewer tablets and MEC computers was secured through password protection, encryption, and other information technology (IT) security processes; for more information about data protection and IT, see the "Data Processing and Information Technology" section.

Ethics Review Board

The NCHS Research ERB protects the rights and welfare of people enrolled

in NHANES. In accordance with federal regulations (45 CFR 46.111), ERB reviewed and approved NHANES protocols, including ongoing changes to the protocol through the amendment process. This process ensured the ethical treatment of participants, including vulnerable populations (e.g., children, pregnant women, and the elderly). For survey years 1999–2010, ERB reviewed and approved the NHANES protocol annually. Table D provides information on the protocol numbers.

Informed Consent

Sample persons were informed of the survey process and their rights as a participant by interviewers and by written materials, such as brochures and flyers. After the sample person understood the entire NHANES process, he or she had the opportunity to consent or assent to participate. Participation was voluntary. Documented signed consent was obtained from sample persons who had reached the age of maturity in their state (usually age 18 and over). A parent or guardian gave permission for minors to participate. In addition, children aged 7–17 provided documented assent prior to participating. An emancipated minor did not need parental permission. For cognitively impaired persons, consent was obtained from guardians, parents, or representatives who had the legal right to consent to medical care on behalf of the impaired person.

NHANES participation has two phases: the home interview and the health examination. Signed informed consent was obtained from every sample person for both phases during the home interview. Interpreters were hired as necessary to help sample persons who did not speak or read English or Spanish.

The consent forms were presented to the sample person in a specific order to ensure all necessary signatures were captured (Table E). The consents are described in detail below; for more information on consents, see the NHANES website at http://www.cdc.gov/nchs/nhanes/nhanes2009-2010/current_nhanes_09_10.htm.

Home interview consent form

Sample persons aged 12 and over, and parents or guardians of sample participants aged 18 and under, read and signed the Home Interview Consent form. If a sample person was unable to read the form, the interviewer read the entire document to the sample person in front of a witness; then the sample person signed the form and completed the in-home personal interview. If the sample person was unable to sign the form, a witness signed the form to indicate that the sample person gave informed consent.

Examination consent brochure and form

An examination consent form was signed by sample persons aged 18 and over. This consent was also signed by sample persons aged 12 and over, and by parents or guardians of sample persons aged 18 and under. Sample persons (or guardian) aged 7–11 signed separate forms; see the "Child examination assent brochure and form" section.

Before scheduling an appointment in the MEC, the interviewer provided the examination consent brochure and form, a health measurements list, and the consent form to the sample person. The "Examination Consent Brochure" addressed the general procedures of the examination components and goals of the survey, discussed data uses and confidentiality, and explained the voluntary nature of participation and the rights of sample persons. The health measurements list showed the components of the examination, including laboratory assessments. As with the Home Interview Consent form, this material was introduced and provided to the sample person so he or she could read the information, ask questions, and sign the consent form. The sample person was given the examination brochure and a copy of the signed consent form to keep.

Table D. Protocols: National Health and Nutrition Examination Survey, 1999–2010

Survey and years conducted	NCHS Ethics Review Board protocol number
NHANES 2005–2010	#2005–2006
NHANES 1999–2004	#98–12

NOTES: NHANES is National Health and Nutrition Examination Survey. NCHS is National Center for Health Statistics.

Table E. Summary of National Health and Nutrition Examination Survey forms used to complete consent process

Sample participant ages	Home interview consent	Examination consent or assent	Examination child assent	Non-DNA specimen storage consent or assent	DNA specimen storage consent or assent
0–11 months	Signed by parent	Signed by parent	. . .	. . .	. . .
1–6 years	Signed by parent	Signed by parent	. . .	Signed by parent	. . .
7–11 years	Signed by parent	Signed by parent	Signed by participant	Signed by parent and participant	. . .
12–17 years	Signed by parent and participant (ages 16 and 17 only)	Signed by parent and participant	. . .	Signed by parent and participant	. . .
18 years and over	Signed by participant	Signed by participant	. . .	Signed by participant	Signed by participant

. . . Category not applicable.

Child examination assent brochure and form

In addition to parents' or guardians' signatures on the examination consent form, minors aged 7–11 agreed to participate in the examination. An assent brochure, which was specifically designed to explain participation to the child and written at a fourth-grade reading level, was presented or read aloud. Questions were answered, and then the child assented by signing his or her own name. The minor was given the brochure and a copy of the signature form to keep.

Consents for specimen storage

NHANES sample persons were asked to consent to have their blood, urine, and saliva specimens stored for future studies. The specimen consent form highlighted the need for stored specimens to help find new ways to prevent, treat, and cure many diseases. The form was designed to answer commonly asked questions posed by sample participants. In 2007, the form was split into two separate specimen storage consents: one for future genetic studies, and one for future nongenetic studies.

The ''Consent/Assent and Parental Permission for Specimen Storage and Continuing Studies'' form was used for sample persons aged 7 and over. The sample person was instructed to read the consent, mark a checkbox if he or she also consented to having his or her blood and urine kept for future health studies, and sign the consent. The parent or guardian of a child under age 18 also signed to provide parental permission for specimen storage. The ''Consent and Parental Permission for Specimen Storage and Continuing Studies Using DNA'' form was used for sample persons aged 20 and over. The sample person was instructed to read the consent, mark a checkbox if he or she consented to have his or her blood kept for future studies that utilized genes to understand genetic links to medical conditions, and sign the consent.

Field Operations

NHANES was operationally designed to achieve high response rates and high-quality data. Field operations activities included creating schedules for site locations, making arrangements to prepare for the arrival of MECs, staffing and training, opening the field office, setting up the MEC, creating an appointment schedule for the MEC, opening the MEC, and closing the MEC. This section provides detailed information on NHANES field operations.

Schedules

Scheduling site locations was a complex task that included multiple considerations. Developing the survey operations schedule involved the sequencing of the annual PSUs (also referred to as site locations) and determining the dates during which individual PSUs would open and close. In any annual NHANES cycle, 15 PSUs or site locations were selected prior to beginning field operations. The calendar dates for work in the PSUs were determined by several factors:

- Location of the last site in the previous year
- Distance between site locations
- Seasonal weather patterns
- Expected number of sample participants in the site location
- Expected number of households to be screened (Appendix) in the site location
- Other factors specific to sites, such as difficulties with MEC transit

After the PSU order was determined, a detailed individualized schedule for each site location was developed. This schedule included dates for travel, opening the field office and MEC, conducting interviews and examinations, and closing the field office and MEC. Each site location was open for approximately 9 weeks.

Advance Arrangements

Advance arrangements were made to prepare for the arrival of the survey. Activities included notifying the community, obtaining MEC site locations, and performing media outreach.

Community notification

Based on U.S. Census Bureau data, a demographic profile of each site location was created. Listing information was assessed, and NHANES staff identified all county officials at a site location who needed to be notified of the arrival of NHANES. After an initial in-person meeting with the local public health director, a notification letter was sent to county health officials, the area agency on aging, local law enforcement, county executives, mayors, fire departments, and school superintendents to inform them of the arrival of NHANES. The letter included the expected number of participants to be examined and offered contact information for any questions. County health officials, the area agency on aging, mayors, and others were asked to provide endorsements of NHANES to be used by interviewers, if needed. The health department was also asked to provide a list of medical and dental clinics for possible referrals.

Location for MEC

Selecting a location for the MEC was a critical part of the survey because the location could greatly affect the survey response rate. A location that was familiar to residents with easy access from the sampled segments was ideal. Plumbing, electrical, sewer, and telecommunications hookup capability also were required.

Media outreach

Prior to household interviewing at a site location, NHANES compiled a list of local newspapers and media outlets. A press kit, which included the press release, the NHANES overview brochure, and other NHANES materials, was sent to these media outlets and newspapers. The goal was for an article about NHANES to be published in one or more local newspapers before data collection began. In addition, an open house was held during the morning of

''dry run'' day; see the ''Setup and dry run'' section. All local media were invited.

Staffing and Training

Staff were selected based on previous experience, academic training, knowledge, skills, and abilities. Many positions required that the staff speak both English and Spanish. Bilingual staff were hired to address the language needs of Spanish-speaking sample participants. Verbal scripts in the MEC were translated into Spanish to assist examiners and interpreters in explaining testing procedures and to ensure a standardized protocol. Interpreters were hired to assist interviewers and examiners when necessary for any language. Sample participants who did not speak Spanish or English were excluded from examination components that contain sensitive information, such as the MEC interview and sexually transmitted disease (STD) testing.

A background check and a security clearance were completed upon hiring each staff member. Field office staff (Appendix), including the interviewers, and MEC staff traveled with the survey and worked 48 weeks of the year. The field office staff consisted of a study manager, field manager, office manager, and assistant office manager at each field office. The MEC staff comprised two examination teams. Each team included the following staff:

- A MEC manager who supervised the examination staff and oversaw examination flow.
- A coordinator who directed sample participants through the MEC, managed appointments, and verified completion of MEC examinations.
- A physician who conducted medical examinations, evaluated for referrals, and served as a safety officer.
- Two health interviewers who administered questionnaires for physical and mental health.
- Two dietary interviewers who administered the 24-hour dietary recall.
- Four health technologists who collected medical examination data such as body measurements, vision tests, respiratory health examinations, bone density scans, hearing tests, and glucose solution for the glucose tolerance test.
- Three medical technologists who processed biological specimens, conducted the complete blood count and pregnancy tests, and prepared specimens for shipment to laboratories across the United States.
- A phlebotomist, who conducted the phlebotomy interview, administered the fasting questionnaire, drew blood for laboratory tests, administered the glucose solution, and served as a backup examiner for other components.

In addition to those listed, a dental hygienist performed the oral health component for 2009–2010. A dentist (or dental examination team made up of a dentist and an oral health recorder) performed the oral health component for 1999–2004. Health technologists were used in the interim.

Annual retraining was conducted for all staff (field office, interviewer, and MEC) to make certain that they were updated on changes to components and protocols and procedures, and that they were introduced to new content. Information on initial training for the MEC staff and field office staff follows.

Field office staff training

The field office staff attended a 10-day interviewer-training course so that they were proficient in the mechanics of sample participant recruitment and household interviewing. The field office staff spent 4 to 5 days learning general field-office procedures and specific details about their roles. The training also educated the staff on how to perform manual opening and closing of site locations, manage case workflow using an automated system, monitor site production using daily reports, and comply with procedures for handling sample participant queries, documentation, and refusals.

Interviewer training

Training was designed to make new interviewers proficient at making contact with residents of sampled households, using screening techniques properly, and obtaining consent to participate from selected individuals. The interviewer training program consisted of a 10-day course and covered:

- The purpose and goals of NHANES and how to properly encourage participation.
- The adherence to confidentiality and high performance standards required for data collection.
- The administration and navigation of the interview, which includes three computerized household questionnaires.
- The case workflow and appropriate use of survey materials.
- The administrative procedures for personnel working in the field environment.

New interviewers shadowed seasoned interviewers for a period of time prior to interviewing on their own.

MEC staff training

The MEC staff was trained according to their specific jobs. Each examination component in the MEC involved multiple roles and responsibilities; therefore, each MEC staff member was trained by a subject matter expert. MEC staff training was rigorous and done through procedure demonstrations and practice. Training included:

- Learning about the objectives and goals of the examination component.
- Demonstrations of protocols and procedures.
- Practicing the procedures.
- Learning about quality control and quality assurance.
- Learning how to maintain and perform calibrations on the equipment.
- Learning the MEC opening and closing protocols.
- Learning to maintain the inventory for supplies.

Site visits by DHANES staff were done throughout the year to observe MEC staff as part of quality assurance.

Opening the Field Office

The NHANES field office was located in the PSU. The field office supported activities regarding household interviewing and MEC data collection. Activities included coordinating procedures (e.g., monitoring site production), managing household case assignments and refusal conversion efforts, scheduling examination appointments, and handling staffing issues.

Opening the field office required hiring a local receptionist; preparing case assignments for field interviews; preparing a map and directions to the MEC for sample participants; receiving survey supplies; setting up computer equipment, telephones, and common areas; and becoming familiar with the sample area (Appendix). The field office opened 1 week before interviewing began and remained open until the MEC examinations ended.

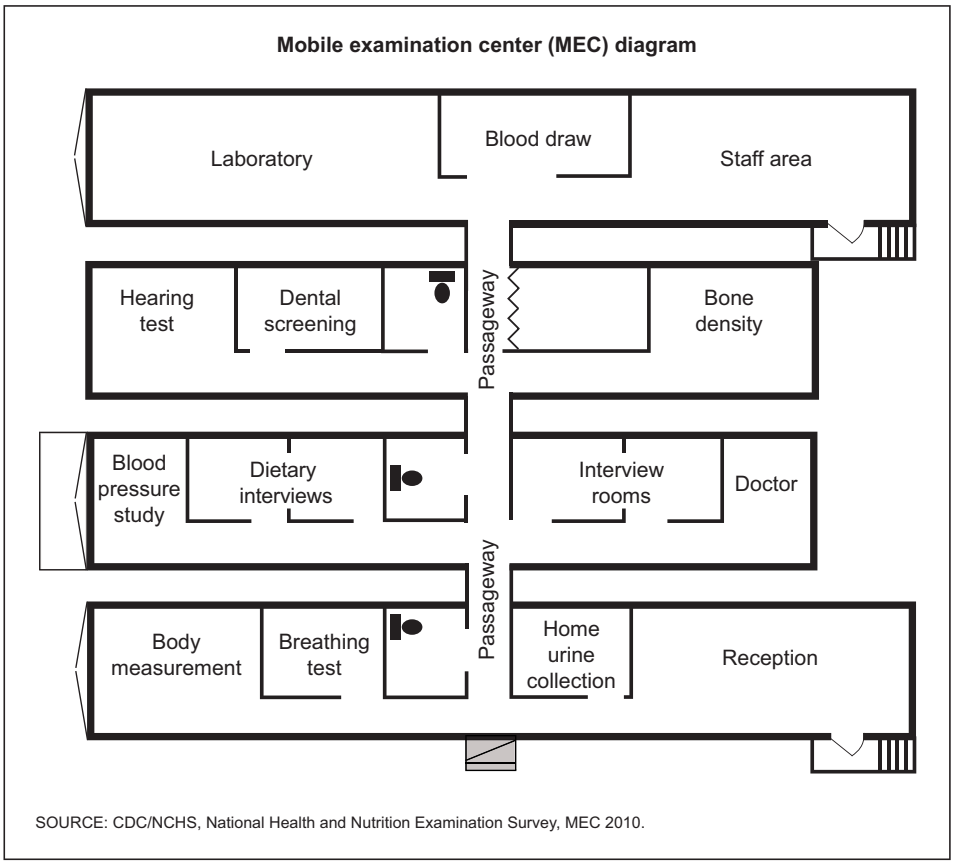

Figure. Floor plan of a mobile examination center used in the National Health and Nutrition Examination Survey, 2010

Mobile Examination Center

Trailer design

NHANES was designed to collect data by direct physical examinations, clinical laboratory tests, and related measurement procedures. Data were collected in a standardized environment to minimize site-specific error. Each MEC was a group of four trailers set up side by side and connected by enclosed passageways (Figure). NHANES 1999–2010 included three MECs, two of which were actively used for data collection while the third traveled to a new location. The layout was identical in all three MECs to avoid bias in data collection between MECs. A MEC tour is available at http://www.cdc.gov/nchs/nhanes/mec_tour/mectour.htm.

All supplies, tools, and materials introduced to the MEC environment were evaluated before they were used. Each MEC had a reception area, nine examination rooms, four interview rooms, a laboratory, three restrooms, and a staff lounge. Specific customizations (e.g., a soundproof booth for audiometry) were featured in each MEC.

Examination rooms

The nine MEC examination rooms varied in size depending on the requirements of the component. For example, a larger room was designated for the dual-energy X-ray absorptiometry, or DXA, instrument. MEC rooms were modified as necessary to accommodate new components.

Safety and special accommodations

The safety of the MEC staff and sample participants was an NHANES priority. Special accommodations in the MEC included a handicapped restroom with handrails, a hydraulic wheelchair lift, and a baby changing table. The MEC was a nonsmoking facility. Fire extinguishers were placed throughout the MEC, and exit doors were highlighted in every trailer. The following was kept in the physician's examination room for emergency response:

- Emergency medical kit
- Automated external defibrillator
- Two portable oxygen tanks
- Portable blood pressure equipment

Pocket masks for cardiopulmonary resuscitation, or CPR, were located throughout the MEC, and examination staff maintained current certification in the American Heart Association's Basic Life Support for Healthcare Providers. Mock emergency drills were held periodically in the MEC to permit practice of the emergency procedures. Telephone numbers for local fire and rescue squads were posted in the MEC, and "911" was used to initiate the local emergency response system.

Setup and dry run

Prior to conducting examinations in the MEC, the trailers were set up with the proper equipment and supplies needed for each component. Once the MEC was set up, the equipment was calibrated and tested to ensure proper functioning. NHANES held a ''dry-run'' day to test the equipment. The dry run usually occurred the day before examinations began and allowed for practice examination sessions to be administered for each component using volunteer examinees. In addition, blood and urine were collected and sent to laboratories. Randomly selected dry-run specimens were also sent with alternate identification numbers for blind duplicate quality control.

Appointment schedule

An appointment for an examination in the MEC was scheduled for each sample participant when the interviewer was in the participant's home. That interviewer called the field office to set up the appointment. Each sample participant was randomly assigned a morning appointment or an afternoon or evening appointment. If a sample participant was unable to attend his or her assigned session, he or she made an alternative appointment. An individual examination could last between 40 minutes and 4 hours, depending on the age and gender of the sample participant.

Each examination session was 4 hours and could include 10–12 sample participants. If a sample participant was assigned to a morning appointment, he or she was asked to fast prior to the appointment. The average time between interview and examination was 2 weeks. A reminder letter was mailed to the participant 1 week before the scheduled exam. The reminder letter included the date and time of the appointment, transportation information, directions to the MEC, appropriate fasting instructions, and the remuneration (cash payment) amount. Forty-eight hours before a MEC examination appointment, the field office staff called the participant to remind him or her of the upcoming appointment. Instructions related to the MEC appointment were reviewed. If the participant did not have a telephone, the interviewer visited the home to provide an in-person reminder.

Opening and closing

Once examinations began, the MEC was open 5 days a week and operated on a rotating schedule to allow sample participants to choose from a variety of appointments. The MEC was closed 2 days a week, and these days changed from week to week. The MEC typically remained open for 6 weeks. Once examinations were concluded in a specific location, the MEC closed and went through ''teardown.'' This involved checking the inventory, repacking supplies, securing equipment, and preparing for travel. The MEC then traveled to the next assigned location.

Remuneration

NHANES had other approaches for gaining participation, which included remuneration and a transportation allowance. NHANES materials were available in both English and Spanish. Sample participants were remunerated at the conclusion of their examination appointment. The amount of the remuneration depended on the sample participant's age and the session attended. Table F shows the remuneration amounts by survey year, participant circumstance, and session.

Each sample participant's session was randomly assigned for morning, afternoon, or evening, as stated above. Sample participants were fully compensated for coming to their assigned session, but were not fully compensated if they attended a nonassigned session. Remuneration was also given to a parent or guardian if his or her child was selected to participate but he or she was not.

Sample participants also received a transportation allowance for driving to the MEC. If a sample participant did not drive, a taxi was provided at no cost. Table G has information on the transportation allowance provided based on survey year, mileage to the MEC location, and whether the location was urban or rural. For information on additional remuneration for other components, see the ''Post-MEC Data Collection'' section.

Household Interview

The NHANES household interview consisted of four parts: screener questionnaire, relationship questionnaire, sample participant questionnaire, and family questionnaire. Trained household interviewers administered the questionnaires in the sample participant's home. In very rare instances, the household interview took place outside of the home (i.e., in the field office or a public location). The interview was conducted using a computer-assisted personal interview system and Blaise software. Interpreters

Table F. Remuneration amount per participant: National Health and Nutrition Examination Survey, 1999–2010

Survey years	Participant circumstance	Attending assigned session	Attending alternative session
1999–2000	Aged 12 and over	$70	$40
	Person with diabetes on insulin	40	40
	Under age 12	30	30
2001–2004	Aged 16 and over	100	70
	Person with diabetes on insulin	70	70
	Aged 12–15	50	30
	Under age 12	30	30
2005–2008	Aged 16 and over	100	70
	Aged 12–15	50	30
	Under age 12	30	30
2009–2010	Aged 16 and over	125	90
	Aged 12–15	90	40
	Under age 12	40	40

Table G. Transportation allowance: National Health and Nutrition Examination Survey, 1999–2010

Survey years	Mileage to MEC[1] location	Urban	Rural
1999–2006	Less than 16 miles	$25	$20
	16–30 miles	35	30
	31–59 miles	45	40
	More than 60 miles	55	50
2007–2010	Less than 16 miles	30	25
	16–30 miles	45	40
	31–59 miles	55	50
	More than 60 miles	70	65

[1]Mobile examination center.

for the household interviews were used for non-English/non-Spanish participants. Table H provides details on each section of the household interview. Specific household interview questions may have changed during the 2-year survey cycles, but the most recent major topics are included in Table H; see respective data documentation available from the NHANES website: http://www.cdc.gov/nchs/nhanes/nhanes_questionnaires.htm. Some household interview sections were related to examination components, laboratory tests, or the MEC interview; see the NHANES Survey Content Brochure at http://www.cdc.gov/nchs/data/nhanes/survey_content_99_12.pdf for more information.

Screener

Prior to screening, households were sent a letter introducing NHANES and providing information that the household address had been selected as part of the NHANES sample. Each screener case assignment consisted of a sampled household address and a randomly assigned, computer-generated message explaining what sex, age, and race or ethnicity was necessary for the specific address. The field interviewer did not know in advance if anyone in the household would be selected to be a participant. In most cases, the screener was conducted on the doorstep.

The field interviewer arrived at the home, showed an official identification badge, and briefly explained the survey's purpose. As a reminder, the field interviewer showed the notification letter stating that the household address was part of the NHANES sample. The field interviewer conducted the screener questionnaire to enumerate the household and to determine eligibility to participate further in NHANES. The screener gathered information regarding each resident's age, gender, race and ethnicity, and income. Based on the questionnaire information collected, a computer algorithm randomly selected one, some, all, or none of the household residents to participate. If no one from the house was selected, it was because no household member met the criteria selected by the algorithm. If eligible individuals were identified, the interviewer proceeded with the relationship questionnaire.

Certain circumstances prevented an interviewer from completing a screener questionnaire, such as:

- A vacant unit or residence.
- An address not qualifying as a dwelling unit.
- A nonexistent sampled dwelling unit.
- A household resident refusing participation.

Relationship Questionnaire

If at least one household member was eligible to participate, the relationship questionnaire was administered after the screener. The intent of the relationship questionnaire was to divide all household residents into individual family units, to determine how many family units were in each household. The U.S. Census Bureau's Current Population Survey (CPS) family definitions were used, to ensure that the appropriate number of family questionnaires was created by the software administered by the field interviewer. All eligible screener and relationship questionnaire respondents were adult household members at least age 18 or an emancipated minor (criteria determined by state law).

Sample Person Questionnaire

Prior to conducting the sample participant or family questionnaires, sample participants (aged 18 and over) were asked to sign a home interview consent form, agreeing to participate in the household interview portion of the survey; see the "Ethical, Privacy, and Confidentiality Considerations" section for informed consent procedures. Sample participants aged 16 and 17 were asked to sign a document of assent. Parents or guardians of participants under age 18 gave parental permission. Eligible sample participants within a household were asked to complete the sample participant questionnaire. Field interviewers were trained to conduct the sample participant questionnaire prior to the family questionnaire, because the family questionnaire has content that is more sensitive. The sample participant questionnaire collected information on the sample participant's demographic, socioeconomic, dietary, and health-related history. The sample participant questionnaire was administered to all eligible participants or their proxies; however, each questionnaire section administered depended on the sample participant's age (Table H).

Family Questionnaire

The family questionnaire was completed for every family unit (e.g., a married couple, a couple living as married, and others) sampled within the household. CPS family definitions were used. More than one "family" applied to households where unrelated persons were residing (e.g., roommates, lodgers, guests without permanent housing, and others). The family questionnaire asked questions about each sample participant as well as the nonsampled head of the family. The questionnaire included sections related to education level, ethnicity, occupation, health insurance coverage, and family income. Information on general household

characteristics was also collected. For more information on the screener, relationship questionnaire, sample participant questionnaire, and family questionnaire, see the NHANES website at http://www.cdc.gov/nchs/nhanes/nhanes2009-2010/questexam09_10.htm.

Household Water Collection Component

At the conclusion of the household interview, the field interviewer collected a water sample in households with a sample participant aged 12 or over. The water collection component consisted of the field interviewer collecting a single tap water sample from the bathtub the sample participant used, or from any nonaerated spigot. The water sample was tested for volatile organic compounds (VOCs) and perchlorates only in a subsample of households. The household water sample test results were then linked to the appropriate sample participants who were part of the VOC/perchlorate water subsample; see the ''MEC Biospecimen Collection'' section for more information on laboratory tests on water.

MEC Examinations and Interviews

NHANES examinations took place in the MEC. The controlled environment of the MEC allowed physical measurements to be done under identical conditions at each survey location. This section addresses examination components and interviews conducted in the MEC for 1999–2010. Eligibility for examination components was determined by the participant's age and gender. Some MEC examinations are related to a household interview section or laboratory test. Procedures and protocols for each component can be found in each component's procedures manual on the NHANES website at http://www.cdc.gov/nchs/nhanes/nhanes_questionnaires.htm.

MEC Examination Components

Table J summarizes NHANES MEC examination components for 1999–2010.

Audiometry

The audiometry component obtained data on hearing impairment, identified risk factors for hearing loss, and monitored early hearing losses consistent with overexposure to noise. The audiometry component consisted of four parts: (a) a pre-examination audiometric questionnaire, (b) a brief otoscopic screening (physical) examination of the ear canals and eardrums, (c) tympanometry, and (d) pure tone air conduction audiometry. This component was conducted on sample participants aged 20–69 for 1999–2004, and participants aged 12–19 and 70 and over for 2005–2010.

Anthropometry

The anthropometry component obtained data on selected body measures to be able to: (a) provide estimates on the prevalence of obesity and related measures; (b) study the association between body measures and such health conditions and risk factors as cardiovascular disease, diabetes, hypertension, and activity and dietary patterns; and (c) monitor growth and development in children. Thirteen body measurements were collected on sample participants. Age ranges varied for each body measurement. This component was conducted during 1999–2010.

Balance

The balance component examined normal and abnormal balance in adults, and the relationship between balance disorders and other factors. The protocol consisted of two parts: (a) a short pre-examination screening questionnaire, and (b) a modified Romberg Test of Standing Balance on Firm and Compliant Support Surfaces. The balance component was conducted on sample participants aged 40–69 for 1999–2000, and sample participants aged 40 and over for 2001–2004.

Bioelectrical impedance analysis

The bioelectrical impedance analysis, or BIA, component measured the electrical impedance of body tissues and assessed fluid volumes, total body water, body cell mass, and fat-free body mass. This component was conducted on sample participants aged 8–49 for 1999–2004.

Blood pressure

See ''Physician examination'' in this section.

Cardiovascular fitness

The cardiovascular (CV) fitness component obtained data on CV fitness to (a) provide prevalence estimates of persons at risk due to poor physical fitness, and (b) study the association between CV fitness and other health conditions and risk factors, such as obesity, CV disease, diabetes, hypertension, activity, and dietary patterns. CV fitness was assessed with a submaximal treadmill test (not a maximal test to exhaustion) on sample participants aged 12–49. This component was conducted for 1999–2006.

Dermatology

The dermatology component obtained data to assess the prevalence of psoriasis and hand dermatitis in the adult population. Four digital images were taken by a health technician using a Kodak DCS760 digital camera with a 50mm lens. The poses were: ''BACK with ELBOWS,'' ''INNER ARM,'' ''FRONT OF LEGS with HANDS,'' and ''BACK OF LEGS with PALMS.'' The dermatology component was conducted on sample participants aged 20–59 during 2003–2004.

Dual-energy X-ray absorptiometry

The dual-energy X-ray absorptiometry, or DXA, component obtained data to assess overall skeletal

Table H. Household interview: National Health and Nutrition Examination Survey, 1999–2010

Questionnaire and section name	Description	Survey years	Age (years)[1]
Screener			
Screener module #1	Enumeration of the household to determine eligible participants; administered at doorstep	1999–2010	18 and over
Relationship			
Screener module #2	Determined relationships of household members to others in household	1999–2010	18 and over
Sample participant			
Acculturation	Participant asked what language is spoken in the home	1999–2010	12 and over
Air quality control	Questions regarding if the air quality was bad, whether the participant did anything differently and, if so, what they did	2007–2010	16 and over
Allergy	Questions regarding if diagnosed with allergies, whether had allergy attack in past year, avoided or removed pets from home because of allergies, type of allergies, age at diagnosis, and allergy symptoms (e.g., rash or sinus infection)	2005–2006	1 and over
Arthritis	Questions regarding pain in the back, neck, or hip area	2009–2010	20–69
Audiometry	Questions regarding quality of hearing, whether participant ever had tubes in ears, more than three ear infections, a hearing aid or other devices, how often hearing aid was worn, whether ringing or buzzing was ever present, if bothered by those symptoms, whether participant's job or personal life required being around loud noises or firearms, and whether hearing protection was used in those instances	1999–2010	1 and over
Balance	Questions regarding dizziness, falling, treatment if any, result of treatment, and blood relatives with same condition	1999–2004	40 and over
Blood pressure	Questions related to high blood pressure diagnosis and treatment	1999–2010	16 and over
Cardiovascular disease	Questions regarding chest pain, when the pain occurs, how often, whether it stops when physical activity stops, length of time it usually occurs, and whether participant also has shortness of breath or pain in arms, legs, or neck	1999–2010	40 and over
Cardiovascular fitness	Questions regarding any restrictions on playing sports, recommended physical activity from physician, pain during physical activity, balance and dizziness problems, and problems walking	2003–2004	12–49
Cognitive functioning	Participants were asked if they wore reading glasses, then they were asked to manually copy symbols shown on a computer screen; no additional questions followed the exercise	1999–2002	60 and over
Demographic information	Questions regarding education, marital status, military service, and other demographic information	1999–2010	All ages from birth
Dermatology	Questions regarding skin and skin diseases, sun exposure, and sun protective behavior	1999–2010	20–59
Diabetes	Questions regarding diagnosis of diabetes, age at diagnosis, history of prediabetes, taking insulin, how much insulin, how often taken, blood tests done in the past year, how often and how much glucose is checked, and how often a doctor or diabetes specialist is seen	1999–2010	1 and over
Dietary screener	Questions regarding food or drink consumed in the past month	2009–2010	2–11
Dietary supplements and prescription medications	Questions regarding dietary supplements, nonprescription antacids, prescription medications, and asthma medications	1999–2010	All ages from birth
Dietary behavior and nutrition	Questions regarding breastfeeding and length of time; milk consumption, type, and amounts; whether participant ate school lunches or breakfasts, was part of a government-sponsored meal program, and how often already-prepared meals were eaten compared with homemade meals; and whether the participant had food allergies or was a vegetarian	1999–2010	All ages from birth
Dust collection	Questions related to location of dust collection	2001–2004	1 and over
Early childhood	Questions regarding birth, birthweight, and current weight	1999–2010	Birth–15
Health insurance	Questions regarding type of insurance coverage, coverage of prescription drugs, and uninsured status during the past 12 months	2005–2010	All ages from birth
Hospital utilization and access to care	Questions regarding overall health and access to medical care	1999–2010	All ages from birth
Immunization	Questions regarding history of hepatitis A, hepatitis B, and human papillomavirus vaccines and the doses received for each	1999–2010	All ages from birth
Introduction and verification	Verification of gender, date of birth, age, and full name	1999–2006	All ages from birth
Kidney conditions	Questions regarding kidney conditions, such as kidney stones and dialysis	1999–2010	20 and over
Medical conditions	Questions regarding the presence of different medical conditions, such as asthma and celiac disease	1999–2010	1 and over
Miscellaneous pain	Questions regarding pain in areas of body and length of time pain was present	1999–2004	20 and over
Occupation	Questions regarding hours worked in previous week, type of work done, how long employed, and whether exposed to fumes of any kind	1999–2010	16 and over

See footnote at end of table.

Table H. Household interview: National Health and Nutrition Examination Survey, 1999–2010—Con.

Questionnaire and section name	Description	Survey years	Age (years)[1]
Sample participant—Con.			
Oral health	Questions regarding the health of teeth and gums	1999–2010	30 and over
Osteoporosis	Questions regarding fractured bones, how fractures occurred and how many times, whether diagnosed with osteoporosis, treatments if any, and family history of fractures or osteoporosis	1999–2010	20 and over
Physical activity and physical fitness	Questions regarding how many days a week more than 1 hour of physical activity is done, hours on the computer in the past 30 days, hours watching TV in the past 30 days, and types and frequency of physical activities	1999–2010	2 and over
Physical functioning	Questions regarding long-term impairments, health problems, special education and assistance, work limitations, and physical and emotional limitations	1999–2010	5 and over
Respiratory health and disease	Questions regarding trouble breathing, persistent cough, duration of cough, phlegm, and restlessness due to cough or breathing problems	1999–2010	1 and over
Sleep disorders	Questions regarding trouble sleeping and diagnosis of sleep disorder	2005–2010	16 and over
Smoking and tobacco use	Questions regarding smoking in the past 5 days, type of tobacco used (e.g., cigar, cigarette, pipe, chewing, and others), how many of those tobacco products were smoked per day, and whether participant is trying to quit	1999–2010	20 and over
Social support	Questions regarding whether participant has emotional support, who from, in need of more support, attends church, needs financial help, and has close friends available to help	1999–2008	60 and over
Tuberculosis	Questions regarding previous tuberculosis (TB) skin tests, TB symptoms, and active TB symptoms	1999–2000	1 and over
Vision	Questions regarding blindness; eyesight quality with glasses or contacts; difficulty performing regular daily activities; history of cataracts, glaucoma, or macular degeneration; and treatments, if any	1999–2008	20 and over
Weight history	Questions regarding self-perception of weight, self-reported weight over the participant's lifetime, attempted weight loss during the past year, and methods used to try to lose weight and to keep from gaining weight	1999–2010	16 and over
Family			
Demographic background and occupation	Questions regarding demographics, such as place of birth and education, and occupation	1999–2010	18 and over
Consumer behavior	Questions regarding eating habits of family and how much money is spent on food	2007–2010	18 and over
Food security	Questions regarding food eaten in the last 12 months and the reasons why certain foods were not eaten	1999–2010	18 and over
Health insurance	Questions regarding family and participant health coverage; kind of coverage; whether plan included dental, limited to specific doctors or could choose, and HMO or PPO; lack of health insurance in the last year; and discontinued health insurance and why	1999–2004	18 and over
Housing characteristics	Questions regarding how many rooms in dwelling unit, how long family has lived there, and year it was built	1999–2010	18 and over
Income	Questions regarding family income; whether income was from a job, Social Security, retirement benefits, disability pension, or state assistance programs; and how much income	1999–2010	18 and over
Pesticide use	Questions regarding products used in or outside of the home	1999–2004	18 and over
Smoking	Questions regarding smoking in the household, who smokes, and how often	1999–2010	18 and over
Tracking and tracing	Questions regarding the spelling of names and street addresses of two persons not related to the family	1999–2010	18 and over

[1]As of 2010. Ages may have been changed from 2-year cycle to 2-year cycle within the continuous National Health and Nutrition Examination Survey (NHANES). However, those changes are not listed here; for more information, see the NHANES website at http://www.cdc.gov/nchs/nhanes.htm.

Table J. Physical examination components at mobile examination center: National Health and Nutrition Examination Survey, 1999–2010

Component	Description	Survey years
Audiometry	Hearing test	1999–2010
Anthropometry	Body measurements such as height, weight, and waist circumference	1999–2010
Balance	Modified Romberg test of balance	1999–2004
Bioelectrical impedance analysis	Estimation of fluid volumes, total body water, and fat-free body mass	1999–2004
Blood pressure	Measurement of systolic and diastolic brachial artery pressure	1999–2010
Cardiovascular fitness	Determination of heart rate during a submaximal treadmill test	1999–2006
Dermatology	Assessment for selected skin conditions from digital images of skin	2003–2004
Dual-energy X-ray absorptiometry	Measurement of body composition and bone density	1999–2010
Lower extremity disease	Determination of ankle brachial pressure index; assessment for peripheral neuropathy	1999–2004
Muscle strength	Strength test of knee flexion and extension; timed walk	1999–2002
Ophthalmology	Visual field testing; grading of digital retinal images for retinal conditions (see "Vision")	2005–2008
Oral health	Assessments of oral diseases and conditions including dental caries, periodontal disease, and other conditions	1999–2010
Respiratory health	Lung function testing and measurement of exhaled nitric oxide	2007–2010
Tuberculin skin test	Tuberculin skin test	1999–2000
Vision	Assessments of near and distance visual acuity (see "Ophthalmology")	1999–2008

changes that often occur with age. This component measured bone mineral content and bone mineral density. A body composition (whole-body) scan was conducted to determine fat mass, lean tissue mass, bone mineral content, and total body fat percentage. This component was conducted on sample participants aged 18 and over in 1999, aged 8 and over for 2000–2004, and aged 8–69 for 2005–2006. Scans of the femur and anterior-posterior spine were conducted on sample participants aged 8 and over for 2005–2010. Femur scans provided bone measurements for the total femur, femoral neck, trochanter, intertrochanter, and Ward's triangle. Spine scans provided bone measurements for the total spine and vertebrae L1–L4.

Lower extremity disease

The lower extremity disease (LED) component collected data to provide prevalence of diagnosed and undiagnosed LED, including those at high risk for late complications of the disease (i.e., ulceration and amputation). The two major manifestations of LED are peripheral vascular disease and peripheral neuropathy. Peripheral vascular disease was evaluated using the ankle brachial pressure index. Peripheral neuropathy was assessed by a sensory examination of the feet using a monofilament. Both tests were conducted on sample participants aged 40 and over. This component was conducted for 1999–2004.

Muscle strength

The muscle strength component (also called physical functioning) assessed lower body strength. Isokinetic strength of the knee extensors and flexors was measured. The muscle strength component was conducted on sample participants aged 50 and over who were also asked to do a measured walk in addition to the isokinetic testing. The 20-foot measured walk and isokinetic testing were conducted during 1999–2002. The 8-foot measured walk was conducted during 2000–2002.

Ophthalmology

The ophthalmology component obtained data to assess the prevalence of vision loss and retinal diseases, such as macular degeneration. Two eye examinations were completed for this component: (a) a visual field test using frequency-doubling technology, or FDT, perimetry and (b) digital fundus photography using an ophthalmic digital imaging system to assess the presence of diabetic retinopathy, age-related macular degeneration, and other retinal diseases (see also the following "Vision" section). The ophthalmology component was conducted on sample participants aged 40 and over for 2005–2008.

Oral health

The oral health component obtained data to monitor oral health status, including risk factors for disease and access to preventive and treatment services. Many assessments have cycled in and out since 1999. Table K shows the oral health assessments for 1999–2010.

Peripheral neuropathy

See "Lower extremity disease" in this section.

Physician examination

The physician examination consisted of a blood pressure assessment on participants aged 8 and over, radial pulse rate determination on participants aged 5 and over, and apical heart rate auscultation on infants from birth to age 4 years. The blood pressure assessment obtained data to assess the prevalence and trends in hypertension, and monitored risk factors for major cardiovascular conditions. This component was conducted during 1999–2010.

The physician examination also consisted of:

- Pretest counseling for STD testing.
- Providing instructions to females on using a swab for self-collecting a vaginal fluid specimen for selected STD tests.
- Counseling participants who have abnormal findings.
- Managing medical emergencies in the MEC.

Respiratory health

The exhaled nitric oxide (ENO) component collected data to provide a noninvasive marker of airway

Table K. Oral health: National Health and Nutrition Examination Survey, 1999–2010

Assessment	Participants' age (years)	Survey years
Basic screening exam	5 and over	2005–2008
	3–19	2009–2010
Coronal caries	2 and over	1999–2004
Dental sealants	2–34	1999–2004
Fluorosis	6–49	1999–2004
	6–19	2009–2010
Functional occlusal	25 and over	2003–2008
Incisal trauma	10–29	1999–2004
Orofacial pain exam	13–69	1999–2004
Periodontitis	. . .	1999–2004
Gingival bleeding	12–49	1999–2000
Loss of attachment	19 and over	1999–2000
	13 and over	1999–2004
	30 and over	2009–2010
Periodontal bleeding	13 and over	2001–2004
Root caries	18 and over	1999–2004
Saliva	40 and over	1999–2000
Tooth count	2 and over	1999–2004
	5 and over	2005–2008
	3–19 and 30 and over	2009–2010
Tooth wear	13 and over	2003–2004

. . . Category not applicable.

inflammation, a factor in asthma and other possible lung diseases. Fractional ENO was measured using a biomedical device. ENO was performed before spirometry because spirometric maneuvers have been shown to reduce exhaled nitric oxide levels. The ENO component was conducted on sample participants aged 6–79 for 2007–2010.

The spirometry component obtained data on chronic obstructive pulmonary disease, or COPD. Lung function was tested to determine the amount and speed of air that a person can exhale after taking in the deepest possible breath. The spirometry component was conducted on sample participants aged 6–79 for 2007–2010.

Tuberculin skin test

The tuberculin (TB) skin test component obtained data to provide information on the extent of tuberculosis infection in the United States. Sample participants aged 1 and over were tested with a TB-purified protein derivative (PPD) product, PPD S–1, the standard antigen. This component was conducted for 1999–2000.

Vision

The vision component obtained data to measure the prevalence of visual impairment and evaluated functional impairment related to vision. This component consisted of three parts: (a) determination of the prescription of a participant's eyeglasses, if worn; (b) a distance visual acuity and objective refraction/keratometric evaluation; and (c) a vision Near Card test (see also the preceding ''Ophthalmology'' section). The vision component was conducted on sample participants aged 12 and over for 1999–2008.

Interviews in the MEC

Dietary interview

The dietary interview component obtained detailed dietary intake information from sample participants. Dietary intake data were used to estimate the types and amounts of foods and beverages consumed; to estimate intakes of energy, nutrients, and non-nutrient food components from foods and beverages; and to assess intake of water. The dietary interview comprised three sections: (a) dietary recall, (b) nutritional supplement and antacid use, and (c) post-recall. This component was conducted on sample participants of all ages (with proxy, if necessary) for 1999–2010. To allow for better estimates of usual nutrient intakes to assess diets in the U.S. population, 2 days of dietary intake data were collected for 2002–2010.

Private health interview

The private health interview consisted of questionnaires addressing many health-related topics that were sensitive and was conducted in a private MEC interview. The interview consisted of the computer-assisted personal interviewing system (CAPI), the audio computer-assisted self-interviewing system (ACASI), and the critical data items. Sample participants aged 8 and over were eligible for the private interview. This component was conducted for 1999–2010.

Computer-assisted personal interviewing

The first part of the private health interview used CAPI and was conducted by a MEC interviewer. Health-related questions were asked based on the sample participant's age and gender. Table L shows the interview sections for the CAPI. All sections of the CAPI could be administered using a proxy interview or an interpreter if needed. As part of the health-related questions, a mental health questionnaire was administered during 1999–2004. It was split into three subsections: (a) the youth Computerized Diagnostic Interview Schedule for Children (CDISC), (b) the parent CDISC, and (c) an NHANES version of the World Health Organization Composite International Diagnostic Interview (CIDI).

The youth CDISC was administered to sample participants aged 8–19 and consisted of questions about panic disorder, generalized anxiety disorder, eating disorders, and depressive disorders. The parent CDISC was a follow-up and is further mentioned in the ''Post-MEC Data Collection'' section. The CIDI was administered to sample participants aged 20–39 and consisted of a panic disorder, generalized anxiety disorder, and depressive disorder diagnostic module, which addressed diagnoses present in the past 12 months. No proxies were used during the CIDI.

Audio computer-assisted self interviewing

The second part of the private interview used an ACASI system. Sample participants aged 12–69 were given a set of headphones and asked sensitive questions (Table L) to which they could respond using the touch screen. The MEC interviewer was not present for the ACASI, and no proxies were allowed.

Critical data items

The third part of the private interview obtained or verified key pieces of data about the sample participant. Critical data items were important for recontacting the sample participant with information regarding his or her examination or laboratory results. Sample participants were verbally asked by the MEC interviewer for the correct or exact spelling of their name, their date of birth, and a correct contact telephone number. For more information on the private interview, see the NHANES website at http://www.cdc.gov/nchs/nhanes/participant.htm.

MEC Biospecimen Collection

NHANES collected biological specimens (biospecimens) during MEC appointments for analysis in laboratories. This included the collecting, processing, storing, and shipping of blood, urine, and other types of specimens. This section provides information on all biospecimens collected for 1999–2010.

MEC Laboratory Team

Each MEC had a laboratory containing a bio-hood, complete blood count (CBC) and differential analyzer, two centrifuges, refrigerators, and freezers. Each MEC laboratory team included three medical technologists and a certified phlebotomist. Staff was certified in accordance with guidelines set forth by the American Society for Clinical Pathology. The medical technologists' tasks included: performing CBCs, pregnancy tests, and other tests; processing, storing, and shipping specimens; assisting the phlebotomist; and printing labels and labeling vials. The chief medical technologist was the most senior member of the laboratory team and was responsible for overseeing all laboratory activities and performing quality control. The phlebotomist's tasks included: administering a questionnaire to screen for conditions that excluded sample participants from the blood draw, determining fasting status, conducting the blood draw, administering the glucose solution, and conducting a second blood draw 2 hours after the solution had been administered for the oral glucose tolerance test.

Specific training for laboratory staff was dependent upon the position. However, all laboratory staff were trained thoroughly to ensure that the laboratory environment was safe. Laboratory staff were aware of hazardous chemicals that they worked with, familiar with product labels and other forms of warning, and knowledgeable about how to handle accidental exposures. The staff was trained annually on each of the following:

- Occupational Safety and Health Administration (OSHA) Bloodborne Pathogen Regulation
- NHANES exposure control plan
- Working safely with hazardous chemicals
- Universal precautions and a set of guidelines for preventing the transmission of bloodborne pathogens such as human immunodeficiency virus (HIV) and hepatitis viruses in health care settings.

Biospecimen Collection

Biospecimens collected in the MEC included blood, hair, nasal swab, oral rinse, urine, and vaginal swab. Table M lists all laboratory tests conducted for 1999–2010. Collection procedures varied based on the specimen types. Laboratories performed more than 545 different biochemical tests, which provided detailed information about the sample participant's health and nutritional status.

Blood

Blood was collected from sample participants aged 1 and over. The phlebotomist used a needle to draw blood from a vein in the antecubital fossa of the participant's arm. The amount of blood drawn varied by age and survey year, but was not more than 128 mL for participants aged 12 and over. Blood was processed and aliquoted into vials for storage in the MEC. The vials were then refrigerated or frozen before transport to laboratories across the United States. Most assays were completed in remote laboratories, except for the CBC and pregnancy tests, which were done in the MEC. If permission was granted, some specimens were aliquoted into vessels and banked for future studies, including genetic studies. If excess serum remained after tests at remote laboratories were completed, it was shipped back to the NHANES biorepositories and stored for future research. This component was conducted for 1999–2010.

Hair

A sample of hair was obtained and analyzed for total mercury level. This procedure consisted of the health technician collecting approximately 100 strands from male and female sample participants aged 1–5, and from females aged 16–49. This component was conducted for 1999–2001.

Nasal swab

A nasal swab was done to understand the extent of *Staphylococcus aureus* nasal colonization, including the prevalence of methicillin-resistant *Staphylococcus aureus*, or MRSA, colonization. This procedure consisted of the health technician inserting the swab 2 cm into the nostril and rotating for 3 seconds, then repeating the procedure in the other nostril. This component was conducted on sample participants aged 1 and over for 2001–2004.

Table L. Mobile examination center interviews: National Health and Nutrition Examination Survey, 1999–2010

Interview component and section	Description	Survey years
Computer-assisted personal interviewing system		
Alcohol	Lifetime and current use (past 12 months)	1999–2010
Bowel health	Fecal incontinence and defecating function	2005–2010
Current health status	Overall health assessment, quality of life (past 30 days), recent illness (past 30 days), blood donation, and HIV testing	1999–2010
Depression screener	Depression symptoms and impairment from depression symptoms; depression measured using the Patient Health Questionnaire (PHQ-9), a nine-item screening instrument that asks questions about the frequency of symptoms of depression over the past 2 weeks, with a final follow-up question to assess overall impairment from depressive symptoms. Response categories "not at all," several days," more than half the days," and "nearly every day" were scored 0–3; a total score was calculated at 0–27. A score of 10 or higher has been well-validated and commonly used in clinical studies to define depression; other methods for defining depression based on this instrument were also used	2005–2010
Dietary screener module	Food and drink consumed in the home, restaurants, and other locations in past 30 days	2009–2010
Kidney conditions	Kidney disease, kidney stones, urinary incontinence, and nocturia	1999–2010
Pesticide exposure	Pesticide use in the home and lawn or garden during the past 7 days	2005–2010
Physical activity	Daily activities, leisure-time activities, and sedentary activities	1999–2010
Prostate conditions	Prostate conditions and whether a rectal examination had been done to check for prostate cancer	2005–2008
Reproductive health	Menstrual history, pregnancy history, lactation, oral contraceptive and hormone replacement therapy use, and other related conditions	1999–2010
Respondent information	Identified relationship of respondent to sample participant; also identified why sample participant could not respond (proxy), and gave information on the use of interpreters and language used for the interview	1999–2010
Tobacco use	Use of cigarettes, pipes, cigars, and other forms of tobacco, as well as nicotine replacement therapies (e.g., nicotine patches), in the past 5 days	1999–2010
Volatile toxicants	Exposure to chemicals that are on priority toxicant or critical contaminant lists	2005–2010
Weight history	Self-perception of weight, reasons for losing weight, and methods used to lose weight	2005–2010
Audio computer-assisted personal interviewing system		
Alcohol	Lifetime and current use (past 12 months); questions not specific to type of alcohol used	1999–2010
Drug use	Lifetime and current use of cocaine and other street drugs and intravenous use of illicit drugs	1999–2010
Food security	Household food security, individual food security, food stamp program benefits, and Women, Infants and Children program benefits	2005–2010
Prostate conditions	Prostate conditions, prostate cancer treatment, and erectile dysfunction	2001–2004
Sexual behavior	Lifetime and current sexual behavior for both men and women; major items included age at first sexual intercourse, number of sexual partners, sexual orientation, circumcision status (men), and history of sexually transmitted diseases	1999–2010
Tobacco use	Cigarette use, including history of use, age at initiation, current use, past 30-day prevalence, amount, cigarette brand, and other related details	1999–2010
Youth conduct disorder	Comprises eight questions from the Diagnostic Interview Schedule for Children Predictive Scales (DPS) developed by the Columbia University College of Physicians and Surgeons/New York State Psychiatric Institute in New York, N.Y., and focused only on those items from the full Conduct Disorder module considered significant predictors of disorder; shown to determine adolescents who are at high probability of meeting diagnostic criteria accurately	1999–2004
Dietary		
Dietary recall	Detailed dietary intake information to estimate types and amounts of foods and beverages (including all types of water) consumed during the 24-hour period prior to the interview (midnight to midnight), and to estimate intakes of energy, nutrients, and other food components from those foods and beverages; following dietary recall, participants were asked questions on salt use, whether respondent is on any type of special diet, frequency of fish and shellfish consumed during the past 30 days, and whether overall intake on the previous day was much more than usual, usual, or much less than usual	1999–2010
Dietary supplement	Types and amounts of dietary supplements consumed during the 24-hour period prior to the interview (midnight to midnight)	2007–2010

Table M. Laboratory tests: National Health and Nutrition Examination Survey, 1999–2010

Analyte	Specimen	Description	Survey years
Acrylamide/Glycidamide	Whole blood	Chemical carcinogen used in synthetic fibers	2003–2010
Albumin	Urine	Major protein in the body	1999–2010
Albumin/Creatinine ratio	Urine	Ratio of albumin to creatinine used to detect kidney disease progression	2009–2010
Allergen total and specific IgE immunoglobulins	Serum	Markers of immune response to allergens	2005–2006
Apolipoprotein (B)	Serum	Protein that binds to lipids and transports them in the body	2005–2010
Arsenic	Urine	Toxic heavy metal	2003–2010
Arsenic (total/speciated)	Urine	Toxic heavy metal	2007–2010
Bacterial vaginosis	Swab	Imbalance in bacteria normally found in the vagina	2001–2004
Biochemistry panel	Serum	Panel of 23 clinical tests used to assess general health	1999–2010
Bone alkaline phosphatase	Serum	Enzyme that removes phosphate from other molecules	1999–2004
Cadmium (blood)	Whole blood	Toxic heavy metal	1999–2010
Caffeine	Urine	Psychoactive stimulant	2009–2010
CD4/CD8	Whole blood	Cells that protect the body from infection	1999–2006
Chlamydia	Urine	Sexually transmitted pathogen	1999–2010
Complete blood count	Whole blood	Panel of 20 clinical tests used to assess general health	1999–2010
Cotinine	Serum	Metabolite of nicotine	1999–2010
C-peptide	Serum	Protein marker of insulin secretion	1999–2004
C-reactive protein	Serum	Protein produced in response to tissue damage and inflammation	1999–2010
Creatinine	Urine/serum	Waste product of normal muscle breakdown	1999–2010
Cryptosporidium (antibody)	Serum	Intestinal parasite usually found in water	1999–2001
Current-use pesticides/Priority pesticides	Urine/serum	Chemicals that repel or destroy pests (insects and rodents)	1999–2010
Fungicides	Urine/serum	Chemicals that destroy fungi	1999–2010
Herbicides	Urine/serum	Chemicals that destroy plants	1999–2010
Dioxins, furans, and coplanar PCBs/Persistent pesticides	Serum	Synthetic chemicals that persist as environmental pollutants	1999–2010
Endotoxins	Dust	Toxins associated with certain bacteria	2005–2006
Environmental pesticides/Halogenated phenolic compounds	Urine	Chemicals that repel or destroy pests (insects and rodents)	1999–2010
Environmental phenols	Urine	Natural and synthetic chemicals containing phenol that may be toxic	1999–2010
Environmental parabens	Urine	Synthetic preservatives that may cause hormone disruption	2005–2010
Erythrocyte protoporphyrin	Whole blood	Protein used in the synthesis of hemoglobin in the red blood cell	1999–2006
Fatty acids	Plasma	Synthetic fat found in food that raises LDL cholesterol and lowers HDL cholesterol	2007–2010
Ferritin	Serum	Iron stored in the body	1999–2010
Fibrinogen	Plasma	Coagulation protein	1999–2002
Flow rate	Urine	Measure of urine quantity produced in a specified time period	2009–2010
Folate (RBC)	Whole blood	Vitamin important in the formation of red blood cells	1999–2010
Folate	Serum	Vitamin important in the formation of red blood cells	1999–2010
Follicle stimulating hormone/LH	Serum	Hormone that regulates ovarian function	1999–2002
Glucose plasma	Plasma	Amount of sugar in the blood	1999–2010
Glycohemoglobin	Whole blood	Measure of average blood glucose in the past 2 to 3 months	1999–2010
Gonorrhea	Urine	Sexually transmitted disease pathogen	1999–2008
Helicobacter pylori	Serum	Bacterium that causes stomach ulcers	1999–2001
Hepatitis B anti-HBs	Serum	Indicates previous exposure to hepatitis B infection, or vaccination	1999–2010
Hepatitis B HBsAg	Serum	Indicates hepatitis B infection	1999–2010
Hepatitis A, C, and D (antibody)	Serum	Serologic tests for antibody to viruses that cause liver disease	1999–2010
Hepatitis C RNA (HCU–RNA) and HCV genotype	Serum	Serologic tests to identify Hepatitis C RNA and genotypes	2007–2010
Hepatitis E	Serum	Serologic tests to identify Hepatitis C RNA and genotypes	2009–2010
Herpes 1 and 2 antibody	Serum	Antibodies to herpes virus	1999–2010
Herpes 1 and 2 antibody	Urine	Antibodies to herpes virus	1999–2010
HIV antibody	Serum	Antibody to HIV	1999–2010
HLA–B27	Serum	Antigen found in blood associated with a number of inflammatory conditions	2009 only
Homocysteine	Plasma	Amino acid in the blood that can be a risk factor for cardiovascular disease	1999–2006
Human papillomavirus	Oral rinse	Virus that infects the skin and may cause cancer	2009–2010
Human papillomavirus	Serum	Virus that infects the skin and may cause cancer	2002–2010

Table M. Laboratory tests: National Health and Nutrition Examination Survey, 1999–2010—Con.

Analyte	Specimen	Description	Survey years
Human papillomavirus	Swab	Virus that infects the skin and may cause cancer	2002–2010
Indoor allergens	Dust	Any substance found in the bed or bedroom that can cause an allergic reaction	2005–2006
Insulin	Serum	Hormone that regulates glucose metabolism	1999–2010
Iodine	Urine	Element that is a component of thyroid hormones	2000–2010
Iron	Serum	Mineral the body needs to make red blood cells	1999–2006
Latex	Serum	Natural or synthetic emulsion of polymer microparticles	1999–2001
Lead	Whole blood	Toxic metal that can affect physical and mental development	1999–2010
Lead dust	Dust	Lead that is recovered from household dust	1999–2004
Total cholesterol, triglycerides, HDL, LDL	Serum	Lipid panel showing concentrations of lipids in the blood	1999–2010
Lipoprotein a (Lpa)	Serum	Low-density lipoprotein that is a risk factor for atherosclerotic disease	2005 only
Measles/Rubella/Varicella (antibody)	Serum	Markers of immunization status	1999–2004
Measles/Mumps/Varicella/Rubella (antibody)	Serum	Markers of immunization status	2009–2010
Mercury	Whole blood	Toxic heavy metal	1999–2010
Mercury	Hair	Toxic heavy metal	1999–2001
Mercury	Urine	Toxic heavy metal	1999–2010
Methylmalonic acid	Plasma	Elevated levels may indicate Vitamin B12 deficiency	1999–2004
MRSA	Swab	Methicillin-resistant *Staphylococcus aureus* (a bacteria resistant to the antibiotic methicillin)	2001–2004
Multi-element metals/heavy metals	Urine	Toxic heavy metals detected in urine	1999–2010
NNAL	Urine	Metabolite of nicotine	2007–2010
NTX (N-telopeptides)	Urine	Breakdown product of collagen, used as a marker of bone turnover	1999–2002
OGTT glucose plasma	Plasma	Oral glucose tolerance test to determine how quickly glucose is cleared from the blood	2005–2010
Omega-3 fatty acids/PUFA	Plasma	Polyunsaturated fat found in food, which has been shown to lower the risk of cardiovascular disease	2007–2010
Organochlorine pesticides	Serum	Diverse synthetic insecticides that are persistent in the environment	1999–2010
Organophosphate insecticides	Urine	Diverse synthetic insecticides that are persistent in the environment	1999–2010
Osmolality	Urine	Measure of urine concentration	2009–2010
Parathyroid hormone	Serum	Hormone that regulates calcium absorption and converts vitamin D to its active form	2003–2006
Perchlorate	Urine	Chemical that interferes with iodine uptake by the thyroid gland	2005–2010
Perchlorate, nitrate, and iodine	Water	Three toxicologically related analytes that affect thyroid function	2005–2008
Perchlorate, nitrate, and thiocyanate	Urine	Nitrate is a component of fertilizer that is a groundwater pollutant; thiocyanate is a compound in tobacco smoke	2007–2010
Phthalates	Urine	Chemicals used in plastic that have been shown to change hormone levels	1999–2010
Phytoestrogens	Urine	Naturally occurring nonsteroidal plant compounds that are similar to estrogen	1999–2010
Polycyclic aromatic hydrocarbons (PAH)	Urine	Atmospheric pollutants produced as byproducts of burning fuel	1999–2010
Polybrominated diphenl ethers (BDEs)	Serum	Flame retardants that bio-accumulate and may cause hormone-disrupting effects	2003–2010
Polyfluorinated compounds	Serum	Persistent organic pollutants	2003–2010
Pregnancy (HCG)	Urine	Hormone diagnostic for pregnancy	1999–2010
PSA (free/total)	Serum	Protein produced by the prostate gland that is elevated in prostate conditions	2001–2010
PSA (complex)	Serum	Prostate-specific antigen complexed to proteins	2007–2010
Selenium	Serum	Essential micronutrient that catalyzes enzyme reactions	1999–2004
Surplus sera	Serum/urine/plasma	Residual sera used for special studies	1999–2010
SRM pesticides	Serum	Selected reaction monitoring (SRM) is a method of chromatography resulting in highly specific quantification of analyte	2003–2010
Syphilis IgG, RR, and TP–PA	Serum	Tests that detect syphilis, a sexually transmitted pathogen	2001–2004
Thyroid function testing (T4, TSH)	Serum	Tests to assess thyroid function	1999–2002
Thyroid function testing (T4, T3, ATG,TGN, APO, TSH)	Serum	Tests to assess thyroid function	2005–2010
TIBC	Serum	Test that determines iron-binding capacity	1999–2006
Toxoplasma (IgG and IgM)	Serum	Antibodies to a parasite that can cause illness in humans	1999–2004
Transferrin receptor	Serum	Carrier protein for transferrin	2003–2010
Transferrin saturation	Serum	Ratio of serum iron and total iron-binding capacity, multiplied by 100	1999–2006
Trichomonos (females)	Swab	Parasite that causes vaginal infection	2001–2004
Tissue transglutaminase and endomysial antibodies	Serum	Markers of celiac disease	2009–2010
Vitamins A and E/Carotenoids	Serum	Nutrient vitamins required for retinal function that act as antioxidants	1999–2006

Table M. Laboratory tests: National Health and Nutrition Examination Survey, 1999–2010—Con.

Analyte	Specimen	Description	Survey years
Vitamin B6	Serum	Part of the vitamin B-complex that acts as an enzyme cofactor in amino acid metabolism	2003–2010
Vitamin B12	Serum	Part of the vitamin B-complex involved in cell metabolism and DNA synthesis	1999–2006
Vitamin C	Serum	Nutrient vitamin that acts as an enzyme cofactor and antioxidant	2001–2006
Vitamin D	Serum	Nutrient vitamin produced in the skin after absorption of ultraviolet light	1999–2010
VOC (blood)	Whole blood	Toxic volatile organic compounds	1999–2010
VOC exposure monitor	Air monitor	Measures environmental exposure to toxic volatile organic compounds	1999–2001
VOC (water)	Water	Toxic volatile organic compounds found in residential water	1999–2010
WBC/DNA	Whole blood	White blood cells used to extract DNA	1999–2002, 2007–2010

Oral rinse

An oral rinse was collected and tested for the presence of multiple types of human papillomavirus (HPV). The examining dentist instructed sample participants aged 14–69 to gargle with mouthwash for 30 seconds and then spit into a specimen container. This component was conducted for 2009–2010.

Urine

Urine was collected for the following purposes: (a) to do a urine pregnancy test on female participants aged 12–59 and menstruating females aged 8–11, (b) to aliquot, store, and transport to multiple laboratories for analysis, (c) to aliquot and bank for future studies, and (d) to do a backup HIV test if the amount of blood collected was insufficient for HIV testing. Participants aged 6 and over were asked to provide random urine by voiding into specimen cups. The amount collected varied. This component was conducted for 1999–2010.

Vaginal swab

Female participants aged 14–59 were asked to self-collect a vaginal specimen using a sterile swab. The vaginal swab was tested for the presence of multiple types of HPV. In privacy, the participant inserted the swab and turned the foam tip against the walls of the vagina while counting to 10. The swab was removed without touching the skin or hair outside of the vagina and placed back into its original container. This component was conducted for 2002–2010.

Oral Glucose Tolerance Test

The oral glucose tolerance test (OGTT) was conducted on sample participants aged 12 and over who were examined in the morning session and had completed at least a 9-hour fast. After the initial blood draw, participants were asked to drink 75 grams of dextrose (10 oz. of glucose solution) within 10 minutes. Two hours later, a second blood sample was drawn. The inclusion of OGTT provided information on the extent of impaired glucose tolerance, or IGT, and diabetes in the U.S. population. This component was conducted for 2005–2010.

Biospecimen Processing and Shipping

Specimens were labeled with a number that corresponded to the participant's sample number. Labels were generated and affixed to vials. This allowed for tracking specimens from MEC processing through receipt in the contract laboratory. All vials were secured to prevent leakage and evaporation. Specimen processing varied. For example, blood processing included centrifuging and storing blood collection tubes; aliquoting whole blood into vials; centrifuging, separating, and aliquoting plasma and serum into vials; performing dilutions; and washing and lysing, or deconstructing, whole blood cells. All specimens were immediately stored at –20°C or refrigerated at 4°–8°C. Once processed, specimens were shipped to a variety of contract laboratories. Wet or dry ice was used if necessary for shipping. Each shipment included a copy of a shipping manifest. Most specimens were packed and shipped once a week.

Quality Assurance and Quality Control

The NHANES MEC laboratory was a Clinical Laboratory Improvement Act-certified laboratory of moderate complexity. Quality assurance and quality control (QA/QC) involved both internal and external surveillance. QA/QC procedures were performed in the MEC as well as in contract laboratories. As part of the overall QA process, all collection materials, vacuum sample vials, and storage containers used were initially prescreened for background contamination levels of blood lead, cadmium, and mercury; and urinary heavy metals, arsenic, iodine, and mercury. EDTA (ethylenediaminetetraacetic acid) tubes were used after prescreening confirmed that they had no contamination. The lot number and expiration dates for all vacuum sample vials, needles, and reagents were recorded.

Specific QC procedures were followed in the laboratory as well. For example, the freezers, refrigerators, and centrifuges were cleaned before the MEC opened, and a temperature reading on these items was conducted daily. On-site calibrations were performed twice each year. The NCHS biomedical engineer certified the revolutions per minute (rpm) of the centrifuges periodically and replaced the high-efficiency particulate air (HEPA) filters as necessary. All instrument maintenance was recorded. NHANES laboratories participated in the College of American Pathologists (CAP) proficiency-testing program. CAP samples were sent three times a year for the CBC and qualitative serum human chorionic gonadotropin (hCG). In addition, blind split samples were used for QC determinations.

Contract laboratories followed their QA/QC guidelines when working with NHANES specimens. However, to ensure QA/QC, NHANES staff conducted annual laboratory inspections and reviewed the QC data from each laboratory.

Post-MEC Data Collection

At the conclusion of their MEC appointment, sample participants were recruited to participate in post-MEC data collection activities (Table N). Eligibility for post-MEC data collection depended on the sample participant's age and gender and whether he or she completed the required components. Sample participants who also participated in any of the post-MEC data collection activities received additional remuneration, summarized in Table N.

Post-MEC data collection activities for 1999–2010 included:

- Allergen dust collection
- Dietary telephone follow-up
- Flexible consumer behavior survey (FCBS)
- Food frequency questionnaire
- Hepatitis C follow-up questionnaire

- Home urine collection
- Parent interview of the computer diagnostic interview schedule for children (CDISC)
- Physical activity monitor (PAM)
- Prostate-specific antigen, or PSA, follow-up questionnaire
- Tuberculin (TB) skin test reading
- Volatile organic compound (VOC) exposure monitor

Allergen Dust Collection

The allergen dust collection component collected bed and floor dust samples to obtain data on allergens and endotoxins. All households that had sample participants aged 1 and over who completed the MEC examination were eligible. This component was collected for 2005–2006.

Dietary Interview Follow-up

To obtain a more complete picture of the usual dietary intake of the U.S. population, a second 24-hour dietary interview of participants was done by telephone. This questionnaire took approximately 30–40 minutes and was conducted 3–10 days after the sample participant's MEC exam. All sample participants aged 1 and over who completed the MEC dietary interview were eligible to participate. Proxy interviews were conducted for children aged 1–11. This interview was conducted for 2002–2010.

Flexible Consumer Behavior Survey

The FCBS was a 15-minute telephone interview that collected information on the sample participant's knowledge, attitude, and beliefs regarding food nutrition and food choices. All sample participants were eligible if they completed the first part of the FCBS during the household interview, and the dietary interview in the MEC. This interview was conducted for 2007–2010.

Table N. Post-MEC examinations: National Health and Nutrition Examination Survey, 1999–2010

Component name	Survey years	Remuneration amount
Allergen dust collection	2005–2006	$50 per family
Dietary phone follow-up	2002–2010	$30 per participant
Flexible consumer behavior survey	2007–2010	$15 per participant
Food frequency	2003–2006	$30 per participant
Hepatitis C follow-up	2001–2010	–
Home urine collection	2009–2010	$40 per participant
Parent composite international diagnostic interview	2000–2004	$30 per participant
Physical activity monitor	2003–2006	$40 per participant
Prostate-specific antigen follow-up	2003–2006	–
Tuberculin skin test	1999–2000	$30 per participant
VOC exposure monitor	1999–2001	$15 per participant

– Quantity zero.

NOTES: MEC is mobile examination center. VOC is volatile organic compound.

Food Frequency Questionnaire

The food frequency questionnaire collected information on how often certain foods were consumed. The questionnaire was sent by mail to examined sample participants aged 2 and over and took approximately 20–30 minutes to complete. This questionnaire was used for 2003–2006.

Hepatitis C Follow-up

The hepatitis C follow-up was a telephone questionnaire conducted on sample participants who tested positive for hepatitis C, to obtain information on their knowledge about their infection and follow-up after notification. The hepatitis C follow-up took place 6 months after the NHANES examination and was approximately 20 minutes in duration. There was no remuneration for participation. This questionnaire was used for 2001–2010.

Home Urine Collection

The home urine collection was done within 10 days of a sample participant's MEC exam. Sample participants aged 6 and over were eligible. The first morning void was collected in a collection cup provided to the sample participant. The specimen was mailed to the laboratory for analysis. See the preceding section on ''MEC Biospecimen Collection'' for more information on the NHANES laboratory. This component was collected for 2009–2010.

Parent Interview of Computerized Diagnostic Interview Schedule for Children

The parent interview of the CDISC was a telephone follow-up for the parent or guardian of select children, aged 8–15, who participated in the CDISC in the MEC. The parent interview of the CDISC took approximately 30 minutes depending on the case. The parent interview was conducted 4–28 days after the child's MEC exam. This interview was conducted for 2000–2004.

Physical Activity Monitor

The PAM component was conducted to assess physical activity levels for sample participants aged 6 and over. Sample participants were asked to wear the PAM for 7 days. After the 7 days, the sample participant mailed the PAM to the contractor home office. This component was conducted for 2003–2006.

Prostate-specific Antigen

The PSA follow-up was a telephone questionnaire conducted on men with high PSA test results, to obtain information on their knowledge of PSA and follow-up after notification. The PSA follow-up took place 6 months after the NHANES examination and was

approximately 15 minutes in duration. There was no remuneration for participation. This questionnaire was asked for 2003–2006.

Tuberculin Skin Test Reading

The TB skin test required a follow-up appointment to measure the reaction. The test measurement took place 46–54 hours after the antigen was placed under the skin of sample participants aged 1 and over. This reading was conducted for 1999–2000.

Volatile Organic Compound Exposure Monitor

The VOC exposure monitor data were collected to measure environmental exposure to toxic VOCs. Selected sample participants aged 20–59 wore small, lightweight passive sampling badges for 48 hours, beginning once they left the MEC. Sample participants returned with the badge and a sample of tap water from their homes. They also had a second blood draw when they returned the monitor and the water sample. This component was conducted for 1999–2001.

Report of Findings

Health measurements and laboratory test results were provided to all sample participants who completed the MEC exam. The NHANES Physician Advisory Group determined which results should be reported back to participants, and how this should be done. Reporting protocols were reviewed and approved by the NCHS Research Ethics Review Board (ERB); for more information on the ERB, see the ''Ethical, Privacy, and Confidentiality Considerations'' section. The reports provided to sample participants were called Reports of Findings.

A preliminary Report of Findings was given to participants at the conclusion of their MEC exam. This preliminary report included a letter of gratitude and all examination results that could be recorded in the MEC. Examples of such results included blood pressure, height and weight, and a complete blood count (CBC).

If abnormal findings were discovered during a MEC examination, the physician discussed these findings with the sample participant. The physician also made referrals if necessary. In general, there were three levels of examination findings and associated referrals.

Level I Finding (Emergency)

A Level I finding was a medical emergency, for example, a dangerously high systolic blood pressure or seizure. The MEC physician managed medical emergencies. An emergency medical kit was available in each MEC so that emergency stabilization could be performed. However, the preferred method of handling medical emergencies was to contact local rescue squads, ambulance services, and hospital emergency rooms. The telephone numbers for local emergency services were posted in the MEC. A Level I finding was rare.

Level II Finding (Early Report)

A Level II finding required the participant to follow up with his or her regular doctor within 2 weeks. These findings were detected either at the MEC or after the examination when laboratory results were sent from the laboratories. The MEC physician evaluated these findings, such as an abnormality in the CBC, and counseled sample participants before they left the examination center. The physician also provided the sample participant with a written report of the condition and urged the participant to make an appointment with his or her primary care physician within the next 2 weeks. If the participant had no primary care physician, the MEC physician had access to a list of providers or clinics where the participant could be evaluated at no charge, or on a sliding-scale fee schedule.

Level II findings also occurred when a laboratory or contractor discovered abnormalities based on NHANES early reporting thresholds. Laboratories transmitted results that met the threshold for early reporting immediately by uploading results to a secure FTP site or e-mailing the results for import. Once abnormal findings were received, an early reporting letter describing the finding was sent to the sample participant (or parent, if a minor), urging the participant to see a medical provider for evaluation. The participant also had the option to talk with the DHANES medical officer. This type of Level II referral usually occurred within 3 weeks after the examination. Again, it was recommended that the participant follow up with his or her regular doctor within 2 weeks of receiving the early report with laboratory abnormalities.

Level III Finding (Routine)

A Level III finding was the routine Report of Findings (i.e., the Final Report of Findings) provided to all sample participants approximately 3–4 months after their examination date. This report was mailed to sample participants and included a letter of gratitude, all final examination results, and a laboratory glossary that helped participants to understand their blood results. Contact information for a DHANES medical officer was also provided should the participant have questions.

Reporting Procedures for Minors

The procedure to report results to minors was similar to that for reporting results to adult sample participants. If a parent or guardian accompanied a minor to the MEC, the preliminary Report of Findings was given to the parent or guardian. Any abnormal findings were communicated to the parent or guardian, and when applicable, NHANES staff requested permission from the parent or

guardian to contact the minor's primary care physician.

If a parent or guardian did not accompany a minor to the MEC, and if there were any abnormal results, NHANES notified the parent or guardian as follows:

- For a Level I finding, the MEC physician immediately called the parent or guardian.
- For a Level II referral, the MEC physician called the parent or guardian to inform him or her and to obtain consent to notify the minor's primary care physician. The MEC physician also gave the parent or guardian a list of providers in the area who could assist in evaluation and treatment.

Reporting Procedures for Sexually Transmitted Diseases and HIV

The reporting of sexually transmitted diseases (STDs) and HIV test results was handled differently from other NHANES examination findings. STD and HIV test results were provided to sample participants by telephone. Because of the medical, social, and emotional consequences of positive STD and HIV tests, disclosure of results was handled such that counseling was provided at the time results were given.

At the time of the MEC examination, the physician provided STD and HIV pretest counseling. The physician explained the purpose of the testing, the reporting procedures, and the confidentiality assurances. The participant could decline the STD or HIV testing at this point.

If the sample participant agreed to the STD and HIV testing, the physician asked the sample participant to provide a password to be used when results were given later. This password was entered into the database. Before leaving the MEC, sample participants were given a paper with a toll-free number, their password, and the date after which their test results were available (approximately 3–4 weeks after the examination). The sample participant was instructed not to share the information with anyone and to call for the test results after the stated date.

Adolescents aged 14–17 were instructed to call for their results the same way as adults. Results, whether positive or negative, were given to the sample participant over the telephone after the sample participant provided the DHANES STD and HIV counselor with a password. Adolescents who did not call for their findings within a 10-day period of the designated dates were notified by telephone. Three attempts were made to contact the adolescent.

Adults who did not call for their findings within a 10-day period of the designated dates were sent a reminder letter from DHANES. If the adult sample participants did not call within a 10-day period after the reminder letter was sent, a second notification letter was sent again reminding them to call DHANES to get their test results. If there was no response after 10 days from the second mailing, a third and final letter was sent.

Results of STD or HIV tests were not put in writing with the sample participant's name or any other personal identifiers, unless the participant requested that the findings be mailed to them. STD results, including HIV, were given in both English and Spanish. DHANES staff who provided results completed a 3-day course on sexually transmitted infections and were HIV counseling certified.

Data Processing and Information Technology

Information technology (IT) played a vital role in the success of NHANES. The vision for NHANES 1999–2010 was to automate as much of the data collection as possible. Objectives included verification of data, utilization of common data elements across components and cycles, reduction of burden on the participant, and minimal post-data collection editing. The requirements for automation were to:

- Maintain an audit trail for data and systems modifications.
- Ensure configuration management in the form of version control over all applications.
- Allow for maximum use of commercial off-the-shelf, or COTS, equipment and software.
- Produce formatted and structured documentation available online.
- Permit a graphical user interface and point of entry validation.
- Ensure a flexible system structure.
- Develop systems compatible with Microsoft Windows.
- Design security functions into all system processes.
- Permit the timely delivery of data from the point of origin to secure storage.

Architecture

In 1999, NHANES developed the Integrated Survey Information System (ISIS), a comprehensive architecture for data collection. Since ISIS was introduced, automated data collection and reporting of interview, examination, and laboratory data has been completed for 177 NHANES sites across the United States. ISIS included a private wide area network, or WAN, and a client–server environment with data replication, providing a built-in disaster recovery system. The infrastructure supported changes in survey requirements as needed and was upgraded when necessary, for example, when new equipment was required for data collection or when security or other system requirements changed.

ISIS used different computing platforms at different points in the data collection process. Tablet personal computers were used by interviewers to collect household interview data, and data were encrypted during all transmissions between the servers in the MEC trailers, the field office, contractor offices, and NHANES' home office. Workstations and database servers were used for database access, data manipulation, review, and numerous other processes. Hardware and software

were upgraded and replaced as requirements changed and IT capabilities advanced.

Data Collection and Processing

NHANES data collection instruments were automated systems that integrated biomedical equipment, questionnaire items, and other data collection and administrative systems, to provide reliable and efficient electronic data capture. All instruments were tested for accuracy, calibration, and adherence to protocols. Data from these automated systems underwent stringent review to confirm the accuracy of the data and the data collection software, as well as compliance with data confidentiality requirements. All collected data were stored in an analytic database, and the data from all components were linked internally by a common identifier.

Because NHANES' reputation depends on maintenance of the confidentiality of all survey participants, all collected and stored NHANES data were protected with a high level of security, including encryption of the data. NHANES data were protected from loss through a system of regular automated backups and secure off-site storage, and NHANES maintained formal processes for disaster recovery and business continuity in compliance with federal regulations.

Data Release

At the conclusion of every 2-year cycle, NHANES data were released to the public. Data were edited to provide consistency and accuracy, and to preserve confidentiality. All direct personal identifiers, as well as any characteristics that could lead to identification, were omitted from the data sets. Data were reviewed by the NCHS Disclosure Review Board (DRB), and based on any recommendations from DRB, the data were then further edited. All data were released in a SAS-readable and -transportable format. Documentation describing edits to the data, and a codebook of data items, were provided for each component. All released data were available on the NHANES website. Some data items were not released publicly due to confidentiality or data quality issues. Data not released due to confidentiality restrictions were accessible via the NHCS Research Data Center (RDC) through a proposal process, and subject to availability and approval. For more information on NCHS RDC, visit http://www.cdc.gov/rdc/.

Data Usability

A standardized variable naming convention was developed to help researchers use the NHANES data sets. This naming convention consisted of each variable having an eight-character name, with defined positions having specific meanings. Positions 1 and 2 represented the topic or subject. For example, the variable name for the urine pregnancy test was URXPREG. The "UR" in positions 1 and 2 indicated that the variable concerns urine, and the "X" in position 3 indicated that this is an examination variable. Other data types were indicated by other letters: Q = questionnaire, A = administrative, S = sampling, C = first random repeat quality-control items, G = gold standard quality-control repeat items, I = item-level components, and D = modified data items. For further information on how to analyze the data, visit http://www.cdc.gov/nchs/tutorials/.

Conclusion

This NHANES plan and operations 1999–2010 report provides an overview of the conduct of NHANES in a single document. For more detailed information on NHANES, see the NHANES website at www.cdc.gov/nhanes. Planning and implementing NHANES 1999–2010 involved numerous organizations and partnerships, and these collaborations were critical to the success of the survey.

NHANES has been in operation for more than 50 years and collects high-quality health data. It is a unique survey in that it collects demographic, diet, medical, and behavioral data. It has remained responsive to new public health needs while maintaining the core measurements necessary for ongoing monitoring of our nation's health. NHANES data have produced valuable tools, such as pediatric growth charts, which provide information on growth of infants and children. NHANES data have also supported national health initiatives and have been used to assist in policy decisions. NHANES continues to provide data on public health thanks to the thousands of Americans who participate each year.

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Appendix. Glossary

Aliquoting—Dividing the blood into equal parts over several vials.

Centrifugation—The process of putting biological samples into an instrument that spins around a central axis to separate materials into different layers with centrifugal force. All work was performed under the laminar-flow biological safety cabinet, using only those materials that the Centers for Disease Control and Prevention had prescreened for possible contamination.

Ethics Review Board—In 2003, the National Health and Nutrition Examination Survey (NHANES) Institutional Review Board changed its name to the National Center for Health Statistics (NCHS) Research Ethics Review Board.

Group quarters—A place where people live or stay that is normally owned or managed by an entity or organization providing housing or services for the residents. These services may include custodial or medical care, as well as other types of assistance, and residency is commonly restricted to those receiving these services. People living in group quarters are usually not related to each other. Group quarters include such places as college residence halls, residential treatment centers, skilled nursing facilities, group homes, military barracks, correctional facilities, workers' dormitories, and facilities for people experiencing homelessness. These are generally grouped into two categories: institutional group quarters and noninstitutional group quarters.

Institutional group quarters—Group quarters providing formally authorized, supervised care or custody in institutional settings, such as correctional facilities; nursing and skilled nursing facilities; inpatient hospice facilities; mental facilities (psychiatric hospital); group homes for juveniles; and residential treatment centers for juveniles. Institutional group quarters are not included in the NHANES sample. (For group quarters included in NHANES, see *Noninstitutional group quarters*.)

Noninstitutional group quarters—Group quarters that do not provide formally authorized, supervised care or custody in institutional settings. These include college or university housing, group homes intended for adults, residential treatment facilities for adults, workers' group living quarters, Job Corps centers, and religious group quarters. Noninstitutional group quarters are included in the NHANES sample.

Household—The person or group of persons living in an occupied dwelling unit.

Low income—Beginning in 2000, NHANES split the sampling domains for white persons and others based on their income status: low income or non-low income. Low-income persons are those at or below 130% of the federal poverty level. The poverty threshold used in this determination was based on the most recent poverty guidelines published by the U.S. Department of Health and Human Services; these thresholds are updated annually by the U.S. Census Bureau.

National Center for Health Statistics (NCHS)—As the nation's principal health statistics agency, NCHS designs, develops, and maintains a number of systems that produce data related to demographic and health concerns. These include data on registered births and deaths collected through the National Vital Statistics System, and data collected by the National Health Interview Survey, NHANES, the National Health Care Surveys, and the National Survey of Family Growth, among others. NCHS is part of the Centers for Disease Control and Prevention, an operating division of the U.S. Department of Health and Human Services (HHS).

National Office of Vital Statistics—Part of the U.S. Public Health Service since transferring from the U.S. Bureau of the Census in 1946, the National Office of Vital Statistics was responsible for producing national vital statistics on births, deaths, fetal deaths, marriages, and divorces. In 1960, HHS merged this office with the National Health Survey program to form NCHS.

Noninstitutionalized civilian population—Includes all people living in households and excludes those persons in institutional group quarters and those on active duty with the military. This is the target population for NHANES.

Occupational Safety and Health Administration (OSHA)—The main federal agency charged with enforcing safety and health legislation. OSHA promulgated two standards relating to the safe use of chemicals in the workplace: "Hazard Communication" (29 CFR 1910.1200) and "Occupational Exposure to Hazardous Chemicals in Laboratories" (29 CFR 1910.1450). For more information on these standards, visit http://www.osha.gov/law-regs.html.

Primary sampling unit (PSU)—The first-stage selection unit in a multistage area probability sample. In NHANES, PSUs are counties or groups of counties in the United States. Some PSUs are so large that they are selected into the survey with a probability of one. These are referred to as PSUs selected with certainty ("certainty PSUs"); all other PSUs are selected without certainty ("noncertainty PSUs").

Sample weight—The estimated number of persons in the target population that an NHANES respondent represents. For example, if a man in the sample represents 12,000 men in his race and ethnicity-income-age category, then his sample weight is 12,000. The NHANES sample weights were adjusted for different sampling rates (of the race and ethnicity-income-age-sex groups), different response rates, and different coverage rates among persons in the sample, so that accurate national estimates can be made from the sample. The product of all of these adjustments is sometimes called the "final" sample weight.

Screener—An interview (usually short) containing a set of questions asked of a household member to determine whether the household contains anyone eligible for the survey. In NHANES, the screener consisted of compiling a household roster and collecting the income level of the household and the race and ethnicity, age, and sex of all household members. In NHANES, only persons aged 18 and over can answer the screener.

Screening—The process of conducting, or attempting to conduct, the screening interview in the selected dwelling units. Occupied dwelling units (households) are screened through the screening interview. Other units can also be screened; the process for these units is simply verification that they are vacant or that they are not dwelling units. See *Screener*.

Segment—A group of housing units located near one another, all of which were considered for selection into the sample. For NHANES, segments consist of a census block, or groups of blocks, and their selection makes up the second stage of sampling for NHANES. Within each segment, a sample of dwelling units was selected.

Weight—See *Sample weight*.

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