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# National Health and Nutrition Examination Survey: National Youth Fitness Survey Plan, Operations, and Analysis, 2012



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



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## National Health and Nutrition Examination Survey: National Youth Fitness Survey Plan, Operations, and Analysis, 2012

Data Evaluation and Methods Research

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

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## Abstract

### Background

In October 2008, the federal government issued its first-ever Physical Activity Guidelines for Americans to provide science-based guidance on the types and amounts of physical activity that provide substantial health benefits for Americans (1). Guidelines for children and adolescents recommend 60 minutes or more of aerobic, muscle-strengthening, or bone-strengthening physical activity daily (1). While the number of children in the United States who meet the recommendations in the Physical Activity Guidelines is unknown, the percentage that is physically active in the United States may be declining. No recent national data exist on the fitness levels of children and adolescents. The National Health and Nutrition Examination Survey's (NHANES) National Youth Fitness Survey (NNYFS) was conducted in 2012 and collected data on physical activity and fitness levels for U.S. children and adolescents aged 3–15 years.

### Objectives

The objective of NNYFS was to provide national-level estimates of the physical activity and fitness levels of children, based on interview and physical examination data. Results from the survey are intended to contribute to the development of policies and programs to improve youth fitness nationally. The data also may be used in the development of national reference standards for measures of fitness and physical activity.

### Methods

The NNYFS survey design used the design for NHANES, which is a multistage probability sample of the civilian noninstitutionalized resident population of the United States. NNYFS consisted of a household interview and a physical activity and fitness examination in a mobile examination center. A total of 1,640 children and adolescents aged 3–15 were interviewed, and 1,576 were examined.

**Keywords:** physical activity in children • mobile examination center

# National Health and Nutrition Examination Survey: National Youth Fitness Survey Plan, Operations, and Analysis, 2012

by *Lori Borrud, Ph.D., Michele M. Chiappa, B.A., Vicki L. Burt, Sc.M., R.N., Jaime Gahche, M.P.H., George Zipf, M.S., National Center for Health Statistics; Sylvia M. Dohrmann, M.S., Westat; and Clifford L. Johnson, M.S.P.H., National Center for Health Statistics*

## Introduction

The first-ever Physical Activity Guidelines for Americans were issued by the federal government in October 2008. The guidelines provided science-based guidance on the types and amounts of physical activity that provide substantial health benefits for Americans (1). Sixty minutes or more of physical activity daily is recommended for children and adolescents. Activities include moderate-intensity or vigorous-intensity aerobic activity (e.g., running, karate, or bicycle riding); muscle-strengthening activity (e.g., tree climbing, swinging, or gymnastics); or bone-strengthening activity (e.g., hopping, skipping, or jumping) (1).

One of every three children in the United States is overweight or obese (2). This may increase children's risk of developing diabetes, heart disease, and cancer over the course of their lives. Regular physical activity in children and adolescents promotes health and fitness and may help prevent obesity (1).

Estimates of the number of U.S. children who meet the physical activity guidelines are limited. Data from the 2001–2009 Health Behavior in School-aged Children quadrennial surveys, nationally representative samples of U.S. children in the 6th through 10th grades, identified significant increases in the number of days per year with at least 60 minutes

of physical activity (3). However, data from the Centers for Disease Control and Prevention's (CDC) Youth Risk Behavior Surveillance System indicate that the percentage of physically active U.S. children in the 9th through 12th grades is declining (4).

The National Health and Nutrition Examination Survey (NHANES) has administered tests of physical activity and fitness that included children and adolescents. A physical activity monitor was fielded for participants aged 6 years and over in 2003–2006 and was implemented again in 2011. In 1999–2004, cardiovascular fitness was reported as estimated maximal oxygen uptake (VO<sub>2</sub> max) from a treadmill test for participants aged 12–49. A grip strength component was implemented in 2011 for participants aged 6 and over. However, the inclusion of additional tests of physical activity and the expansion on tests previously done in NHANES for children as young as age 3 years would provide further information to evaluate changes in the health of children and adolescents over time. The NHANES National Youth Fitness Survey (NNYFS) was the first national survey of physical activity and fitness in children and adolescents and was conducted jointly with NHANES in 2012. For information on NHANES, visit <http://www.cdc.gov/nchs/nhanes.htm>.

# Planning and Sample Design

In 2011, CDC’s National Center for Health Statistics (NCHS) received Affordable Care Act funds from the U.S. Department of Health and Human Services (HHS) to plan, implement, and conduct NNYFS. No national study of the physical fitness of U.S. children had been conducted since the mid-1980s. The HHS Secretary had dedicated funds to obesity prevention and fitness—one of four critical priorities for the department (1). The obesity prevention and fitness priority aims to “advance activities to improve nutrition and increase physical activity to promote healthy lifestyles and reduce obesity-related conditions and costs” (5).

The NNYFS sample was designed so that data from components common to NNYFS and NHANES in 2012, such as the body measures, physical activity monitor, muscle strength (grip strength), physical activity questionnaire, and dietary recall could be analyzed together. NNYFS included additional tests of cardiovascular capacity, performance endurance, core strength, upper and lower body strength, and gross motor skills, as well as questions on health characteristics and drug, alcohol, and tobacco use. The NHANES–NNYFS project involved identifying which activities could be conducted in both surveys to provide a larger sample size for analysis, developing an innovative sample design that incorporated both surveys, training interviewers to administer questionnaires for both studies simultaneously, and refurbishing NHANES trailers for a new use.

The planning and implementation of NNYFS data collection took about 8 months, which included the refurbishing of three NHANES trailers, preparing protocols for the physical activity and fitness tests, planning and conducting a feasibility study of the tests, purchasing equipment to outfit the refurbished trailers, developing a physical activity questionnaire, and hiring and training

health examiners. Challenges included incorporating 10 NNYFS components into the limited space of a single trailer and a tight survey schedule. Screening, interviewing, and examining for NNYFS were accelerated because the mobile examination centers (MECs) were operating at each survey location between 2½ and 3 weeks, compared with 5 to 6 weeks for NHANES.

## Children’s Physical Activity Feasibility Study

Planning for a feasibility study of NNYFS components began in early spring 2011, with input from recognized experts in physical activity and kinesiology from within the federal government and academia and from a review of the scientific literature. Six tests were selected or developed by staff from NCHS’ Division of Health and Nutrition Examination Surveys (DHANES) that would provide nationally representative data on fitness and physical activity while still being conducted in the limited space available in a single trailer. To provide the most accurate evaluation of the feasibility of these tests in a confined mobile environment, DHANES staff conducted the Children’s Physical Activity Feasibility Study (CPAFS) in a refurbished NHANES trailer in 2011. One hundred sixty-nine children aged 3–15 were recruited and participated in the study. Necessary consent was obtained prior to participation. CPAFS included one test to measure physical activity, five tests of endurance and muscle strength, and one measurement of height and weight (Table A).

## Sample Design

NNYFS was conducted concurrently with NHANES in 2012, the second year of the NHANES 2011–2012 survey cycle, with survey participants selected from an independent sample of dwelling units (DUs) within the segments selected for that year of NHANES. The minimum measure of size for the 2012 segments was increased above the rates established for the NHANES 2011–2014 sample to ensure sufficient DUs for both surveys in the selected segments.

NHANES and NNYFS used four stages of sampling. First, primary sampling units (PSUs) (mostly counties) were selected to meet the analytic goals for NHANES. Second, segments large enough to ensure there were enough DUs for both surveys were selected within PSUs. The third and fourth stages involved selecting DUs or households specific to NNYFS and individuals within those households, so that no households had both NHANES and NNYFS participants. The NNYFS design differed from that of NHANES in that participants were selected based on sex and age only (income and race and Hispanic origin were not selection criteria).

The goal for NNYFS was to interview and examine approximately 1,500 children and adolescents aged 3–15 with approximately equal sample sizes for each single year of age. In addition, six analytic domains (males 3–5, females 3–5, males 6–11, females 6–11, males 12–15, and females 12–15) were defined for the survey. The targeted number of examinations and actual number of achieved interviews

**Table A. Children’s Physical Activity Feasibility Study, 2011**

Test	Target age (years)
Physical activity monitor—accelerometer . . . . .	3–5
Endurance performance—treadmill . . . . .	6–11
Lower body muscle strength (sitting and prone positions, extension, and flexion) . . . . .	6–15
Modified pull-up (upper body muscle strength) . . . . .	5–15
Plank exercise (core strength and muscular endurance) . . . . .	3–15
Gross motor skills (balance and coordination) . . . . .	3–5



**Table B. Examinations by sample domain, NNYFS 2012**

Sex and age (years) domain	Target number of examinations (percent)	Number of interviews (percent)	Number of examinations (percent)
Males, 3–5 . . . . .	173 (11.5)	187 (11.4)	179 (11.3)
Males, 6–11 . . . . .	346 (23.1)	377 (23.0)	358 (22.7)
Males, 12–15 . . . . .	231 (15.4)	259 (15.8)	250 (15.9)
Females, 3–5 . . . . .	173 (11.5)	181 (11.0)	173 (11.0)
Females, 6–11 . . . . .	346 (23.1)	385 (23.5)	374 (23.7)
Females, 12–15 . . . . .	231 (15.4)	251 (15.3)	242 (15.4)
Total, 3–15 . . . . .	1,500 (100.0)	1,640 (100.0)	1,576 (100.0)

NOTE: NNYFS is National Health and Nutrition Examination Survey National Youth Fitness Survey.

and examinations, by the six age-sex analytic domains, are shown in [Table B](#). A total of 2,065 children and adolescents aged 3–15 were selected to participate in the survey. Of these, 1,640 (79.4%) were interviewed and 1,576 (76.3%) were examined.

## Ethical, Privacy, and Confidentiality Considerations

The NNYFS protocol was developed to comply with the HHS Policy for Protection of Human Research Subjects (45 CFR part 46) (<http://www.hhs.gov/ohrp/human-subjects/guidance/45cfr46.html>) and was approved by the NCHS Research Ethics Review Board (ERB). All data collected were protected by three federal laws: the Privacy Act of 1974 (5 U.S.C. 552a), section 308(d) of the Public Health Service Act (42 U.S.C. 242m), and the Confidential Information Protection and Statistical Efficiency Act (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 ... .” These strict prohibitions, forbidding even unintentional, unauthorized disclosures, guided the behavior of all NCHS and contractor staff. Any violation of these laws could result in fines or imprisonment.

### Ethics Review Board

The NCHS Research ERB protected the rights and welfare of NNYFS participants. In accordance with Federal Regulation 45 CFR 46.111, the NCHS Research ERB reviewed and approved NNYFS protocols and any changes.

### Informed Consent

The informed consent process for NNYFS followed the procedures established for NHANES. If the parent or guardian for one or more sample persons identified through the screening process was available, the interviewer continued with the home interview. If

the parent or guardian for the selected sample person was not available, the interviewer made an appointment to return to administer the sample person and family questionnaires. Documented signed consent was obtained from each sample person’s parent or guardian (required to be age 18 or over) prior to the household interview and the appointment at the NNYFS MEC. Sample persons aged 7–15 provided additional signed assent to participate in the examination portion of NNYFS. Participants were provided a copy of their signed parent or guardian consent and a consent brochure, which included information on participation. The consent brochure is available on the NNYFS website at <http://www.cdc.gov/nchs/nyfs/brochures.htm>.

In addition, participants aged 12–15 answered the questions in the Physical Activity section of the sample person questionnaire themselves and signed a consent form for that section. The appointment for the MEC examination was made after the home interview was completed. If participants were not available at the time of the household interview, they were able to consent to the physical activity questions at the MEC before their examination. [Table C](#) provides a summary of the forms used to complete the consent process for NNYFS.

## Field Operations

NNYFS was operationally designed to achieve high response rates—a minimum of 1,500 children—and high-quality data. Field operations included advance arrangement activities, staffing, training, and interviewing.

**Table C. Summary of forms used in the consent process, NNYFS 2012**

Participant age (years)	Home interview consent for participants aged 3–15	Home interview assent for physical activity questions	Parental permission to audiotape household interview	Parental consent or assent permission for examination	Child assent for examination
3–5 . . . . .	Signed by parent	...	Signed by parent	Signed by parent	...
6–11 . . . . .	Signed by parent	...	Signed by parent	Signed by parent	Signed by participant (ages 7–11)
12–15 . . . . .	Signed by parent	Signed by participant	Signed by parent	Signed by parent	Signed by participant

... Category not applicable.

NOTE: NNYFS is National Health and Nutrition Examination Survey National Youth Fitness Survey.

## Advance Arrangements

All DUs selected for NNYFS were sent an advance letter approximately 3 weeks before interviewing began that introduced NNYFS, provided contact information for NCHS, and explained that an interviewer would be making a home visit. All other advance arrangement activities for NNYFS, such as finding locations for the trailers and notifying local community leaders, were performed in conjunction with NHANES. Details of advance arrangement activities are available in “The National Health and Nutrition Examination Survey: Plan and Operations, 1999–2010” (6).

## Staffing

The field staff included the field office and interviewers. The field office consisted of a study manager, field manager, office manager, and two assistant office managers at each survey location. The field office supported both NHANES and NNYFS with regard to household interviewing and examining data collection. The interviewers also supported both surveys and were proficient in contacting residents of sampled households. Interviewers administered the screener questionnaire, obtained all consents, and administered all household interview questions.

## Household Interview

### Screener

The NNYFS screener module consisted of a set of questions to determine if any child in the household was eligible to participate in the survey. The interviewer verified the household address and asked questions regarding the number of people living in the household, the names of household members, and their age and sex. This was a very brief interview and was conducted at the door. If an eligible child was identified, the interviewer proceeded with the household interview. Circumstances preventing an interviewer from completing a screener questionnaire included:

- A vacant unit or residence
- An address not qualifying as a DU
- A nonexistent sampled DU
- A household resident refusing to participate

### Sample person and family questionnaires

The household interview included administration of the sample person questionnaire and a short family questionnaire. The sample person questionnaire collected information on the participant’s demographic, socioeconomic, dietary, and health-related history (Table D). It was

administered to all eligible participants or their proxies. Participants aged 12–15 were required to answer the questions in the Physical Activity section themselves. If they were not at home at the time of the household interview, they were asked the physical activity questions at the MEC.

The family questionnaire (Table E) was completed for every family unit (e.g., a married couple, a couple living as married, and others) sampled within the household. The U.S. Census Bureau’s Current Population Survey family definitions were used (7). The family questionnaire included questions on the country of birth and level of education of the nonsampled head of the household and on family income. All NNYFS questionnaires are available on the NNYFS website at <http://www.cdc.gov/nchs/nyfs/questionnaires.htm>.

At the conclusion of the household interview, the interviewer scheduled an appointment for the participant to be examined in the NNYFS MEC. A reminder letter was mailed to the participant 1 week before the scheduled examination. The letter included the date and time of the examination appointment, transportation information, directions to the MEC, instructions on what to wear and bring, and the remuneration amount. The letter also emphasized the requirement that all children be accompanied by an individual aged 18 or over. Forty-eight hours before an examination

**Table D. Sample person questionnaire, NNYFS 2012**

Questionnaire section	Description
Acculturation (ACQ)	Primary language(s) used at home, and mother’s and father’s countries of origin
Demographics (DMQ)	Level of education, race and Hispanic origin, and country of origin
Diabetes (DIQ)	History of diabetes and prediabetes; now taking insulin or diabetic pills
Dietary supplements and prescription medication (DSQ)	Use of supplements, nonprescription antacids, and prescription medications
Diet behavior and nutrition (DBQ)	School breakfast and lunch program utilization, number of meals eaten away from home, use of ready-to-eat foods, frozen meals, and frozen pizzas
Early childhood (ECQ)	Whether mother smoked while pregnant, weight at birth, and history of overweight
Health insurance (HIQ)	Health care coverage and type of insurance
Hospital utilization and access to care (HUQ)	General health status, place goes to most often when sick
Medical conditions (MCQ)	History of asthma, and use of medication for asthma, trouble seeing, and menstruation
Physical activity (PAQ)	Vigorous- or moderate-intensity activities and sports and frequency and length of time spent in those activities, walking and bicycling for travel, sitting, television viewing, and computer and video game use (additional questions were asked of participants aged 12–15)
Physical functioning (PFQ)	Physical impairments, use of special equipment, participation in special education, or use of early intervention services
Respiratory health and disease (RHQ)	Wheezing and limitation of activity due to wheezing or whistling

NOTE: NNYFS is National Health and Nutrition Examination Survey National Youth Fitness Survey.

**Table E. Family questionnaire, NNYFS 2012**

Questionnaire section	Description
Demographic background or occupation (DMQ–FAM) . . .	Level of education, race and Hispanic origin, and country of origin of nonsample participant head of household
Income (INQ) . . . . .	Family and total household income

NOTE: NNYFS is National Health and Nutrition Examination Survey National Youth Fitness Survey.

appointment, the field office staff called the participant's home as a reminder of the upcoming examination. Instructions related to the examination were reviewed with the participant or the parent or guardian. If the participant did not have a phone, the interviewer visited the home to provide an in-person reminder.

## Mobile Examination Center Operations

The NNYFS MEC consisted of a single trailer that traveled with the four NHANES MEC trailers, but it was not physically connected to any of the NHANES trailers at survey sites. All locations for the NHANES trailers were chosen to accommodate the additional stand-alone NNYFS trailer. The NNYFS trailer was designed to accommodate physical activity and fitness examinations and interviews, and it consisted of two large examination rooms and one interview room (Figure).

The MEC was a nonsmoking facility. Each MEC was equipped with safety equipment and supplies.

## Staffing

NNYFS employed one examination team that spent 2½ to 3 weeks at each survey location. The MEC staff was selected based on their previous experience with children, academic training, knowledge, skills, and abilities. The staff included two nurse practitioners and two examiners with degrees in exercise physiology and nutrition or kinesiology. Two of the staff members were bilingual to address language needs of Spanish-speaking survey participants. Training for the MEC staff was rigorous and included learning the objectives and goals of each examination component, demonstrating protocols and procedures, live practicing of protocols and procedures with the contractor's home office staff and paid volunteers, learning the quality control and quality assurance procedures, maintaining and calibrating equipment, learning MEC opening and closing

protocols, and maintaining supply inventory.

## Safety Precautions

All children were accompanied to the MEC by an individual aged 18 or over. The nurse practitioners administered the "Nurse Review," which asked the parent or guardian questions regarding physical disabilities, injuries, surgeries, or medications that would exclude their child from participating in a component. "The Nurse Review Program Manual" can be found at [http://www.cdc.gov/nchs/data/mnyfs/Nurse\\_Review.pdf](http://www.cdc.gov/nchs/data/mnyfs/Nurse_Review.pdf). MEC staff were present during all examination components, which were stopped immediately when any participant complained of discomfort or pain. All components also were stopped immediately if the participant was not able to follow instructions sufficiently.

## Examinations

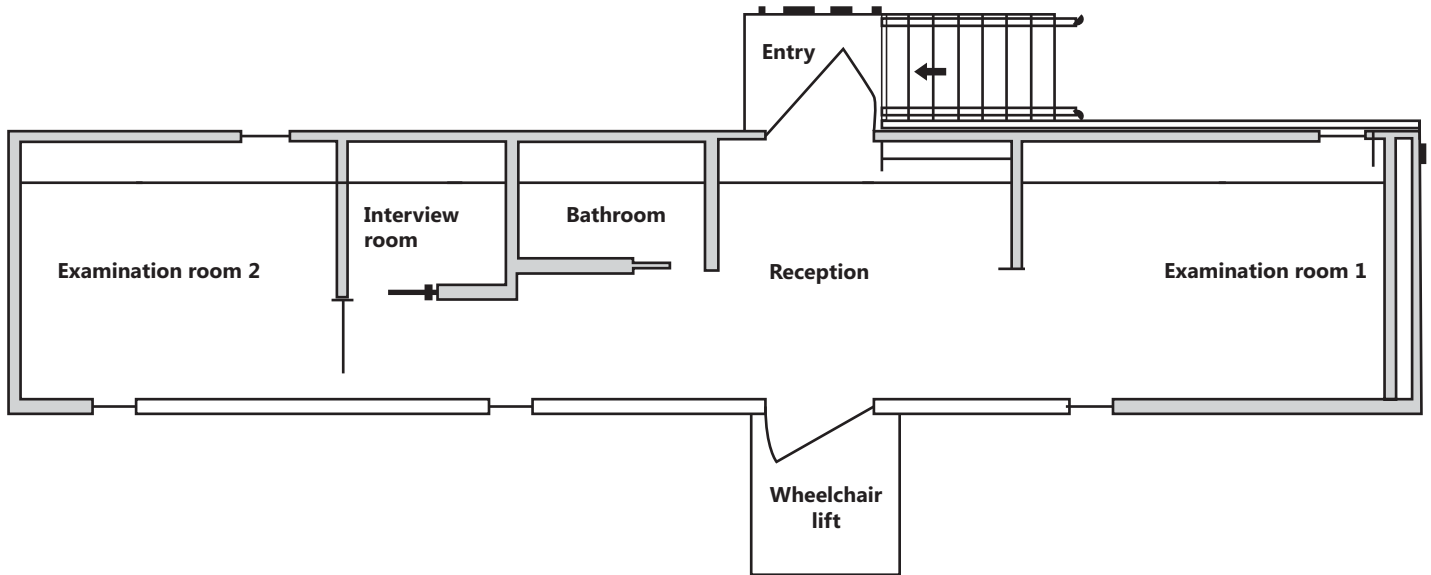
The NNYFS examination components had either been administered in NHANES or tested in CPAFS and included standardized measurements of anthropometry, core strength, upper and lower body muscle strength, cardiovascular fitness, and gross motor development. The NNYFS examination components are listed in Table F.

**Table F. Examination components, NNYFS 2012**

Component	Target age (years)	Source	Report of findings
Body measures . . . . .	3–15	NHANES	Yes (height, weight, and body mass index)
Core muscle strength (plank) . . . . .	3–15	CPAFS	No
Gross motor skills . . . . .	3–5	CPAFS	No
Lower body muscle strength (extension at the knee in sitting position) . . . . .	6–15	CPAFS	No
Upper body muscle strength (grip strength) . . . . .	6–15	NHANES	Yes (ages 7–15 only)
Upper body muscle strength (modified pull-up) . . . . .	5–15	CPAFS	Yes
Physical activity monitor (accelerometer) . . . . .	3–15	NHANES and CPAFS	No
Aerobic fitness (maximal and submaximal exercise test) . . . . .	6–15	NHANES and CPAFS	Yes (ages 12–15 only)
Computer-assisted self-interview . . . . .	12–15	NHANES	No
Dietary recall interview . . . . .	3–15	NHANES	No
Physical activity questionnaire (if not administered in the household interview) . . . . .	12–15	NHANES	No

NOTES: NNYFS is National Health and Nutrition Examination Survey National Youth Fitness Survey. NHANES is National Health and Nutrition Examination Survey. CPAFS is Children's Physical Activity Feasibility Study.





SOURCE: CDC/NCHS, National Health and Nutrition Examination Survey, National Youth Fitness Survey, 2012.

**Figure. Diagram of mobile examination center, 2012**

All participants were asked to dress in comfortable, loose-fitting, short-sleeved or sleeveless shirts and shorts. Participants wore running or tennis shoes and socks. Shorts and shoes were available for children who did not come appropriately dressed for the examination.

The controlled environment of the MEC allowed physical measurements to be conducted under identical conditions at each survey site. Eligibility for examination components was determined by the participant's age and any exclusions identified during the Nurse Review. The following sections describe the MEC examination and interview components. More detailed information on the components is available on the NNYFS website (<http://www.cdc.gov/nchs/nyfs.htm>).

## Body measures

All participants aged 3–15 were eligible for the body measures component. Measurements included height and weight; lengths of the entire arm and upper arm; midarm, midcalf, and waist circumferences; and subscapular, triceps, and calf skinfold thickness. The NNYFS body measures component included the same standardized methods that have been employed in NHANES since the first survey was conducted in 1960–1962. Height, weight, and body mass index (calculated as weight in kilograms divided by height in meters squared) were included in the “Report of Findings.” More information is available in the “Body Measures Procedures Manual” at [http://www.cdc.gov/nchs/data/nyfs/Body\\_Measures.pdf](http://www.cdc.gov/nchs/data/nyfs/Body_Measures.pdf).

## Core muscle strength—plank

Participants aged 3–15 were eligible for the plank or core muscle strength component. The plank exercise assessed muscular endurance and core strength around the trunk and pelvis. The component used the front plank position, in which the participant lies face down on a mat, resting on the forearms with hands clenched or palms flat on the floor. The participant then pushes off the floor, rising up onto toes,

and maintains the position as long as possible while keeping the back straight without the stomach dropping or hips rising up. No results were reported to the participants. These data will provide the first nationally representative data on core strength for children and adolescents. For more information, see the “Plank Exercise Procedures Manual” (<http://www.cdc.gov/nchs/data/nyfs/Plank.pdf>).

## Gross motor skills

Participants aged 3–5 were eligible for the gross motor skills component. Gross motor skills involve the large muscles of the body that enable major body movement such as walking, maintaining balance, coordination, jumping, and reaching. Children with better-developed motor skills may find it easier to be active and engage in more physical activity than those with less-developed motor skills.

The Test of Gross Motor Development (TGMD–2) (8) was used for this component. TGMD–2 has been used by researchers in the United States and internationally and is a norm-referenced measure of common gross motor skills that develop early in life. TGMD–2 consists of two subtests with six skills for each subtest: locomotor (running, galloping, hopping, leaping, horizontal jumping, and sliding); and object control (striking a stationary ball, stationary dribbling, kicking, catching, overhand throwing, and underhanded rolling). The developer of TGMD–2 provided consultation on the component. No results were reported to the participant. The gross motor skills component will provide the first nationally representative data on locomotion and object-control skills for young children. For more information, see the gross motor skills procedures manual (<http://www.cdc.gov/nchs/data/nyfs/TGMD.pdf>).

## Lower body muscle strength

Participants aged 6–15 were eligible for the lower body muscle strength (LBMS) component. A hand-held dynamometer (HHD) was used to assess LBMS (quadriceps strength) through

measurement of maximum isometric knee extension force in the sitting position. The LBMS chair was specifically developed and built for isometric testing. The participant's hips, thighs, and upper body were secured on the test chair with straps. Isometric resistance was supplied using a belt passing through a strap on the HHD and around the chair. Participants were asked to push their legs as hard as possible against the HHD in three tests of each leg, alternating legs. A professor of kinesiology, physiology, and neurobiology provided consultation for the component. No results were reported to the participant. The LBMS component will provide the first nationally representative LBMS data for children and adolescents. For more information, see the lower body muscle strength procedures manual at [http://www.cdc.gov/nchs/data/nyfs/Lower\\_Body\\_Muscle\\_Strength.pdf](http://www.cdc.gov/nchs/data/nyfs/Lower_Body_Muscle_Strength.pdf).

## Upper body muscle strength—grip strength

Participants aged 6–15 were eligible for the muscle strength or grip strength component. NHANES implemented the isometric grip strength test in 2011 to provide data for comparison with data on upper body muscle strength from National Health Examination Survey cycles II and III, 1963–1970, which included a grip test for children aged 6–11 and 12–17, respectively. The NHANES grip strength test was developed in collaboration with the National Cancer Institute.

NNYFS used the same protocol for the grip strength test that was used in NHANES. Participants were asked to squeeze a dynamometer adjusted for their hand size as hard as possible three times in each hand, alternating hands. A derived variable (in pounds of force) created from the sum of the highest reading from each hand was included in the Report of Findings. The classification of strength included in the Report of Findings for ages 7–14 was based on reference data from the Canada Fitness Survey Longitudinal Study (9) and, for age 15, from the *Canadian Physical Activity, Fitness & Lifestyle Approach* (10).

Results were not reported to participants aged 6 years. For more information, see the grip strength procedures manual at [http://www.cdc.gov/nchs/data/nyyfs/Handgrip\\_Muscle\\_Strength.pdf](http://www.cdc.gov/nchs/data/nyyfs/Handgrip_Muscle_Strength.pdf).

### Upper body muscle strength—modified pull-up

Participants aged 5–15 were eligible for the modified pull-up component. The modified pull-up measures upper body muscle (back, shoulder, forearm, and arm) strength. The component used a specially constructed horizontal bar positioned at a height that allowed participants to clasp the bar with an overhand grasp when lying flat on their back. Participants raise their body by flexing the arm until the chest touches a strap hanging down from the horizontal bar, then lower back to the starting position while keeping the body straight with the hips up and only the heels touching. The procedure was repeated as many times as possible. The number of correctly completed pull-ups was compared with the number of age- and sex-specific Healthy Fitness Zone pull-ups in FitnessGram and provided to participants in their Report of Findings. FitnessGram is a battery of health-related fitness items scored using criterion-referenced standards (11). The modified pull-up component will provide the first nationally representative data against which schools can compare results from their districts. For more information, see the modified pull-up procedures manual at [http://www.cdc.gov/nchs/data/nyyfs/Modified\\_Pullup.pdf](http://www.cdc.gov/nchs/data/nyyfs/Modified_Pullup.pdf).

### Physical activity monitor—accelerometer

All participants aged 3–15 were eligible for the physical activity monitor (PAM) component, including children who were wheelchair-bound. At the MEC, monitors were placed on the wrist of the participant's nondominant arm. Participants were asked to wear the monitors 24 hours a day for 7 full days, with measurements beginning the day after their examination. The monitors were water-resistant and could be worn while swimming, showering, or bathing.

While a PAM component for measuring physical activity was fielded in NHANES in 2011 for ages 6 and over, to be consistent with the NNYFS component, eligibility was changed in 2011 to include ages 3–5. The same accelerometer used in NHANES was used in NNYFS. After the monitors were returned in provided postage-paid envelopes, remuneration checks for \$40 were mailed to the survey participants. No results were reported to participants from the PAM component. Currently, there are no reporting standards. Data collected in the 2012 NHANES and NNYFS will provide the first nationally representative data on measured physical activity levels for children aged 3–5. For more information, see the “Physical Activity Monitor Procedures Manual” at [http://www.cdc.gov/nchs/data/nyyfs/Physical\\_Activity\\_Monitor.pdf](http://www.cdc.gov/nchs/data/nyyfs/Physical_Activity_Monitor.pdf).

### Aerobic fitness—maximal and submaximal exercise test

Participants aged 6–15 were eligible for the treadmill component. Two treadmill protocols were used in NNYFS. The protocol developed for ages 6–11 measured endurance performance based on duration on the treadmill, with increasing speed and incline. The protocol had been approved by the NCHS Research ERB and tested successfully in CPAFS. The treadmill protocol for ages 12–15 was a submaximal exercise test that had been conducted previously in NHANES 1999–2006 to measure aerobic capacity ([http://www.cdc.gov/nchs/nhanes/nhanes2003-2004/CVX\\_C.htm](http://www.cdc.gov/nchs/nhanes/nhanes2003-2004/CVX_C.htm)). A treadmill designed specifically for exercise testing was used for both protocols. Four leads with electrodes were attached to the participant's chest to measure heart rate.

Participants were given time to practice before test initiation in order to familiarize themselves with treadmill walking and a cool-down period at the end of the test. Two examiners were present during the treadmill test: one monitoring the heart rate data and treadmill and the other encouraging and monitoring the participant. As the test proceeded, the examiner continually assessed the participant by direct

observation and by reviewing heart rate readings. The treadmill component included two levels of priority criteria that warranted an emergency stop of the protocol. Stopping criteria included distress observed by the health examiner or reported by the participant, a request by the participant to stop, and equipment failure. A pediatric cardiologist provided consultation for the treadmill component. Results were not reported to participants aged 6–11 because there are no established standards against which to evaluate endurance performance in children. The Report of Findings for participants aged 12–15 provided incline, speed, duration, and general fitness classification, relative to the same sex and age group, based on estimated maximum work capacity (VO<sub>2</sub> max) in FitnessGram (11). For more information, see the treadmill procedures manual at <http://www.cdc.gov/nchs/data/nyyfs/Treadmill.pdf>.

### Mobile Examination Center Interviews

#### Physical activity questionnaire

The physical activity questionnaire was administered to participants aged 12–15 in the MEC only if the participant was unavailable to answer questions during the household interview; see [Table D](#) for more information on the physical activity questionnaire.

#### Dietary recall

All participants aged 3–15 were eligible for the dietary recall interview. The dietary interview for NNYFS was the same interviewer-administered, computer-assisted, 24-hour dietary recall administered in NHANES. NNYFS included only the in-person interview in the MEC; unlike NHANES, the second-day telephone interview was not conducted. The objective of the dietary interview component was to obtain detailed dietary intake information from NNYFS participants on the 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). The dietary interview also included questions on dietary supplements (e.g., vitamins, minerals, herbals, and nonprescription antacids) consumed during the 24-hour period. The dietary interview component (called “What We Eat in America”) is conducted as a partnership between the U.S. Department of Agriculture and HHS. The questions were included in NNYFS to be used as covariates in the analysis of the physical activity and fitness data.

### Computer-assisted self-interview

A short computer-assisted self-interview (CASI) questionnaire was completed by participants aged 12–15 in the interview room on a touch-screen monitor. The questionnaire did not have an audio component. A small number of questions from the NHANES Tobacco Use, Alcohol Use, and Drug Use questionnaire sections were included in the self-interview. There were no proxy respondents for CASI, and MEC staff were not present. The questions were included in NNYFS to be used as covariates in the analysis of the physical activity and fitness data.

## Report of Findings and Remuneration

All NNYFS Reports of Findings were provided in the MEC at the end of the examination appointment; none were mailed. The Report of Findings was given to participants aged 12 and over and to the parent or guardian of younger participants. The Report of Findings was provided for components for which standards were available and against which results could be measured. Several of the NNYFS physical activity and fitness components had not been conducted on a national level previously, and therefore standards were not available. If the participant was accompanied by an adult other than the parent or guardian, the child received the Report of Findings in a folder

**Table G. Remuneration amounts, NNYFS 2012**

Circumstance	Payment (in dollars)
Participation by children aged 12–15 years . . . . .	60–75
Participation by children under age 12 years . . . . .	40–55
Return of the physical activity monitor . . . . .	40
Parent incentive . . . . .	20

NOTE: NNYFS is National Health and Nutrition Examination Survey National Youth Fitness Survey.

labeled “For the attention of [the child’s parent or guardian].”

The average participant burden for NNYFS was estimated at 2 hours: 30 minutes for the household interview and 90 minutes for the trailer examination. However, because the actual time burden depended on the participant’s age, the remuneration amount also varied by participant age. For example, the examination time was least for participants aged 3–5 and greatest for those aged 12–15. Therefore, participants aged 12–15 received higher remuneration. See [Table G](#) for remuneration amounts. The remuneration was provided at the end of the participant’s examination appointment. The parent or guardian of each participant also was given a monetary incentive, a transportation allowance (not to exceed \$70.00 for driving the participant to the examination appointment), and childcare expenses (up to \$5.25 per hour for up to 6 hours), if necessary.

## Data Release and Analytic Guidelines

The NNYFS data are publicly available and may be downloaded freely from the NNYFS data page (<http://wwwn.cdc.gov/nchs/nhanes/search/nnyfs12.aspx>). Data files are released as SAS transport files in .XPT format, but they may be used with any package that supports this file format, such as SUDAAN, SPSS, or STATA. Note that NNYFS is a complex probability sample, and proper analysis of the data requires statistical software that specifically incorporates sample design complications such as weighting and clustering. Data that cannot be released publicly are available through NCHS’

Research Data Center [(RDC) <http://www.cdc.gov/rdc/>].

Prior to beginning any analysis, the reader is strongly encouraged to read all relevant documentation to understand how data were collected and released, and to understand sample sizes, coding of missing values, skip patterns for questionnaire sections, and other relevant information. Each data file name on the NNYFS data page contains a “Doc File” link, which allows the reader to view the documentation, including the codebook with the frequency distribution for each item in a particular data file.

The recommended approach for the analysis of NNYFS data is design-based analysis. Design-based analytic procedures explicitly consider features of the survey design, such as differential selection probabilities and geographic clustering. Important resources for all NHANES analyses, including NNYFS, are the “National Health and Nutrition Examination Survey: Analytic Guidelines, 1999–2010” (12) and the NHANES Web tutorials (13), which are designed to assist NHANES users in understanding and analyzing the data. The most important consideration in analyzing NNYFS data is the survey design. Survey sample weights should be used, and the complex survey design must be taken into account for variance estimation.

## Key Demographic Variables of Interest

Two age variables are released with the public data files. RIDAGEYR, (age at screening) records the best age in years of the sample child at time of the household screening, and RIDEXAGY (age at examination) records the best age in years at date of examination. Age at screening was used to determine

eligibility for an examination component. Each respondent’s actual or imputed date of birth was used to calculate RIDAGEYR. NCHS used a procedure to impute age at screening, when the date of birth was missing or refused but the respondent’s age in years was provided:

- If month of birth was missing or not given, it was imputed as 7.
- If day of birth was missing or not given, it was imputed as 1.
- If the year of birth was missing or not given, it was imputed as the year of the screening interview minus the age in years provided by the respondent during the screening interview.

Read the “Demographic Variables and Sample Weights” data documentation on the NHANES website ([http://www.cdc.gov/nchs/nyyfs/Y\\_DEMO.htm](http://www.cdc.gov/nchs/nyyfs/Y_DEMO.htm)) for further detail on these age variables.

### Defining age group categories

Age groups used in an analysis should be determined by what is most appropriate for the specific analysis, in conjunction with established statistical reliability criteria. Although single year of age is provided in the publicly released data, the sample sizes for such a detailed age classification are too small for meaningful analysis, so some form of age grouping is required. When possible, age grouping should be consistent with the survey design groupings: 3–5, 6–11, and 12–15 years. Table H provides the interview and examination sample sizes for these age groupings. The NNYFS questionnaire items and examinations were administered to participants in age ranges that correspond to these sample design age groups.

### Race and Hispanic origin

Race and Hispanic origin was determined based on self-identification (or parent identification) by respondents with five categories reported in the released data. The race and Hispanic origin variable, RIDRETH1, was derived from responses to the survey questions on race and Hispanic origin.

**Table H. Distribution of sample by age at screening, NNYFS 2012**

Age (years) at screening (RIDAGEYR)	Number of interviewed children (RIDSTATR = 1 or 2)	Number of examined children (RIDSTATR = 2)	
		n (unweighted percent)	
3–5	368 (22.4)	352	(22.3)
6–11	762 (46.5)	732	(46.5)
12–15	510 (31.1)	492	(31.2)
Total	1,640 (100.0)	1,576	(100.0)

NOTES: NNYFS is National Health and Nutrition Examination Survey National Youth Fitness Survey. RIDSTATR is the interview and examination status of the sample person.

Respondents who self-identified as Mexican American or other Hispanic (i.e., RIDRETH1 = 1 or 2, respectively) were categorized as such, regardless of their other race identities. Categories for non-Hispanic persons who self-identified as white or black (i.e., RIDRETH1 = 3 or 4) include only those who reported a single race. All non-Hispanic persons reporting multiple races were categorized in the “Other race” category. Table J shows the NNYFS sample distribution by RIDRETH1.

The RIDRETH1 variable is consistent with the race and Hispanic origin variable available for NHANES survey cycles in that the Mexican-American and other Hispanic categories may include persons of multiple races, and the non-Hispanic white and black categories include only those reporting a single race.

Because NNYFS (unlike NHANES) does not contain oversamples of any race or Hispanic origin subgroup, analyses of subgroups (e.g., the above-mentioned age categories) within categories of RIDRETH1 may be based on small sample sizes. Therefore,

analyses by race and Hispanic origin previously performed using NHANES data may not be possible.

### Family Relationship

NNYFS was not designed to produce estimates at the household or family level, only at the person level. As such, it is not recommended that analysts use the NNYFS public or nonpublic data to produce household or family-level estimates. Only limited information on family and household members’ relationships was collected in NNYFS. The publicly released data do not contain information on whether one or more survey participants are related or live in the same household. This information, and information on whether the participants live in the same household, is only available through RDC.

### Geographic and Seasonal Considerations

NNYFS interviewed and examined a nationally representative sample of

**Table J. Distribution of sample by race and Hispanic origin, NNYFS 2012**

Race and Hispanic origin (RIDRETH1)	Number of interviewed children (RIDSTATR = 1 or 2)	Number of examined children (RIDSTATR = 2)	
		n (unweighted percent)	
Mexican American, regardless of race	249 (15.2)	242	(15.4)
Other Hispanic, regardless of race	246 (15.0)	238	(15.1)
Non-Hispanic white, single race	639 (39.0)	619	(29.2)
Non-Hispanic black, single race	371 (22.6)	345	(21.9)
Other race (including multiracial persons)	135 (8.2)	132	(8.4)
Total	1,640 (100.0)	1,576	(100.0)

NOTES: NNYFS is National Health and Nutrition Examination Survey National Youth Fitness Survey. RIDSTATR is the interview and examination status of the sample person.

children located in 15 PSUs across the country. This means that the sampled children in these 15 PSUs represent the approximately 3,000 counties in the United States. No geographic location, including true PSUs, is released on the publicly available data files, in order to protect the identification of NNYFS respondents.

Due to operational considerations, the geographical scheduling of the NNYFS MEC was restricted by weather considerations. MEC operations avoided certain geographic areas during the winter. Thus, the statistical efficiency of the sample is diminished for any variable that may be related to seasonal variation that differs by region of the country. In particular, consumption of certain foods may be subject to seasonality by geographical interaction. Most NNYFS variables are not subject to seasonality constraints. The variable RIDEXMON, in the public release demographic data file, provides the 6-month time period in which the examination was performed (November 1 through April 30 and May 1 through October 21).

## Effect of Nonresponse

Like most population-based sample surveys, NNYFS experienced both participant (unit) and component (item) nonresponse. In a statistical sense, nonresponse can be considered ignorable or nonignorable. If the data are missing at random and the characteristics of the nonrespondents are similar to the characteristics of the respondents, the nonresponse can be considered ignorable. However, nonrespondents may have characteristics significantly different from respondents. In this case, the nonresponse mechanism may be nonignorable with respect to the data analysis. Ignoring nonresponse in this case leads to biased estimates.

## Unit or sample child nonresponse

All eligible children selected to participate in NNYFS who completed the household interview questionnaire were defined as “interviewed,” and all interviewed children who completed one

or more examination components in the MEC were defined as “MEC-examined.” Not all children in the NNYFS sample were interviewed, and not all interviewed children were examined. Unit or sample child nonresponse, which is the failure to obtain any information on an individual selected to participate in the NNYFS survey, can occur at both the interview and the examination phases of the survey. Survey weights specific to the interview and examination help account for any loss due to nonresponse at these stages of the survey.

The interview response rate for NNYFS was 79.4%, and the examination response rate (conditional on the interview) was 96.1%. This resulted in an overall examination response rate of 76.3% (see also [http://www.cdc.gov/nchs/nyfs/response\\_rate\\_population\\_totals.htm](http://www.cdc.gov/nchs/nyfs/response_rate_population_totals.htm)). However, not all the households selected for NNYFS responded to the screening interview. Applying the screener response rate (98.5%) to the overall examination response rate results in a survey response rate of 75.2%.

Nonresponse bias resulting from missing data can be an important source of survey error. Nonresponse bias can be substantial when two conditions hold: (a) the response rate is relatively low and (b) the difference between the characteristics of respondents and nonrespondents is relatively large. An analysis was conducted to assess the relationship between response status and characteristics of the NNYFS sampled children.

The NNYFS nonresponse bias analysis was conducted in two stages. An initial analysis involved the comparison of selected demographic and socioeconomic characteristics (e.g., age, sex, race and Hispanic origin, general health status, and median income of geographic sampling unit) of respondents with those of nonrespondents. Further analyses were then conducted, focusing on nonresponse bias in final outcome statistics. All analyses used design-based methods for estimating variances to the extent possible.

The initial analyses showed some indication of potential for bias in the

respondent sample, prior to conducting nonresponse adjustments, to the extent that the characteristics analyzed are related to health. However, several of the characteristics found to be significantly related to response status were either used, or highly correlated with those used, in the weighting adjustments, indicating that the bias may have been reduced through the weighting adjustments.

To determine if any of the potential bias identified in the analyses described above remained after the weighting adjustments, estimates of the characteristics of selected persons from the full sample (including nonrespondents) were compared with estimates for respondents only, before and after weighting adjustments for interviewed and examined persons. Very few estimates indicated large relative differences across the stages of weighting for interviewed persons, and none indicated large relative differences for examined persons.

The nonresponse bias analyses performed to date demonstrate potential nonresponse bias before weighting adjustments, but the weighting adjustments reduced this bias. However, the potential for nonresponse bias may still exist because not all characteristics could be evaluated as part of this nonresponse bias analysis. The methods and results of these and other nonresponse bias analyses will be presented in detail in a forthcoming report.

Adjustments made for survey nonresponse account only for interview or examination nonresponse, but they do not account for component or item nonresponse (e.g., a child declined to participate in the cardiovascular fitness test but completed all other examination components).

## Component or item nonresponse

There were several components in the NNYFS examination (including physical activity tests, tests of muscle strength and endurance, body measurements, and personal interviews), and each component contained a number of items. Some examinees may not have



participated in all components for which they were eligible or may not have fully completed a particular component, thus resulting in component or item nonresponse. These missing values may distort analysis results.

Analysts must evaluate the extent of missing data in the variables to be used in their analyses to determine whether the data are usable without additional reweighting for item nonresponse. As a general rule, if 10% or less of data for the main outcome variable for a specific component is missing for eligible examinees, it is usually acceptable to continue analysis without further evaluation or adjustment. However, if more than 10% of the data for a variable is missing, the analyst may need to further examine respondents and nonrespondents with respect to the main outcome variable and decide whether imputation of missing values or use of adjusted weights is necessary. It is important to note that even if the overall component is missing less than 10%, a subgroup within the component may exceed 10% and may need further examination for statistical bias.

The component nonresponse varies substantially by demographic characteristics of the participants, the type of component, and survey cycle. Analysts are strongly encouraged to examine component nonresponse to determine whether the survey sample weights need to be adjusted. See previous NHANES publications where component or item nonresponse adjustment and reweighting have been addressed (12,14).

### Other key concepts about missing data

NNYFS assigns missing values as follows:

- A period (.) for **numeric** variables
- A blank for **character** variables

However, other types of data also may be important to consider as **unavailable for analysis and part of the unit nonresponse for that variable**. When a sample child refuses to answer a question, a “refused” response is

**Table K. Unavailable values in data, NNYFS 2012**

Code	Description	Action
Period (.)	Missing numeric value	None
(Blank)	Missing character value	None
7 or 77 or 777	“Refused” response	Code as missing (period or blank)
9 or 99 or 999	“Don’t know” response	Code as missing (period or blank)

NOTE: NNYFS is National Health and Nutrition Examination Survey National Youth Fitness Survey.

assigned a value of either “7,” “77,” or “777,” depending on the number of digits in the variable value range. A “don’t know” response is assigned a value of either “9,” “99,” or “999,” which is also dependent on the number of digits in the variable value range; see [Table K](#).

### Survey Sample Weights

The objective of NNYFS was to produce data representative of noninstitutionalized children in the United States. The weighting of sample data permits analysts to produce estimates of statistics they would have obtained if the entire sampling frame had been surveyed. A sample weight is assigned to each child. Sample weights can be considered as measures of the number of children represented by the particular sampled child.

Weighting takes into account several features of the survey: the differential probabilities of selection for each child, nonresponse to survey instruments, and differences between the final sample and the total population.

The sample weighting was implemented in three steps. The first step involved the computation of weights to compensate for unequal probabilities of selection for various age groups. The second step adjusted for participant nonresponse. Weights were adjusted for nonresponse to the household interview when creating the interview weights and further adjusted for nonresponse to the MEC examination when creating the examination weights. In the third step, the sample weights were poststratified to match U.S. Census Bureau estimates of all noninstitutionalized children in the United States. These steps were

performed for respondents at each stage of the survey: the screener, personal interview, and the examination.

The weighting methodology is similar to that used for NHANES. A more detailed discussion of the weights produced for that survey can be found in “The National Health and Nutrition Examination Survey: Estimation Procedures, 2007–2010” (14).

### Determining the appropriate sample weight for analysis

Three different sample weights are available with the NNYFS data release. Use of the correct sample weight for NNYFS analyses is extremely important and depends on the variables being used. A good rule of thumb is to use “the least common denominator” approach. With this method, the analyst checks the variables of interest. The variable that was collected on the smallest number of children is the least common denominator, and the sample weight that applies to that variable is the appropriate one to use for that particular analysis.

Any eligible child who did not respond to the interview was assigned an interview weight of zero (see “Unit or sample child nonresponse” for overall response rates). These children were considered ineligible for the examination and also were assigned an examination weight of zero. Their records were not included in the publicly released data. Children who did complete the interview and were eligible for the examination but did not complete it were assigned examination weights of zero, and their records were included in the public release. These cases, which have a zero examination weight, should be treated as missing when the

**Table L. Appropriate use of weights, NNYFS 2012**

Weight	Application
Interview weight . . . . .	Use when analyzing data from the home interview only. Do not use if the analysis also includes variables that were collected on examined children in the MEC.
Examination weight . . . . .	Use when analyzing data from the MEC examination. Do not use if the analysis includes variables collected as part of the dietary interview.
Dietary weight . . . . .	Use when analyzing data from the day 1, 24-hour dietary recall.

NOTES: NNYFS is National Health and Nutrition Examination Survey National Youth Fitness Survey. MEC is mobile examination center.

examination data are analyzed. **Table L** lists the appropriate use of each set of weights calculated for NNYFS.

## Variance Estimation

The complex, multistage, probability cluster design of NNYFS will affect variance estimates (sampling error). Typically, individuals within a cluster (e.g., county, school, city, or census block) are more similar to one another than those in other clusters, and this homogeneity of individuals within a given cluster is measured by the intracluster correlation. When working with a complex sample, the ideal situation is to limit the correlation between sample persons within clusters. This is accomplished by sampling fewer people within each cluster but sampling more clusters. However, because of operational limitations similar to those for NHANES (e.g., cost of moving the survey MECs or geographic distances between PSUs), NNYFS visited only 15 PSUs.

Variances should be calculated for all survey estimates using the appropriate methods for complex sample surveys to aid in determining statistical reliability. However, it is also important to assess the reliability of the estimated variances themselves.

### Variance estimation methods

For complex sample surveys, exact mathematical formulas for variance estimation are usually not available. Variance approximation procedures are required to provide reasonable, approximately unbiased, and design-consistent estimates of variance. Variance estimates computed using standard statistical software packages that assume simple random sampling are generally too low (i.e., significance

levels are overstated) and biased because they do not account for the differential weighting and the correlation among sample persons within a cluster. Two variance approximation procedures, which account for the complex sample design, are replication methods and Taylor series linearization. Currently, NCHS recommends the use of Taylor series linearization for variance estimation in NNYFS.

For either linearization or replication, strata and PSU variables must be available on the survey data file. Because of confidentiality issues, true PSUs cannot be released. In order to use the Taylor series approach for variance estimation, masked variance units (MVUs) were created and provided in the demographic data file. The NNYFS MVUs are equivalent to pseudo-PSUs used to estimate variance in past NHANES surveys. MVUs on the data file are not the “true” design PSUs. They are a collection of secondary sampling units aggregated into groups for the purpose of variance estimation. They produce variance estimates that closely approximate the variances that would have been estimated using the “true” design.

Software such as SUDAAN, Stata, SPSS, and SAS survey procedures can be used to estimate sampling errors by the Taylor method. Software packages that assume a simple random sample should not be used for computing variances for NNYFS. The stratum (SDMVSTRA) and PSU (SDMVPSU) needed for Taylor series linearization are included in the demographic data file for the NNYFS data release. See the NHANES tutorial (<http://www.cdc.gov/nchs/tutorials/NHANES/preparing/intro.htm>) for more detail on software programming code for analysis. Refer to the NHANES estimation procedures report (14) for more information on

variance estimation in NHANES surveys.

### Other sources of variability

As with any survey, quality control procedures were established in NNYFS to ensure that sources of error are limited and that the data are of high quality. It is inherent to any measurement process that some sources of variation cannot be controlled, and users should be aware of these. Some variables may be subject to within-responder variation. For example, outcomes from a 24-hour dietary recall questionnaire will not be the same if taken on a different day. A child’s measured performance on various physical activity measures also may vary as a result of fatigue or other factors. By reading the data collection protocols, users should be better able to interpret NNYFS data relative to the data collection procedures used.

### Statistical Reliability of Estimates

Issues of precision and statistical reliability should be addressed for each specific analysis. This is especially true for NNYFS, given the small number of PSUs in the sample. The statistical reliability of an estimate depends on the sample size on which it is based, the relative standard error and the design effect of the estimate, the reliability of the estimated standard error, and whether the estimate of interest is a rare event or extreme proportion. Each of these factors is described further in “National Health and Nutrition Examination Survey: Analytic Guidelines, 1999–2010” (12).

If an analysis results in an estimate that cannot be considered reliable, a reliable estimate may be obtained by

collapsing subdomains to increase the analytic sample size.

## Estimation of Population Counts

To understand the public-health impact of a condition, it is often helpful to calculate population counts in addition to the prevalence of a health condition. By quantifying the number of people with a particular condition or risk factor, counts directly speak to the burden or magnitude of the condition.

There are a few basic steps in calculating a population count for NNYFS:

1. Calculate the unadjusted (crude) prevalence of the health condition or risk factor.
2. Use the relevant population totals from the 2011 American Community Survey (ACS) to determine population estimates in NNYFS. Because NNYFS is a nationally representative survey of noninstitutionalized children in the U.S. population, population estimates are based on the ACS totals for this aspect of the U.S. population. ACS-based population tables for NNYFS by race and ethnicity, sex, and age are located at [http://www.cdc.gov/nchs/nyfs/response\\_rate\\_population\\_totals.htm](http://www.cdc.gov/nchs/nyfs/response_rate_population_totals.htm).
3. Multiply the prevalence of the risk factor or health condition of interest by the corresponding ACS-based population total to obtain an estimate of the number of noninstitutionalized U.S. children with the risk factor or condition. To calculate age-, sex-, or race and ethnicity-specific population estimates, multiply the prevalence of the health condition in each subdomain by the ACS population total for the respective subdomain.
4. Report population totals to the nearest thousand with a 95% confidence interval, based on the 95% confidence intervals computed from the prevalence estimate.

Although the noninstitutionalized ACS population totals are used to calculate the final sampling weights for

NNYFS, the sum of the final sampling weights for all sample children with the risk factor or health condition of interest cannot be used to arrive at population estimates. The total population estimate for a given risk factor or health condition from the interviewed sample should equal the sum of the final interview weights for individuals with that health condition. However, if there are a significant number of exclusions or missing data for a health condition, summing the weights will not produce an accurate population estimate. Therefore, summing the final sampling weights to arrive at population estimates is not recommended.

Note that the population totals generated in NNYFS can only be representative of the number of children with the health condition in the noninstitutionalized U.S. population.

## Combining NNYFS and NHANES Data

The NNYFS sample was designed so that data from components common to both surveys in 2012, such as the body measures, physical activity monitor, muscle strength (grip strength), physical activity questionnaire, dietary recall, and specific household interview questions could be analyzed together. Therefore, data from NNYFS may be combined with data from NHANES. Combined weights for NNYFS and NHANES 2012 (1-year weights) are available through RDC (<http://www.cdc.gov/rdc/>).

Information on the proposal process and approval are available on the NHANES website.

## Conclusions

NCHS' DHANES conducted NNYFS in 2012, collecting the first national data on physical activity measures and physical fitness levels of children and adolescents in the United States since the 1980s. This 1-year survey provided data representative of the U.S. youth population aged 3–15 years, and it is currently the only survey to obtain

direct physical measures in children and adolescents on a national level. NNYFS demonstrated that a survey of tests of physical activity and fitness can be conducted successfully in a limited mobile environment. Together with NHANES questionnaire and examination data, NNYFS data will provide a comprehensive picture of the physical health of children in the United States.

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## Appendix. Glossary

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**Ethics Review Board**—In 2003, the NHANES Institutional Review Board changed its name to the NCHS Research Ethics Review Board.

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

**National Center for Health Statistics (NCHS)**—NCHS is the nation's principal health statistics agency. It 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, the National Health Interview Survey, the National Health and Nutrition Examination Survey (NHANES), the National Health Care Surveys, and the National Survey of Family Growth, among others. NCHS is one of the institutes of the Centers for Disease Control and Prevention, which is part of the U.S. Department of Health and Human Services.

**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 NNYFS sample.

**Noninstitutionalized civilian population**—Includes all people living in households, excluding institutionalized group quarters and active-duty military personnel. This is the target population for the NHANES National Youth Fitness Survey (NNYFS).

**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.

For NHANES, the selection of segments comprises the second stage of sampling. Within each segment, a sample of dwelling units was selected.

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