Physical Activity in US Youth: Results from the NHANES National Youth Fitness Survey

Tala H. Fakhouri, PhD MPH
Senior Service Fellow
Board of Scientific Counselors
January 28th, 2014
Outline

- Physical Activity in Children and Adolescents
- Overview of the NHANES National Youth Fitness Survey (NNYFS)
- Results from the NNYFS
  - Measures of Muscular Strength
  - Physical Activity
  - TV and Computer Use
  - Cardiorespiratory Fitness Levels
Outline

- Physical Activity in Children and Adolescents

- Overview of the NHANES National Youth Fitness Survey (NNYFS)

- Results from the NNYFS
  - Measures of Muscular Strength
  - Physical Activity
  - TV and Computer Use
  - Cardiorespiratory Fitness Levels
Background: Physical Activity in Children and Adolescents

- Along with diet, *regular* physical activity prevents overweight and obesity
  - 1 in 3 children and adolescents either overweight or obese

- Also increases lean body mass, muscle, and bone strength

- Fosters psychological well-being
Background: Physical Activity Guidelines for Americans

- Physical Activity Guidelines for Americans published in 2008
- The guidelines: One hour or more a day, every day
- National data on the fitness levels of youth very limited

2008 Physical Activity Guidelines for Americans
Be Active, Healthy, and Happy!
www.health.gov/paguidelines
Outline

- Physical Activity in Children and Adolescents

- Overview of the NHANES National Youth Fitness Survey (NHYFS)

- Results from the NHANES NNYFS
  - Measures of Muscular Strength
  - Physical Activity
  - TV and Computer Use
  - Cardiorespiratory Fitness Levels
Objective of the NHANES National Youth Fitness Survey (NNYFS)

- Provide national-level estimates of physical activity and fitness levels among 3-15 years of age

Results are intended to:
- Development of policies and programs
- Development of national reference standards
- Measure progress towards national objectives for youth fitness
Sampling Design of NNYFS

Stage 1: Counties (Stands)

Stage 2: Segments

Stage 3: Households

Stage 4: Sample Person

NHANES

NNYFS
NNYFS: In-Home Interviews

- Demographic questions
- Health history questions
- Behavioral questions
NNYFS: Mobile Examination Center (MEC)

- Single trailer
- Designed to accommodate physical activity examinations and interviews
### NNYFS: Mobile Examination Center (MEC)

#### Components

<table>
<thead>
<tr>
<th>Body measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core muscle strength (plank)</td>
</tr>
<tr>
<td>Gross motor skills</td>
</tr>
<tr>
<td>Lower body muscle strength (extension at the knee in sitting position)</td>
</tr>
<tr>
<td>Upper body muscle strength (grip strength)</td>
</tr>
<tr>
<td>Upper body muscle strength (modified pull-up)</td>
</tr>
<tr>
<td>Physical activity monitor (accelerometer)</td>
</tr>
<tr>
<td>Aerobic Fitness (maximal and submaximal exercise test)</td>
</tr>
<tr>
<td>Dietary recall interview</td>
</tr>
</tbody>
</table>
Outline

- Physical Activity in Children and Adolescents
- Overview of the NHANES National Youth Fitness Survey (NYFS)

- Results from the NNYFS
  - Measures of Muscular Strength
  - Physical Activity
  - TV and Computer Use
  - Cardiorespiratory Fitness Levels
Measures of Muscular Strength in U.S. Children and Adolescents, 2012

The first nationally representative data on core, upper body, and lower body measures of muscle strength
Core or Abdominal Strength
Core or Abdominal Strength – Plank: Differences by age and sex

Figure 1. Number of seconds plank position held among children and adolescents aged 6–15 years, by sex and age group: United States, 2012

1Significantly different from those aged 12–15 years in the same sex group, p < 0.05.
2Significantly different from males in the same age group, p < 0.05.

NOTE: Access data table for Figure 1 at: http://www.cdc.gov/nchs/data/databriefs/db139_table.pdf#1.

Lower Body Strength – Knee Extension Differences by age and sex

Figure 2. Maximum right knee extension force among children and adolescents aged 6–15 years, by sex and age group: United States, 2012

- Girls:
  - 6–11 years: 44 lbs
  - 12–15 years: 77 lbs

- Boys:
  - 6–11 years: 43 lbs
  - 12–15 years: 86 lbs

NOTES: The knee extension score used was the maximum force exerted by the right knee. Access data table for Figure 2 at: [http://www.cdc.gov/nchs/data/databriefs/db139_table.pdf#2](http://www.cdc.gov/nchs/data/databriefs/db139_table.pdf#2).

Upper Body Strength – Hand Grip: Differences by age and sex

Figure 4. Combined grip strength force among children and adolescents aged 6–15 years, by sex and age group: United States, 2012.

- Girls:
  - 6–11 years: 68 lbs
  - 12–15 years: 116 lbs

- Boys:
  - 6–11 years: 71 lbs
  - 12–15 years: 143 lbs

NOTES: The combined grip strength score was the sum of the largest readings from each hand. Access data table for Figure 4 at: http://www.cdc.gov/nchs/data/databriefs/139_table.pdf#4.

Upper Body Strength – Modified Pull-Ups

Figure 3. Number of modified pull-ups completed among children and adolescents aged 6–15 years, by sex and age group: United States, 2012

- Girls:
  - 6–11 years: 4
  - 12–15 years: 14

- Boys:
  - 6–11 years: 25
  - 12–15 years: 10

*Significantly different from males in the same age group, *p* < 0.05.
*Significantly different from those aged 12–15 years in the same sex group, *p* < 0.05.

NOTE: Access data table for Figure 3 at: [http://www.cdc.gov/nchs/data/databriefs/db139_table.pdf](http://www.cdc.gov/nchs/data/databriefs/db139_table.pdf).

55% of female Marine recruits could not pass a minimum 3-pullup requirement
Conclusions

- The first nationally representative estimates of strength for U.S. children and adolescents

- No significant differences between the sexes for younger children

- Adolescent boys had more strength than adolescent girls

- Adolescent boys and girls had more strength than younger aged boys and girls
Physical Activity in U.S. Youth Aged 12-15 Years, 2012

The most recent national data from 2012 on physical activity among youth, by sex and weight status
Only 27% of Boys and 23% of Girls Physically Active for 1 Hour or More Daily

Figure 1. Percentage of youth who were physically active, by number of days per week and sex: United States, 2012

* Does not meet standard of statistical reliability and precision (relative standard error of ≥30% but <40%).

NOTES: Physically active is defined as engaging in any kind of moderate-to-vigorous physical activity, including activities both in school and outside of school, that increased heart rate and made breathing harder some of the time for at least 60 minutes.

Weighted percentages are shown. Access data table for Figure 1 at: http://www.cdc.gov/nchs/data/databriefs/db141_table.pdf#1.

The Most Common Activities among Active Boys

Figure 2. The top five activities outside of school-based physical education and gym classes reported among boys aged 12–15 years: United States, 2012

- Basketball: 48.0%
- Running: 33.5%
- Football: 27.4%
- Bike riding: 24.0%
- Walking: 23.6%

NOTES: Based on any physical activity, regardless of intensity, reported in the past week. More than one activity could be reported. Access data table for Figure 2 at: http://www.cdc.gov/nchs/data/databriefs/db141_table.pdf#2.
The Most Common Activities among Active Girls

Figure 3. The top five activities outside of school-based physical education and gym classes reported among girls aged 12-15 years: United States, 2012

NOTES: Based on any physical activity, regardless of intensity, reported in the past week. More than one activity could be reported. Access data table for Figure 3 at: http://www.cdc.gov/nchs/data/databriefs/db141_table.pdf#3.

Physical Activity and Weight Status

Figure 4. The percentage of youth who were physically active daily, by weight status and sex: United States, 2012

- Normal-weight
- Overweight
- Obese

Boys: 29.5% (Normal-weight), 18.0% (Overweight), 24.1% (Obese)
Girls: 29.5% (Normal-weight), 20.1% (Overweight), 19.6% (Obese)

NOTES: Physically active is defined as engaging in any kind of moderate-to-vigorous physical activity, including activities both in school and outside of school, that increased heart rate and made breathing harder some of the time for at least 60 minutes. Access data table for Figure 4 at: http://www.cdc.gov/nchs/data/databriefs/db141_table.pdf#4.
Conclusions

- About 1 out of 4 U.S. youth met national physical activity guidelines.
- Basketball was the most popular activity among active boys.
- Running was the most popular activity among active girls.
- Among boys, increased weight status was associated with decreased physical activity.
A Lower Percentage of Obese Youth Viewed TV for 2 Hours or Less Compared to Normal and Overweight Youth

Unpublished, in progress, Herrick et al
Cardiorespiratory Fitness Decreased as Weight Status Increased

- Normal-Weight: 54.1%
- Overweight: 30.0%
- Obese: 20.0%

Unpublished, in progress, Gahche et al.
Conclusions

- NNYFS was conducted in 2012
- First nationally representative data on physical activity, fitness, and strength among youth
- NNYFS included Interviews and examinations
- Results are intended for the development of programs and policies, and for the developments of national reference standards
Acknowledgments

NHANES National Youth Fitness Survey Planning and Operations Team:

- Lori Borrud
- Vicki Burt
- Jennifer Dostal
- Mark Eberhardt
- Bethene Ervin
- Jaime Gahche
- Qiuping Gu
- Jeffery Hughes
- Brian Kit
- Ivey Miller
- Lisa Mirel
- Tatiana Nwankwo
- Michelle Poulos
- Neda Sarafrazi
- Denise Schaar
- Ana Terry
- Chia-Yih Wang
- George Zipf

Jaime Gahche and Kirsten Herrick
• **Target:** Ages 3-15 years

• **Protocol:**
  - Height and weight
  - Lengths of the entire arm and upper arm
  - Mid-arm, mid-calf, and waist circumferences
  - Subscapular, triceps, and calf skinfold thicknesses
Test of Gross Motor Development (TGMD-2)

- **Objective:** Assess coordination and balance
  - First nationally representative data on locomotion and object control skills for young children.
- **Target:** Ages 3-5 years
- **Protocol:** The TGMD-2 consists of two subtests:
  - Locomotor: Run, gallop, hop, leap, horizontal jump, slide
  - Object Control: striking a stationary ball, stationary dribble, kick, catch, overhand throw, and underhand roll
Abdominal or Core Muscle Strength

• **Objective:** Assess muscular endurance and core strength
  – First nationally representative data on core strength for children and adolescents.

• **Target:** Ages 3-15 years

• **Protocol:** Front plank position; maintain position for as long as possible
Objective: Obtain detailed dietary intake information on the types and amounts of foods and beverages consumed
   - First nationally representative data on both fitness and nutrition measures.

Target: Ages 3 to 15

Protocol: 24-hour dietary recall (only 1 day of recall)
   - Detailed information about food and beverages reported using measurement and visual aids recorded
   - Usage of dietary supplement use and non-prescription antacids
Physical Activity Monitor or Accelerometer

- **Objective:** Measure the physical activity levels of participants by recording body movement during everyday activities.
  - First nationally representative data on measured physical activity levels for children ages 3–5 years.
- **Target:** Ages 3-15 years
- **Protocol:** monitor is worn on the wrist, non-dominant arm, continuously for 7 days
- Water resistant – swimming, showering, bathing
Upper Body Muscle Strength

- **Objective:** Measure upper body muscle (back, shoulder, forearm, and arm) strength.
  - First nationally representative data in which schools can compare results from their districts.
- **Target:** Ages 5 to 15
- **Protocol:** Modified pull up
  - Participant raises his/her body by flexing the arm, keeping body straight with only the heels touching the ground
  - Repeated as many times as possible
- Results are compared to Fitnessgram® criterion-referenced standards.
Lower Body Muscle Strength

- **Objective:** Collect nationally representative data on lower body muscle strength
  - first nationally representative lower body muscle strength data for children and adolescents.
- **Target:** Ages 6-15 years
- **Protocol:** Measure knee extension force using a hand-held dynamometer
- Repeated 3 times on each leg
**Objective:** to provide nationally representative data on muscle strength

**Target:** Ages 6 to 15

**Protocol:** handgrip dynamometer was used to measure isometric grip strength

– Participant squeezes the dynamometer three times in each hand

**NNYFS** used the same protocol for the grip strength test used in NHANES.
• **Objective:** to estimate aerobic fitness levels

• **Target:** Ages 6-15 years

• **Protocol:**
  – Maximal treadmill test measuring endurance (ages 6-11y)
  – Sub-maximal treadmill test measuring cardiorespiratory fitness (12-15y)

• **NHANES 1999-2006** for ages 12-49 years