

South Carolina FitnessGram

School Year 2017-2018

FITNESSGRAM[®]
The Cooper Institute[®]



South Carolina
FOUNDATION

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Introduction

Physical fitness and health in children and youth. The term physical fitness has been defined as “the ability to perform daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure-time pursuits and meet unforeseen emergencies.” Physical fitness is typically operationalized as the composite of several components, each of which relates to the ability to perform a specific type of physical activity. A sub-set of these components comprises “health-related physical fitness,” and these include cardiorespiratory endurance, muscular strength and endurance, flexibility and weight status. In children and youth, the components of health-related physical fitness have been linked to short and long-term health outcomes. FitnessGram is a physical fitness testing protocol that is widely used in schools across the United States. Included in the FitnessGram test are measures of each of the components of health-related physical fitness. For each test item, criterion-referenced standards have been established and individual test performances are rated as corresponding to the following categories: Healthy Fitness Zone, Needs Improvement, or Needs Improvement – Health Risk.

Weight status and health in children and youth. In the context of public health surveillance, weight status is typically assessed using body mass index (BMI), an expression of the ratio between weight and height. In children and youth, weight status is evaluated as the age/sex-specific BMI percentile. Children and youth found to be over the 85th percentile for their age/sex group are considered overweight, and those over the 95th percentile are rated as obese. It has been extensively documented that young persons who are overweight or obese, as compared with their normal weight counterparts, manifest less favorable cardiometabolic risk factor profiles, are more likely to be overweight as adults, and are at increased risk for future development of multiple non-communicable diseases. Over the past three decades the rates of overweight and obesity in U.S. children and youth have increased dramatically. Consequently, prevention of excessive weight gain during childhood and adolescence has become an important public health goal. In this report, weight status is assessed using BMI which is placed in the following categories: normal weight, overweight, and obese.

Fitness, weight status and academic performance in children and youth. A substantial and growing body of evidence indicates that physical activity exerts a positive effect on cognition and learning in children and youth. This research has been conducted using many different study designs and methodologies. Neuroscience research has demonstrated that

physical activity produces beneficial effects on brain function, and field research has observed that increased physical activity exerts positive effects on student learning. Several studies have observed positive associations between children's physical fitness and their academic performance. Because the primary goal of schools is to promote students' academic achievement, the observation that physical activity during the school day can promote learning has important implications for school policy and practices.

Purpose of the project. The primary purpose of the project is to determine the status of health-related physical fitness in South Carolina school children. The South Carolina FitnessGram project is supported by the BlueCross BlueShield of South Carolina Foundation, the South Carolina Department of Health and Environmental Control, and the South Carolina Department of Education. The University of South Carolina serves as the data analysis center for the project.

South Carolina FitnessGram

Project Description. The South Carolina (SC) FitnessGram project is a state-wide observational study to evaluate and ultimately improve health-related fitness among approximately 770,000 public school students in SC. Its primary purpose is to describe health-related fitness in students attending public schools across the state. The findings from this project will be used to support planning and implementation of evidence-based programs and policies to improve health-related fitness. All SC public schools serving grades K-12 were eligible to participate in the SC FitnessGram project. Each school was asked to conduct fitness testing and record health-related fitness data for students enrolled in physical education class. Physical education teachers implemented six fitness test items in grades 5, 8 and in the high school physical education course required for graduation. Height and weight only was measured for second grade students. Data collected during the 2016-2017 school year were summarized, and a detailed report was released to the public in 2018. The data summarized and presented in this report were collected during the 2017-2018 school year.

Data Collection & Management. During school year 2017-2018, FitnessGram data was provided by nearly 700 public schools across 61 school districts in SC. These samples represent approximately 59% of public schools and 74% of school districts in SC. In participating schools, FitnessGram was administered by school staff (e.g., physical education teacher) during physical education class. Prior to administration of the FitnessGram test items, school staff received training support through the Presidential Youth Fitness Program. Staff reported students' performance on the FitnessGram components using a web-based version of the FitnessGram software. All data were loaded into the SC FitnessGram state system and a de-identified research extract file was downloaded by the SC Department of Education (SCDE). The University of South Carolina received de-identified student data from the SCDE to assess health-related fitness among SC students.

Data Cleaning. The initial dataset provided by SCDE included 217,257 unique entries. During the data cleaning process, the sample was reduced to data for the 2nd, 5th, 8th, and 9th-12th grade students (n=157,340). 5,293 entries were removed because no fitness test item information was provided. Then, 764 entries were removed due to implausible values for age. Next, 52,881 records were deleted for students for whom data were available for more than one test administration. Only data for a student's first test administration was included in the analysis sample. This yielded a final sample of 98,402 students. In this sample implausible

values for some test items were deleted: BMI (n=563), cardiorespiratory fitness (n=48), and the other FitnessGram items (n=423). Deleted values were set to missing.

Analytic Sample. Table 1 provides student characteristics for the FitnessGram sample during school year 2017-2018. The sample was 51.5% male, 51.9% non-Hispanic White, and 37.2% of students were classified as overweight or obese. Additionally, the proportion of students across regions of SC varied considerably (Appendix A).

Table 1. SC FitnessGram sample characteristics (n=98,402 students).

	Girls (n=47,707)		Boys (n=50,695)		Total (n=98,402)	
	n	Percent	n	Percent	n	Percent
Grade						
2	12,215	25.7%	12,457	24.6%	24,672	25.2%
5	18,198	38.1%	18,842	37.2%	37,040	37.6%
8	9,609	20.1%	11,000	21.6%	20,609	20.9%
High School	7,685	16.1%	8,396	16.6%	16,081	16.3%
Weight Status						
Normal weight	26,779	62.4%	28,754	63.4%	55,533	62.8%
Overweight	7,490	17.4%	7,209	15.9%	14,699	16.7%
Obese	8,661	20.2%	9,403	20.7%	18,064	20.5%
Race/ethnicity						
White	24,227	51.5%	26,233	52.3%	50,460	51.9%
Black	15,105	32.1%	15,747	31.4%	30,852	31.7%
Hispanic	4,826	10.3%	5,102	10.2%	9,928	10.2%
Other	2,922	6.1%	3,044	6.1%	5,966	6.2%
Poverty Status ^a						
No	17,751	38.8%	19,116	39.2%	36,867	39.0%
Yes	27,972	61.2%	29,609	60.8%	57,581	61.0%

^a Poverty status defined as student enrollment in Medicaid, Supplemental Nutrition Assistance Program (SNAP), Temporary Assistance for Needy Families (TANF), Foster Care Services within the past three years (February 2014 to January 2017); and/or student homelessness/migrant status during school year 2017-2018. Data sources: PowerSchool, Medicaid Eligibility, and DSS (TANF, SNAP, and Foster Care) files at day 135 of school year 2017-2018.

Results by FitnessGram Component

1. Weight Status

Definition. Weight status is typically determined as the ratio between body weight and height expressed in categories based on the distribution of scores seen in a population. A common expression of weight status is BMI expressed in categories: normal weight, overweight or obese. In large samples, BMI is highly correlated with body composition. Body composition refers to the ratio between fat mass and fat free mass, the so-called “percent body fat.” Accordingly, persons who are overweight or obese, based on assessment of BMI, typically have higher percentages of body fat than persons in the normal weight category.

Relationship to health. Maintenance of normal weight is an important indicator of good health in persons of all ages. Conversely, elevated levels of body weight and fatness are associated with increased risk for development of non-communicable diseases including cardiovascular disease, type 2 diabetes, and several cancers. In children and adolescents, overweight and obesity are associated with adverse status for cardiometabolic risk factors such as blood pressure, blood lipids and insulin sensitivity. In addition, in youth, excessive weight and fatness can negatively affect physical function and can have adverse psychological and social effects.

Measures. Weight status was assessed using BMI. To determine BMI, trained school staff measured height and weight. BMI was then calculated using the following standard equation: $BMI = \text{weight (kg)} / \text{height (m}^2\text{)}$. For youth, BMI is typically reported as a percentile (range: 0-100) relative to other individuals of the same sex and age.

Variable for analysis. Using CDC growth charts, each student’s age- and sex-specific BMI percentile was determined and then categorized into one of the following weight status categories: normal weight (<85th percentile), overweight (85th percentile to <95th percentile), and obese (\geq 95th percentile).

Results: Weight Status

Overall Sample. Height and weight was measured for approximately 88,296 students and BMI was calculated. In the total sample, which includes boys and girls in 2nd, 5th, 8th, and high school grades, approximately 62.9% of students had a BMI percentile that below the 85th percentile (normal weight). Of the remaining students, 16.7% were overweight; and 20.5% were obese. No marked gender difference in weight status was observed. These findings indicate that nearly two out of every five SC students has an unfavorable weight status for health (Table 1a).

Table 1a. Weight Status among Total Sample and By Sex, SC FitnessGram School Year 2017-2018

Weight Status Variables	Total		Males		Females	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Height, ft (mean, SD)	88,296	4.9 (0.5)	45,366	4.9 (0.6)	42,930	4.8 (0.5)
Height, cm (mean, SD)	88,296	148.6 (16.5)	45,366	150.1 (0.6)	42,930	147.0 (14.9)
Weight, lbs (mean, SD)	88,296	104.8 (43.7)	45,366	106.1 (45.4)	42,930	103.4 (41.8)
Weight, kg (mean, SD)	88,296	47.5 (19.8)	45,366	48.1 (20.6)	42,930	46.9 (19.0)
Weight Status (CDC program)						
BMI (mean, SD)	88,296	20.7 (5.5)	45,366	20.5 (5.3)	42,930	21.0 (5.7)
Normal	55,533	62.8%	28,754	63.4%	26,779	62.4%
Overweight	14,699	16.7%	7,209	15.9%	7,490	17.5%
Obese	18,064	20.5%	9,403	20.7%	8,661	20.1%

Weight Status in Girls. BMI was observed to increase with increasing age and grade level in girls. BMI increased from 17.8 in 2nd graders to 24.4 in high school girls. The percent of girls that were categorized as having a normal weight was 68.0% in 2nd grade. This percent then decreased in 5th grade and was 60.7% in high school girls (Table 1b).

Table 1b. Weight Status among Females By Grade Level, SC FitnessGram School Year 2017-2018

Variable	Grade							
	2 nd Grade		5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD	n	Mean, SD
Height, ft (mean, SD)	12,069	4.2 (0.2)	15,825	4.8 (0.3)	8,612	5.3 (0.2)	6,424	5.3 (0.2)
Height, cm (mean, SD)	12,069	128.6 (6.8)	15,825	147.5 (8.6)	8,612	160.6 (7.0)	6,424	162.0 (6.8)
Weight, lbs (mean, SD)	12,069	65.4 (17.8)	15,825	100.6 (31.2)	8,612	133.5 (36.5)	6,424	141.4 (38.9)
Weight, kg (mean, SD)	12,069	29.7 (8.1)	15,825	45.6 (14.2)	8,612	60.6 (16.6)	6,424	64.2 (17.6)
Weight Status (CDC program)								
BMI (mean, SD)	12,069	17.8 (3.7)	15,825	20.7 (5.1)	8,612	23.4 (5.8)	6,424	24.4 (6.3)
Normal	8,209	68.0%	9,476	59.9%	5,197	60.4%	3,897	60.7%
Overweight	1,789	14.8%	2,908	18.4%	1,644	19.0%	1,149	17.8%
Obese	2,071	17.2%	3,441	21.7%	1,771	20.6%	1,378	21.5%

As shown in Figures 1a and 1b, BMI and weight status varied across grades and race/ethnicity groups. Concerning race/ethnicity, the percentage of girls with normal weight was lower among Black and Hispanic girls compared to White girls and girls of other race/ethnicity groups (including multiracial). Additionally, the percentage of girls with a normal weight status was lower among students in poverty.

Figure 1a. Weight Status, Body Mass Index (mean), Girls

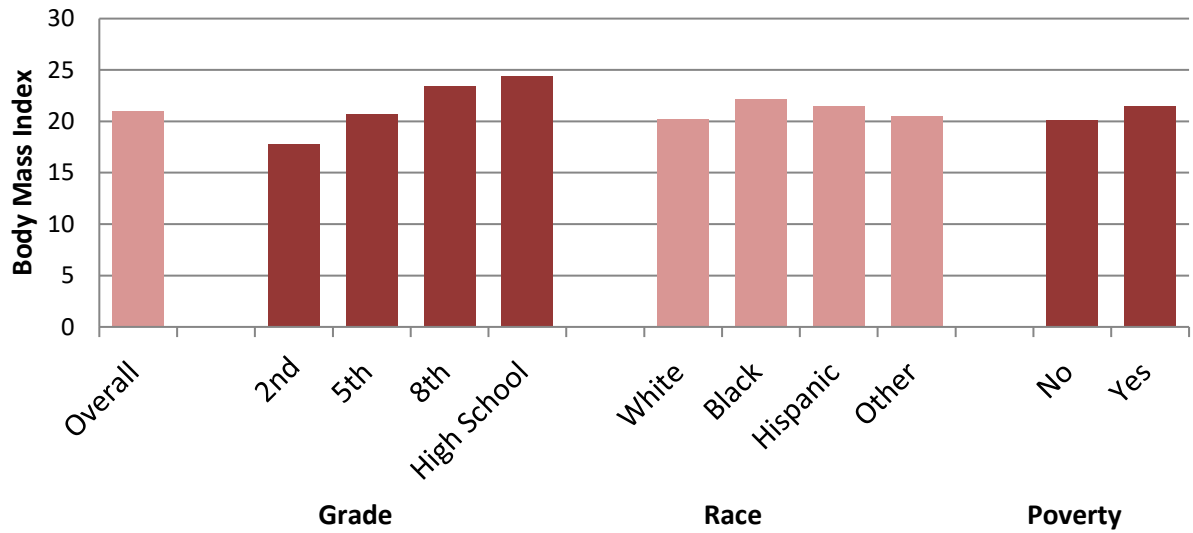
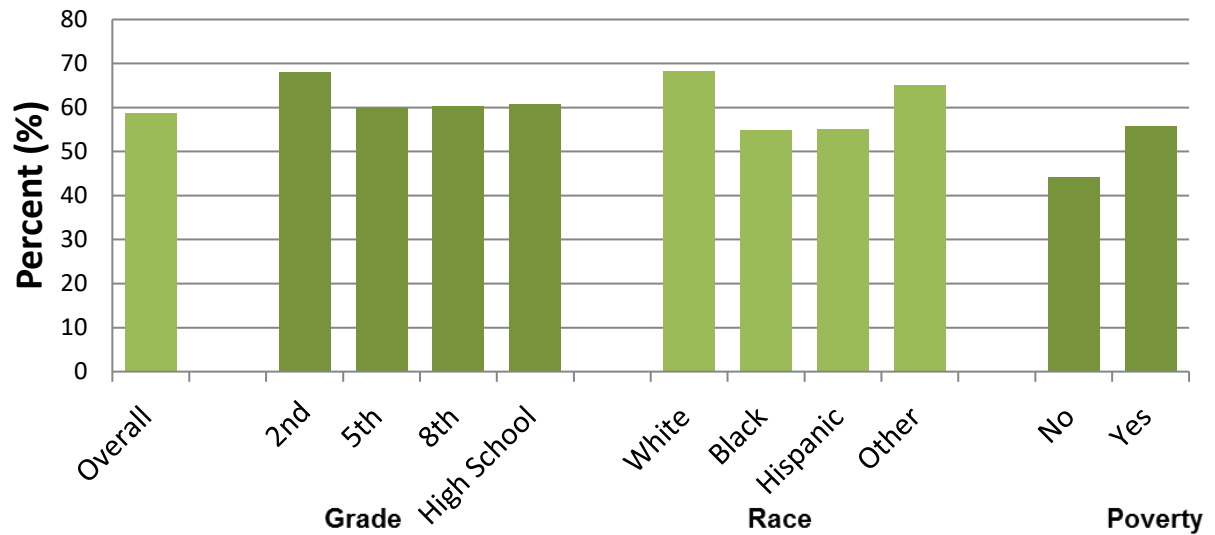


Figure 1b. Weight Status, Percent Attaining Normal Weight Status, Girls



Weight Status in Boys. Similar to girls, BMI increased with increasing age and grade level among boys. BMI increased from 17.6 in 2nd graders to 23.4 in high school boys. The percent of boys that were normal weight was 68.8% in 2nd grade. The percentage of normal weight boys decreased from 2nd to 5th grade before increasing slightly to 64.4% in high school boys (Table 1c).

Table 1c. Weight Status among Males_By Grade, SC FitnessGram School Year 2017-2018

Variable	Grade							
	2 nd Grade		5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD	n	Mean, SD
Height, ft (mean, SD)	12,307	4.3 (0.2)	16,279	4.8 (0.3)	9,873	5.5 (0.3)	6,907	5.7 (0.3)
Height, cm (mean, SD)	12,307	129.6 (6.6)	16,279	146.2 (8.2)	9,873	166.5 (9.0)	6,907	172.3 (8.2)
Weight, lbs (mean, SD)	12,307	65.5 (16.5)	16,279	96.9 (30.0)	9,873	138.4 (39.6)	6,907	154.1 (42.4)
Weight, kg (mean, SD)	12,307	29.7 (7.5)	16,279	43.9 (13.6)	9,873	62.8 (17.9)	6,907	69.9 (19.2)
Weight Status (CDC program)								
BMI (mean, SD)	12,307	17.6 (3.4)	16,279	20.3 (5.0)	9,873	22.5 (5.5)	6,907	23.4 (5.8)
Normal	8,464	68.8%	9,688	59.5%	6,155	62.4%	4,447	64.4%
Overweight	1,731	14.1%	2,795	17.2%	1,612	16.3%	1,071	15.5%
Obese	2,112	17.1%	3,796	23.3%	2,106	21.3%	1,389	20.1%

BMI and weight status varied across grade, race/ethnicity, and poverty status (Figures 1c and 1d). Compared to girls, differences in BMI across race/ethnicity groups were less pronounced. The percentage of boys that were normal weight was lower among Hispanic boys compared to the remaining race/ethnicity groups. Again, the percentage of normal weight boys was lower among students in poverty.

Figure 1c. Weight Status, Body Mass Index (mean), Boys

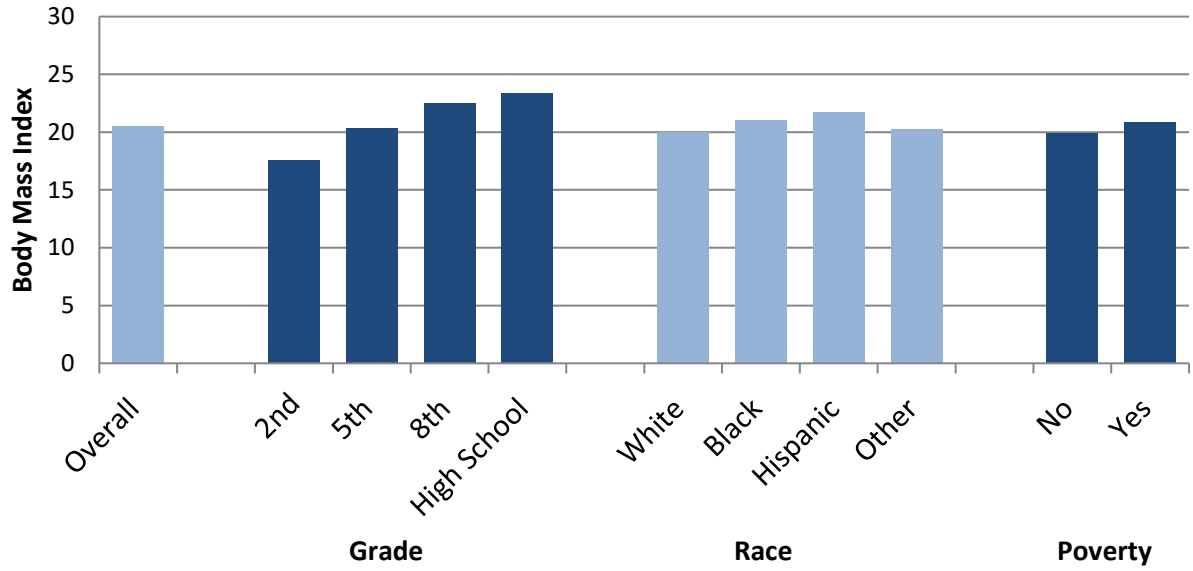
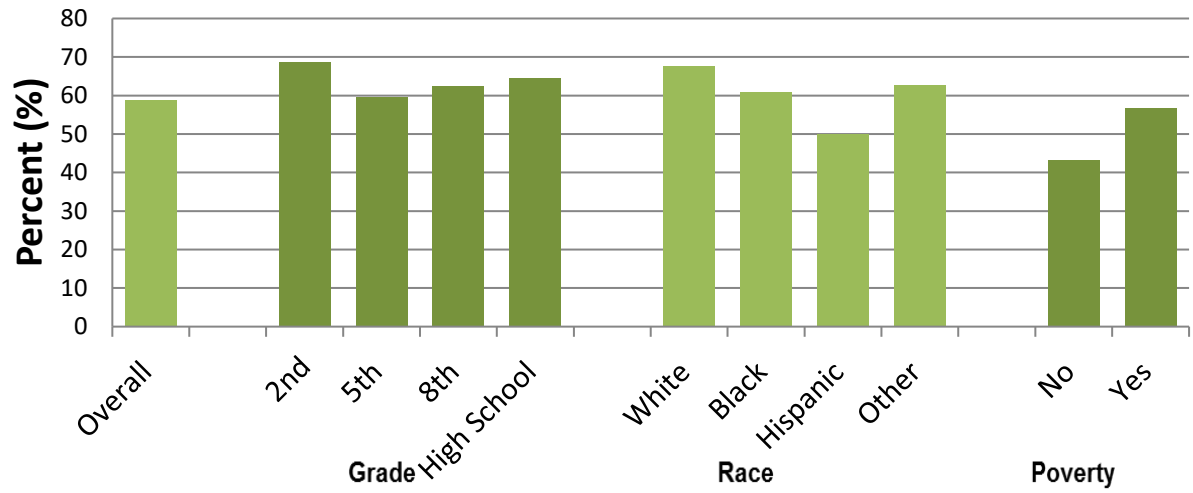


Figure 1d. Weight Status, Percent Attaining Normal Weight Status, Boys



Key Findings and Conclusions

A key finding was that rates of overweight and obesity among SC students are high with 37.2% failing to maintain a healthy weight status.

The following patterns were observed for weight status:

- The percentage of normal weight students was similar in girls and boys.
- The percentage of normal weight students tended to decrease with increasing age and grade level among both genders.
- The percentage of normal weight students was lower in Black and Hispanic students than in White and other race/ethnicity students. These trends were more pronounced in girls than boys.
- The percentage of normal weight students was lower among students in poverty compared to students not in poverty.

2. Cardiorespiratory Fitness

Definition. Cardiorespiratory fitness refers to a person's ability to perform large-muscle, whole-body physical activity for extended periods of time. Examples of physical activities that require cardiorespiratory fitness are brisk walking, running, stair-climbing, and participation in sports such as basketball and soccer. Cardiorespiratory fitness depends on the functional capacity of the body's cardiovascular, respiratory, and muscular systems. A physiological measure of this capacity is maximal aerobic power, or the maximal rate at which the body is able to take in, transport and consume oxygen (VO₂max).

Relationship to Health. Maintaining good levels of cardiorespiratory fitness is important to health during childhood, adolescence, and adulthood. During all life stages, higher cardiorespiratory fitness is associated with lower risk for future development of conditions such as heart disease, type 2 diabetes, and certain cancers. Also, cardiorespiratory fitness is needed to perform physically demanding occupational tasks. Consequently, good cardiorespiratory fitness during adolescence is an important prerequisite to eligibility for occupations such as law enforcement, farming, and military service.

Measures. In the FitnessGram protocol cardiorespiratory fitness is measured with one of three optional field tests: 1) Progressive Aerobic Cardiovascular Endurance Run (PACER) test; 2) 1-mile run test; or 3) a walk test. The majority of students completing the FitnessGram protocol in SC completed the PACER test. The PACER is a multistage exercise test that involves running back and forth across a 15 or 20-meter space at a progressively increasing pace. The PACER is scored as the number of laps that are completed before fatigue causes the student to fall behind the prescribed pace. Some students completed the 1-mile run test. Performance on the 1-mile run test is scored as the time required to run and/or walk the 1-mile distance.

Variable for analysis. Performance on each of the cardiorespiratory fitness tests can be used to estimate the student's maximal aerobic power (VO₂max). Each student's performance is scored as the corresponding VO₂max value, and that score is placed in one of three categories that are based on age- and sex-specific criteria. The categories are: 1) Healthy Fitness Zone; 2) Needs improvement; 3) Needs Improvement – Health Risk.

Results: Cardiorespiratory Fitness

Overall Sample. Over 66,000 students completed tests of cardiorespiratory fitness, and most of them completed the PACER test. In the total sample, which includes boys and girls in 5th, 8th and high school grades, 33,357 scored in the Healthy Fitness Zone. The remainder was approximately equally divided between those who scored in the Needs Improvement and Needs Improvement – Health Risk categories. Because cardiorespiratory fitness is a powerful predictor of long-term health, it is a great concern that nearly one-half of SC’s students tested did not attain the Healthy Fitness Zone and that approximately one quarter scored in the Needs Improvement – Health Risk category.

A clear gender difference was observed. Estimated VO₂max was higher in boys than girls, and a greater percentage of boys than girls (58.0% vs. 41.3%) scored in the Healthy Fitness Zone for the test of cardiorespiratory fitness. Additionally, among those failing to attain the Healthy Fitness Zone, a larger percentage of girls than boys scored in the Needs Improvement – Health Risk category (27.3% vs. 23.2%) (Table 2a). These findings indicate that low cardiorespiratory fitness is a particular concern in girls, but that a substantial percentage of boys also performed at a very low level on this test.

Table 2a. Cardiorespiratory Fitness for Total Sample and By Sex; SC FitnessGram School Year 2017-2018

Cardiorespiratory Fitness Variables	Total		Females		Males	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Estimated VO ₂ max	66,727	41.8 (6.5)	31,839	40.0 (5.1)	34,888	43.5 (7.1)
Field Test						
1-Mile Run	3,508	44.3 (6.3)	1,323	41.1 (5.0)	2,185	46.3 (6.2)
PACER	63,205	41.7 (6.4)	30,511	39.9 (5.1)	32,694	43.4 (7.1)
Walk	14	48.7 (14.2)	5	50.5 (14.7)	9	47.7 (14.7)
Fitness Zone Categories	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	33,357	50.0%	13,132	41.3%	20,225	58.0%
Needs Improvement	16,542	24.8%	9,988	31.4%	6,554	18.8%
Needs Improvement – Health Risk	16,828	25.2%	8,719	27.3%	8,109	23.2%

**The Healthy Fitness Zone categories do not equal the total for the FitnessGram Estimated VO₂max component due to missing values*

Cardiorespiratory Fitness in Girls. Cardiorespiratory fitness declined with increasing age and grade level in girls. VO₂max decreased from 40.9 in 5th graders to 38.2 in high school girls. The percentage of girls attaining the Healthy Fitness Zone decreased from 44.7% in fifth graders to 36.5% in high school girls (Table 2b).

As shown in Figures 2a and 2b, cardiorespiratory fitness was associated with weight status such that poorer performance was observed in those who were overweight and obese than in those who were normal weight. The percentage of girls in the Healthy Fitness Zone was 54.4% in normal weight girls but decreased to 31.2% in those who were overweight and to 13.0% in those who were obese. Also, performance on the cardiorespiratory fitness test was associated with race/ethnicity and poverty status. The percentage of girls in the Healthy Fitness Zone for cardiorespiratory fitness was lower among Black students and students living in poverty.

Table 2b. Cardiorespiratory Fitness Among Females by Grade; SC FitnessGram School Year 2017-2018

Cardiorespiratory Fitness Variables	Grade*					
	5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Estimated VO ₂ max	16,880	40.9 (5.6)	8,736	39.3 (5.5)	6,223	38.2 (5.4)
Field Test						
1-Mile Run	371	43.2 (5.3)	108	41.4 (4.7)	844	40.2 (4.5)
PACER	16,509	40.9 (4.5)	8,628	39.3 (5.5)	5,374	37.9 (5.4)
Walk	0	0.0	0	0.0	5	50.5 (14.7)
Fitness Zone Categories	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	7,548	44.7%	3,312	37.9%	2,272	36.5%
Needs Improvement	6,222	36.9%	2,359	27.0%	1,407	22.6%
Needs Improvement: Health Risk	3,110	18.4%	3,065	35.1%	2,544	40.9%

*cardiorespiratory fitness was not assessed for 2nd grade students

Figure 2a. Cardiorespiratory Fitness, Estimated VO₂max (mean), Girls

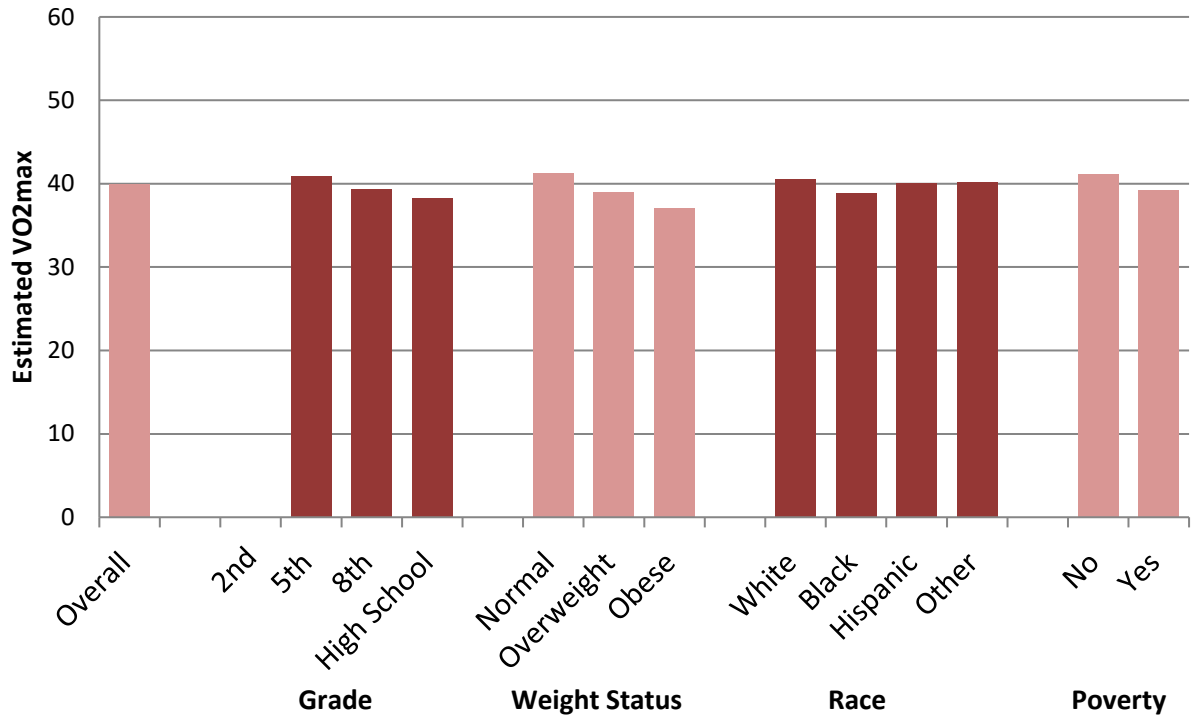
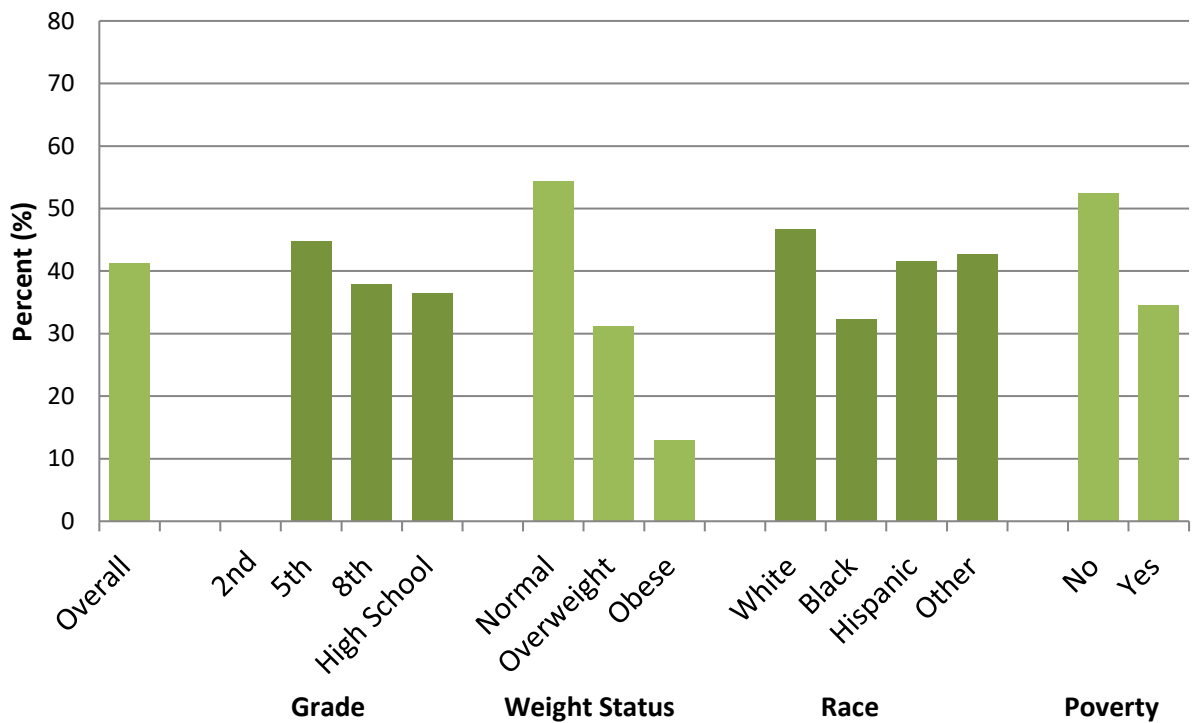


Figure 2b. Cardiorespiratory Fitness, Percent Attaining Healthy Fitness Zone, Girls



Cardiorespiratory Fitness in Boys. In boys, cardiorespiratory fitness as reflected by VO₂max increased modestly with increasing age and grade levels. However, the percentage of boys attaining the Healthy Fitness Zone decreased from 60.2% in 5th graders to 57.6% in 8th graders and to 53.0% in high school students (Table 2c).

The same association between cardiorespiratory fitness and weight status was observed in boys as in girls. Over 71.0% of normal weight boys scored in the Healthy Fitness Zone, but much smaller percentages of overweight and obese boys attained the Healthy Fitness Zone. The association between race/ethnicity and cardiorespiratory fitness was less pronounced in boys than girls (Figures 2c & 2d). A similar pattern between cardiorespiratory fitness and poverty status was also observed. Specifically, a smaller percentage of boys in poverty attained the Healthy Fitness Zone for cardiorespiratory fitness compared to boys not living in poverty.

Table 2c. Cardiorespiratory Fitness Among Males By Grade, SC FitnessGram; School Year 2017-2018

Cardiorespiratory Fitness Variables	Grade*					
	5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Estimated VO ₂ max	17,583	43.0 (6.1)	10,101	44.1 (7.8)	7,204	44.1 (8.00)
Field Test						
1-Mile Run	443	47.4 (6.3)	210	46.0 (6.1)	1,532	46.1 (6.2)
PACER	17,140	42.9 (6.1)	9,891	44.1 (7.8)	5,663	43.6 (8.3)
Walk	0	0	0	0	9	47.7 (14.7)
Fitness Zone Categories	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	10,587	60.2%	5,818	57.6%	3,820	53.0%
Needs Improvement	4,406	25.1%	1,212	12.0%	936	13.0%
Needs Improvement: Health Risk	2,590	14.7%	3,071	30.4%	2,448	34.0%

*cardiorespiratory fitness was not assessed for 2nd grade students

Figure 2c. Cardiorespiratory Fitness, Estimated VO2max (mean), Boys

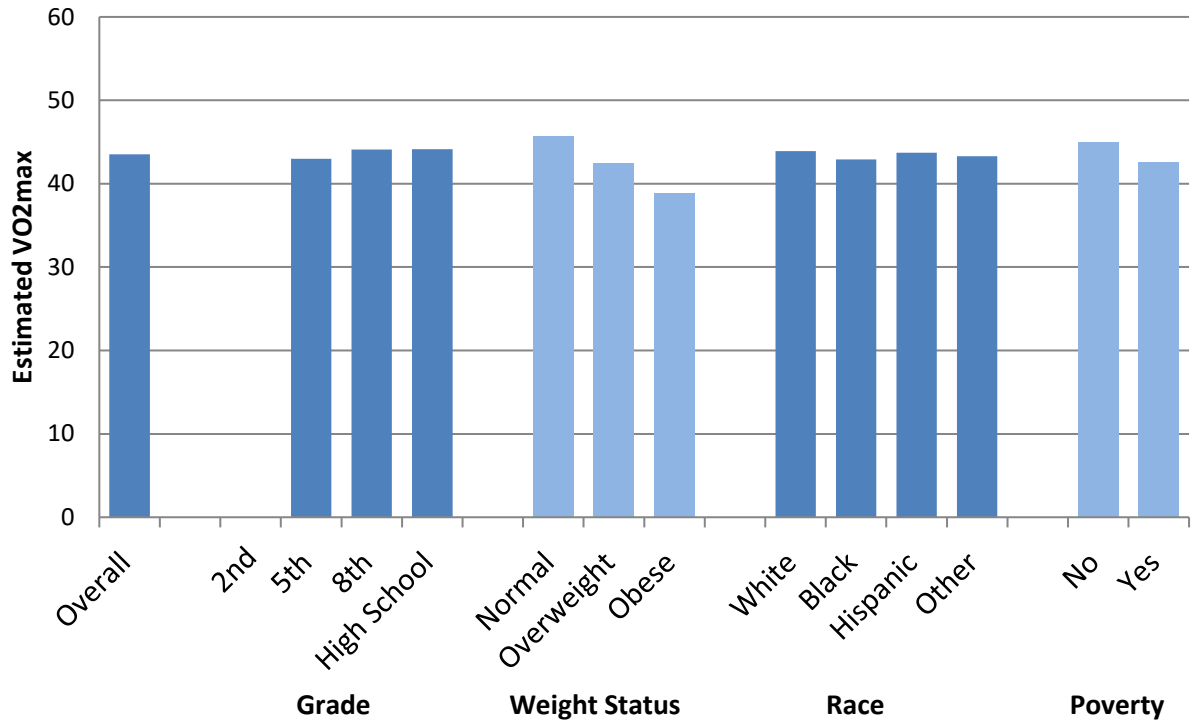
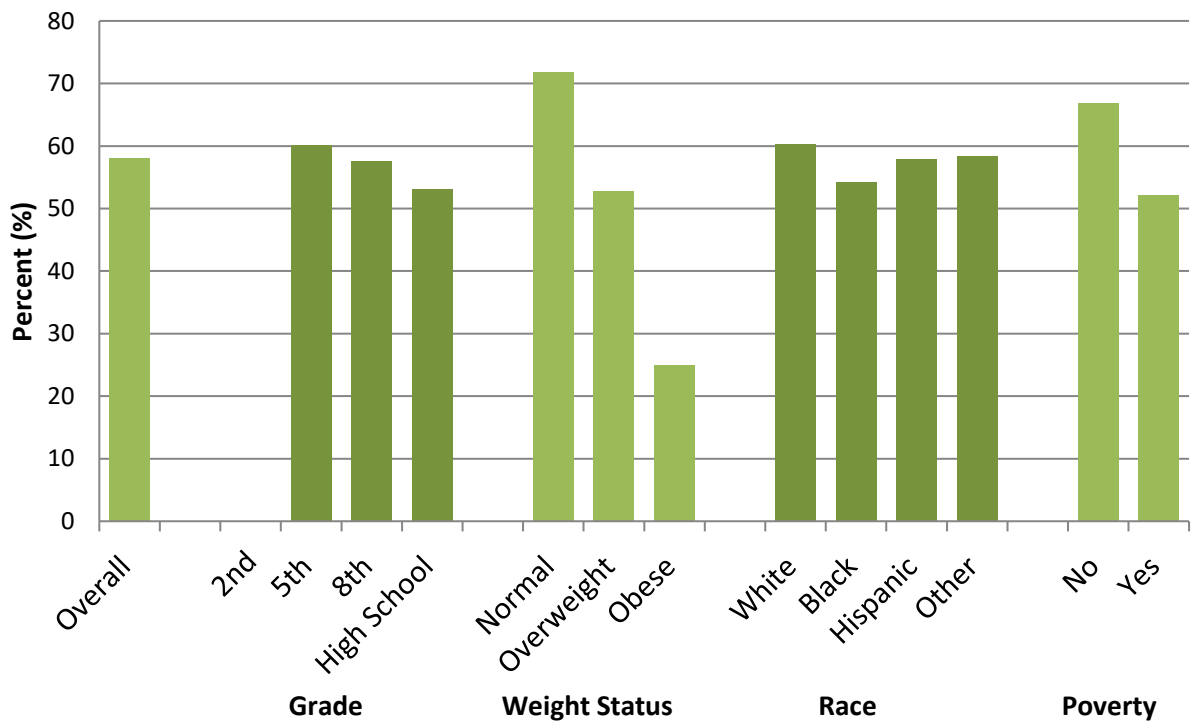


Figure 2d. Cardiorespiratory Fitness, Percent Attaining Healthy Fitness Zone, Boys



Key Findings and Conclusions

A key finding was that *half* of SC students attained the Healthy Fitness Zone for cardiorespiratory fitness.

The following patterns were observed:

- A smaller percentage of girls than boys attained the Healthy Fitness Zone.
- The percentage of students attaining the Healthy Fitness Zone decreased with increasing age and grade level, and this trend was particularly pronounced in girls.
- The percentage of students attaining the Healthy Fitness Zone was lower in Black students than in White students, and these trends were more pronounced in girls than boys.
- Performance on the cardiorespiratory fitness test was associated with weight status such that a higher percentage of normal weight students attained the Healthy Fitness Zone than did those in the overweight or obese categories.
- Among girls and boys, the percentage of students attaining the Healthy Fitness Zone for cardiorespiratory fitness was lower among students in poverty.

3. Upper Body Strength and Endurance – Push Ups

Definition. Muscular strength is the ability to generate force through contraction of the skeletal muscles and to apply that force to the body or to external objects. Muscular endurance refers to the ability to perform repeated muscle contractions or to sustain a muscle contraction against external resistance. Upper body muscular strength and endurance is a person's ability to generate force and to perform repeated muscular contractions against resistance using the musculature of the upper arm girdle.

Relationship to Health. Upper body muscular strength and endurance is related to health through its impact on daily function. Persons with adequate upper body muscular strength and endurance can perform household and occupational tasks safely, appropriately and without undue stress. Further, they are able to support their body weight with the upper body musculature as may be necessary in performance of leisure activities and in cases of emergency.

Measures. The 90° push-up is the recommended test item to assess upper body strength and endurance in the FitnessGram protocol. Alternate assessment tests include the modified pull-up, pull-up, and the flexed arm hang. The majority of the students completing the FitnessGram protocol in SC completed the 90° push-up test. The objective of the test is to complete as many push-ups as possible at a rhythmic pace (cadence = 20 push-ups per minute or 1 push-up every 3 seconds). The test ceases when the student can no longer perform a push-up or when a second form correction is made (e.g., not maintaining pace; not achieving 90° angle with elbows).

Variable for analysis. Performance on the push-up test for upper body strength and endurance is scored by counting the number of 90° push-ups performed. Each student's score is then placed in one of two Healthy Fitness Zone categories using age- and sex-specific criteria. The categories are: 1) Healthy Fitness Zone; 2) Needs Improvement.

Results: Upper Body Strength and Endurance

Overall Sample. Approximately 66,000 students completed the push-up test of upper body strength and endurance. For the total sample of students, which included boys and girls in grades 5, 8, and high school, the mean number of push-ups completed was 10.6. 57.2% of the

total sample scored in the Healthy Fitness Zone while the remaining 42.8% scored in the Needs Improvement category. In general, boys performed slightly better than girls on the upper body strength and endurance test component. On average, boys performed nearly five more push-ups than girls. Additionally, slightly more boys scored in the Healthy Fitness Zone compared to girls (59.0% vs. 55.2%) (Table 3a). These findings suggest that nearly three in every five SC students have adequate levels of upper body strength and endurance for health.

Table 3a. Upper Body Strength/Endurance - Push Ups; Total Sample and By Sex, SC FitnessGram School Year 2017-2018

Upper Body Strength and Endurance Variables	Total		Males		Females	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Push-Ups	66,267	10.6 (7.8)	34,298	12.8 (8.2)	31,969	8.3 (6.6)
Fitness Zone Categories	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	37,881	57.2%	20,251	59.0%	17,630	55.2%
Needs Improvement	28,386	42.8%	14,047	41.0 %	14,339	44.8%

Upper Body Strength and Endurance in Girls. In girls, upper body strength and endurance increased from 5th grade to 8th grade and then were maintained in high school. Specifically, the number of push-ups performed increased from 7.4 in 5th grade to 9.2 in both 8th grade and in high school (Table 3b). The percentage of girls attaining the Healthy Fitness Zone increased from 47.6% in fifth graders to 64.4% in high school girls.

As shown in Figures 3a and 3b, upper body strength and endurance was associated with weight status such that poorer performance was observed in those who were overweight and obese compared to those who were normal weight. The percentage of girls in the Healthy Fitness Zone was 64.5% in normal weight girls but decreased to 49.9% in those who were overweight and to 32.8% in those who were obese. Also, performance on the upper body strength and endurance test varied across race/ethnicity groups and poverty status. Push-up performance was poorer in Black and Hispanic girls than in White girls and girls from other races/ethnicities backgrounds; and poorer among girls living in poverty.

Table 3b. Upper Body Strength/Endurance - Push Ups; Females By Grade, SC FitnessGram School Year 2017-2018

Upper Body Strength and Endurance Variables	Grade					
	5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Push-Ups	16,323	7.4 (6.4)	8,790	9.2 (6.7)	6,856	9.2 (6.7)
Fitness Zone Categories	n	Percent	n	Percent	n	Percent
% Healthy Fitness Zone	7,762	47.6%	5,452	62.0%	4,416	64.4%
% Needs Improvement	8,561	52.4%	3,338	38.0%	2,440	35.6%

**upper body strength and endurance was not assessed for 2nd grade students*

Figure 3a. Upper Body Strength/Endurance, Push-Ups (mean), Girls

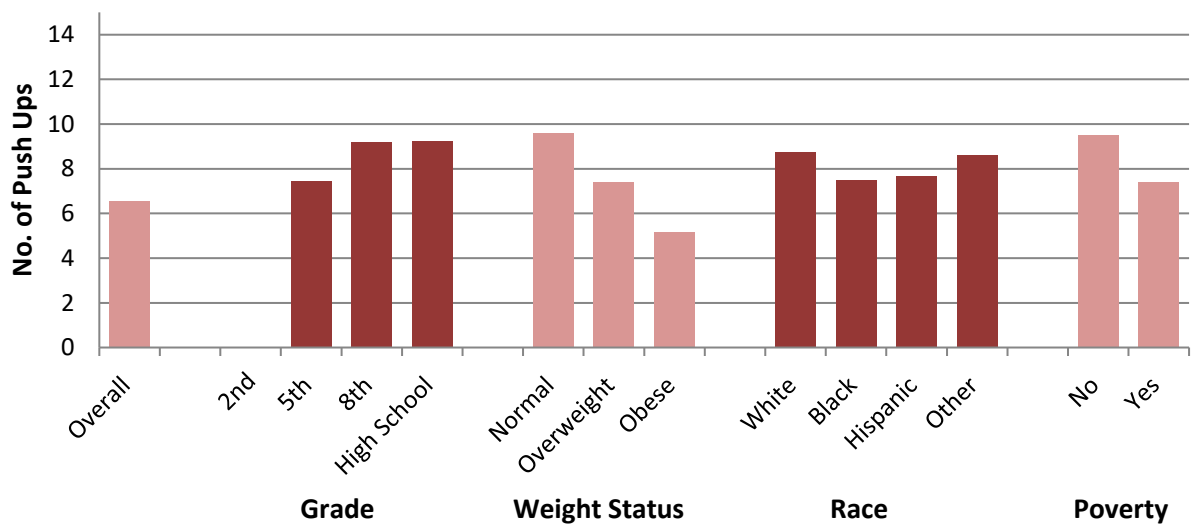
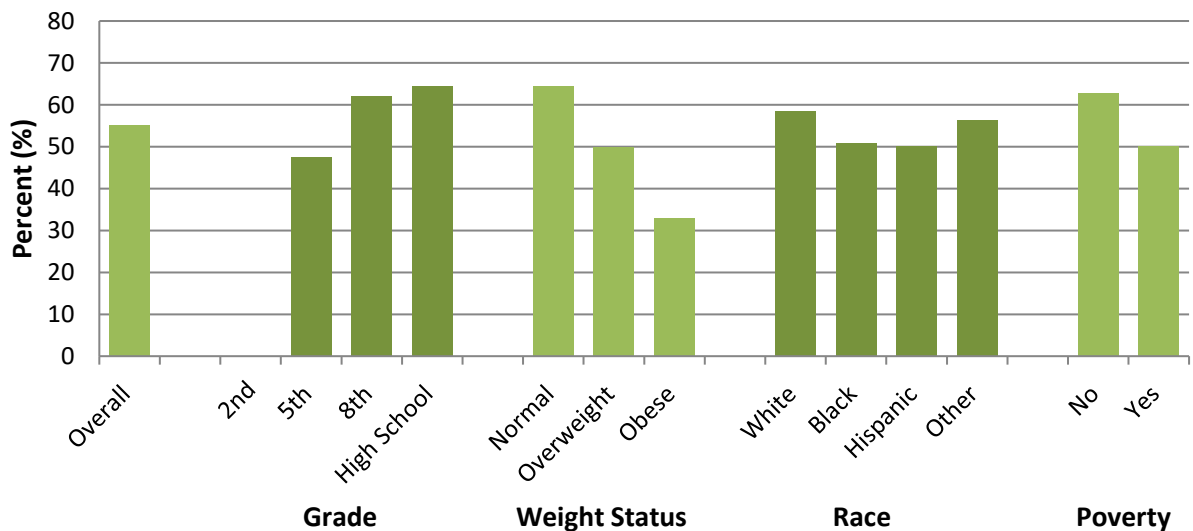


Figure 3b. Upper Body Strength/Endurance – Push-Ups, Percent Attaining Healthy Fitness Zone, Girls



Upper Body Strength and Endurance in Boys. Among boys, upper body strength and endurance increased with increasing age and grade levels. However, the percentage of boys attaining the Healthy Fitness Zone decreased modestly from 61.7% in 5th graders to 56.4% in high school students (Table 3c).

The same association between upper body strength and endurance and weight status was observed in boys as in girls. Over 68% of normal weight boys scored in the Healthy Fitness Zone, but much smaller percentages of overweight and obese boys attained the Healthy Fitness Zone. The association between race/ethnicity and upper body strength and endurance was less pronounced in boys than girls, with Hispanic students performing slightly worse than other race/ethnicity groups. Similar to girls, the percentage of boys attaining the Healthy Fitness Zone for upper body strength was poorer among students in poverty (Figures 3c and 3d).

Table 3c. Upper Body Strength/Endurance – Push-Ups; Males By Grade, SC FitnessGram; School Year 2017-2018

Upper Body Strength and Endurance Variables	Grade					
	5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Push-Ups (mean, SD)	16,809	10.3 (7.6)	10,021	14.3 (7.9)	7,468	16.3 (8.1)
Fitness Zone Categories	n	Percent	n	Percent	n	Percent
% Healthy Fitness Zone	10,366	61.7%	5,670	56.6%	4,215	56.4%
% Needs Improvement	6,443	38.3%	4,351	43.4%	3,253	43.6%

**upper body strength and endurance was not assessed for 2nd grade students*

Figure 3c. Upper Body Strength/Endurance, Push-Ups (mean), Boys

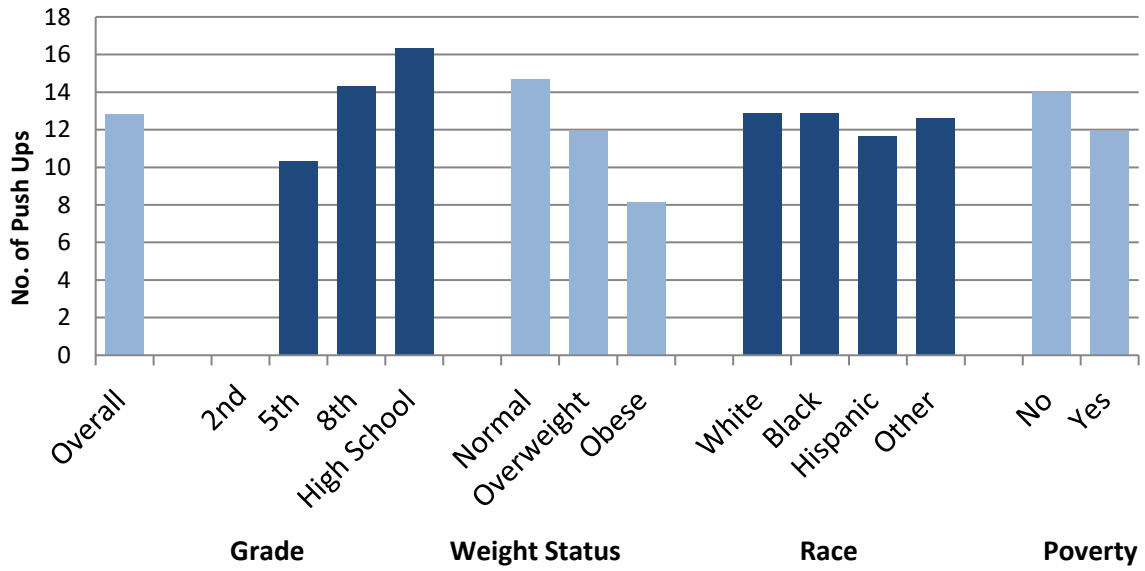
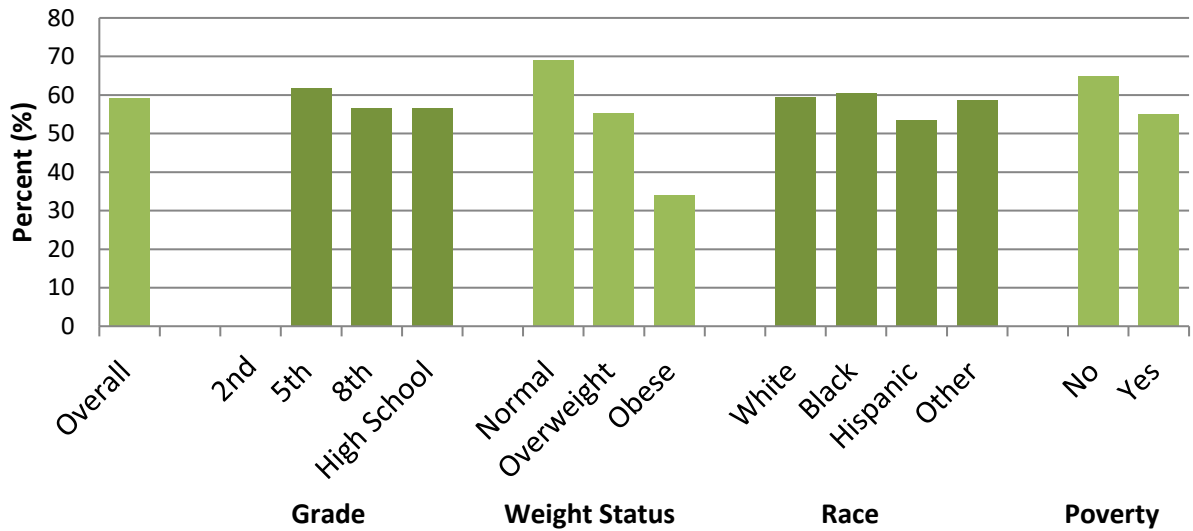


Figure 3d. Upper Body Strength/Endurance – Push-Ups, Percent Attaining Healthy Fitness Zone, Boys



Key Findings and Conclusions

A key finding of the assessment of upper body strength and endurance was that 57.1% of SC students attained the Healthy Fitness Zone for push-ups.

The following patterns were observed:

- Overall, the percentage of students scoring in the Healthy Fitness Zone category for push-ups was similar for boy and girls.
- Across grade levels, the percentage of girls attaining the Healthy Fitness Zone increased with increasing grade level while the percentage of boys decreased with increasing grade level.
 - In 5th grade, a smaller percentage of girls than boys attained the Healthy Fitness Zone for push-ups (47.6% vs. 61.7%).
 - In high school, a larger percentage of girls than boys attained the Healthy Fitness Zone for push-ups (64.4 vs. 56.4%).
- Among girls, the percentage of students attaining the Healthy Fitness Zone was lower in Black and Hispanic students than in White students. In boys, the percentage attaining the Healthy Fitness Zone was lower in Hispanic students compared to White and Black students.
- Performance on the upper body strength and endurance test was associated with weight status such that a higher percentage of normal weight students attained the Healthy Fitness Zone than did those in the overweight or obese categories.
- Concerning poverty status, the percentage of students attaining Healthy Fitness Zone for upper body strength was lower among students in poverty compared to those not living in poverty.

4. Abdominal Muscular Strength and Endurance – Curl-Ups

Definition. Muscular strength is the ability to generate force through contraction of the skeletal muscles and to apply that force to the body or to external objects. Muscular endurance refers to the ability to perform repeated muscle contractions or to sustain a muscle contraction against external resistance. Abdominal muscular strength and endurance is a person's ability to generate force and to perform repeated muscular contractions against resistance using the musculature of the abdomen.

Relationship to Health. Abdominal muscular strength and endurance is important in promoting good posture and alignment of the pelvis and spine. An adequate level of abdominal strength and endurance is important and impacts health through maintenance of lower back health.

Measures. The curl-up is the recommended test item to assess abdominal muscular strength and endurance in the FitnessGram protocol. Students lie on their backs with knees bent, feet flat on the floor, and arms parallel to the body with palms facing down. To perform a curl-up, students lift their head and shoulders off the mat and stretch their fingers across a measuring strip and then lower back down to the floor. The objective of the curl-up test is to complete as many curl-ups as possible at a specified pace of one curl-up every three seconds (max 75 curl-ups). The test ceases when 1) the student can no longer perform a curl-up, 2) the second form correction is made, or 3) the student completes 75 curl-ups.

Variable for analysis. Performance on the curl-up test for abdominal muscular strength and endurance is scored by counting the number of curl-ups performed with correct form. Each student's score is then categorized into one of two Healthy Fitness Zone categories using age- and sex-specific criteria. The categories are: 1) Healthy Fitness Zone; 2) Needs Improvement.

Results: Abdominal Muscular Strength and Endurance

Overall Sample. Approximately 68,000 students completed the curl-up test for abdominal muscular strength and endurance. The average number of curl-ups completed was 26.9 for the total sample, which included boys and girls from grades 5, 8 and high school. A majority of the students (68.4%) in the total sample scored in the Healthy Fitness Zone category for abdominal

muscular strength and endurance; the remaining 31.6% scored in the Needs Improvement category. On average, boys performed slightly better on the abdominal muscular strength and endurance test than girls (Table 4a).

Table 4a. Abdominal muscular Strength and Endurance –Curl-Ups; SC FitnessGram; Total Sample and By Sex, School Year 2017-2018

Abdominal Strength and Endurance Variables	Total		Males		Females	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Curl-Ups (mean, SD)	67,570	26.9 (19.6)	35,102	29.5 (20.4)	32,468	24.0 (18.4)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	46,225	68.4%	24,819	70.7%	21,406	65.9%
Needs Improvement	21,345	31.6%	10,283	29.3%	11,062	34.1%

Abdominal Muscular Strength and Endurance in Girls. Among girls, the number of curl-ups completed during the muscular strength and endurance test increased from 5th grade to 8th grade and then decreased slightly in high school. However, the percentage of girls attaining the Healthy Fitness Zone increased from 61.3% in fifth graders to 70.7% in high school girls (Table 4b).

Across demographic subgroups, differences in performance on the curl-up test for abdominal muscular strength and endurance emerged (Figures 4a and 4b). Similar to other FitnessGram test components, poorer performance on the abdominal muscular strength and endurance test was observed in overweight and obese students compared to normal weight students. Comparing race/ethnicity groups, performance on the abdominal muscular strength and endurance test was poorer in Black and Hispanic girls compared to White girls and girls from other races/ethnicities. Poorer performance on the abdominal muscular strength and endurance test was also observed among students in poverty.

Table 4b. Abdominal Muscular Strength and Endurance – Curl-Ups; SC FitnessGram; Females
By Grade, School Year 2017-2018

Abdominal Muscular Strength and Endurance Variables	Grade					
	5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Curl-Ups (mean, SD)	16,594	20.1 (16.8)	8,965	29.8 (20.5)	6,910	25.8 (16.5)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	10,171	61.3%	6,349	70.8%	4,886	70.7%
Needs Improvement	6,423	38.7%	2,615	29.2%	2,024	29.3%

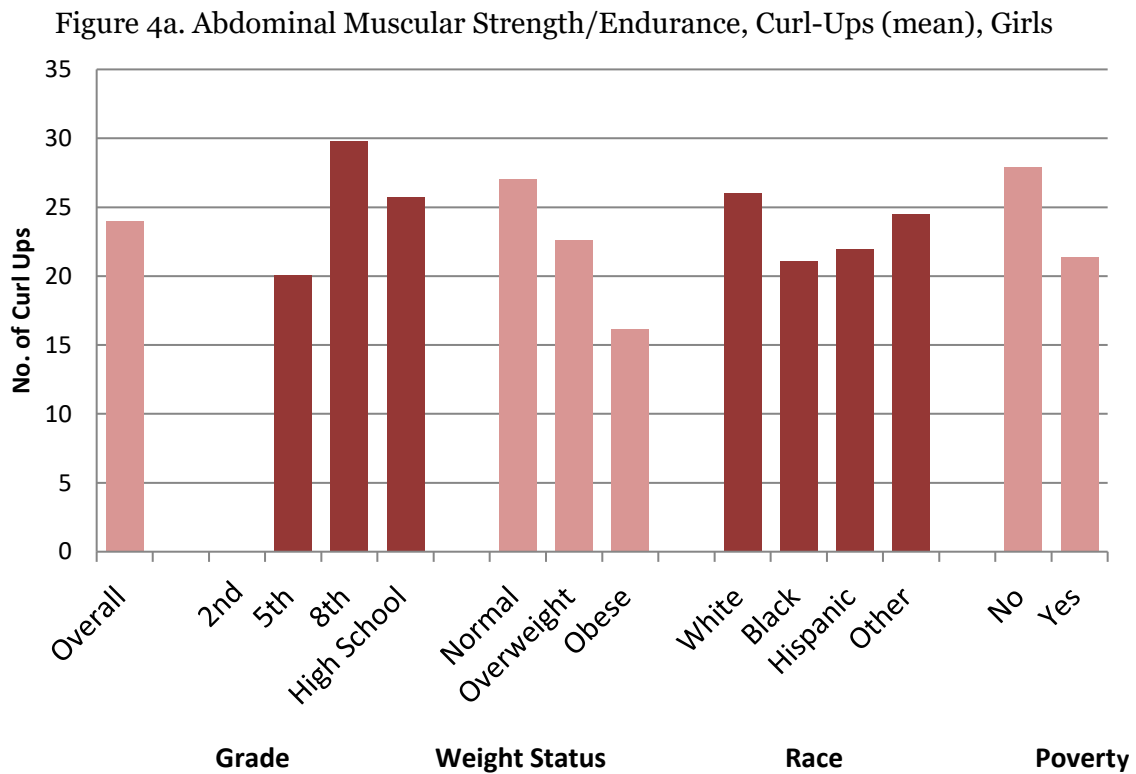
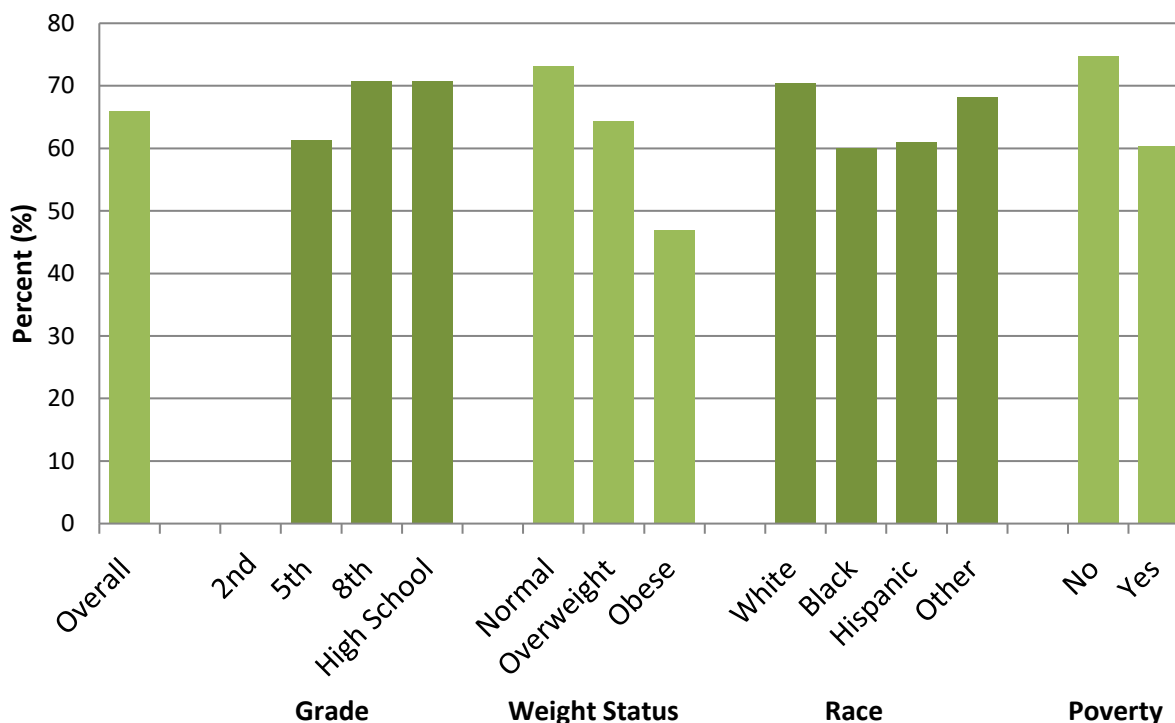


Figure 4b. Abdominal Muscular Strength/Endurance – Curl-Ups, Percent Attaining Healthy Fitness Zone, Girls



Abdominal Muscular Strength and Endurance in Boys. Similar to girls, the number of curl-ups completed during the abdominal muscular strength and endurance test increased from 5th to 8th grade, and then decreased slightly in high school. The percentage of boys attaining the Healthy Fitness Zone for abdominal muscular strength and endurance followed a similar trend (Table 4c).

The same association between abdominal muscular strength and endurance and weight status was observed in boys as in girls. Approximately 78% of normal weight boys scored in the Healthy Fitness Zone while only 70.7% of overweight and 52.0% of obese boys attained the Healthy Fitness Zone. While a similar pattern between race/ethnicity and abdominal muscular strength and endurance was observed, it was less pronounced in boys than girls. Again, poorer performance on the abdominal muscular strength and endurance test was also observed among students in poverty (Figures 4c and 4d).

Table 4c. Abdominal Muscular Strength and Endurance - SC FitnessGram; Males By Grade, School Year 2017-2018

Abdominal Strength and Endurance Variables	Grade*					
	5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Curl-Ups (mean, SD)	17,224	22.2 (18.0)	10,259	38.2 (21.2)	7,619	34.4 (18.3)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	11,292	65.6%	7,862	76.6%	5,665	74.4%
Needs Improvement	5,932	34.4%	2,397	23.4%	1,954	25.6%

Figure 4c. Abdominal Muscular Strength/Endurance, Curl-Ups (mean), Boys

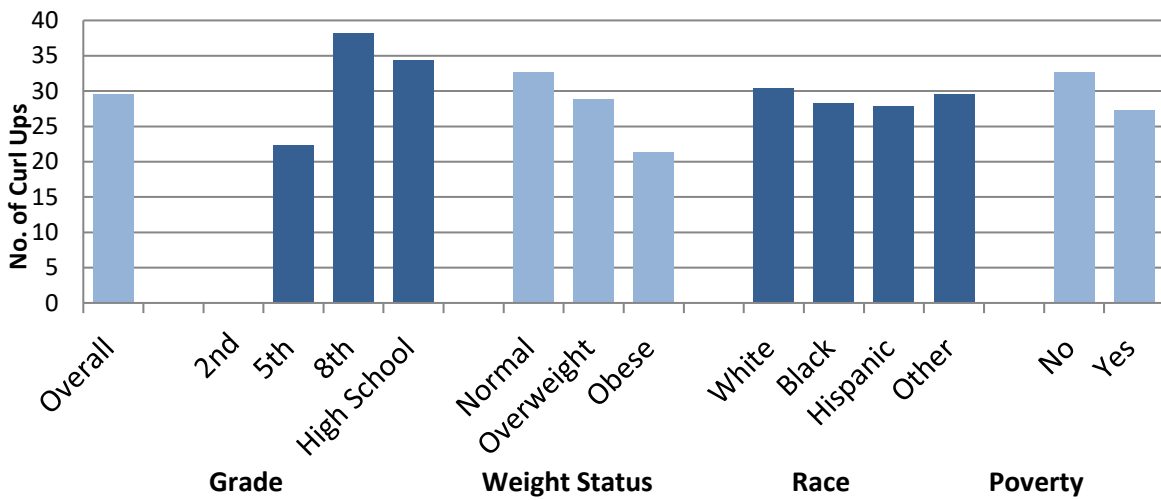
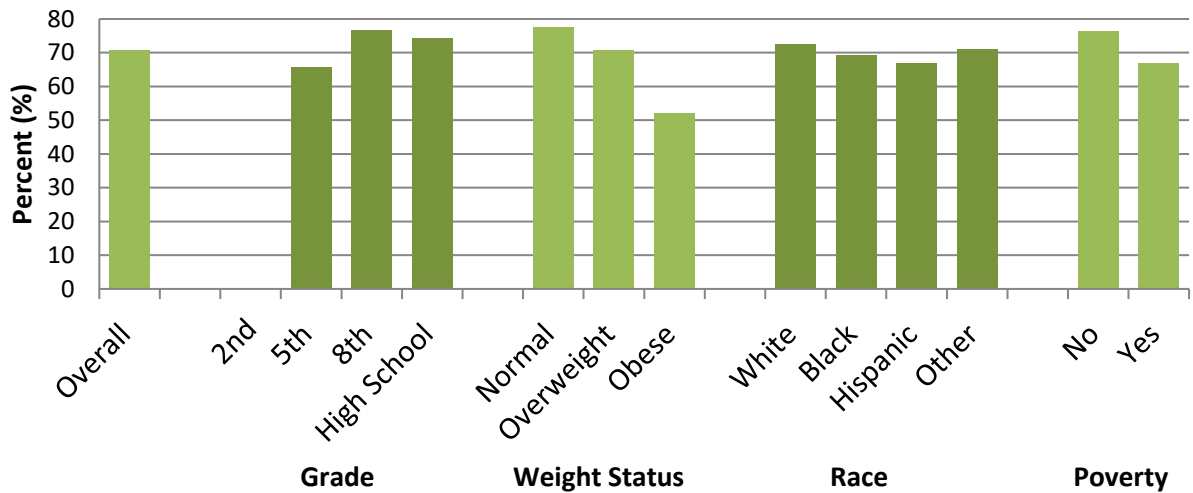


Figure 4d. Abdominal Muscular Strength/Endurance – Curl-Ups, Percent Attaining Healthy Fitness Zone, Boys



Key Findings and Conclusions

A key finding of the assessment of abdominal muscular strength and endurance was that 68.4% of SC students attained the Healthy Fitness Zone for curl-ups.

The following patterns were observed:

- Overall, the percentage of students scoring in the Healthy Fitness Zone category for curl-ups was slightly higher among boys compared to girls.
- Across grade levels, the percentage of girls and boys attaining the Healthy Fitness Zone increased from elementary to middle school and then decreased in high school.
- The percentage of students attaining the Healthy Fitness Zone was lower in Black and Hispanic students than in White students. This difference was slightly more pronounced in girls than boys.
- Performance on the abdominal muscular strength and endurance test was associated with weight status such that a higher percentage of normal weight students attained the Healthy Fitness Zone than did those in the overweight or obese categories.
- The percentage of students attaining the Healthy Fitness Zone for abdominal strength and endurance was lower among students in poverty.

5. Trunk Extensor Strength and Flexibility – Trunk Lift

Definition. Muscular strength is the ability to generate force through contraction of the skeletal muscles and to apply that force to the body or to external objects. Muscular flexibility refers to the range of motion in a joint or series of joints and is influenced by the length and extensibility of the muscles that cross the joint. Trunk extensor strength and flexibility is a person's ability to contract the musculature of the low back and hamstrings while having adequate flexibility in the abdominal and hip flexor muscles to extend the torso.

Relationship to Health. Trunk extensor strength and flexibility is important in maintaining correct posture and lower back health. To maintain good low back health, individuals must have adequate strength in back extensor muscles and sufficient, but not excessive, flexibility of the low back, hamstrings, and hip flexor muscles. The strength and flexibility of the trunk extensor muscles affect an individual's ability to perform activities of daily living such as picking up and carrying objects.

Measures. The trunk lift is the recommended test item to assess trunk extensor strength and flexibility in the FitnessGram protocol. The objective of the trunk lift is to use the muscles of the back to lift the upper body off the floor in a controlled manner while keeping the neck in a neutral position. A ruler is then used to measure the distance from the floor to the student's chin. The test is scored in inches, with a maximum score of 12.

Variable for analysis. Performance on the trunk lift test for trunk extensor strength and flexibility is scored by measuring in inches the distance the student lifts her/his chin from the floor. Each student's score is then categorized into one of two Healthy Fitness Zone categories using age- and sex-specific criteria. The categories are: 1) Healthy Fitness Zone; 2) Needs Improvement.

Results: Trunk Extensor Strength and Endurance

Overall Sample. Approximately 59,000 students completed the trunk extensor strength and flexibility component of the FitnessGram protocol. In the total sample, which included girls and boys in grades 5, 8 and high school, the average distance that students were able to lift the upper body was 10.1 inches. Performance was similar among boys and girls, with girls

performing slightly better than boys. The total percentage of students scoring in the Healthy Fitness Zone for trunk extensor strength and endurance was 76.9% with more girls scoring in this zone than boys (79.4% vs. 69.4%, respectively) (Table 5a). Compared to the other FitnessGram test components, a greater percentage of students scored in the Healthy Fitness Zone. These findings suggest that three in every four SC students has adequate trunk extensor strength and flexibility to maintain good health.

Table 5a. Trunk Extensor Strength – Trunk Lift, Total Sample and By Sex, SC FitnessGram School Year 2017-2018

Trunk Extensor Strength Variables	Total		Males		Females	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Trunk Lift (mean, SD)	59,459	10.1 (2.2)	30,674	9.9 (2.3)	28,785	10.2 (2.2)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	45,710	76.9%	22,867	74.5%	22,843	79.4%
Needs Improvement	13,749	23.1%	7,807	25.5%	5,942	20.6%

Trunk Extensor Strength and Endurance in Girls. In girls, scores on the trunk lift were observed to increase from 5th grade to 8th grade and then were maintained in high school. Overall, the percentage of students scoring in the Healthy Fitness Zone increased from 5th grade to high school (75.8% vs. 83.5%, respectively) (Table 5b).

Across demographic groups, some differences in performance on the trunk lift test for trunk extensor strength and flexibility were observed (Figures 5a and 5b). Unlike results from the other FitnessGram test components, poorer performance on the trunk extensor strength and flexibility test was not observed in overweight and obese students compared to normal weight students. By race/ethnicity, achievement of the Healthy Fitness Zone for trunk lift was slightly lower in Black and Hispanic girls compared to White girls. Additionally, girls in poverty performed slightly worse compared to girls not living in poverty (Figures 5a and 5b).

Table 5b. Trunk Extensor Strength – Trunk Lift, Females By Grade, SC FitnessGram School Year 2017-2018

Trunk Extensor Strength Variables	Grade					
	5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Trunk Lift (mean, SD)	14,974	10.0 (2.2)	7,876	10.5 (2.0)	5,937	10.5 (2.1)
Healthy Fitness Zone	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	11,358	75.8%	6,530	82.9%	4,955	83.5%
Needs Improvement	3,616	24.2%	1,344	17.1%	982	16.5%

Figure 5a. Trunk Strength/Endurance, Trunk Lift (mean), Girls

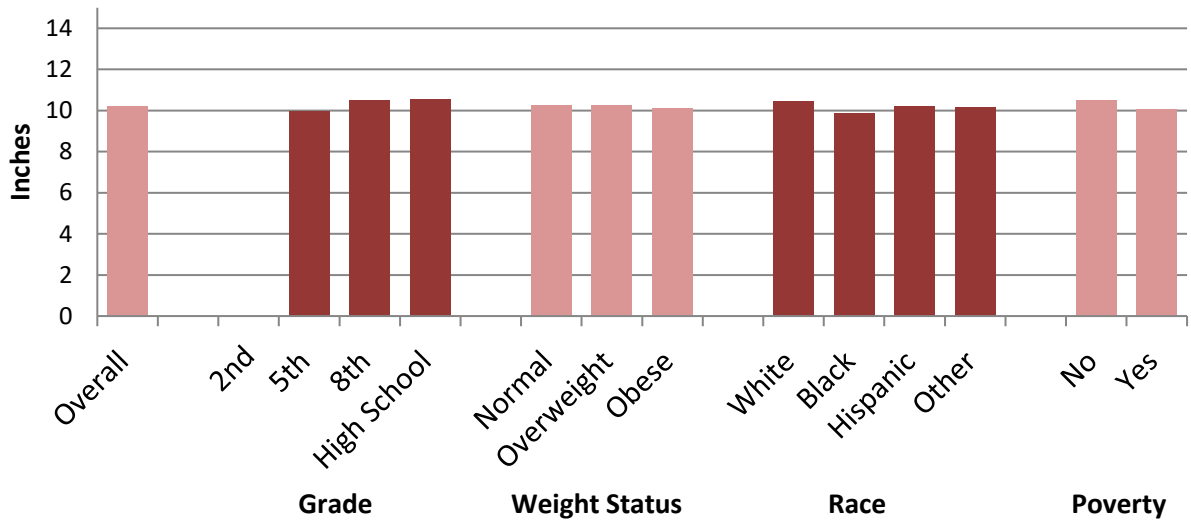
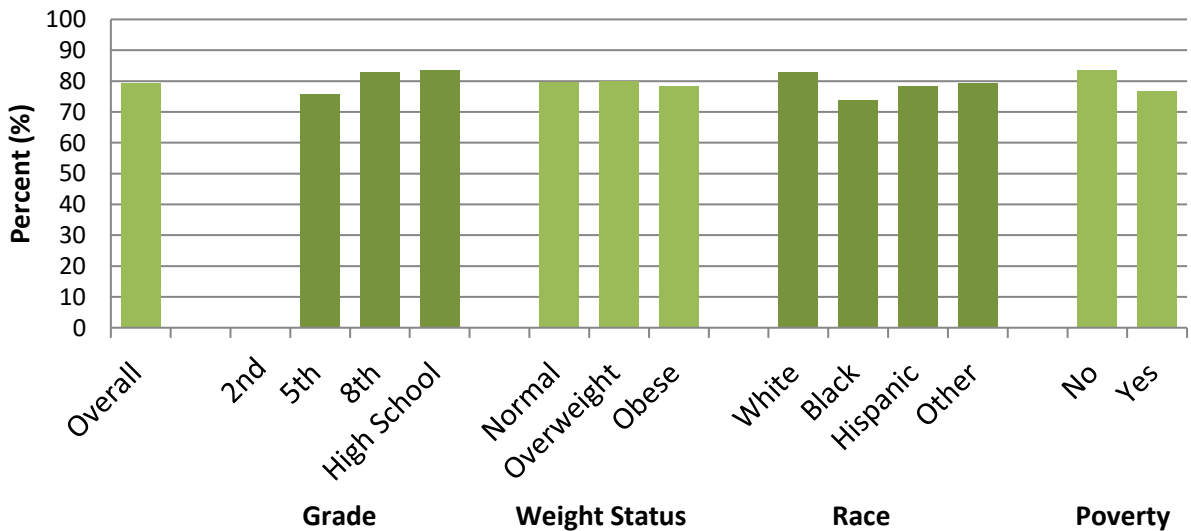


Figure 5b. Trunk Strength/Endurance – Trunk Lift, Percent Attaining Healthy Fitness Zone, Girls



Trunk Extensor and Endurance in Boys. Among boys, scores on the trunk lift were observed to increase from 5th grade to 8th grade and then were maintained in high school. The percentage of students scoring in the Healthy Fitness Zone increased from 69.9% in 5th grade to 79.7% in high school (Table 5c).

Similar patterns across demographic groups were observed in boys and girls. Concerning weight status, poorer performance on the trunk extensor strength and flexibility test was not observed in overweight and obese students compared to normal weight students. By race/ethnicity, performance on the trunk lift test was slightly better in White boys compared to other race/ethnicity groups. While less pronounced compared to other test components, poorer performance on the trunk extensor and endurance test was observed among male students in poverty (Figures 5c and 5d).

Table 5c. Trunk Extensor Strength – Trunk Lift, Males By Grade, SC FitnessGram School Year 2017-2018

Trunk Extensor Strength Variables	Grade					
	5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Trunk Lift (mean, SD)	15,421	9.6 (2.3)	8,880	10.2 (2.2)	6,373	10.3 (2.2)
Healthy Fitness Zone	n	Percent	n	Percent	n	Percent
% Healthy Fitness Zone	10,785	69.9%	7,001	78.8%	5,081	79.7%
% Needs Improvement	4,636	30.1%	1,879	21.2%	1,292	20.3%

Figure 5c. Trunk Strength/Endurance, Trunk Lift (mean), Boys

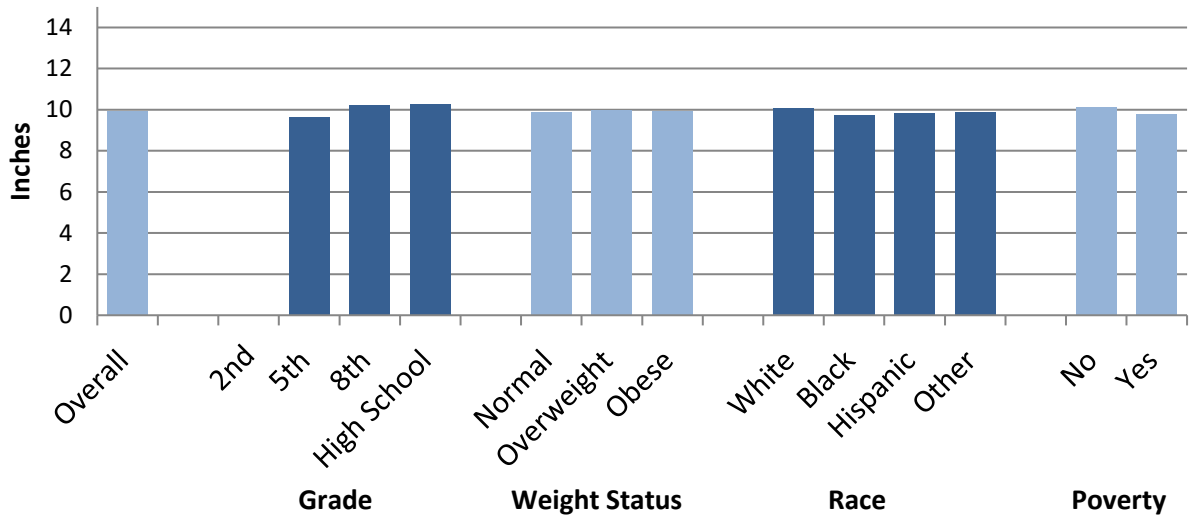
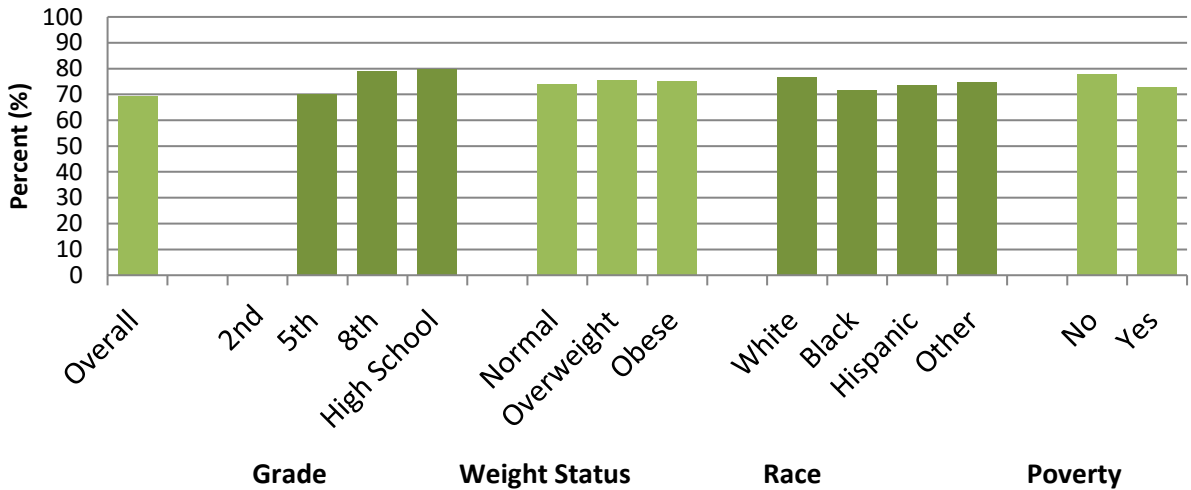


Figure 5d. Trunk Strength/Endurance – Trunk Lift, Percent Attaining Healthy Fitness Zone, Boys



Key Findings and Conclusions

A key finding of the assessment of trunk extensor strength and flexibility was that 76.9% of SC students attained the Healthy Fitness Zone for trunk lift.

The following patterns were observed:

- Overall, the percentage of students scoring in the Healthy Fitness Zone category for the trunk lift was slightly greater for girls than boys.

- Across grade levels, the percentage of girls and boys attaining the Healthy Fitness Zone tended to increase with increasing grade level.
- The percentage of students attaining the Healthy Fitness Zone was lower in Black and Hispanic students than in White students. This difference was more pronounced in girls than boys.
- Performance on the trunk extensor strength and flexibility test was not associated with weight status; normal weight students tended to perform worse than overweight or obese students.
- Poorer performance on the trunk extensor and endurance test was observed among students in poverty. This pattern was less pronounced in the trunk extensor and endurance test component compared to the other test components.

6. Flexibility - Sit and Reach

Definition. Muscular flexibility refers to the range of motion in a joint or series of joints and is influenced by the length and extensibility of the muscles that cross the joint. The back-saver sit and reach test predominately is a measure of the hamstring muscles.

Relationship to Health. Maintaining an adequate level of flexibility is important for functional health and mobility. Some major benefits of adequate flexibility include reduced risk of injury and improved performance of daily activities. Normal hamstring flexibility allows for 1) proper rotation of the pelvis in forward bending movements; and 2) posterior tilting of the pelvis for proper sitting.

Measures. The back-saver sit and reach is the recommended test item to assess flexibility in the FitnessGram protocol. An alternate assessment test is the shoulder stretch. The majority of the students completing the FitnessGram protocol in SC completed the sit and reach test. To perform the test, a student sits down at the test apparatus with one leg bent and the other fully extended. The arms are then extended forward over the measuring scale. The student then extends the opposite leg and repeats the test for the other side of the body. The objective of the test is to be able to reach the specified distance on both sides of the body. The test is scored in inches, with a maximum score of 12.

Variable for analysis. Performance on the sit and reach test for flexibility is scored by measuring in inches the distance the student is able to reach forward towards the extended foot.

Two scores are taken; one for the right side of the body and one for the left side of the body. Each student's scores are then categorized into one of two Healthy Fitness Zone categories using age- and sex-specific criteria. The categories are: 1) Healthy Fitness Zone; 2) Needs Improvement. In order to be classified in the Healthy Fitness Zone category, a student must meet the standard on both the right and left side of the body.

Results: Flexibility

Overall Sample. Approximately 66,000 students completed the sit and reach test for flexibility. In the total sample, which included girls and boys in grades 5, 8 and high school, the average distance that students were able to reach forward was 9.8 inches. Performance was better among girls than boys. The total percentage of students scoring in the Healthy Fitness Zone for sit and reach was 71.6 % and was similar among girls and boys (Table 6a).

Table 6a. Flexibility – Sit and Reach, Total Sample and By Sex, SC FitnessGram School Year 2017-2018

Flexibility Variables	Total		Males		Females	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Sit and Reach, Left (mean, SD)	66,043	9.8 (2.4)	34,109	9.2 (2.5)	31,934	10.5 (2.1)
Sit and Reach, Right (mean, SD)	65,571	9.8 (2.4)	33,880	9.2 (2.5)	31,691	10.5 (2.1)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	47,017	71.7%	24,324	71.8%	22,693	71.6%
Needs Improvement	18,525	28.3%	9,540	28.2%	8,985	28.4%

Flexibility in Girls. Among girls, raw scores on the sit and reach test increased with increasing age and grade level. The percentage of girls scoring in the Healthy Fitness Zone

increased from 5th grade to 8th grade then decreased slightly in high school (67.7% vs. 79.0% vs. 71.5%, respectively) (Table 6b).

Table 6b. Flexibility – Sit and Reach, Females By Grade, SC FitnessGram School Year 2017-2018

Flexibility Variables	Grade					
	5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Sit and Reach, Left	16,274	10.1 (2.1)	8,672	10.9 (1.8)	6,988	11.0 (1.9)
Sit and Reach, Right	16,130	10.1 (2.2)	8,631	10.9 (1.8)	6,930	11.0 (1.9)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	10,920	67.7%	6,817	79.0%	4,956	71.5%
Needs Improvement	5,202	32.3%	1,809	21.0%	1,974	28.5%

Across demographic groups, slight differences in performance on the sit and reach test were observed (Figures 6a and 6b). Slightly poorer performance on the sit and reach test for flexibility test was observed in overweight and obese students compared to normal weight students; Black and Hispanic girls compared to White girls; and students in poverty.

Figure 6a. Flexibility, Sit and Reach (mean), Girls

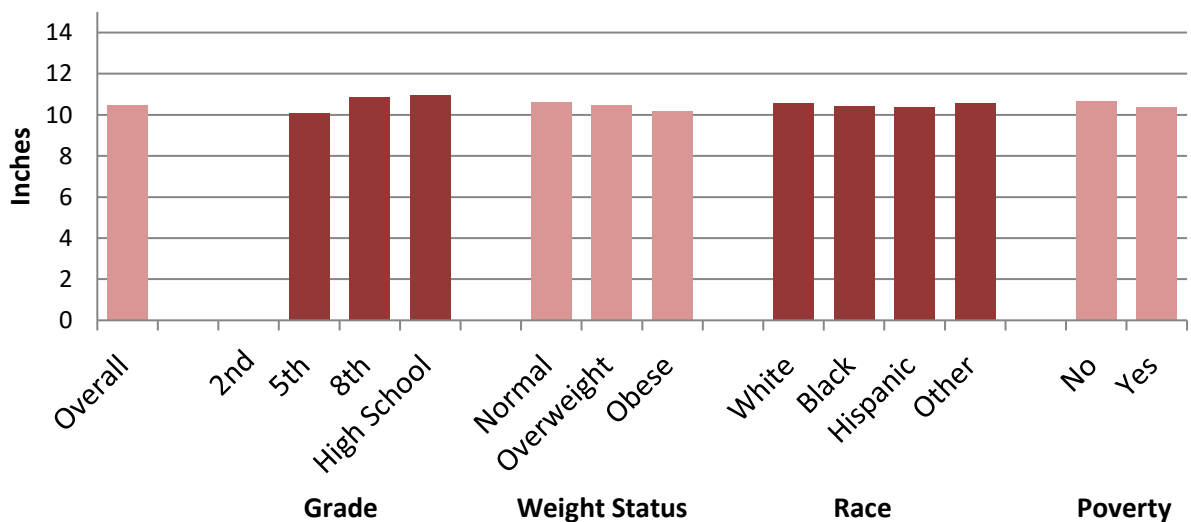
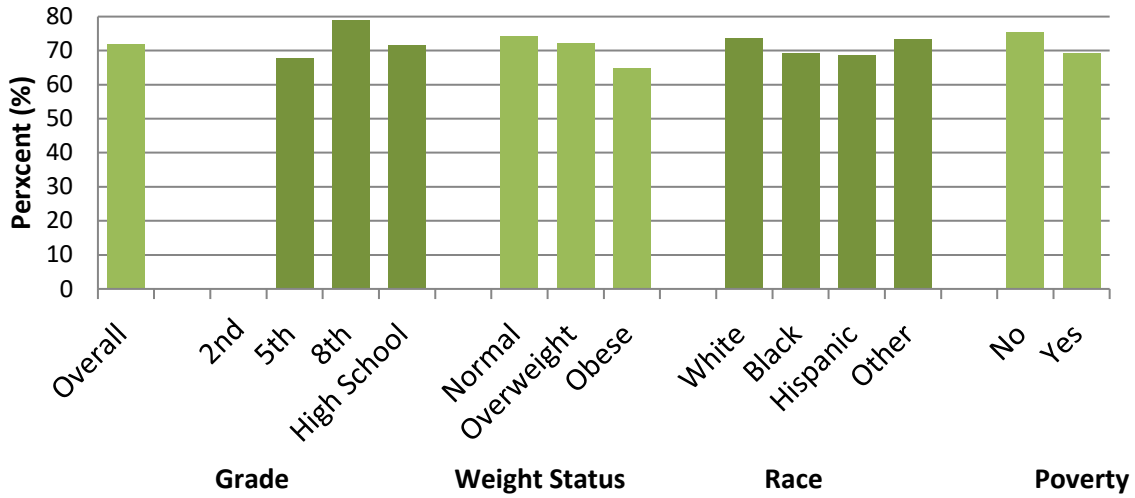


Figure 6b. Flexibility- Sit and Reach, Percent Attaining Healthy Fitness Zone, Girls



Flexibility in Boys. The percentage of boys attaining the Healthy Fitness Zone for flexibility increased with increasing age and grade level (65.3% to 75.2% to 81.9%, respectively) (Table 6c). Additionally, similar patterns across demographic groups were observed in boys and girls. Concerning weight status, a lower percentage of overweight and obese boys compared to normal weight boys attained the Healthy Fitness Zone for flexibility. By race/ethnicity, there was no discernable difference in the sit and reach test performance (Figures 6c and 6d).

Table 6c. Flexibility – Sit and Reach; SC FitnessGram; Males By Grade, School Year 2017-2018

Flexibility Variables	Grade					
	5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Sit and Reach, Left	16,788	8.7 (2.4)	9,818	9.4 (2.5)	7,503	9.9 (2.4)
Sit and Reach, Right	16,640	8.7 (2.4)	9,782	9.4 (2.5)	7,458	9.9 (2.4)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
% Healthy Fitness Zone	10,859	65.3%	7,356	75.2%	6,109	81.9%
% Needs Improvement	5,770	34.7%	2,422	24.8%	1,348	18.1%

**flexibility was not assessed for 2nd grade students*

Figure 6c. Flexibility, Sit and Reach (mean), Boys

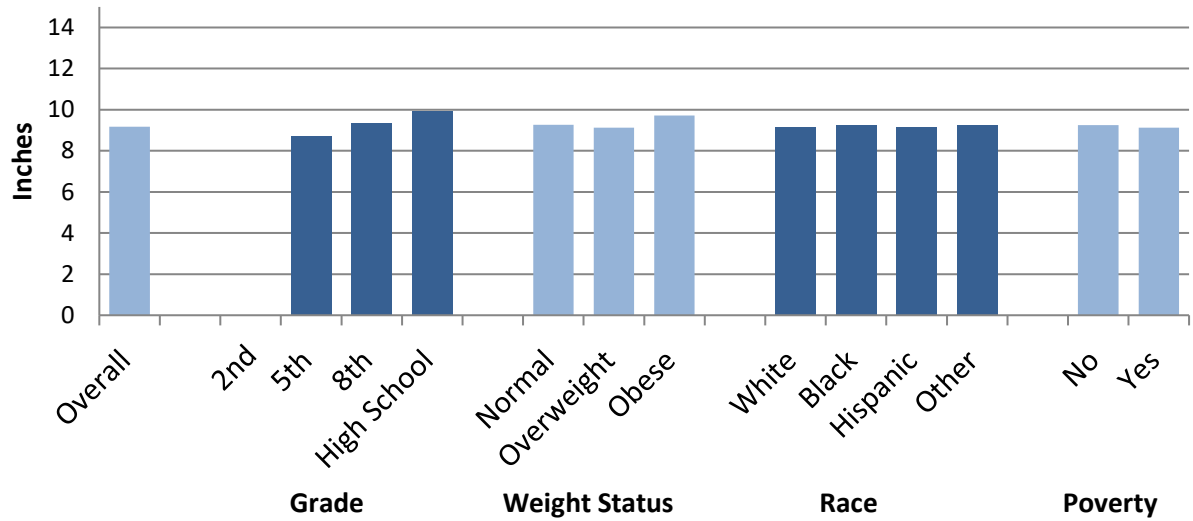
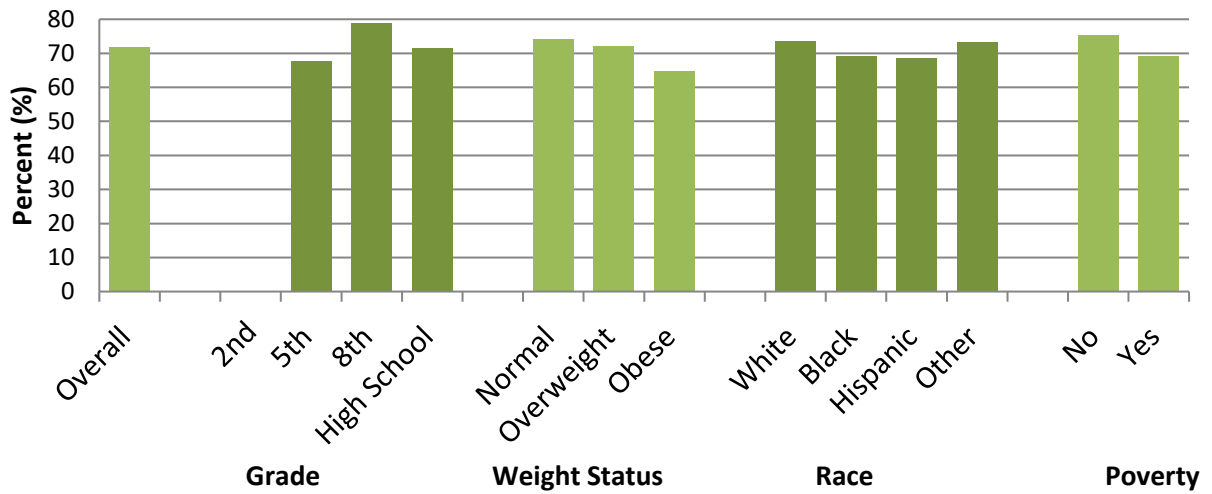


Figure 6d. Flexibility – Sit and Reach, Percent Attaining Healthy Fitness Zone, Boys



Key Findings and Conclusions

A key finding of the assessment of flexibility as measured by the sit and reach test was that 71.7% of SC students attained the Healthy Fitness Zone for flexibility.

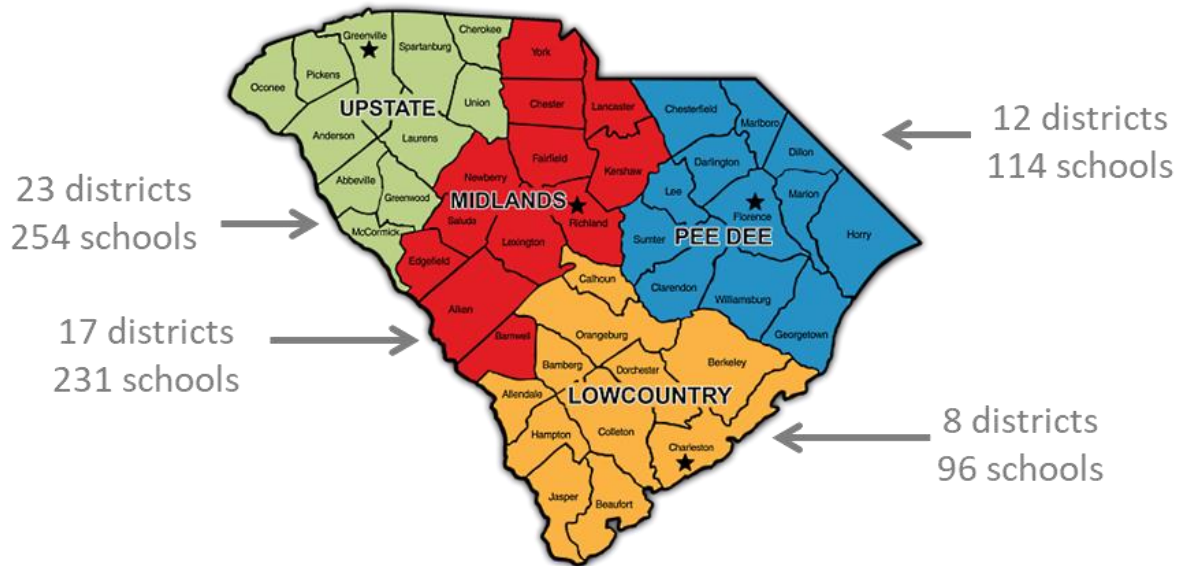
The following patterns were observed:

- Overall, the percentage of students scoring in the Healthy Fitness Zone category for flexibility was similar among girls and boys.
- Across grade levels, the percentage of boys attaining the Healthy Fitness Zone increased with increasing grade level, while girls increased from 5th grade to 8th grade and then decreased in high school.
- The percentage of students attaining the Healthy Fitness Zone varied slightly across race/ethnicity groups and was different among girls and boys.
- Performance on the sit and reach test was associated with weight status; normal weight students tended to perform slightly better than overweight or obese students.
- Poorer performance on the sit and reach test for flexibility was observed among students in poverty. This pattern was more pronounced in boys compared to girls.

APPENDICES

Appendix A. Sample Distribution

Figure 1. Number of schools and school districts participating in the SC FitnessGram project by DHEC Public Health Region during school year 2017-2018.



*2 schools from South Carolina Public Charter School District
TOTAL = 61 Districts, 697 Schools*

Table 1. Number of students, schools, and school districts participating in the SC FitnessGram project by DHEC Public Health Region during school year 2017-2018.

Health Region	Districts (n)	Schools (n)	Students*
Lowcountry	8	96	12841
Midlands	17	231	32272
Pee Dee	12	114	12706
Upstate	23	254	40510
Public Charter School District	1	2	73
TOTAL	61	697	98,402

Table 2. Number of students and schools participating in South Carolina FitnessGram project by school district and DHEC health district during school year 2017-2018

Region	District	Schools in District (n)	Schools Participating in Study (n)	Students Participating in Study (n)
LOW COUNTRY 8 of 19 Districts Participating	Allendale Co School District	4	3	251
	Bamberg School District 1	3	3	203
	Beaufort Co School District	32	25	2971
	Charleston Co School District	82	27	3578
	Dorchester Co School District 2	24	21	4510
	Hampton Co School District 1	7	1	116
	Orangeburg School District 4	8	4	323
	Orangeburg School District 5	14	12	889
	Total	174	96	12841
MIDLANDS 17 of 23 Districts Participating	Aiken Co School District	40	39	4980
	Barnwell School District 45	4	3	389
	Chester Co School District	12	3	288
	Clover School District 2	10	9	1492
	Fairfield Co School District	7	5	338
	Kershaw Co School District	18	14	1751
	Lancaster Co School District	20	16	2455
	Lexington Co School District 1	29	24	4241
	Lexington Co School District 2	13	2	156
	Lexington Co School District 3	4	4	422
	Newberry Co School District	13	11	1138
	Richland Co School District 1	46	36	4041
	Richland Co School District 2	37	36	6396
	Rock Hill School District 3	26	21	3377
Saluda Co School District 1	5	2	191	

	Williston School District 29	3	1	56
	York School District 1	8	5	561
	Total	295	231	32272
PEE DEE 12 of 17 Districts Participating	Chesterfield Co School District	16	14	1459
	Clarendon School District 3	2	2	322
	Darlington Co School District	21	9	854
	Florence School District 1	23	12	2028
	Florence School District 2	2	1	29
	Georgetown Co School District	19	17	1546
	Horry Co School District	53	25	3271
	Lee Co School District	5	4	244
	Marion County School District	19	5	348
	Marlboro Co School District	8	3	279
	Sumter School District	25	18	2117
	Williamsburg Co School District	11	4	209
	Total	204	114	12706
	UPSTATE	Abbeville Co School District	8	3
Anderson School District 1		14	14	2228
Anderson School District 2		7	6	794
Anderson School District 3		5	5	537
Anderson School District 4		6	5	575
Anderson School District 5		18	12	1924
Cherokee Co School District 1		13	10	845
Greenville Co School District		85	79	16623
Greenwood School District 50		13	10	1378
Laurens Co School District 55		9	6	563
Laurens Co School District 56		5	5	676
McCormick Co School District		3	2	177

23 of 25 Districts Participating	Oconee Co School District	16	13	1355
	Pickens Co School District	23	20	3039
	Spartanburg School District 1	10	8	735
	Spartanburg School District 2	15	13	2226
	Spartanburg School District 3	7	3	321
	Spartanburg School District 4	4	4	641
	Spartanburg School District 5	12	4	818
	Spartanburg School District 6	14	13	2540
	Spartanburg School District 7	12	10	1155
	Union Co School District	7	6	796
	Ware Shoals School District 51	3	3	319
Total	309	254	40510	
NA	SC Public Charter School District	39	2	73
	Total	39	2	73
Total	1021	697	98402	

Appendix B. Summary Tables for FitnessGram Results

Table 1. Summary of SC FitnessGram Scores; Males & Females, School Year 2017-2018

Variable	Total (n=98,402)		Grade							
			2 nd Grade (n=24,672)		5 th Grade (n=37,040)		8 th Grade (n=20,609)		High School (n=16,081)	
	n	Mean, SD / %	n	Mean, SD / %	n	Mean, SD / %	n	Mean, SD / %	n	Mean, SD / %
Age (mean, SD)	98,402	11.1 (2.7)	24,672	7.6 (0.5)	37,040	10.5 (0.6)	20,609	13.5 (0.6)	16,081	14.8 (1.0)
Race/Ethnicity (%)	97,206									
American Indian (I)	272	0.3%	79	0.3%	91	0.3%	67	0.3%	35	0.2%
Asian (A)	1,664	1.7%	429	1.8%	609	1.7%	396	1.9%	230	1.5%
Black or African American (B)	30,852	31.7%	7,624	31.2%	11,714	32.0%	6,002	29.5%	5,512	35.0%
Hispanic or Latino (H)	9,928	10.2%	2,576	10.5%	3,948	10.8%	1,965	9.7%	1,439	9.2%
Hawaiian or Pacific Islander (P)	122	0.1%	26	0.1%	41	0.1%	34	0.2%	21	0.1%
White (W)	50,460	51.9%	12,622	51.6%	18,710	51.1%	11,120	54.6%	8,008	50.9%
Other/Unknown (M)	3,908	4.0%	1,100	4.5%	1,533	4.2%	785	3.9%	490	3.1%
Poverty Status (%)	94,448		23,671		35,611		19,876		15,290	
No	36,867	39.0%	8,535	36.1%	13,269	37.3%	8,490	42.7%	6,573	43.0%
Yes	57,581	61.0%	15,136	63.9%	22,342	26.75	11,386	57.3%	8,717	57.0%
Height, ft (mean, SD)	88,296	4.9 (0.5)	24,376	4.2 (0.2)	32,104	4.8 (0.3)	18,485	5.4 (0.3)	13,331	5.5 (0.3)
Height, cm (mean, SD)	88,296	148.6 (16.5)	24,376	129.1 (6.7)	32,104	146.8 (8.4)	18,485	163.7 (8.6)	13,331	167.4 (9.1)
Weight, lbs (mean, SD)	88,296	104.8 (43.7)	24,376	65.5 (17.1)	32,104	98.7 (30.7)	18,485	136.1 (38.2)	13,331	148.0 (41.2)
Weight, kg (mean, SD)	88,296	47.5 (19.8)	24,376	29.7 (7.8)	32,104	44.8 (13.9)	18,485	61.7 (17.3)	13,331	67.1 (18.7)
Body Mass Index (CDC program)										
BMI (mean, SD)	88,296	20.7 (5.5)	24,376	17.7 (3.6)	32,104	20.5 (5.1)	18,485	22.9 (5.7)	13,331	23.9 (6.1)
Normal	55,533	62.8%	16,673	68.4%	19,164	59.7%	11,352	61.4%	8,344	62.6%
Overweight	14,699	16.7%	3,520	14.4%	5,703	17.8%	3,256	17.6%	2,220	16.7%

Obese	18,064	20.5%	4,183	17.2%	7,237	22.5%	3,877	21.0%	2,767	20.7%
Cardiorespiratory Fitness										
Estimated VO ₂ max (mean, SD)	66,727	41.8 (6.5)	--	--	34,463	42.0 (5.5)	18,837	41.9 (7.2)	13,427	41.4 (7.5)
% Healthy Fitness Zone	33,357	50.0%	--	--	18,135	52.6%	9,130	48.5%	6,092	45.4%
% Needs Improvement	16,542	24.8%	--	--	10,628	30.8%	3,571	19.0%	2,343	17.5%
% Needs Improvement – Health Risk	16,828	25.2%	--	--	5,700	16.6%	6,136	32.5%	4,992	37.1%
Mile - Estimated VO ₂ max (mean, SD)	3,508	44.3 (6.3)	--	--	814	45.5 (6.2)	318	44.4 (6.0)	2,376	44.0 (6.3)
Pacer - Estimated VO ₂ max (mean, SD)	63,205	41.7 (6.4)	--	--	33,649	41.9 (5.5)	18,519	41.8 (7.2)	11,037	40.8 (7.6)
Walk - Estimated VO ₂ max (mean, SD)	14	48.7 (14.2)	--	--	0	0.0	0	0.0	14	48.7 (28.3)
Upper Body Strength/Endurance										
Push Ups (mean, SD)	66,267	10.6 (7.8)	--	--	33,132	8.9 (7.2)	18,811	11.9 (7.8)	14,324	12.9 (8.2)
% Healthy Fitness Zone	37,881	57.2%	--	--	18,128	54.7%	11,122	59.1%	8,631	60.35
% Needs Improvement	28,386	42.8%	--	--	15,004	45.3%	7,689	40.9%	5,693	39.7%
Modified Pull Up (mean, SD)	272	2.9 (3.3)	--	--	229	2.9 (3.2)	43	3.3 (4.0)	0	0.0%
% Healthy Fitness Zone	57	21.0%	--	--	52	22.7%	5	11.6%	0	0.0%
% Needs Improvement	215	79.0%	--	--	177	77.3%	38	88.4%	0	0.0%
% Exempt	0	0.0%	--	--						
Flexed Arm Hang (mean, SD)	1021	13.0 (16.0)	--	--	870	13.0 (16.7)	151	13.4 (11.1)	0	
% Healthy Fitness Zone	870	85.2%			520	59.8%	81	53.6%		
% Needs Improvement	151	14.8%			350	40.2%	70	46.4%		
Upper Body Strength HFZ	72481				36,816		20,143		15,522	
% Healthy Fitness Zone	38,606	53.3%	--	--	18,598	50.5%	11,244	55.8%	8,764	56.5%
% Needs Improvement	28,394	39.2%	--	--	15,009	40.8%	7,692	38.2%	5,693	36.6%
% Incomplete	4,573	6.2%	--	--	2,725	7.4%	980	4.9%	868	5.6%
% Exempt	908	1.3%	--	--	484	1.3%	227	1.1%	197	1.3%

Abdominal Strength/Endurance										
Curl Ups (mean, SD)	67,570	26.9 (19.6)	--	--	33,818	21.2 (17.4)	19,223	34.3 (21.3)	14,529	30.3 (18.0)
% Healthy Fitness Zone	46,225	68.4%	--	--	21,463	63.5%	14,211	73.9%	10,551	72.6%
% Needs Improvement	21,345	31.6%	--	--	12,355	26.5%	5,012	26.1%	3,978	27.4%
Trunk Extensor Strength										
Trunk Lift (mean, SD)	59,459	10.1 (2.2)	--	--	30,395	9.8 (2.3)	16,754	10.4 (2.1)	12,310	10.4 (2.2)
% Healthy Fitness Zone	45,710	76.9%	--	--	22,143	72.9%	13,531	80.8%	10,036	81.5%
% Needs Improvement	13,749	23.1%	--	--	8,252	27.1%	3,223	19.2%	2,274	18.5%
Flexibility										
Sit and Reach, Left (mean, SD)	66,043	9.8 (2.4)	--	--	33,062	9.4 (2.4)	18,490	10.1 (2.3)	14,491	10.4 (2.2)
Sit and Reach, Right (mean, SD)	65,571	9.8 (2.4)	--	--	32,770	9.4 (2.4)	18,413	10.1 (2.3)	14,388	10.4 (2.3)
% Healthy Fitness Zone	47,017	71.7%	--	--	21,779	66.5%	14,173	77.0%	11,065	76.9%
% Needs Improvement	18,525	28.3%	--	--	10,972	33.5%	4,231	23.0%	3,322	23.1%
Shoulder Stretch, Right (mean, SD)	1,835	0.8 (0.4)	--	--	975	0.8 (0.4)	374	0.8 (0.4)	486	0.8 (0.4)
Shoulder Stretch, Left (mean, SD)	1,835	0.9 (0.3)	--	--	973	0.9 (0.3)	376	0.9 (0.3)	486	0.9 (0.3)
% Healthy Fitness Zone	1,418	69.9%	--	--	743	66.2%	302	75.3%	373	73.8%
% Needs Improvement	415	20.5%	--	--	230	20.5%	72	18.0%	113	22.4%
% Incomplete	187	9.2%	--	--	144	12.8%	25	6.2%	18	3.6%
% Exempt	8	0.4%	--	--	5	0.5%	2	0.5%	1	0.2%

Table 2. Summary of SC FitnessGram Scores; Males, School Year 2017-2018

Variable	Total (n=50,695)		Grade							
			2 nd Grade (n=12,457)		5 th Grade (n=18,842)		8 th Grade (n=11,000)		High School (n=8,396)	
	n	Mean, SD	n	Mean, SD	n	Mean, SD	n	Mean, SD	n	Mean, SD
Age (mean, SD)	50,695	11.2 (2.7)	12,457	7.6 (0.5)	18,842	10.6 (0.6)	11,000	13.6 (0.6)	8,396	14.9 (1.0)
Race/Ethnicity (%)	50,126									
American Indian (I)	159	0.3%	49	0.4%	52	0.3%	39	0.4%	19	0.2%
Asian (A)	831	1.7%	211	1.7%	293	1.6%	208	1.9%	199	1.4%
Black or African American (B)	15,747	31.4%	3,784	30.7%	5,928	31.8%	3,078	28.3%	2,957	35.8%
Hispanic or Latino (H)	5,102	10.2%	1,303	10.6%	2,003	10.7%	1,044	9.6%	752	9.1%
Hawaiian or Pacific Islander (P)	67	0.1%	16	0.1%	22	0.1%	16	0.2%	13	0.2%
White (W)	26,233	52.3%	6,435	52.1%	9,596	51.4%	6,058	55.8%	4,144	50.2%
Other/Unknown (M)	1,987	4.0%	546	4.4%	766	4.1%	424	3.9%	251	3.0%
Poverty Status (%)	48,725		11,947		18,155		10,609		8,014	
No	19,116	39.2%	4,350	36.4%	6,727	37.1%	4,586	43.2%	3,453	43.1%
Yes	29,609	60.8%	7,597	63.6%	11,428	62.9%	6,023	56.8%	4,561	56.9%
Height, ft (mean, SD)	45,366	4.9 (0.6)	12,307	4.3 (0.2)	16,279	4.8 (0.3)	9,873	5.5 (0.3)	6,907	5.7 (0.3)
Height, cm (mean, SD)	45,366	150.1 (0.6)	12,307	129.6 (6.6)	16,279	146.2 (8.2)	9,873	166.5 (9.0)	6,907	172.3 (8.2)
Weight, lbs (mean, SD)	45,366	106.1 (45.4)	12,307	65.5 (16.5)	16,279	96.9 (30.0)	9,873	138.4 (39.6)	6,907	154.1 (42.4)
Weight, kg (mean, SD)	45,366	48.1 (20.6)	12,307	29.7 (7.5)	16,279	43.9 (13.6)	9,873	62.8 (17.9)	6,907	69.9 (19.2)
Body Mass Index (CDC program)										
BMI (mean, SD)	45,366	20.5 (5.3)	12,307	17.6 (3.4)	16,279	20.3 (5.0)	9,873	22.5 (5.5)	6,907	23.4 (5.8)
Normal	28,754	63.4%	8,464	68.7%	9,688	59.5%	6,155	62.4%	4,447	64.4%
Overweight	7,209	15.9%	1,731	14.1%	2,795	17.2%	1,612	16.3%	1,071	15.5%
Obese	9,403	20.7%	2,112	17.2%	3,796	23.3%	2,106	21.3%	1,389	20.1%
Cardiorespiratory Fitness										
Estimated VO ₂ max (mean, SD)	34,888	43.5 (7.1)	--	--	17,583	43.0 (6.1)	10,101	44.1 (7.8)	7,204	44.1 (8.0)
% Healthy Fitness Zone	20,225	58.0%	--	--	10,587	60.2%	5,818	57.6%	3,820	53.0%

% Needs Improvement	6,554	18.8%	--	--	4,406	25.1%	1,212	12.0%	936	13.0%
% Needs Improvement – Health Risk	8,109	23.2%	--	--	2,590	14.7%	3,071	30.4%	2,448	34.0%
Mile - Estimated VO ₂ max (mean, SD)	2,185	46.3 (6.2)	--	--	443	47.4 (6.3)	210	46.0 (6.1)	1,532	46.1 (6.2)
Pacer - Estimated VO ₂ max (mean, SD)	32,694	43.4 (7.1)	--	--	17,140	42.9 (6.1)	9,891	44.1 (7.8)	5,663	43.6 (8.3)
Walk - Estimated VO ₂ max (mean, SD)	9	47.7 (14.7)	--	--	0	0	0	0	9	47.7 (14.7)
Upper Body Strength/Endurance										
Push Ups (mean, SD)	34,298	12.8 (8.2)	--	--	16,809	10.3 (7.6)	10,021	14.3 (7.9)	7,468	16.3 (8.1)
% Healthy Fitness Zone	20,251	59.0%	--	--	10,366	61.7%	5,670	56.6%	4,215	56.4%
% Needs Improvement	14,047	41.0 %	--	--	6,443	38.3%	4,351	43.4%	3,253	43.6%
Modified Pull Up (mean, SD)	152	3.5 (3.7)	--	--	110	3.6 (3.6)	42	3.3 (4.1)	0	0.0
% Healthy Fitness Zone	32	21.1%	--	--	27	24.6%	5	11.9%	0	0.0%
% Needs Improvement	120	78.9%	--	--	83	75.4%	37	88.1%	0	0.0%
% Exempt			--	--						
Flexed Arm Hang (mean, SD)	512	13.9 (16.5)	--	--	449	14.4 (17.5)	63	10.8 (5.3)	0	0.0%
% Healthy Fitness Zone	306	59.8%	--	--	287	63.9%	19	30.2%	0	0.0%
% Needs Improvement	206	40.2%			162	36.1%	44	69.8%		
Upper Body Strength HFZ										
% Healthy Fitness Zone	20,749	55.2%	--	--	10,642	56.9%	5,767	53.7%	4,340	53.3%
% Needs Improvement	14,057	37.4%	--	--	6,450	34.5%	4,354	40.6%	3,253	39.9%
% Incomplete	2,325	6.2%	--	--	1,369	7.3%	499	4.7%	457	5.6%
% Exempt	459	1.2%	--	--	257	1.3%	108	1.0%	94	1.2%
Abdominal Strength/Endurance										
Curl Ups (mean, SD)	35,102	29.5 (20.4)	--	--	17,224	22.2 (18.0)	10,259	38.2 (21.2)	7,619	34.4 (18.3)
% Healthy Fitness Zone	24,819	70.7%	--	--	11,292	65.6%	7,862	76.6%	5,665	74.3%
% Needs Improvement	10,283	29.3%	--	--	5,932	34.4%	2,397	23.4%	1,954	25.7%
Trunk Extensor Strength										
Trunk Lift (mean, SD)	30,674	9.9 (2.3)	--	--	15,421	9.6 (2.3)	8,880	10.2 (2.2)	6,373	10.3 (2.2)
% Healthy Fitness Zone	22,867	74.5%	--	--	10,785	69.9%	7,001	78.8%	5,081	79.7%

% Needs Improvement	7,807	25.5%	--	--	4,636	30.1%	1,879	21.2%	1,292	20.3%
Flexibility										
Sit and Reach, Left (mean, SD)	34,109	9.2 (2.5)	--	--	16,788	8.7 (2.4)	9,818	9.4 (2.5)	7,503	9.9 (2.4)
Sit and Reach, Right (mean, SD)	33,880	9.2 (2.5)	--	--	16,640	8.7 (2.4)	9,782	9.4 (2.5)	7,458	9.9 (2.4)
% Healthy Fitness Zone	24,324	71.8%	--	--	10,859	65.3%	7,356	75.2%	6,109	81.9%
% Needs Improvement	9,540	28.2%	--	--	5,770	34.7%	2,422	24.8%	1,348	18.1%
Shoulder Stretch, Right (mean, SD)	859	0.8 (0.4)	--	--	491	0.8 (0.4)	148	0.8 (0.4)	220	0.8 (0.4)
Shoulder Stretch, Left (mean, SD)	857	0.8 (0.4)	--	--	489	0.8 (0.4)	148	0.8 (0.4)	220	0.8 (0.4)
% Healthy Fitness Zone	617	64.9%	--	--	349	62.1%	115	71.0%	153	67.4%
% Needs Improvement	240	25.2%	--	--	140	24.9%	33	20.4%	67	29.5%
% Incomplete	91	9.6%	--	--	71	12.6%	14	8.6%	6	2.6%
% Exempt	3	0.3%	--	--	2	0.4%	0	0.0%	1	0.5%

Table 3. Summary of SC FitnessGram Scores; Females, School Year 2017-2018

Variable	Total (n=47,707)		Grade							
			2 nd Grade (n=12,215)		5 th Grade (n=18,198)		8 th Grade (n=9,609)		High School (n=7,685)	
	n	Mean, SD	n	Mean, SD	n	Mean, SD	n	Mean, SD	n	Mean, SD
Age (mean, SD)	47,707	11.0 (2.6)	12,215	7.6 (0.5)	18,198	10.5 (0.5)	9,609	13.5 (0.6)	7,685	14.7 (0.9)
Race/Ethnicity (%)	47,080									
American Indian (I)	113	0.2%	30	0.3%	39	0.2%	28	0.3%	16	0.2%
Asian (A)	833	1.8%	218	1.8%	316	1.8%	188	2.0%	111	1.5%
Black or African American (B)	15,105	32.1%	3,840	31.7%	5,786	32.2%	2,924	30.8%	2,555	34.2%
Hispanic or Latino (H)	4,826	10.3%	1,273	10.5%	1,945	10.8%	921	9.7%	687	9.2%
Hawaiian or Pacific Islander (P)	55	0.1%	10	0.1%	19	0.1%	18	0.2%	8	0.1%
White (W)	24,227	51.5%	6,187	51.1%	9,114	50.7%	5,062	53.3%	3,864	51.7%
Other/Unknown (M)	1,921	4.1%	554	4.6%	767	4.3%	361	3.8%	239	3.2%
Poverty Status (%)	45,723		11,724		17,456		9,267		7,276	
No	17,751	38.8%	4,185	35.7%	6,542	37.5%	3,904	42.1%	3,120	42.9%
Yes	27,972	61.2%	7,539	64.3%	10,914	62.5%	5,363	57.9%	4,156	57.1%
Height, ft (mean, SD)	42,930	4.8 (0.5)	12,069	4.2 (0.2)	15,825	4.8 (0.3)	8,612	5.3 (0.2)	6,424	5.3 (0.2)
Height, cm (mean, SD)	42,930	147.0 (14.9)	12,069	128.6 (6.8)	15,825	147.5 (8.6)	8,612	160.6 (7.0)	6,424	162.0 (6.8)
Weight, lbs (mean, SD)	42,930	103.4 (41.8)	12,069	65.4 (17.8)	15,825	100.6 (31.2)	8,612	133.5 (36.5)	6,424	141.4 (38.9)
Weight, kg (mean, SD)	42,930	46.9 (19.0)	12,069	29.7 (8.1)	15,825	45.6 (14.2)	8,612	60.6 (16.6)	6,424	64.2 (17.6)
Body Mass Index (CDC program)										
BMI (mean, SD)	42,930	21.0 (5.7)	12,069	17.8 (3.7)	15,825	20.7 (5.1)	8,612	23.4 (5.8)	6,424	24.4 (6.3)
Normal	26,779	62.4%	8,209	68.0%	9,476	59.9%	5,197	60.4%	3,897	60.7%
Overweight	7,490	17.5%	1,789	14.8%	2,908	18.4%	1,644	19.1%	1,149	17.8%
Obese	8,661	20.1%	2,071	17.2%	3,441	21.7%	1,771	20.5%	1,378	21.5%
Cardiorespiratory Fitness										
Estimated VO ₂ max (mean, SD)	31,839	40.0 (5.1)	--	--	16,880	40.9 (5.6)	8,736	39.3 (5.5)	6,223	38.2 (5.4)
% Healthy Fitness Zone	13,132	41.3%	--	--	7,548	44.7%	3,312	37.9%	2,272	36.5%
% Needs Improvement	9,988	31.4%	--	--	6,222	36.9%	2,359	27.0%	1,407	22.6%

% Needs Improvement – Health Risk	8,719	27.3%	--	--	3,110	18.4%	3,065	35.1%	2,544	40.9%
Mile - Estimated VO ₂ max (mean, SD)	1,323	41.1 (5.0)	--	--	371	43.2 (5.3)	108	41.4 (4.7)	844	40.2 (4.5)
Pacer - Estimated VO ₂ max (mean, SD)	30,511	39.9 (5.1)	--	--	16,509	40.9 (4.5)	8,628	39.3 (5.5)	5,374	37.9 (5.4)
Walk - Estimated VO ₂ max (mean, SD)	5	50.5 (14.7)	--	--	0	0.0	0	0.0	5	50.5 (14.7)
Upper Body Strength/Endurance										
Push Ups (mean, SD)	31,969	8.3 (6.6)	--	--	16,323	7.4 (6.4)	8,790	9.2 (6.7)	6,856	9.2 (6.7)
% Healthy Fitness Zone	17,630	55.2%	--	--	7,762	47.6%	5,452	62.0%	4,416	64.4%
% Needs Improvement	14,339	44.8%	--	--	8,561	52.4%	3,338	38.0%	2,440	35.6%
Modified Pull Up (mean, SD)	120	2.2 (2.5)	--	--	119	2.2 (2.5)	1	1.0 (0.0)	0	0.0
% Healthy Fitness Zone	25	20.8%	--	--	25	21.0%	0	0.0%	0	0.0%
% Needs Improvement	95	79.2%	--	--	94	79.0%	1	100.0%	0	0.0%
% Exempt			--	--						
Flexed Arm Hang (mean, SD)	509	12.2 (15.4)	--	--	421	11.5 (15.7)	88	15.2 (13.6)	0	0.0
% Healthy Fitness Zone	421	82.7%	--	--	233	55.3%	62	70.5%	0	0.0%
% Needs Improvement	88	17.3%	--	--	188	44.7%	26	29.5%	0	0.0%
Upper Body Strength HFZ										
% Healthy Fitness Zone	17,857	51.2%	--	--	7,956	44.0%	5,477	58.2%	4,424	60.0%
% Needs Improvement	14,337	41.1%	--	--	8,559	47.3%	3,338	35.5%	2,440	33.0%
% Incomplete	2,248	6.4%	--	--	1,356	7.5%	481	5.1%	411	5.6%
% Exempt	449	1.3%	--	--	227	1.2%	119	1.2%	103	1.4%
Abdominal Strength/Endurance										
Curl Ups (mean, SD)	32,468	24.0 (18.4)	--	--	16,594	20.1 (16.8)	8,965	29.8 (20.5)	6,910	25.8 (16.5)
% Healthy Fitness Zone	21,406	65.9%	--	--	10,171	61.3%	6,349	70.8%	4,886	70.7%
% Needs Improvement	11,062	34.1%	--	--	6,423	38.7%	2,615	29.2%	2,024	29.3%
Trunk Extensor Strength										
Trunk Lift (mean, SD)	28,785	10.2 (2.2)	--	--	14,974	10.0 (2.2)	7,876	10.5 (2.0)	5,937	10.5 (2.1)
% Healthy Fitness Zone	22,843	79.4%	--	--	11,358	75.8%	6,530	82.9%	4,955	83.5%
% Needs Improvement	5,942	20.6%	--	--	3,616	24.2%	1,344	17.1%	982	16.5%

Flexibility										
Sit and Reach, Left (mean, SD)	31934	10.5 (2.1)	--	--	16,274	10.1 (2.1)	8,672	10.9 (1.8)	6,988	11.0 (1.9)
Sit and Reach, Right (mean, SD)	31,691	10.5 (2.1)	--	--	16,130	10.1 (2.2)	8,631	10.9 (1.8)	6,930	11.0 (1.9)
% Healthy Fitness Zone	22,693	71.6%	--	--	10,920	67.7%	6,817	79.0%	4,956	71.5%
% Needs Improvement	8,985	28.4%	--	--	5,202	32.3%	1,809	21.0%	1,974	28.5%
Shoulder Stretch, Right (mean, SD)	976	0.8 (0.4)	--	--	484	0.8 (0.4)	226	0.8 (0.4)	266	0.9 (0.3)
Shoulder Stretch, Left (mean, SD)	978	0.9 (0.3)	--	--	484	0.9 (0.3)	228	0.9 (0.3)	266	0.9 (0.3)
% Healthy Fitness Zone	801	74.4%	--	--	394	70.4%	187	78.2%	220	79.1%
% Needs Improvement	175	16.3%	--	--	90	16.1%	39	16.2%	46	16.6%
% Incomplete	96	8.9%	--	--	73	13.0%	11	4.6%	12	4.3%
% Exempt	5	0.4%	--	--	3	0.5%	2	0.8%	0	00%

Appendix C. FitnessGram Significance Tables

Table 1. Weight Status – Statistical significance of Inter-Group Differences

Figure	Comparison	Girls	Boys
		P<.05=*/ NOT DIFFERENT=NS	P<.05=*/ NOT DIFFERENT=NS
BMI by grade	2/5 2/8 2/9 5/8 5/9 8/9	* * * * * *	* * * * * *
Weight Status by grade	2/5 2/8 2/9 5/8 5/9 8/9	* * * NS NS NS	* * * * * NS
BMI by Race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	* * * * * *	* * * * * *
Weight Status by Race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	NS * * * * *	* * * * * *
BMI by Poverty	No Yes	* *	* *
Weight Status by Poverty	No Yes	* *	* *

Table 2. Cardiorespiratory Fitness (CRF) - Statistical Significance of Inter-Group Differences

Figure	Comparison	Girls	Boys
		P<.05=*/ NOT DIFFERENT=NS	P<.05=*/ NOT DIFFERENT=NS
CRF by grade	5/8 5/9 8/9	* * *	* * NS
CRF HFZ by grade	5/8 5/9 8/9	* * *	* * *
CRF by Weight status	Normal/Overweight Normal/Obese Overweight/Obese		
CRF HFZ by Weight status	Normal/Overweight Normal/Obese Overweight/Obese		
CRF by Race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	* * * NS * *	* * * * * NS
CRF HFZ by Race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	* * * NS * *	* * * NS * *
CRF by poverty	No Yes	* *	* *
CRF HFZ by poverty	No Yes	* *	* *

HFZ=Healthy Fitness Zone

Table 3. Upper Body Strength (Push-ups) - Statistical Significance of Inter-Group Differences

Figure	Comparison	Girls	Boys
		P<.05=*/ NOT DIFFERENT=NS	P<.05=*/ NOT DIFFERENT=NS
Pushup by grade	5/8	*	*
	5/9	*	*
	8/9	NS	*
HFZ by grade	5/8	*	*
	5/9	*	*
	8/9	*	NS
Pushup by Weight status	Normal/Overweight	*	*
	Normal/Obese	*	*
	Overweight/Obese	*	*
HFZ by Weight status	Normal/Overweight	*	*
	Normal/Obese	*	*
	Overweight/Obese	*	*
Pushup by race	Black/Hispanic	NS	*
	Black/ Other	*	NS
	Black / White	*	NS
	Hispanic / Other	*	*
	Hispanic/White	*	*
	Other/White	NS	NS
HFZ by race	Black/Hispanic	NS	*
	Black/ Other	*	NS
	Black / White	*	NS
	Hispanic / Other	*	*
	Hispanic/White	*	*
	Other/White	NS	NS
Pushup by poverty	No	*	*
	Yes		
HFZ by poverty	No	*	*
	Yes		

HFZ=Healthy Fitness Zone

Table 4. Trunk Extensor Strength- Statistical Significance of Inter-Group Differences

Figure	Comparison	Girls	Boys
		P<.05=*/ NOT DIFFERENT=NS	P<.05=*/ NOT DIFFERENT=NS
By grade	5/8 5/9 8/9	* * NS	* * NS
HFZ by grade	5/8 5/9 8/9	* * NS	* * NS
By Weight status	Normal/Overweight Normal/Obese Overweight/Obese	NS * *	NS NS NS
HFZ by Weight status	Normal/Overweight Normal/Obese Overweight/Obese	NS * NS	* NS NS
By race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	* * * NS * *	* * * NS * *
HFZ by race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	* * * NS * *	* * * NS * NS
By poverty	No Yes	* *	* *
HFZ by poverty	No Yes	* *	* *

HFZ=Healthy Fitness Zone

Table 5. Flexibility (Sit and Reach) – Statistical Significance of Inter-Group Differences

	Comparison	Girls		Boys	
		P<.05=*/NOT DIFFERENT=NS		P<.05=*/NOT DIFFERENT=NS	
		L	R	L	R
By grade	5/8	*	*	*	*
	5/9	*	*	*	*
	8/9	*	*	*	*
HFZ by grade	5/8	*		*	
	5/9	*		*	
	8/9	NS		*	
By Weight status	Normal/Overweight	*	*	*	*
	Normal/Obese	*	*	*	*
	Overweight/Obese	*	*	*	*
HFZ by Weight status	Normal/Overweight	*		NS	
	Normal/Obese	*		*	
	Overweight/Obese	*		*	
By race	Black/Hispanic	NS	NS	NS	NS
	Black/ Other	*	*	NS	NS
	Black / White	*	*	*	*
	Hispanic / Other	*	*	NS	NS
	Hispanic/White	*	*	NS	NS
	Other/White	NS	NS	NS	NS
HFZ by race	Black/Hispanic	NS		NS	
	Black/ Other	*		NS	
	Black / White	*		*	
	Hispanic / Other	*		NS	
	Hispanic/White	*		*	
	Other/White	NS		NS	
By poverty	No	*	*	*	*
	Yes				
HFZ by poverty	No	*		*	
	Yes				

HFZ=Healthy Fitness Zone; R=Right; L=Left

Table 6. Abdominal Strength (Curl-ups)-Statistical Significance of Inter-Group Differences

Figure	Comparison	Girls	Boys
		P<.05=*/ NOT DIFFERENT=NS	P<.05=*/ NOT DIFFERENT=NS
By grade	5/8 5/9 8/9	* * *	* * *
HFZ by grade	5/8 5/9 8/9	* * NS	* * *
By Weight status	Normal/Overweight Normal/Obese Overweight/Obese	* * *	* * *
HFZ by Weight status	Normal/Overweight Normal/Obese Overweight/Obese	* * *	* * *
By Race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	* * * * * *	NS * * * * NS
HFZ by Race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	NS * * * * *	* NS * * * NS
By Poverty	No Yes	* *	* *
HFZ by poverty	No Yes	* *	* *

HFZ=Healthy Fitness Zone