Prevalence of Youth Fitness in the United States: Baseline Results from the NFL PLAY 60 FITNESSGRAM Partnership Project

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Objective To assess age- and sex-specific patterns of 6 health-related fitness components in youth, baseline data from the NFL PLAY 60 FITNESSGRAM Partnership Project were analyzed.

Study design A total of 192 848 students from 1st through 12th grade in 725 schools completed the standard FITNESSGRAM testing in 2010-2014, including assessments of aerobic capacity (AC), body mass index (BMI), upper body strength and endurance, trunk extensor strength and flexibility, abdominal strength and endurance, and flexibility. Individual data were aggregated by grade and sex. Age- and sex-specific health-related criterion-referenced standards were used to classify fitness results into the healthy fitness zone (HFZ), needs improvement zone, or needs improvement health risk.

Results The proportion of youth meeting the HFZ for AC varied considerably by grade for both boys (62.1%-37.6%) and girls (49.1%-26.1%) among 1st-12th grade. There was less variability by age and sex for achievement of the BMI HFZ (ranged from 52.7%-65.0%). The prevalence of achievement was similar for the remaining fitness components. Significantly lower achievement was found in the middle school years for BMI HFZ in both sexes and for AC HFZ achievement in boys. Continuous age-related lower HFZ achievement was evident in girls for AC.

Conclusions The results provide updated health-related fitness profiles for US youth and identify the critical ages when youth fitness levels start to decline. *(J Pediatr 2015;167:662-8)*.

There is relatively little known about current levels of fitness in US children and adolescents, aside from the well-documented statistics on the prevalence of overweight and obesity.[1,2] The last national youth fitness survey that covered the full developmental age range was conducted more than 25 years ago.[3,4] The Institute of Medicine (IOM) recently released recommendations for assessments that could be used in a national fitness study as well as recommendations for field based assessments in school programs.[5] FITNESSGRAM (FG) is a comprehensive youth fitness battery developed by The Cooper Institute for use in school testing.[6] FG has been the predominant testing system for school fitness assessment and has been adopted by the Presidential Youth Fitness Program.[7]

Although FG has been designed to serve primarily educational goals, there is clear potential for the data to contribute to advancing knowledge about current levels of health-related fitness in youth. The Texas Youth Fitness Study adopted FG tests, which provided valuable information about fitness patterns in the state[8] and also demonstrated that trained teachers can provide reliable and valid fitness data.[9] A new study conducted by The Cooper Institute known as the NFL PLAY 60 FITNESSGRAM Partnership Project offers potential to study youth fitness on a national level.

The NFL PLAY 60 FITNESSGRAM Partnership Project is a participatory research network that tracks health and fitness data from over 1000 schools across the country. The present study describes the distribution of health-related fitness in 1st-12th grade youth from this large nationwide sample of schools.

Abdominal	Abdominal strength and endurance	NIZ	Needs improvement zone
AC	Aerobic capacity	PA	Physical activity
BMI	Body mass index	PACER	Progressive aerobic cardiovascular endurance run
FG	FITNESSGRAM	PE	Physical education
HFZ	Healthy fitness zone	Trunk	Trunk extensor strength and flexibility
MVPA	Moderate and vigorous physical activity	Upper body	Upper body strength and endurance
NFL	National Football League		
NIHR	Needs improvement health risk		

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Methods

The NFL PLAY 60 FITNESSGRAM Partnership Project was designed to train schools from each NFL franchise region on the use of FG to assess and promote physical activity (PA) and physical fitness in youth.[10] Each of the NFL franchises was given 35 FG web-based program licenses to distribute to schools or affiliated partner organizations (eg, YMCAs). Registered sites received training in the use of FG and were asked to submit FG results through a secure national FG server. Data from over 232 007 students from 785 schools has been compiled over the 3-year enrollment phase (November 2010 to July 2014). The project was viewed as an exempted study by the local Institutional Review Board because of the school collaboration and the de-identified nature of the data.

Most schools have been enrolled in the NFL PLAY 60 FITNESSGRAM Partnership Project for multiple years, but these analyses were restricted to the first assessment (ie, year 1) obtained upon initial enrollment in this project. Therefore, the analyses used "baseline" data from each school to evaluate fitness patterns. Schools may collect data from some grades, but not others, so it was important to ensure that fitness data were representative of a given grade prior to analyses. Previous research by our team compared the impact of different cleaning and screening methods on fitness outcomes, and these procedures were used in the present study.[11] For inclusion of grade-level data, we required that at least 15 student records be available as well as a sex ratio (female:male) of between 0.5 and 2.0. This helped to ensure an appropriate sample size and sex balance within each grade. A total of 192 848 individual student fitness scores from 725 schools were included in the present analyses, and this resulted in grade level observations ranging from 3692-4270 for the different fitness components.

Participating sites were provided with equipment, training, and technical support to help assess health-related fitness with the FG test battery, which includes assessments of aerobic capacity (AC), body mass index (BMI), abdominal strength and endurance (abdominal), trunk extensor strength and flexibility (trunk), upper body strength and endurance (upper body), and flexibility. Details on the specific items in the battery are provided in the FG Test Administration Manual, but short summaries of the protocols for each test component are provided below.[12]

The progressive aerobic cardiovascular endurance run (PACER) is the recommended test for AC. The intensity is progressively increased each minute similar to a graded exercise test. Students run across a 20-m distance to a timed cadence and complete as many laps as possible until they cannot keep up. Students that fail to reach the finish line on time on 2 successive laps are instructed to stop. The 1-mile run is also provided as alternative tests to measure AC.

The BMI is the recommended test for body composition, and this assessment requires collection of both height and weight. The BMI is then calculated using the standard formula: BMI = weight (kg)/[height (m)]^2.

The curl-up is the recommended test for abdominal. Students being tested are instructed to keep heels on the mat and curl up slowly, sliding fingers across the measuring strip until reaching the other side. The curl-ups are completed at a timed cadence (1 curl-up every 3 seconds) with the maximal attainable score of 75.

The trunk lift is the recommended test for trunk. During the test, the student lies on the mat in a prone position and lifts the upper body off the floor. The distance from the floor to the chin is measured with a maximum score being 12 inches.

A 90° push-up is the recommended test to measure upper body. The student lies in a prone position on a mat with hands placed under or slightly wider than shoulders, and then lowers the body using the arms until the elbows bend at a 90° angle, and the upper arms are parallel to the floor. The push-ups are completed at a timed cadence (1 push-up every 3 seconds) until they cannot complete any more. The flexed arm hang is the alternative test to assess upper body.

The back-saver sit and reach is the recommended test to evaluate lower body joint flexibility. In this assessment, the student is required to fully extend 1 leg with the foot flat against the face of the box while the other knee is bent with the sole of the foot flat on the floor. The student is told to reach forward (with overlapping hands and palms facing down) as far as possible. The shoulder stretch is provided as an alternative test to assess upper body flexibility.

The FG uses criterion-referenced standards to evaluate fitness performance to provide information on the degree of fitness needed to maintain good healthy condition.[13] The raw test scores (eg, PACER laps, mile run time, height, weight, and other test components) were processed using the most current set of FG standards adopted in v 10.0 of the software. Although the data were collected from 2010-2014, all of the values were processed with the latest standards. Consistent with standard practice in FG, the test results were classified in 2 or 3 fitness zone categories depending on the assessment. There are 3 zones for AC and BMI (healthy fitness zone [HFZ], needs improvement zone [NIZ], and needs improvement health risk [NIHR]) but only 2 zones for the other tests (HFZ and NIZ). Our analyses were restricted to the proportion of youth classified in the HFZ and NIHR (for AC and BMI only). The grade level of HFZ and NIHR achievement of each fitness indicator was calculated as follows:

$$\%\ \text{HFZ (NIHR) achievement} = \frac{\text{Number of students in the HFZ (NIHR) per grade}}{\text{Total number of students performed the test per grade}}$$

The grade level HFZ and NIHR achievement is the smallest unit for statistical analysis in the present study. Grade level aggregate data were used instead of age level because it is