

South Carolina FitnessGram

School Year 2015-2016

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 the FitnessGram protocol, weight status is assessed using BMI which is placed in the following categories: Healthy Fitness Zone (normal weight), Needs Improvement (overweight), and Needs Improvement – Health Risk (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.

Purposes of the project. The South Carolina FitnessGram Project is supported by the Blue Cross Blue Shield 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. The purposes of the project are:

- To determine the status of health-related physical fitness in South Carolina school children.
- To describe the relationships between health-related physical fitness and academic performance in South Carolina school children.

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 740,000 public school students in South Carolina. Its primary purpose is to capture health-related fitness data from 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 South Carolina public schools serving grades K-12 were eligible to participate in the FitnessGram project. Each school was asked to conduct fitness testing and record health-related fitness data for students enrolled in physical education class.

Data Collection & Management. During school year 2015-2016, approximately 630 (51%) public schools across 49 (48%) school districts participated in the SC FitnessGram project. In participating schools, the FitnessGram was administered by school staff (e.g., physical education teacher) during physical education class. Prior to administration of the FitnessGram, school staff received training support through the President's 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 South Carolina students.

Data Cleaning. The initial dataset provided from SCDE included 186,380 unique entries. During the data cleaning process, the sample was reduced to the first measurement for 2nd, 5th, 8th, and 9th-12th grade students with FitnessGram data. Specifically, 50,410 entries were removed due to missing FitnessGram, data and 49,397 duplicate measurements for students were removed; yielding a sample of 86,573. Finally, implausible values for age (n=762), body mass index (n=552), cardiorespiratory fitness (n=19), and the remaining FitnessGram components (n=16) were removed; yielding a final sample size of 85,810 students.

Analytic Sample. Table 1 provides student characteristics for the FitnessGram sample during school year 2015-2016. The sample was 50.9% male, 54.7% non-Hispanic White, and 38.8% of students were classified as overweight or obese. Additionally, the proportion of students across regions of South Carolina varied considerably.

Table 1. South Carolina FitnessGram sample characteristics (n=85,810 children).

	Boys		Girls		Total	
	N	%	N	%	N	%
Grade	43718		42092		85810	
2	10234	23.41	9990	23.73	20224	23.57
5	16278	37.23	15918	37.82	32196	37.52
8	9054	20.71	8217	19.52	17271	20.13
High School	8152	18.65	7967	18.93	16119	18.78
Weight Status	35333		34166		69500	
Normal weight	21920	62.04	20622	60.36	42542	61.21
Overweight	5731	16.22	6218	18.20	11950	17.19
Obese	7682	21.74	7326	21.44	15008	21.59
Race/ethnicity	42000		40444		82444	
White	23044	54.87	22062	54.55	45106	54.71
Black	12546	29.87	12289	30.39	24835	30.12
Hispanic	4195	9.99	3832	9.47	8027	9.74
Other	2215	5.27	2261	5.59	4476	5.43
Regions	41841		40336		82177	
Low Country	5423	12.96	5117	12.69	10540	12.83
Midlands	9400	22.47	8942	22.17	18342	22.32
Pee Dee	7716	18.44	7529	18.67	15245	18.55
Upstate	19302	46.13	18748	46.48	38050	46.30

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 body mass index (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 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. In the FitnessGram protocol, weight status was assessed using body mass index (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 categorized into one of the following weight status categories: underweight (<5th percentile), normal weight (5th percentile to <85th percentile), overweight (85th percentile to <95th percentile), and obese (\geq 95th percentile). These categories correspond to the FitnessGram Healthy Fitness Zone categories for weight status: 1) Very Lean; 2) Healthy Fitness Zone; 3) Needs improvement; 4) Needs Improvement – Health Risk.

Results: Weight Status

Overall Sample. Height and weight was measured for nearly 70,000 students and BMI was calculated. In the total sample, which includes boys and girls in 2nd, 5th, 8th, and high school grades, approximately 60% of students had a BMI percentile that was considered normal weight and scored in the Healthy Fitness Zone. Of the remaining students, 20.4% scored in the Needs-Improvement – Health Risk category; 16.6% in the Health Risk category; and 4.0% in the Very Lean category. No marked gender difference in weight status was observed. These findings indicate that approximately two out of every five South Carolina students has an unfavorable weight status for health (Table 1a).

Table 1a. Weight Status among Total Sample and By Sex, South Carolina FitnessGram School Year 2015-2016

Weight Status Variables	Total		Females		Males	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Height, ft (mean, SD)	69,499	4.9 (0.5)	34,166	4.8 (0.5)	35,333	4.9 (0.6)
Height, cm (mean, SD)	69,499	148.3 (16.5)	34,166	146.9 (14.9)	35,333	149.6 (17.8)
Weight, lbs (mean, SD)	69,499	105.2 (43.5)	34,166	104.4 (41.7)	35,333	106.1 (45.2)
Weight, kg (mean, SD)	69,499	47.7 (19.7)	34,166	47.4 (18.9)	35,333	48.1 (20.5)
Body Mass Index (FitnessGram)						
BMI (mean, SD)	67,252	20.8 (5.4)	33,072	21.0 (5.6)	34,180	20.5 (5.3)
% Healthy Fitness Zone	39,775	59.1%	19,430	58.8%	20,345	59.5%
% Needs Improvement	11,311	16.6%	5,837	17.7%	5,294	15.5%
% Needs Improvement – Health Risk	13,686	20.4%	6,666	20.2%	7,020	20.5%
% Very Lean	2,660	4.0%	1,139	3.4%	1,521	4.5%
Body Mass Index (CDC program)						
BMI (mean, SD)	69,499	20.9 (5.5)	34,166	21.2 (5.7)	35,333	20.6 (5.3)
Normal	42,542	61.2%	20,622	60.4%	21,920	62.0%
Overweight	11,949	17.2%	6,218	18.2%	5,731	16.2%
Obese	15,008	22.6%	7,326	21.4%	7,682	21.7%

Weight Status in Girls. Body mass index (BMI) was observed to increase with increasing age and grade level in girls. BMI, as calculated by the FitnessGram program, increased from 17.9

in 2nd graders to 24.2 in high school girls. The percent of girls scoring in the Healthy Fitness Zone was 62.2% in 2nd grade. This percent then decreased during 5th and 8th grade before increasing slightly to 59.7% in high school girls (Table 1b).

Table 1b. Weight Status among Females By Grade Level, South Carolina FitnessGram School Year 2015-2016

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)	9,519	4.2 (0.2)	12,646	4.8 (0.3)	6,120	5.3 (0.2)	5,881	5.3 (0.2)
Height, cm (mean, SD)	9,519	128.8 (7.0)	12,646	147.3 (8.7)	6,120	160.3 (6.8)	5,881	161.8 (7.0)
Weight, lbs (mean, SD)	9,519	66.7 (18.2)	12,646	101.3 (31.5)	6,120	134.8 (36.3)	5,881	140.6 (38.3)
Weight, kg (mean, SD)	9,519	30.3 (8.3)	12,646	45.9 (14.2)	6,120	61.1 (16.5)	5,881	63.8 (17.4)
Body Mass Index (FitnessGram)								
BMI (mean, SD)	9,519	17.9 (3.8)	12,646	20.8 (5.1)	6,120	23.6 (5.9)	5,881	24.2 (6.1)
% Healthy Fitness Zone	5,922	62.2%	6,959	56.9%	3,258	56.0%	3,291	59.7%
% Needs Improvement	1,500	15.8%	2,192	17.9%	1,161	20.0%	984	17.9%
% Needs Improvement – Health Risk	1,685	17.7%	2,626	21.5%	1,257	21.6%	1,098	19.9%
% Very Lean	412	4.3%	488	3.7%	142	2.4%	137	2.5%
Body Mass Index (CDC program)								
BMI (mean, SD)	9,519	18.1 (3.8)	12,646	20.9 (5.2)	6,120	23.7 (5.9)	5,881	24.3 (6.1)
Normal	6,098	64.1%	7,432	58.8%	3,496	57.1%	3,596	61.2%
Overweight	1,563	16.4%	2,329	18.4%	1,265	20.7%	1,061	18.0%
Obese	1,858	19.5%	2,885	22.8%	1,359	22.2%	1,224	20.8%

As shown in Figures 1a and 1b, BMI and weight status varied across grades, race/ethnicity groups, and regions. Concerning race/ethnicity, the percentage of girls in the Healthy Fitness Zone was lower among Black and Hispanic girls compared to White girls and girls of other race/ethnicity groups (including multiracial). Little variation in BMI and the percentage of girls in the Healthy Fitness Zone was observed across DHEC health regions.

Figure 1a. Weight Status, Girls

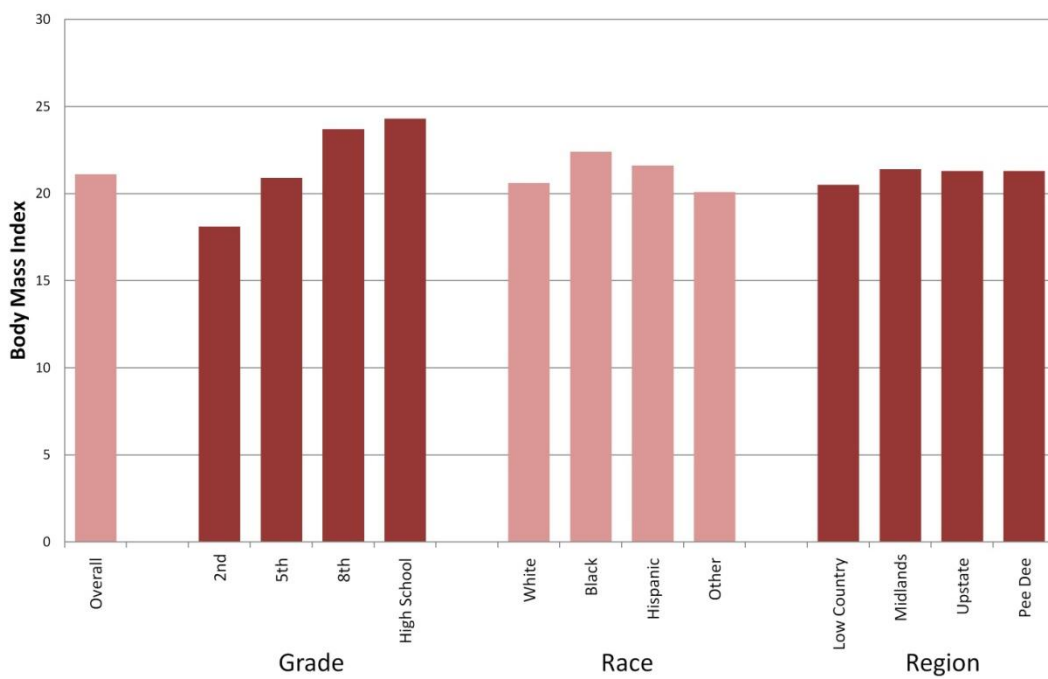
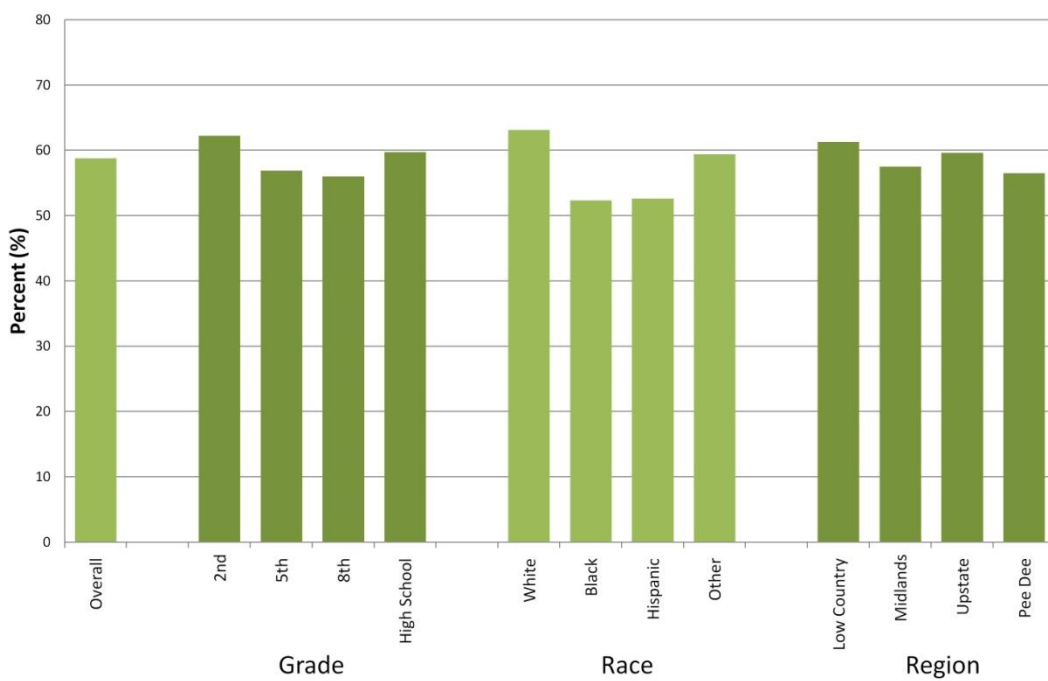


Figure 1b. Weight Status, Percent Attaining Healthy Fitness Zone, Girls



Weight Status in Boys. Similar to girls, body mass index (BMI) increased with increasing age and grade level among boys. BMI, as calculated by the FitnessGram program, increased from 17.7 in 2nd graders to 23.5 in high school boys. The percent of boys scoring in the Healthy Fitness Zone was 64.1% in 2nd grade. The percentage of boys in the Healthy Fitness Zone decreased during 5th and 8th grade before increasing slightly to 60.0% in high school boys (Table 1c).

Table 1c. Weight Status among Males By Grade, - South Carolina FitnessGram School Year 2015-2016

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)	9,803	4.2 (0.2)	13,051	4.8 (0.3)	6,530	5.5 (0.3)	5,949	5.6 (0.3)
Height, cm (mean, SD)	9,803	129.5 (6.8)	13,051	146.0 (8.2)	6,530	166.5 (9.0)	5,949	171.9 (9.0)
Weight, lbs (mean, SD)	9,803	66.5 (17.2)	13,051	97.0 (29.4)	6,530	139.3 (38.7)	5,949	154.5 (42.4)
Weight, kg (mean, SD)	9,803	30.2 (7.8)	13,051	44.0 (13.3)	6,530	63.2 (17.6)	5,949	70.1 (19.2)
Body Mass Index (FitnessGram)								
BMI (mean, SD)	9,803	17.7 (3.6)	12,633	20.3 (4.9)	6,184	22.5 (5.4)	5,560	23.5 (5.8)
% Healthy Fitness Zone	6,281	64.1%	7,080	56.0%	3,646	59.0%	3,338	60.0%
% Needs Improvement	1,436	14.6%	2,097	16.6%	962	15.6%	799	14.4%
% Needs Improvement – Health Risk	1,681	17.2%	2,861	22.7%	1,312	21.2%	1,166	21.0%
% Very Lean	405	4.1%	595	4.7%	264	4.3%	257	4.6%
Body Mass Index (CDC program)								
BMI (mean, SD)	9,803	17.8 (3.6)	13,051	20.4 (4.9)	6,530	22.6 (5.4)	5,949	23.6 (5.8)
Normal	6,404	65.3%	7,702	59.0%	4,035	61.8%	3,779	63.5%
Overweight	1,547	15.8%	2,218	17.0%	1,072	16.4%	894	15.0%
Obese	1,852	18.9%	3,131	24.0%	1,423	21.8%	1,276	21.5%

BMI and weight status varied across grades, race/ethnicity groups, and regions (Figures 1c and 1d). Compared to girls, differences in race/ethnicity were less pronounced. The percentage of boys in the Healthy Fitness Zone was lower among Black and Hispanic boys compared to the remaining race/ethnicity groups. Again, minimal variation in BMI and the percentage of boys in the Healthy Fitness Zone was observed across DHEC health regions.

Figure 1c. Weight Status, Boys

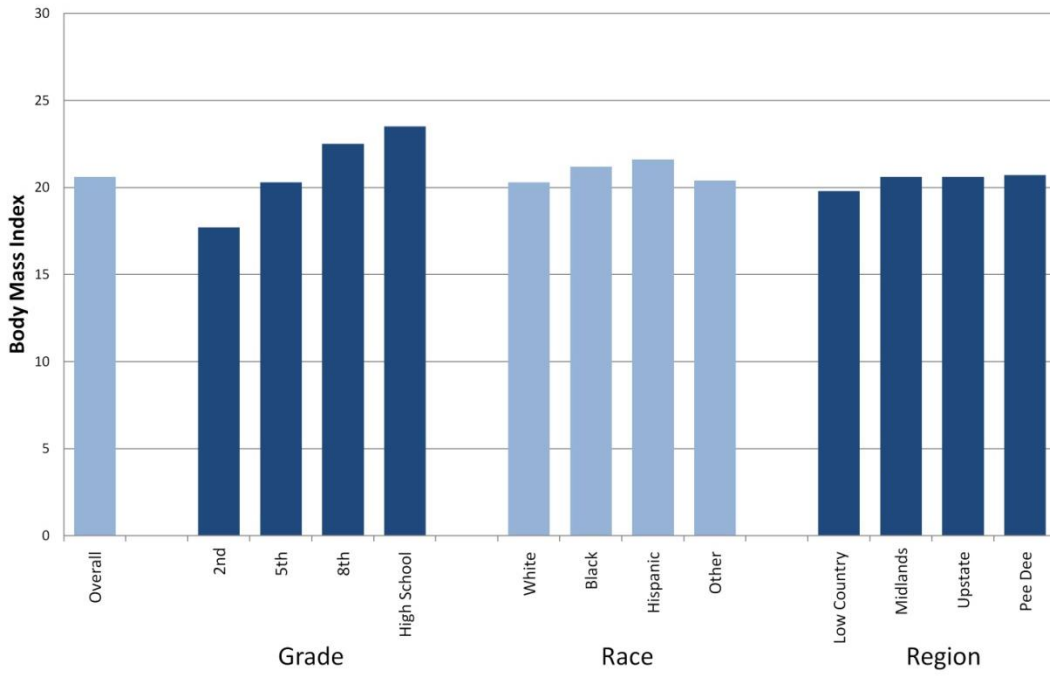
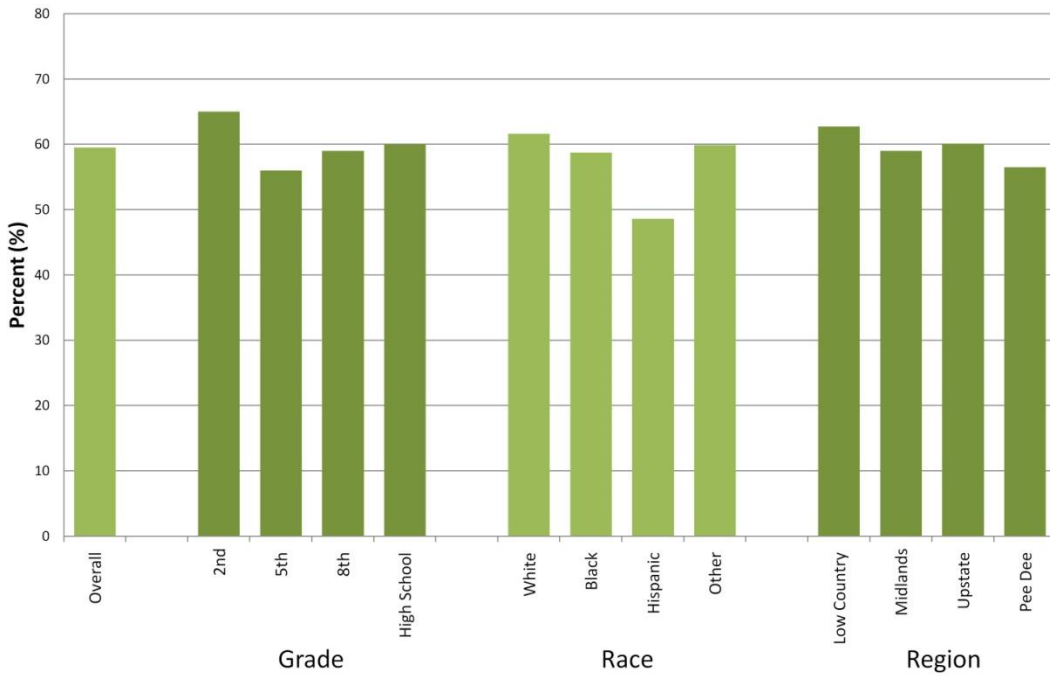


Figure 1b. Weight Status, Percent Attaining Healthy Fitness Zone, Boys



Key Findings and Conclusions.

A key finding was that rates of overweight and obesity among South Carolina students are high with nearly 40% failing to attain the Healthy Fitness Zone for weight status.

The following patterns were observed:

- The percentage of students attaining the Healthy Fitness Zone for weight status was very similar in girls and boys.
- The percentage of students attaining the Healthy Fitness Zone decreased with increasing age and grade level among both genders.
- The percentage of students attaining the Healthy Fitness Zone was lower in Black and Hispanic students than in White and other race/ethnicity students. These trends were more pronounced in girls than boys.

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 South Carolina completed the PACER test. The PACER is a multistage exercise test that involves running back and forth across a 20-meter space at a progressively increasing pace. The PACER is scored as the number of 20-meter 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 57,000 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, just over one-half 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 South Carolina’s students 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 (58.7% vs. 42.9%) scored in the Healthy Fitness Zone for the test of cardiorespiratory fitness. However, among those failing to attain the Healthy Fitness Zone, a larger percentage of boys than girls scored in the Needs Improvement – Health Risk category (32.0% vs. 26.9%) (Table 2a). These findings indicate that low cardiorespiratory fitness is a particular concern in girls, but that a substantial percentage of boys performed at a very low level on this test.

Table 2a. Cardiorespiratory Fitness for Total Sample and By Sex; South Carolina FitnessGram School Year 2015-2016

Cardiorespiratory Fitness Variables	Total		Females		Males	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Estimated VO ₂ max	57,800	41.9 (6.4)	28,026	39.9 (5.0)	29,774	43.7 (7.0)
Field Test						
PACER	55,280	41.8 (6.4)	26,954	39.9 (5.0)	28,582	43.6 (7.0)
1-Mile Run	2,401	44.0 (6.2)	1,009	40.8 (4.9)	1,392	46.4 (6.0)
Walk Test	119	43.2(12.6)	63	38.0(10.1)	56	48.7(13.0)
Fitness Zone Categories	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	29,503	51.0%	12,034	42.9%	17,469	58.7%
Needs Improvement	13,924	23.1%	8,400	30.0%	895	18.6%
Needs Improvement – Health Risk	14,275	24.7%	7,551	26.9%	6,724	32.0%
Missing height and/or weight data	87	0.2%	35	0.1%	52	0.8%
Incomplete	11	0.02%	6	0.0%	5	0.1%

Cardiorespiratory Fitness in Girls. Cardiorespiratory fitness declined with increasing age and grade level in girls. VO₂max decreased from 40.7 in 5th graders to 38.4 in high school girls. The percentage of girls attaining the Healthy Fitness Zone decreased from 45.6 % in fifth graders to 39.0% in high school girls (Table 2b).

Table 2b. Cardiorespiratory Fitness Among Females by Grade; South Carolina FitnessGram School Year 2015-2016

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	14,377	40.7 (4.2)	7,097	39.6 (5.8)	6,552	38.4 (5.5)
Field Test						
PACER	14,152	40.7 (4.2)	6,956	39.6 (5.7)	5,846	38.2 (5.6)
Mile	225	43.0 (4.4)	131	40.8 (5.2)	653	40.0 (4.7)
Walk	131	40.8 (5.2)	10	41.0 (4.7)	53	37.6 (6.4)
Fitness Zone Categories	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	6,553	45.6%	2,924	41.2%	2,557	39.0%
Needs Improvement	5,155	35.9%	1,802	26.4%	1,443	22.0%
Needs Improvement: Health Risk	2,666	18.5%	2,368	33.4%	2,517	38.4%

**cardiorespiratory fitness was not assessed for 2nd grade students (n=9,990)*

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 over 50% in normal weight girls but decreased to 35% in those who were overweight and to 15% in those who were obese. Also, performance on the cardiorespiratory fitness test was associated with race/ethnicity. Performance on the cardiorespiratory fitness test was lower in Black and Hispanic girls than in White girls.

Figure 2a. Cardiorespiratory Fitness, Girls

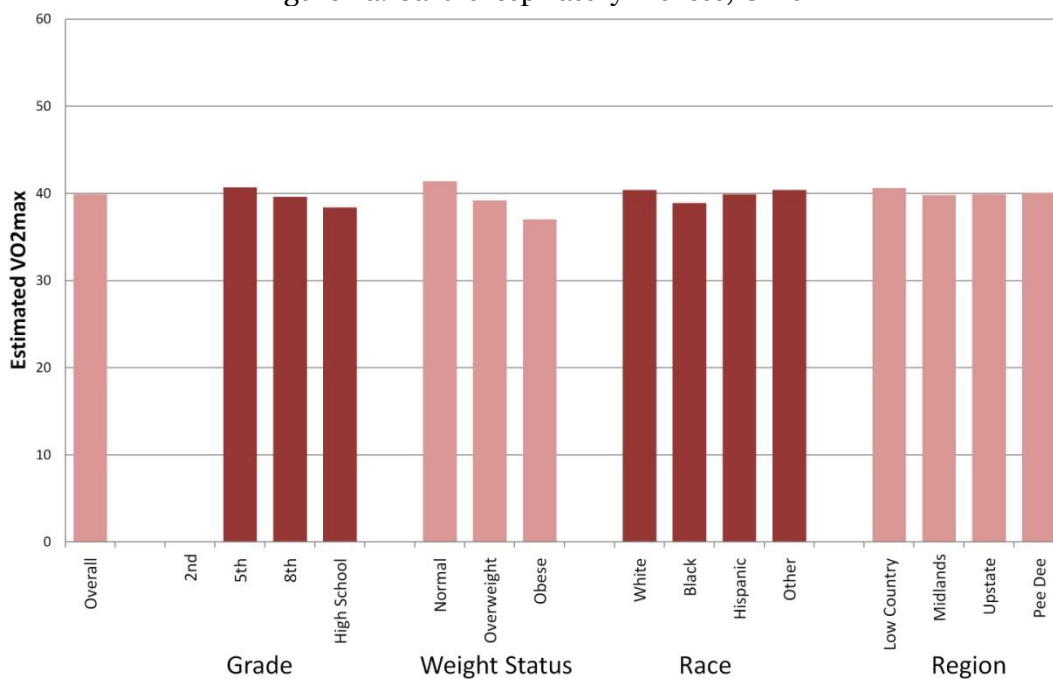
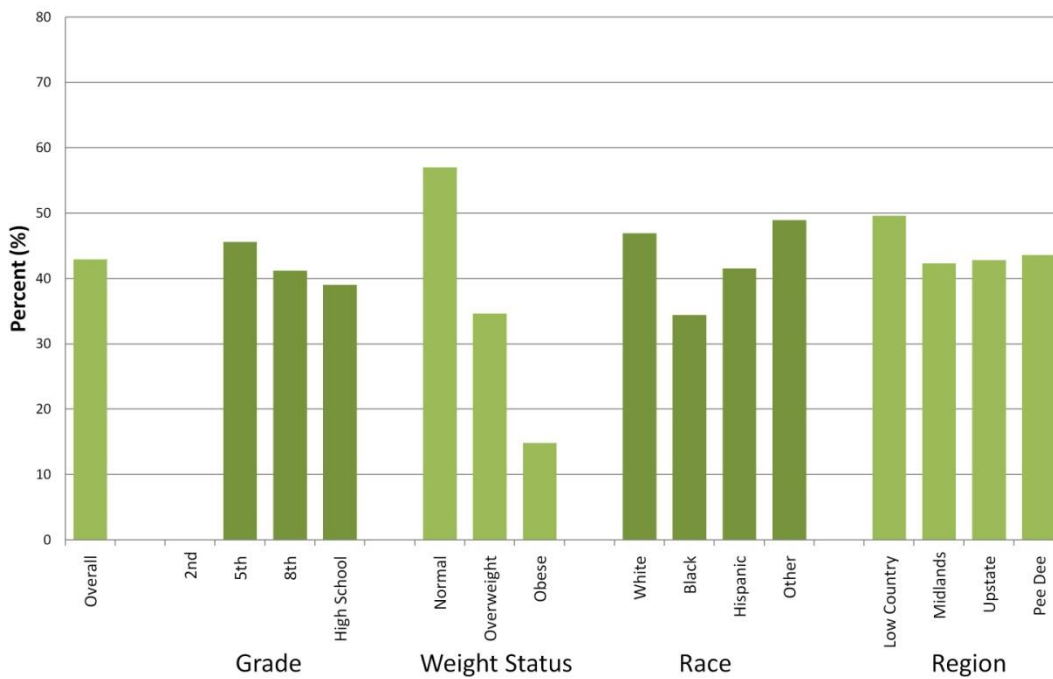


Figure 2b. Cardiorespiratory Fitness, Percent Attaining Healthy Fitness Zone, Girls



Cardiorespiratory Fitness in Boys. In boys, cardiorespiratory fitness as reflected by VO₂max remained roughly constant with increasing age and grade levels. However, the percentage of boys attaining the Healthy Fitness Zone decreased modestly from 60.8% in 5th graders to 58.5% in 8th graders and to 54.2% in high school students (Table 2c). The same association between cardiorespiratory fitness and weight status was observed in boys as in girls. Over 70% 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).

Table 2c. Cardiorespiratory Fitness Among Males By Grade, South Carolina FitnessGram; School Year 2015-2016

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	14,892	42.9(5.7)	8,011	44.6 (7.9)	6,871	44.6 (8.2)
Field Test						
PACER	14,569	42.8(5.7)	7,807	44.5 (7.9)	5,961	44.4 (8.4)
Mile	334	47.0(5.5)	193	46.9 (5.6)	865	46.0 (6.3)
Walk	0	--	11	62.1(12.6)	45	45.5(10.9)
Fitness Zone Categories	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	9,061	60.8%	4,687	58.5%	3,721	54.2%
Needs Improvement	3,594	24.1%	1,035	12.9%	895	13.0%
Needs Improvement: Health Risk	2,236	15.0%	2,289	28.6%	2,199	32.0%

*cardiorespiratory fitness was not assessed for 2nd grade students (n=9,990)

Figure 2c. Cardiorespiratory Fitness, Boys

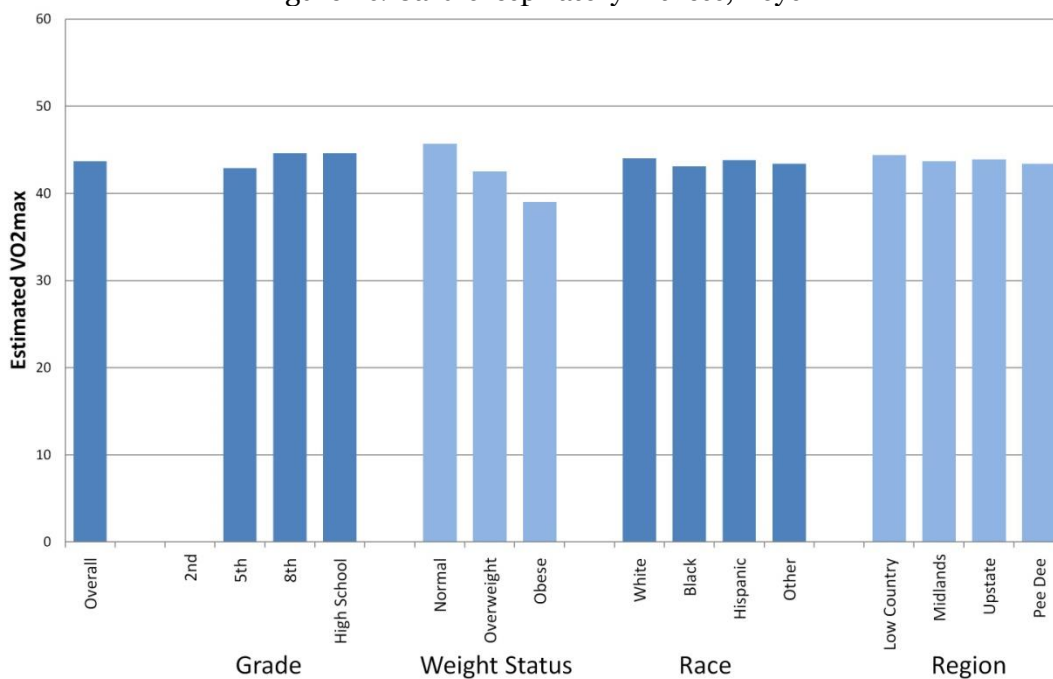
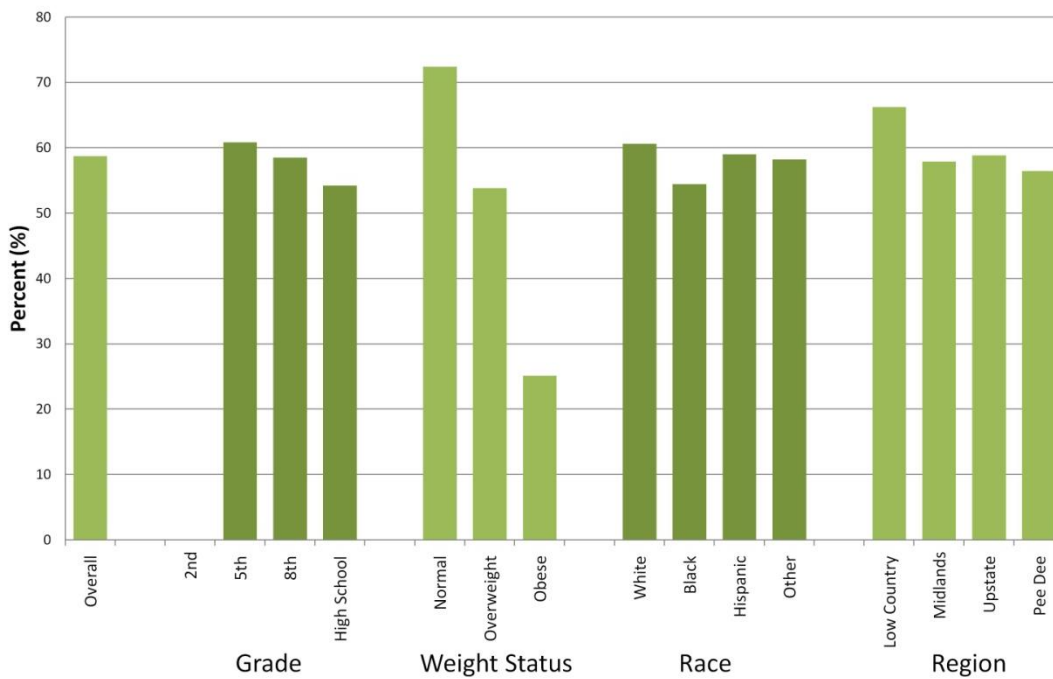


Figure 2d. Cardiorespiratory Fitness, Percent Attaining Healthy Fitness Zone, Boys



Key Findings and Conclusions.

A key finding was that only one-half of South Carolina 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 and Hispanic 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.

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 South Carolina 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. Over 55,000 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 11.2. Approximately 60% of the

total sample scored in the Healthy Fitness Zone while the remaining 40% 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 five more push-ups than girls. Additionally, slightly more boys scored in the Healthy Fitness Zone compared to girls (60.3% vs. 56.9%) (Table 3a). These findings suggest that only three out of every five South Carolina 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, South Carolina FitnessGram School Year 2015-2016

Upper Body Strength and Endurance Variables	Total		Females		Males	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Push-Ups	55,475	11.2 (8.6)	27,142	8.8 (7.3)	28,333	13.5 (9.0)
Fitness Zone Categories	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	32,510	58.6%	15,430	56.9%	17,080	60.3%
Needs Improvement	22,901	41.3%	11,682	43.1%	11,219	39.6%
Incomplete	63	0.1%	30	0.1%	33	0.1%
Exempt	1	0.0%	0	0.0%	1	0.0%

Upper Body Strength and Endurance in Girls. In girls, upper body strength and endurance increased from 5th grade to 8th grade and then declined slightly in high school (Table 3b). Specifically, the number of push-ups performed increased from 7.5 in 5th grade to approximately 10 in 8th grade, and then decreased to 9.5 push-ups in high school. The percentage of girls attaining the Healthy Fitness Zone increased from 48.0% in fifth graders to 64.6% in high school girls.

Table 3b. Upper Body Strength/Endurance - Push Ups; Females By Grade, South Carolina
FitnessGram School Year 2015-2016

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)	13,645	7.5 (6.5)	6,968	9.9 (6.8)	6,403	9.5 (6.7)
Fitness Zone Categories	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	6,554	48.0%	4,617	66.3%	4,133	64.6%
Needs Improvement	7,082	51.9%	2,344	33.6%	2,256	35.2%
Incomplete	9	0.1%	7	0.1%	14	0.2%

**upper body strength and endurance was not assessed for 2nd grade students (n=9,990)*

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 over 65% in normal weight girls but decreased to 53% in those who were overweight and to 37% in those who were obese. Also, performance on the upper body strength and endurance test varied across race/ethnicity groups. Push-up performance was lower in Black and Hispanic girls than in White girls and girls from other races/ethnicities backgrounds. Some regional differences were also observed.

Figure 3a. Upper Body Strength/Endurance – Push-Ups, Girls

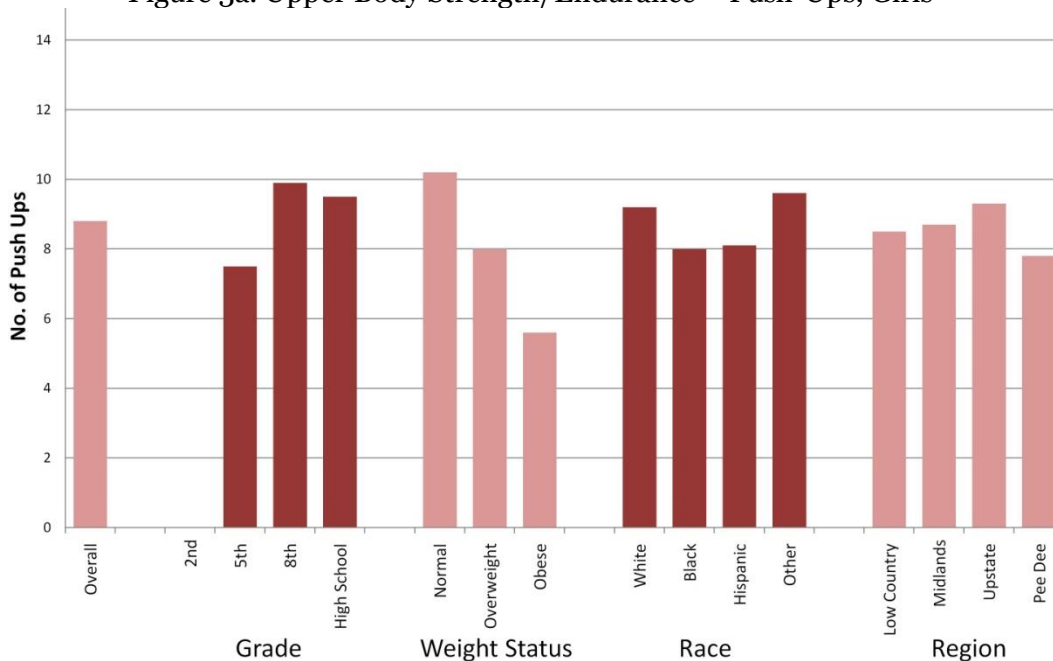
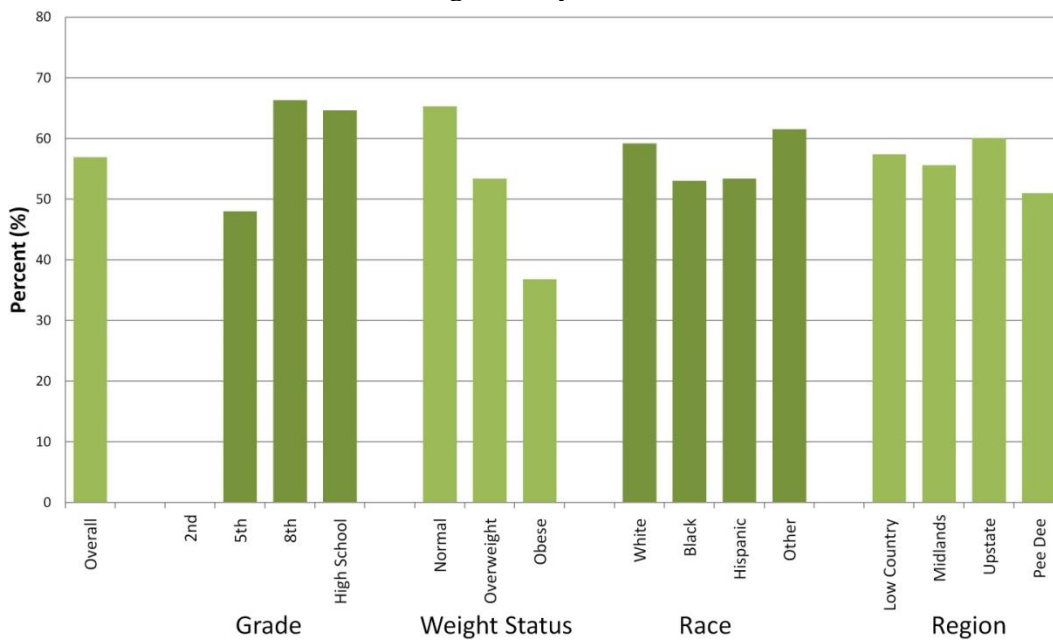


Figure 3b. Upper Body Strength/Endurance – Push-Ups, Percent Attaining Healthy Fitness Zone, Girls



Upper Body Strength and Endurance in Boys. Among boys, upper body strength and endurance increased with increasing age and grade levels, with the largest gains observed from 5th grade to 8th grade. However, the percentage of boys attaining the Healthy Fitness Zone decreased modestly from 60.9% in 5th graders to 54.9% 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 70% 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. Similar to girls, little variation in the percentage of boys attaining Healthy Fitness Zone for upper body strength and endurance was observed across regions of South Carolina (Figures 3c and 3d).

Table 3c. Upper Body Strength/Endurance – Push-Ups; Males By Grade, South Carolina FitnessGram; School Year 2015-2016

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	13,959	10.4 (7.6)	7,739	15.0 (7.7)	6,212	16.2 (7.7)
Fitness Zone Categories	n	Percent	n	Percent	n	Percent
% Healthy Fitness Zone	8,502	60.9%	4,751	61.4%	3,407	54.9%
% Needs Improvement	5,442	39.0%	2,979	38.5%	2,798	45.0%
% Incomplete	15	0.1%	9	0.1%	6	0.1%
% Exempt	0	0.0%	0	0.0%	1	0.0%

**upper body strength and endurance was not assessed for 2nd grade students (n=9,990)*

Figure 3c. Upper Body Strength/Endurance – Push-Ups, Boys

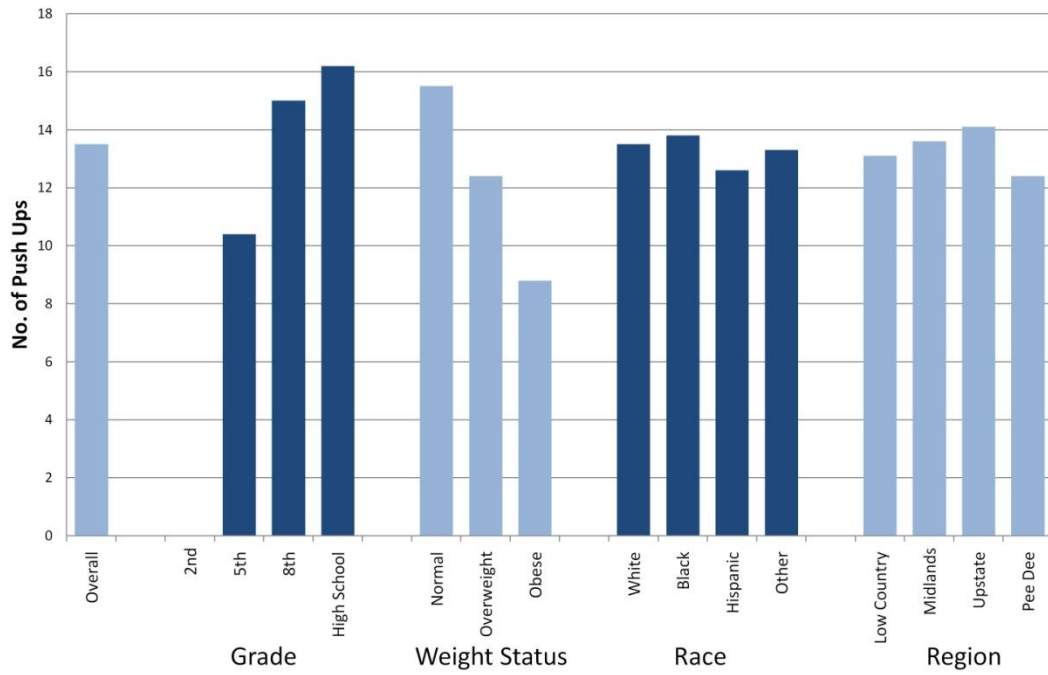
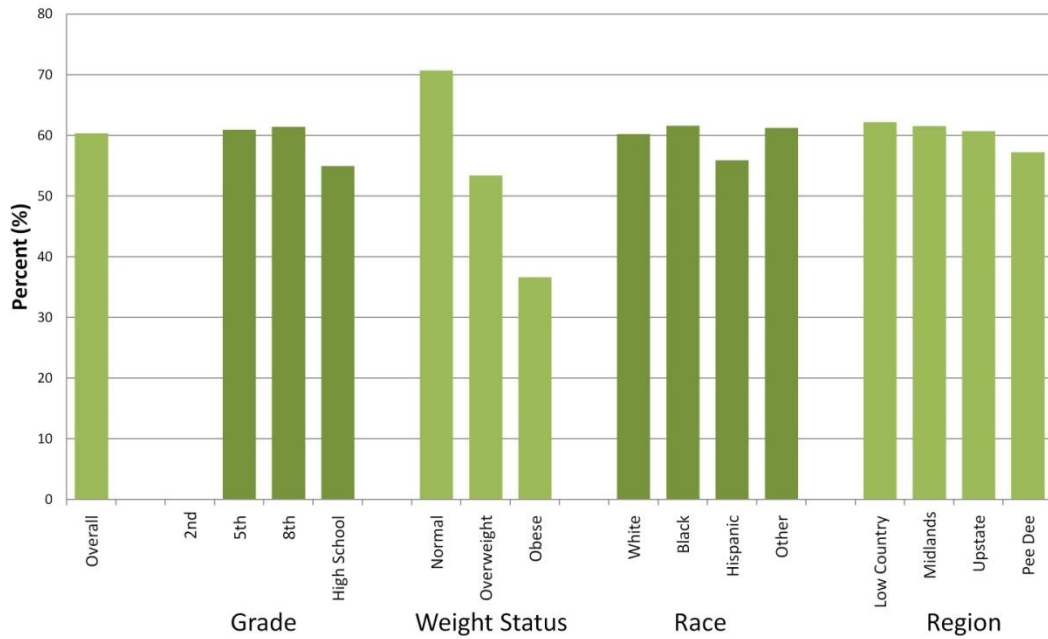


Figure 3d. Upper Body Strength/Endurance – Push-Ups, Percent Attaining Healthy Fitness Zone, Boys



Key Findings and Conclusions.

A key finding of the assessment of upper body strength and endurance was that roughly 60% of South Carolina 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 (48.0% vs. 60.9%).
 - In high school, a larger percentage of girls than boys attained the Healthy Fitness Zone for push-ups (64.6 vs. 54.9%).
- 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.

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 57,000 students completed the curl-up test for abdominal muscular strength and endurance. The average number of curl-ups completed was 27.8 for the total sample, which included boys and girls from grades 5, 8 and high school. A majority of the students (70%) in the total sample scored in the Healthy Fitness Zone category for abdominal

muscular strength and endurance; the remaining 30% 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; South Carolina FitnessGram; Total Sample and By Sex, School Year 2015-2016

Abdominal Strength and Endurance Variables	Total		Females		Males	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Curl-Ups (mean, SD)	57,412	27.8 (19.8)	28,077	24.7 (18.3)	29,335	30.6 (20.6)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	40,293	70.2%	19,200	68.4%	21,093	71.9%
Needs Improvement	17,054	29.7%	8,842	31.5%	8,212	28.0%
Incomplete	64	0.1%	35	0.1%	29	0.1%
Exempt	1	0.0%	0	0.0%	1	0.0%

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 (Table 4b). However, the percentage of girls attaining the Healthy Fitness Zone increased from 62.7% in fifth graders to 75.4% in high school girls.

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 lower in Black and Hispanic girls compared to White girls and girls from other races/ethnicities. Additionally, some regional differences were also observed.

Table 4b. Abdominal Muscular Strength and Endurance – Curl-Ups; South Carolina FitnessGram; Females By Grade, School Year 2015-2016

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)	13,820	21.0(17.4)	7,515	29.1(19.5)	6,742	27.6(17.3)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	8,670	62.7%	5,450	72.5%	5,080	75.4%
Needs Improvement	5,139	37.2%	2,048	27.3%	1,655	25.6%

*abdominal strength was not assessed for 2nd grade students (n=9,990)

Figure 4a. Abdominal Muscular Strength/Endurance – Curl-Ups, Girls

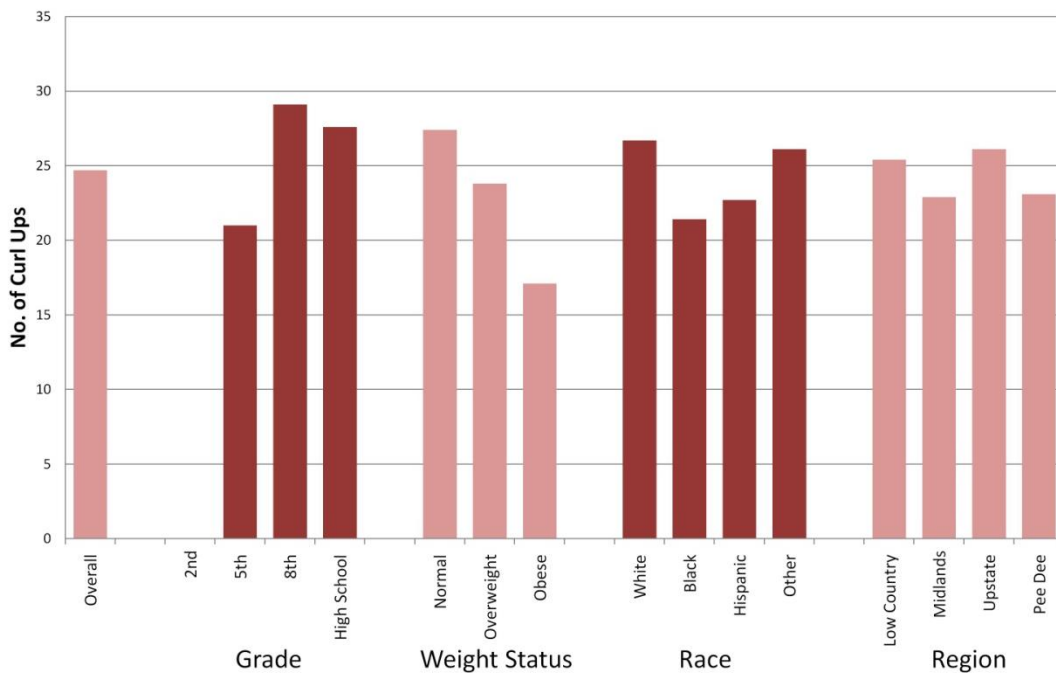
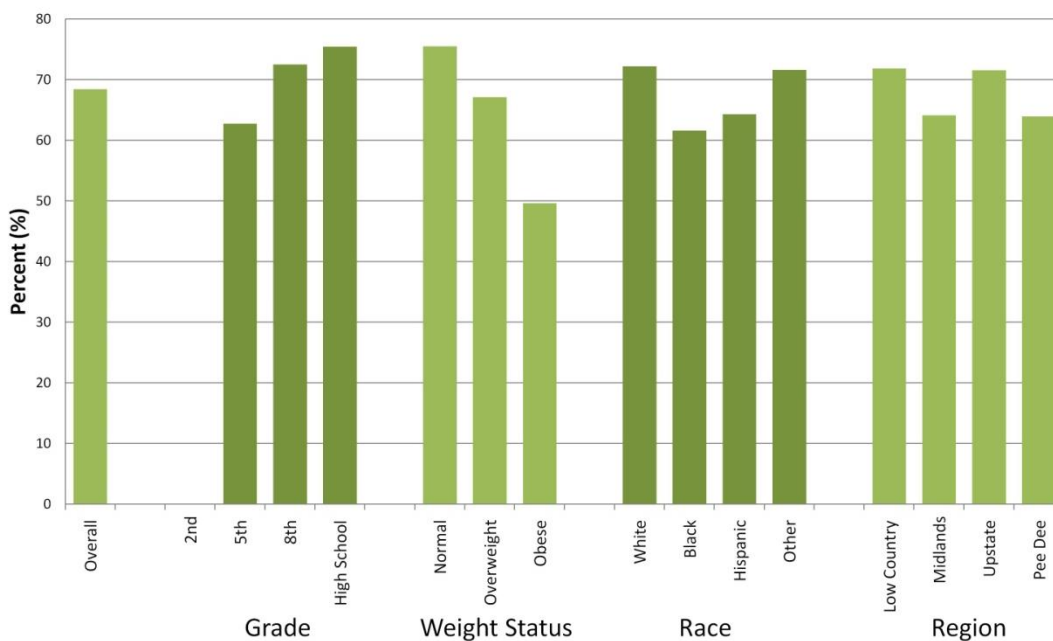


Figure 4b. Abdominal Muscular Strength/Endurance – Curl-Ups, Percent Attaining Healthy Fitness Zone, Girls



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. However, the percentage of boys attaining the Healthy Fitness Zone for abdominal muscular strength and endurance steadily increased with increasing age and grade level (Table 4c).

The same association between abdominal muscular strength and endurance and weight status was observed in boys as in girls. Nearly 80% of normal weight boys scored in the Healthy Fitness Zone while only 71% of overweight and 54% of obese boys attained the Healthy Fitness Zone. While differences were observed, the association between race/ethnicity and abdominal muscular strength and endurance was less pronounced in boys than girls. Across South Carolina regions, little variation in the percentage of boys attaining Healthy Fitness Zone for abdominal muscular strength and endurance was observed (Figures 4c and 4d).

Table 4c. Abdominal Muscular Strength and Endurance - South Carolina FitnessGram; Males
By Grade, School Year 2015-2016

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)	14,209	23.4(18.5)	8,340	38.8 (21.4)	6,786	35.7 (18.6)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	9,462	66.6%	6,386	76.6%	5,245	77.3%
Needs Improvement	4,730	33.3%	1,945	23.3%	1,537	5.1%

**abdominal strength was not assessed for 2nd grade students (n=10,234)*

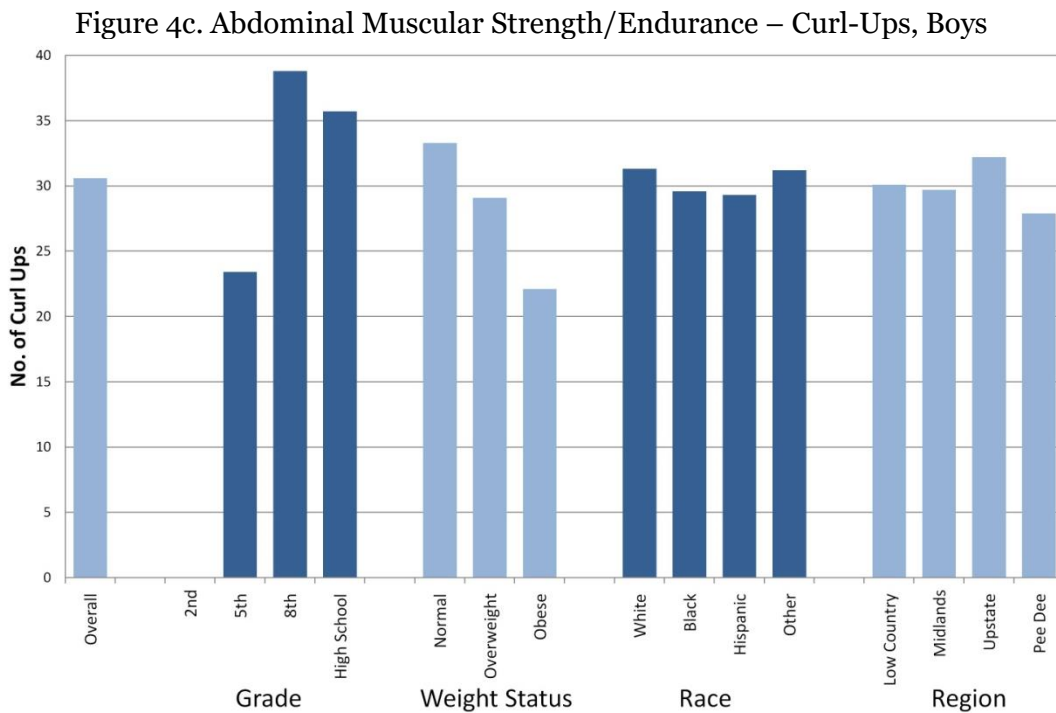
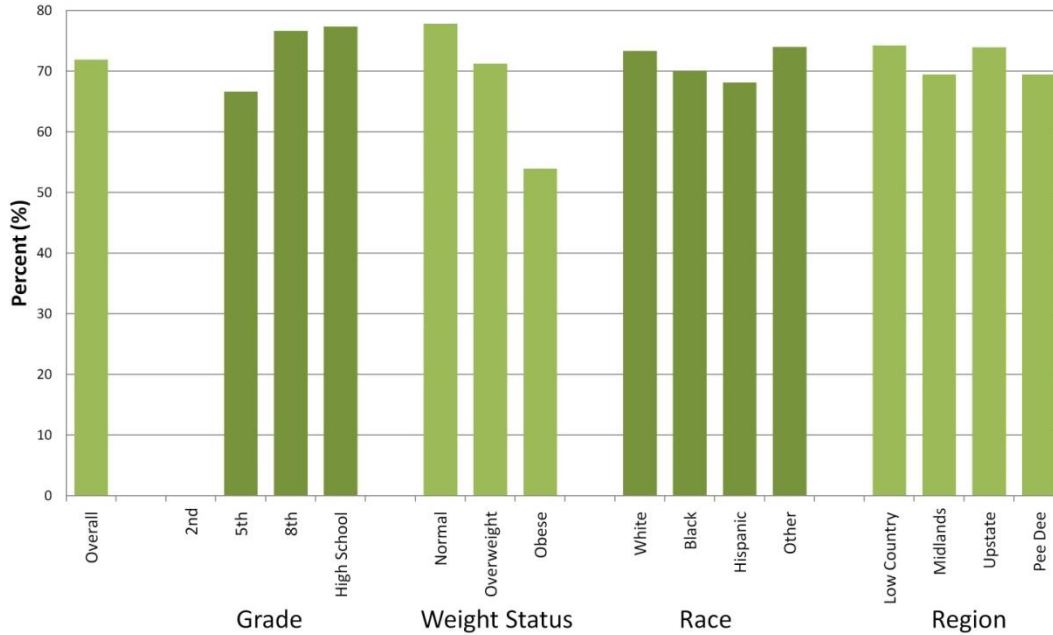


Figure 4d. Abdominal Muscular Strength/Endurance – Curl-Ups, Percent Attaining Healthy Fitness Zone, Boys



Key Findings and Conclusions.

A key finding of the assessment of abdominal muscular strength and endurance was that approximately 70% of South Carolina 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 similar for boy and girls.
- Across grade levels, the percentage of girls and boys attaining the Healthy Fitness Zone increased 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 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.

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. Over 42,000 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 10.0 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% with more girls scoring in this zone than boys (79% vs. 74%, 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 South Carolina students has adequate trunk extensor strength and flexibility to maintain good health.

Table 5a. Trunk Extensor Strength – Trunk Lift, Total Sample and By Sex, South Carolina FitnessGram School Year 2015-2016

Trunk Extensor Strength Variables	Total		Females		Males	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Trunk Lift (mean, SD)	42,606	10.0 (2.3)	20,906	10.2 (2.2)	21,700	9.8 (2.3)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	32,534	76.4%	16,510	79.0%	16,024	73.8%
Needs Improvement	10,029	23.5%	4,369	20.9%	5,660	26.1%

Trunk Extensor Strength and Endurance in Girls. In girls, scores on the trunk lift were observed to increase with increasing age and grade level. Similarly, the percentage of students scoring in the Healthy Fitness Zone increased from 5th grade to high school (77.6% vs. 80.8%, 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, performance on the trunk lift test was lower in Black and Hispanic girls compared to White girls. Additionally, some regional differences were also observed with students from the Midlands region performing worse compared to the other regions (Figures 5a and 5b).

Table 5b. Trunk Extensor Strength – Trunk Lift, Females By Grade, South Carolina
FitnessGram School Year 2015-2016

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)	10,916	10.1 (2.2)	5,248	10.3 (2.2)	4,742	10.4 (2.2)
Healthy Fitness Zone	n	Percent	n	Percent	n	Percent
% Healthy Fitness Zone	8,469	77.6%	4,210	80.2%	3,831	80.8%
% Needs Improvement	2,442	22.4%	1,038	19.8%	889	18.8%
% Incomplete	5	0.1%	0	0.0%	22	0.5%

Figure 5a. Trunk Strength/Endurance – Trunk Lift, Girls

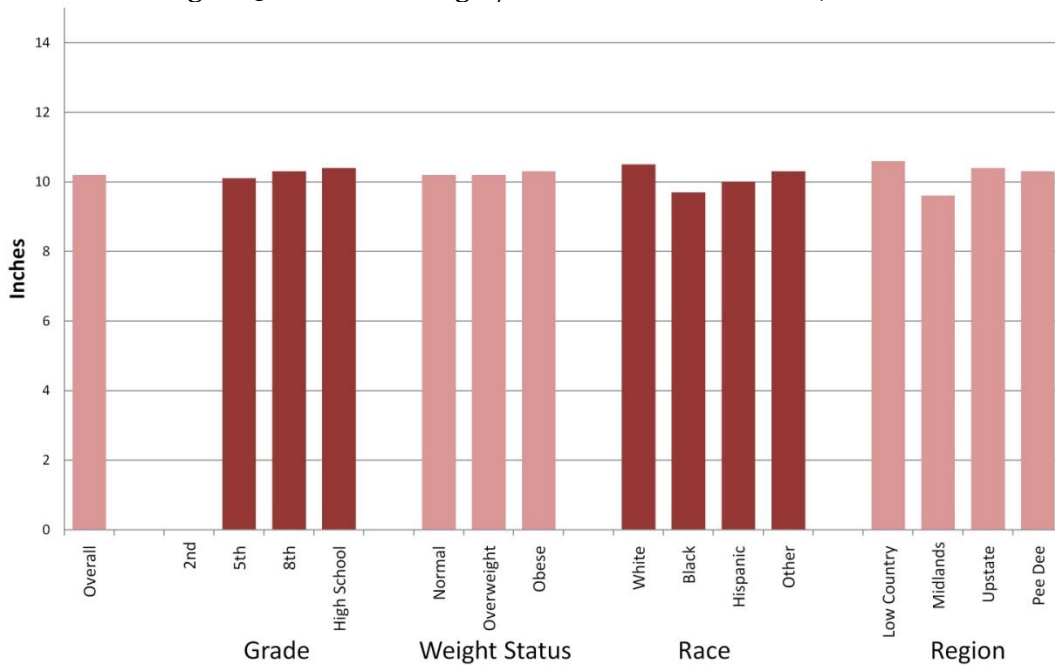
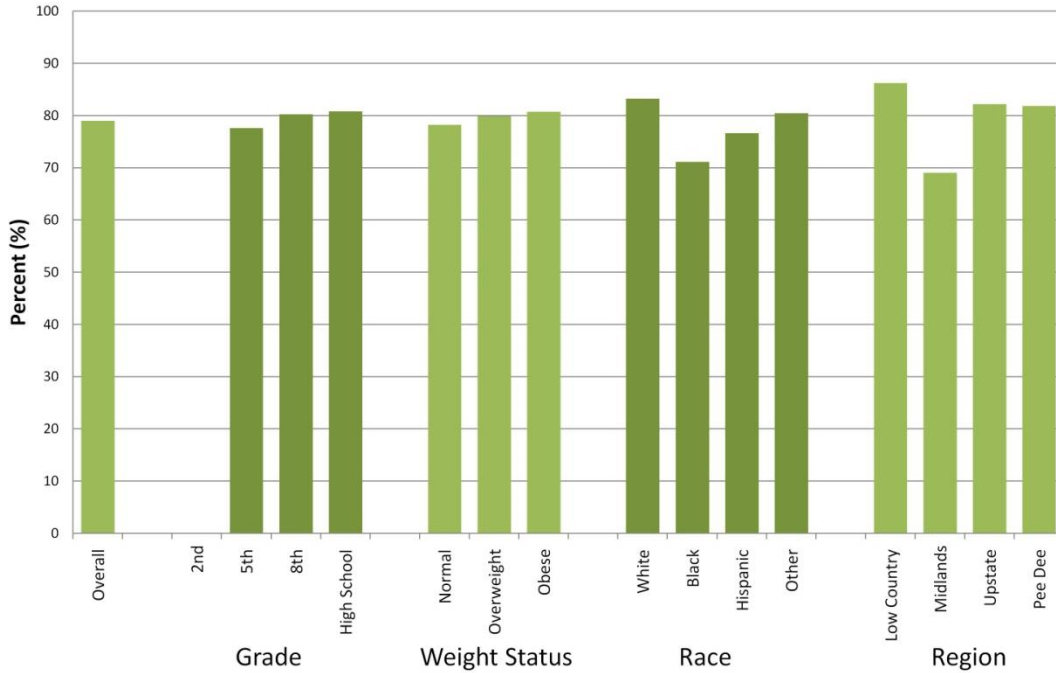


Figure 5b. Trunk Strength/Endurance – Trunk Lift, Percent Attaining Healthy Fitness Zone, Girls



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 71.6% in 5th grade to 76.5% in high (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 lower in Black and Hispanic boys compared to White boys. Boys from the Midlands region performed worse compared to boys from the other regions across South Carolina (Figures 5c and 5d).

Table 5c. Trunk Extensor Strength – Trunk Lift, Males By Grade, South Carolina FitnessGram School Year 2015-2016

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)	11,265	9.7 (2.3)	5,960	10.1(2.3)	4,475	10.1(2.3)
Healthy Fitness Zone	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	8,064	71.6%	4,538	76.1%	3,422	76.5%
Needs Improvement	3,195	28.4%	1,422	23.9%	1,043	23.3%

Figure 5c. Trunk Strength/Endurance – Trunk Lift, Boys

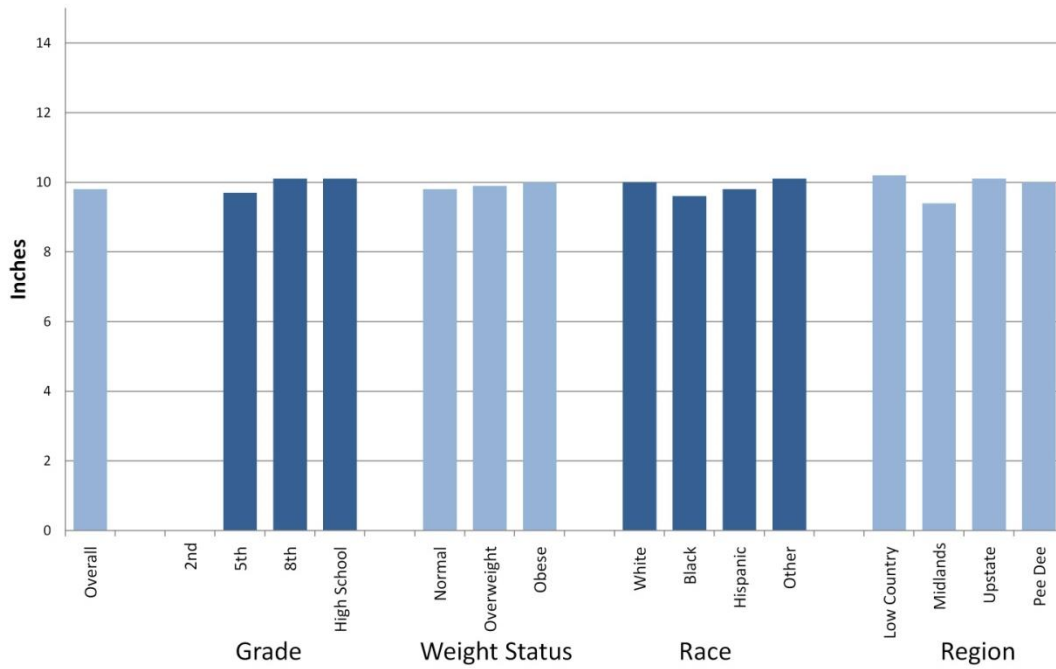
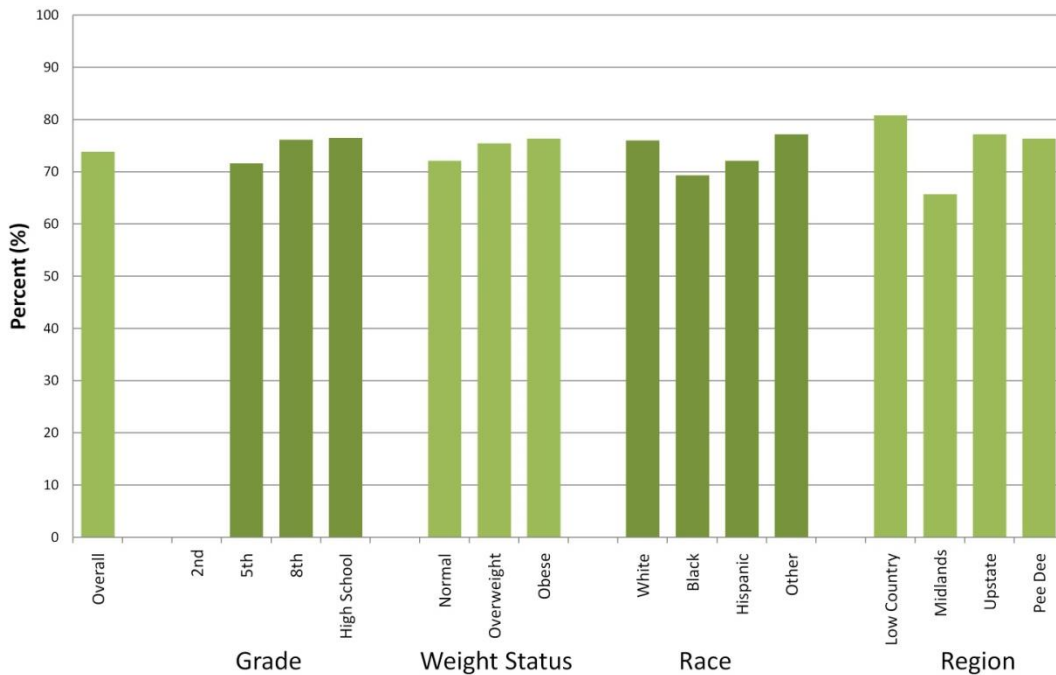


Figure 5d. Trunk Strength/Endurance – Trunk Lift, Percent Attaining Healthy Fitness Zone, Boys



Key Findings and Conclusions.

A key finding of the assessment of trunk extensor strength and flexibility was that approximately 77% of South Carolina 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 increased 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.

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 South Carolina 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 54,000 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 9.7 inches. Performance was better among girls than boys. The total percentage of students scoring in the Healthy Fitness Zone for sit and reach was 64% and was similar among girls and boys (Table 6a).

Table 6a. Flexibility – Sit and Reach, Total Sample and By Sex, South Carolina FitnessGram School Year 2015-2016

Flexibility Variables	Total		Females		Males	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Sit and Reach, Left (mean, SD)	54,076	9.7 (2.5)	26,510	10.4 (2.2)	27,564	9.0 (2.6)
Sit and Reach, Right (mean, SD)	53,478	9.7 (2.5)	26,220	10.5 (2.1)	27,258	9.0 (2.6)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	37,361	63.5%	18,220	63.4%	19,141	63.7%
Needs Improvement	15,886	27.0%	7,879	27.4%	8,007	26.6%
Incomplete	5,153	8.8%	2,450	8.5%	2,703	9.0%
Exempt	402	0.7%	191	0.7%	211	0.7%

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 declined in high school (59% vs. 72% vs. 63%, respectively) (Table 6b). 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 obese students compared to normal weight students. By race/ethnicity, performance on the sit and reach test was slightly lower in Hispanic girls compared to White girls.

Table 6b. Flexibility – Sit and Reach, Females By Grade, South Carolina FitnessGram School Year 2015-2016

Flexibility Variables	Grade					
	5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Sit and Reach, Left	12,848	10.0 (2.2)	7,179	10.8 (2.1)	6,485	10.9 (1.9)
Sit and Reach, Right	12,647	10.0 (2.2)	7,138	10.8 (2.0)	6,435	11.0 (1.9)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
% Healthy Fitness Zone	8,341	58.9%	5,501	72.0%	4,378	63.2%
% Needs Improvement	4,254	30.0%	1,600	20.9%	2,025	29.2%
% Incomplete	1,469	10.4%	494	6.5%	487	7.0%
% Exempt	105	0.7%	49	0.6%	37	0.5%

Figure 6a. Flexibility - Sit and Reach, Girls

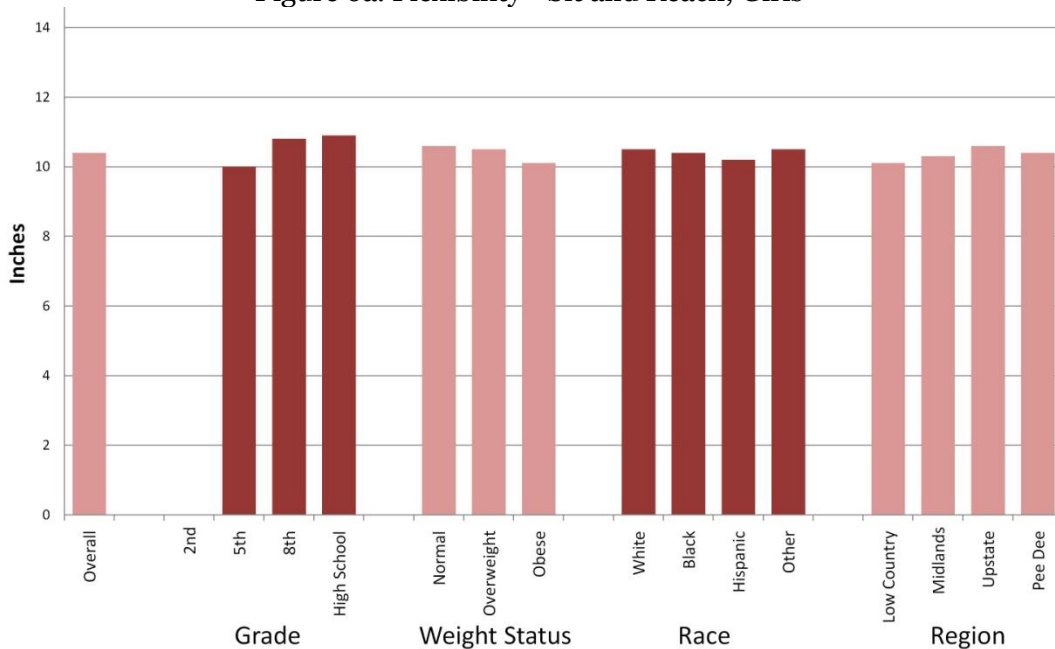
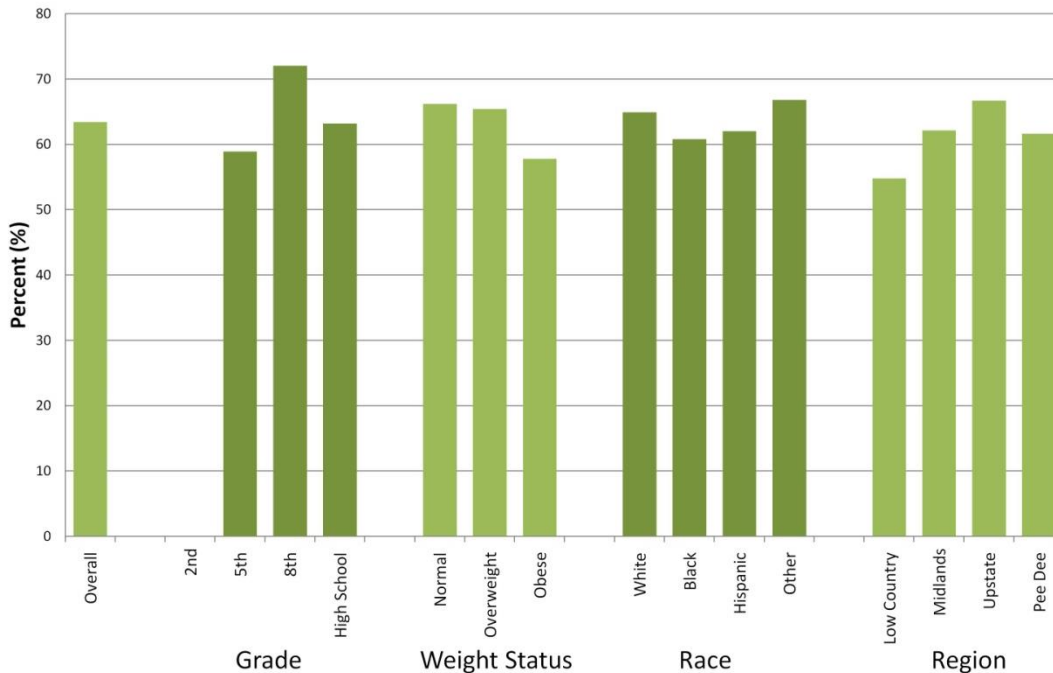


Figure 6b. Flexibility – Sit and Reach, Percent Attaining Healthy Fitness Zone, Girls



Flexibility in Boys. Similar to girls, raw scores on the sit and reach test for flexibility increased with increasing age and grade level. The percentage of boys attaining the Healthy Fitness Zone for flexibility also increased with increasing age and grade level (57% to 68% to 72%, respectively)(Table 6c).

Additionally, similar patterns across demographic groups were observed in boys and girls. Concerning weight status, a lower percentage of obese boys compared to normal weight boys attained the Healthy Fitness Zone for flexibility. By race/ethnicity, performance on the sit and reach test was lower in White boys compared to all other groups. Some variations were observed across regions with boys from the Low Country performing worse compared to boys from the other regions across South Carolina (Figures 6c and 6d).

Table 6c. Flexibility – Sit and Reach; South Carolina FitnessGram; Males By Grade, School Year 2015-2016

Flexibility Variables	Grade					
	5 th Grade		8 th Grade		High School	
	n	Mean, SD	n	Mean, SD	n	Mean, SD
Sit and Reach, Left	13,137	8.5 (2.5)	7,916	9.1 (2.7)	6,511	9.7 (2.4)
Sit and Reach, Right	12,939	8.6 (2.5)	7,866	9.2 (2.7)	6,453	9.7 (2.5)
Healthy Fitness Zone Category	n	Percent	n	Percent	n	Percent
Healthy Fitness Zone	8,291	56.9%	5,771	68.4%	5,079	71.9%
Needs Improvement	4,598	31.6%	2,057	24.4%	1,352	19.2%
Incomplete	1,558	10.7%	563	6.7%	582	8.2%
Exempt	113	0.8%	50	0.6%	48	0.7%

Figure 6c. Flexibility - Sit and Reach, Boys

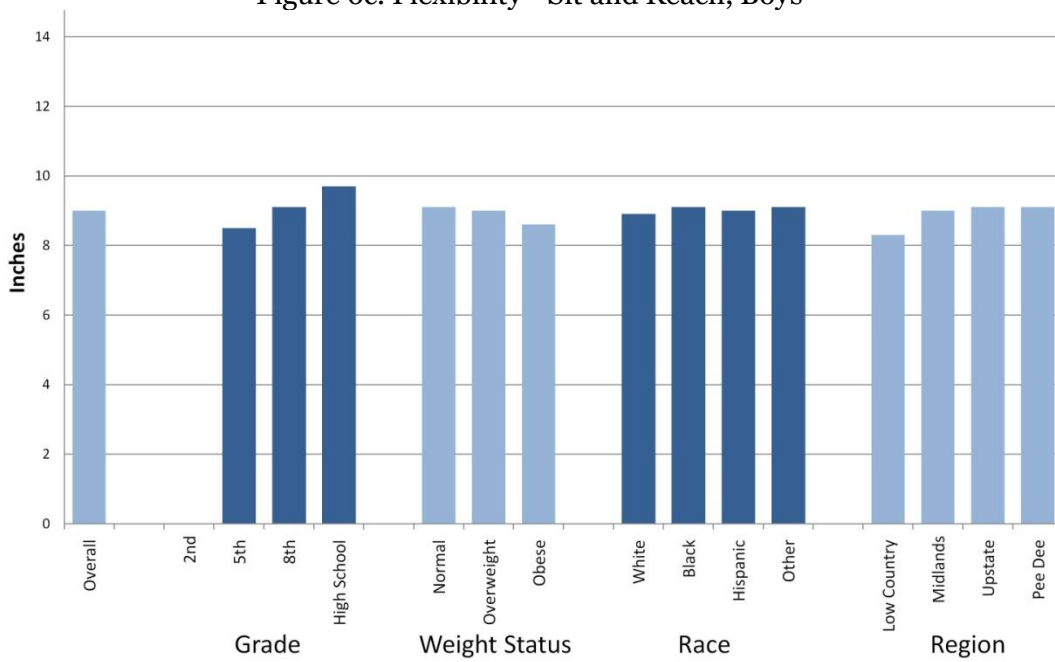
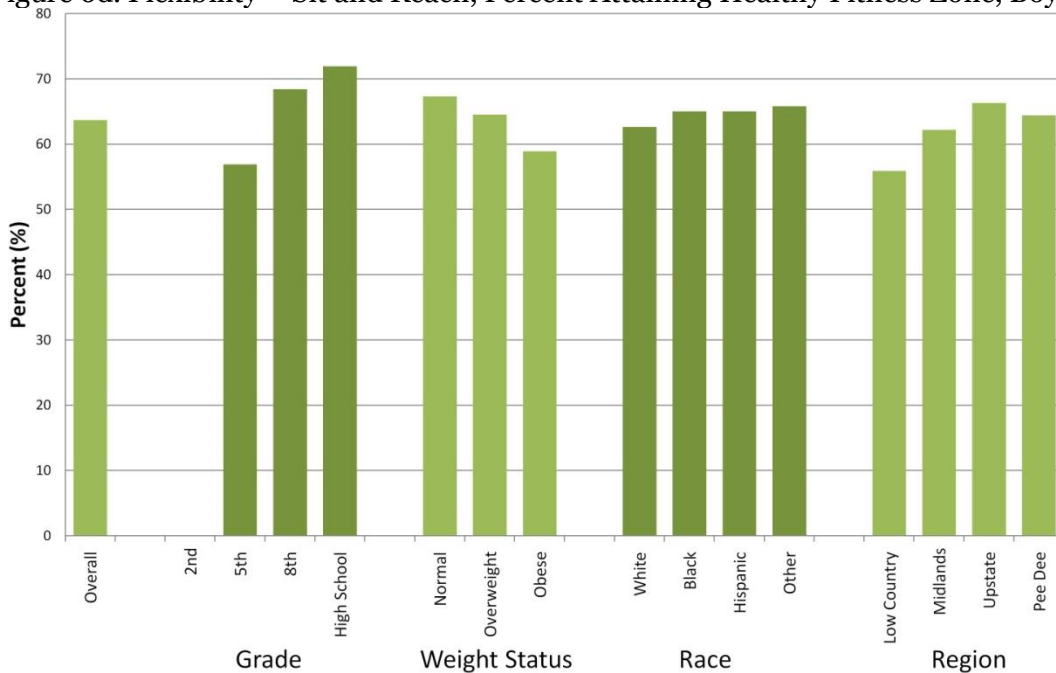


Figure 6d. Flexibility – Sit and Reach, Percent Attaining Healthy Fitness Zone, Boys



Key Findings and Conclusions.

A key finding of the assessment of flexibility as measured by the sit and reach test was that approximately 64% of South Carolina 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.

South Carolina FitnessGram and Academic Performance

The secondary purpose of this report is to examine the relationship between health-related fitness and academic performance. The following section of this report aims to summarize the association between two health-related fitness components (i.e., cardiorespiratory fitness and weight status) and two academic subject areas (i.e., English language arts and math) among South Carolina students during school year 2015-2016. Additional tables examining the association between health-related fitness and academic performance for the remaining academic subjects and by demographics groups are presented in the Appendix.

Data Management. De-identified academic performance data was provided to the University of South Carolina from the South Carolina Department of Education. Using a unique student identification number, academic performance data was linked with health-related fitness data. Prior to analyses, the academic data was cleaned and checked for implausible values.

Academic Tests Description. Academic performance was assessed using data from three standardized tests (Table 7):

- South Carolina College- and Career-Ready Assessments (SC READY):
 - a statewide assessment in English language arts (ELA) and math for students in 3rd through 8th grade. Student performance is categorized into one of four established categories: exceeds, meets, approaches, and does not meet.
- South Carolina Palmetto Assessment of State Standards (SCPASS):
 - a statewide assessment in social studies and science that is administered to students in 4th through 8th grades. Student performance is categorized into one of three categories: exemplary, met, and not met.
- End-of-Course Examination Program (EOCEP):
 - a statewide assessment program of end of course tests for English language arts, math (i.e., Algebra 1/Math for technologies) for students in high school (grades 9-12). Academic performance for the EOCEP is assessed using letter grades (i.e., A, B, C, D, F).

Analytic Sample (Table 7). Of the 85,810 students with FitnessGram data, academic performance data was available for approximately 65% of the students. The analytic sample included 5th grade (50.5%), 8th grade (26.3%), and high school (23.2%) students across the state

of South Carolina. The sample was approximately 51% males, 56% non-Hispanic White, and varied considerably by region. Additional descriptives are provided below (Table 8).

Table 7. Summary of Academic Tests Used to Assess the Relationship between Health-Related Fitness and Academic Performance Among South Carolina Students, School Year 2015-2016.

Academic Test	Subject Areas	Grades Administered	Standards
SC READY	ELA Math	3 rd – 8 th	Exceeds Meets Approaches Does Not Meet
SCPASS	Social Studies Science	4 th – 8 th	Exemplary Met Not Met
EOCEC	ELA Algebra 1/Math	9 th – 12 th	A, B, C, D, F

Table 8. Analytic Sample for South Carolina Students with Health-Related Fitness and Academic Performance Data, School Year 2015-2016.

	5th Grade (n=28,275)	8th Grade (n=14,742)	High School (n=12,966)	Total (n=55,983)
Gender	%	%	%	%
Male	50.7	52.7	50.7	51.2
Female	49.3	47.3	49.3	48.8
Race/Ethnicity				
White	56.0	56.5	54.7	55.8
Black	28.4	28.9	31.9	29.3
Hispanic	9.9	9.6	8.9	9.6
Other	5.7	5.1	4.5	5.3
Regions				
Low Country	14.2	9.4	10.1	12.0
Midlands	25.7	19.9	20.4	23.0
Pee Dee	20.8	13.3	16.5	17.8
Upstate	39.3	57.4	53.0	47.2

*cardiorespiratory fitness and academic data

Results: Weight Status and Academic Performance

Overall Sample. Among the 56,000 girls and boys in grades 5, 8 and high school that provided FitnessGram and academic data for analysis approximately 60% obtained a Healthy Fitness Zone for weight status. Among 5th and 8th grade students that attained the Healthy Fitness Zone, approximately half met or exceeded academic performance standards for ELA and Math and approximately two-thirds obtained satisfactory or exemplary status for social studies and science (Tables 9a-9c).

Table 9a. Percentage of Students in Healthy Fitness Zone for Weight Status by Performance on the South Carolina college- and Career-Ready Assessments (SC READY).

Academic Test Subject	Grade Level	Academic Performance Level			
		Does Not Meet	Approaches	Meets	Exceeds
ELA	5 th Grade	19.0	34.2	30.6	16.3
	8 th Grade	19.2	33.4	31.9	15.6
Math	5 th Grade	17.4	31.6	28.2	22.9
	8 th Grade	24.9	38.0	20.8	16.3

Table 9b. Percentage of Students in Healthy Fitness Zone for Weight Status by Performance on the South Carolina Palmetto Assessment of State Standards (SCPASS).

Academic Test Subject	Grade Level	Academic Performance Level		
		Not Met	Mets	Exemplary
Science	5 th Grade	28.3	45.7	26.1
	8 th Grade	29.6	34.1	36.3
Social Studies	5 th Grade	23.5	38.7	37.9
	8 th Grade	26.7	34.5	38.9

Table 9c. Percentage of Students in Healthy Fitness Zone for Weight Status by Performance on the End-of-Course Examination Program (EOCEP).

Academic Test Subject	Grade Level	Academic Performance Level				
		F	D	C	B	A
ELA	High School	20.8	19.6	26.6	21.8	11.2
Algebra 1 / Math	High School	16.7	19.5	29.1	17.8	16.8

Figure 9a. Associations between weight status and English language arts academic test performance among 5th grade students in South Carolina.

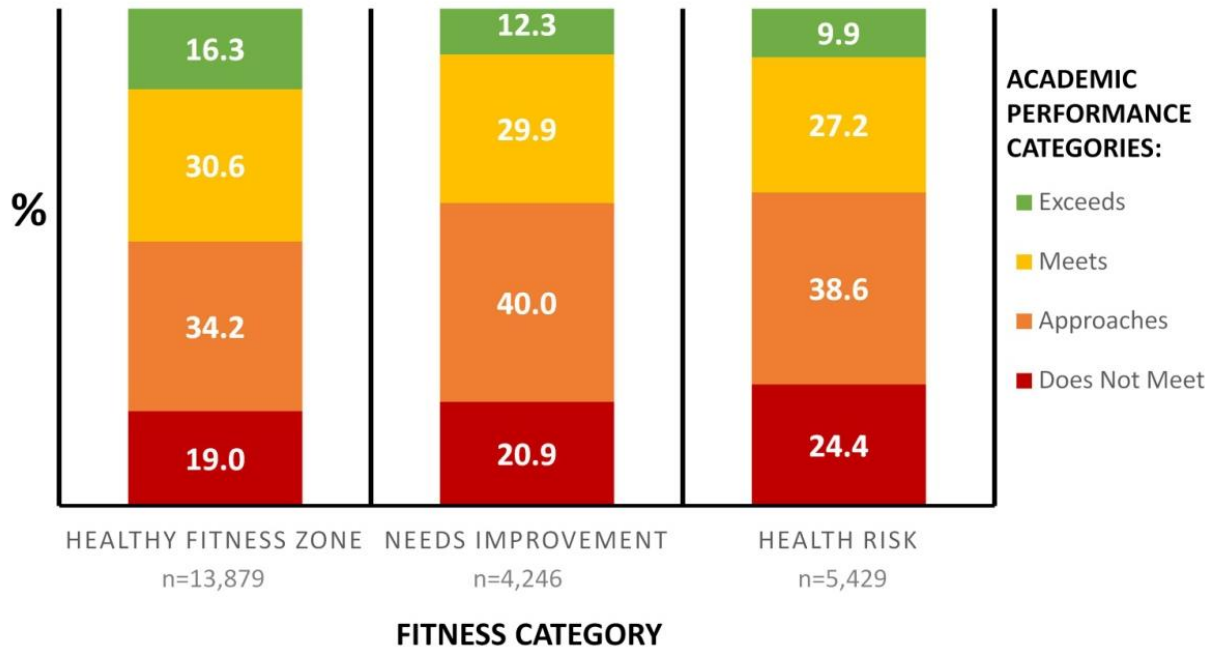


Figure 9b. Associations between weight status and English language arts academic test performance among 8th grade students in South Carolina.

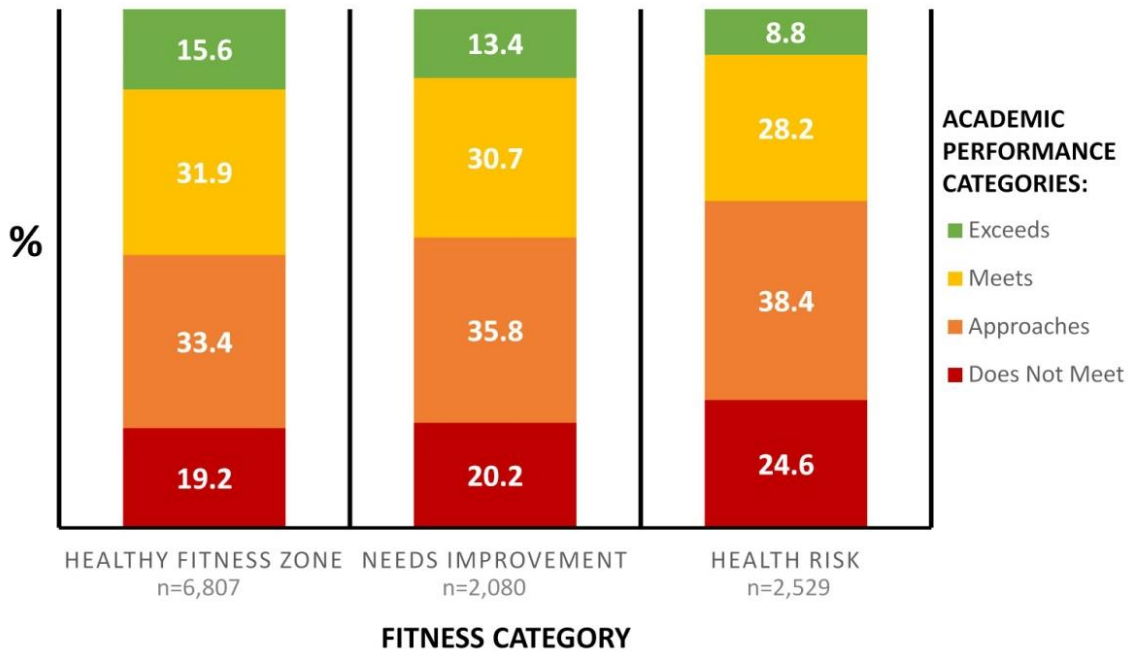


Figure 9c. Associations between weight status and English language arts academic test performance among high school students in South Carolina.

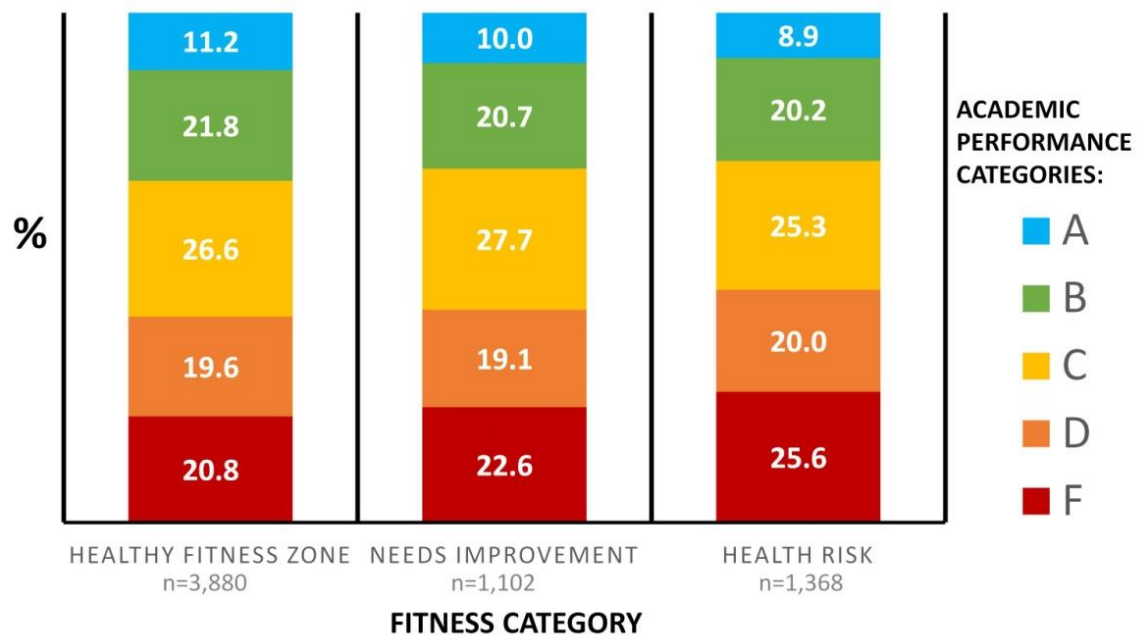


Figure 9d. Associations between weight status and mathematics academic test performance among 5th grade students in South Carolina.

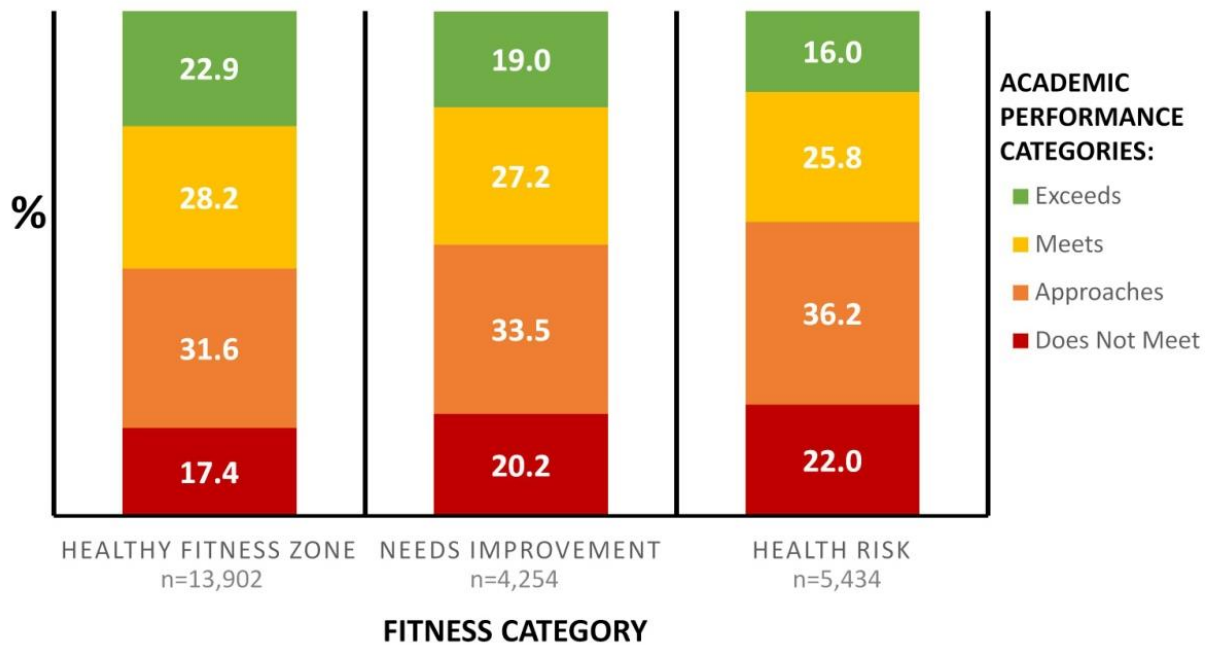


Figure 9e. Associations between weight status and mathematics academic test performance among 8th grade students in South Carolina.

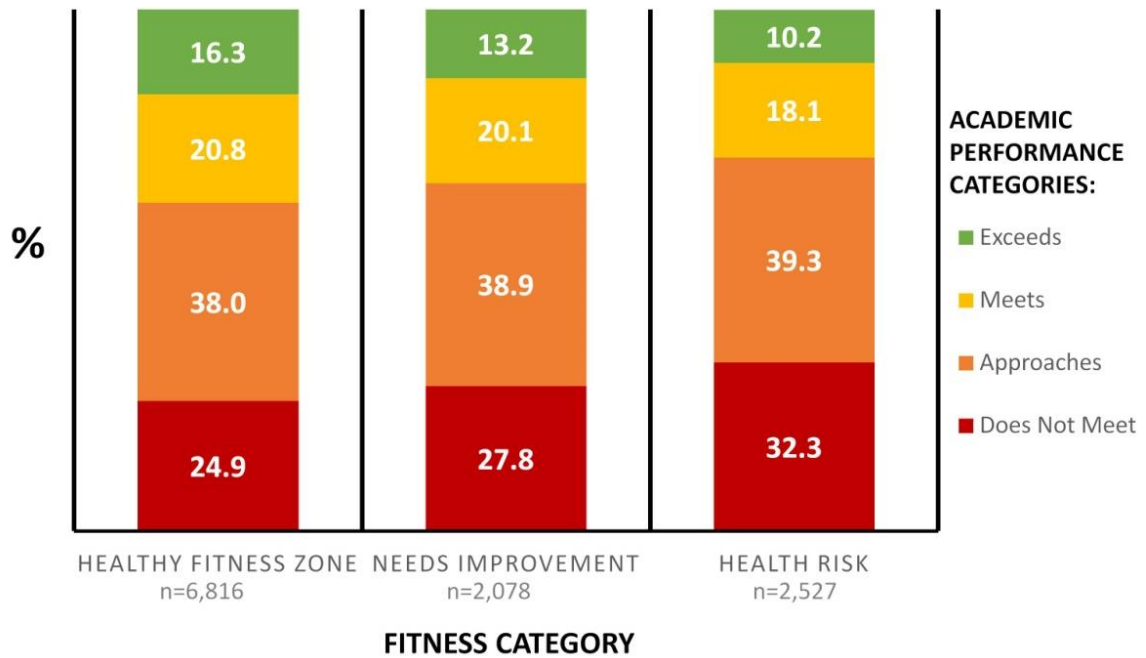
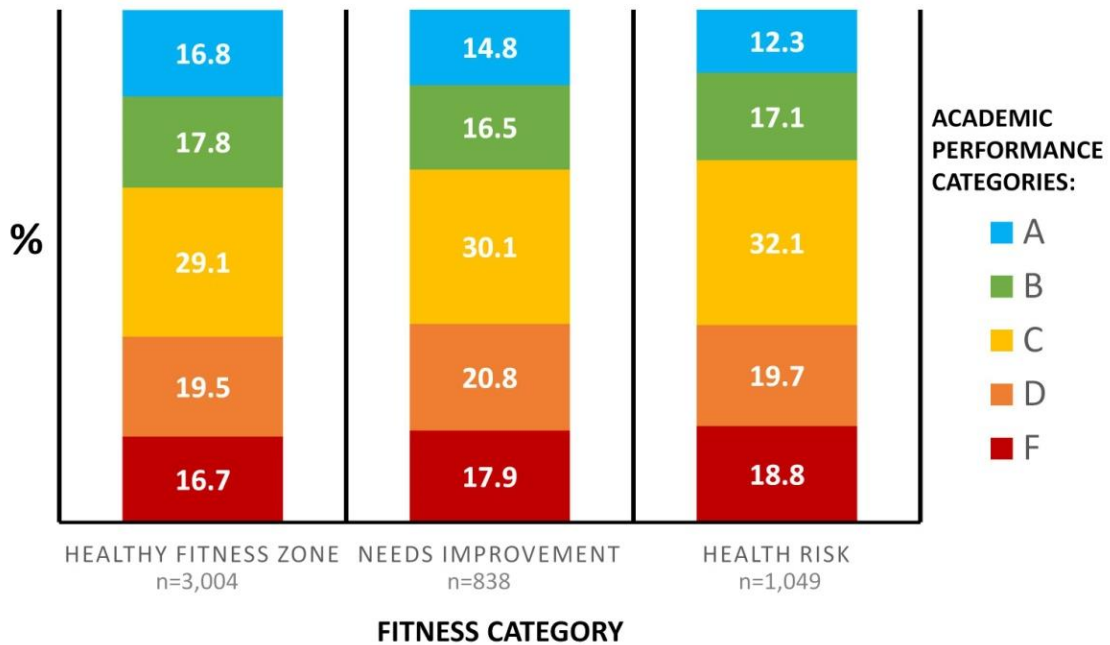


Figure 9f. Associations between weight status and mathematics academic test performance among high school students in South Carolina.



Key Findings and Conclusions

A key finding of the examination of weight status and academic performance was that better weight status was consistently associated with better academic performance (Figures 9a-9f).

The following patterns were observed:

- Compared to students scoring the Needs Improvement and Health Risk categories for weight status, a higher percentage of students in the Healthy Fitness Zone for weight status exceeded or met standards for academic performance in English language arts.
- Similarly, a higher percentage of students in the Healthy Fitness Zone for weight status exceeded or met academic performance standards in mathematics compared to students scoring in the other Fitness Zone categories.
- The observed pattern between weight status and academic performance was similar across each grade level examined.
- Additional comparisons by sex, race/ethnicity, and region are available in the appendix.

Results: Cardiorespiratory Fitness and Academic Performance

Overall Sample. Of the 56,000 girls and boys in grades 5, 8 and high school that provided FitnessGram and academic data for analysis approximately 53% obtained a Healthy Fitness Zone for cardiorespiratory fitness. Among 5th and 8th grade students that attained the Healthy Fitness Zone, approximately half met or exceeded academic performance standards for ELA and Math and two-thirds obtained satisfactory or exemplary status for social studies and science. \ (Tables 10a-10c).

Table 10a. Percentage of Students in Healthy Fitness Zone for Cardiorespiratory Fitness by Performance on the South Carolina College- and Career-Ready Assessments (SC READY).

Academic Test Subject	Grade Level	Academic Performance Level			
		Does Not Meet	Approaches	Meets	Exceeds
ELA	5 th Grade	16.9	33.7	31.6	17.7
	8 th Grade	17.0	31.8	33.4	17.8
Math	5 th Grade	14.9	30.0	29.1	26.0
	8 th Grade	21.2	36.0	23.0	19.8

Table 10b. Percentage of Students in Healthy Fitness Zone for Cardiorespiratory Fitness by Performance on the South Carolina Palmetto Assessment of State Standards (SCPASS).

Academic Test Subject	Grade Level	Academic Performance Level		
		Not Met	Mets	Exemplary
Science	5 th Grade	25.0	46.4	28.7
	8 th Grade	25.7	33.1	41.2
Social Studies	5 th Grade	20.6	38.0	41.4
	8 th Grade	23.0	33.1	43.9

Table 10c. Percentage of Students in Healthy Fitness Zone for Cardiorespiratory Fitness by Performance on the End-of-Course Examination Program (EOCEP).

Academic Test Subject	Grade Level	Academic Performance Level				
		F	D	C	B	A
ELA	High School	19.2	20.2	27.3	22.3	10.9
Algebra 1 / Math	High School	15.6	18.5	30.0	18.6	17.3

Figure 10a. Associations between cardiorespiratory fitness and English language arts academic test performance among 5th grade students in South Carolina.

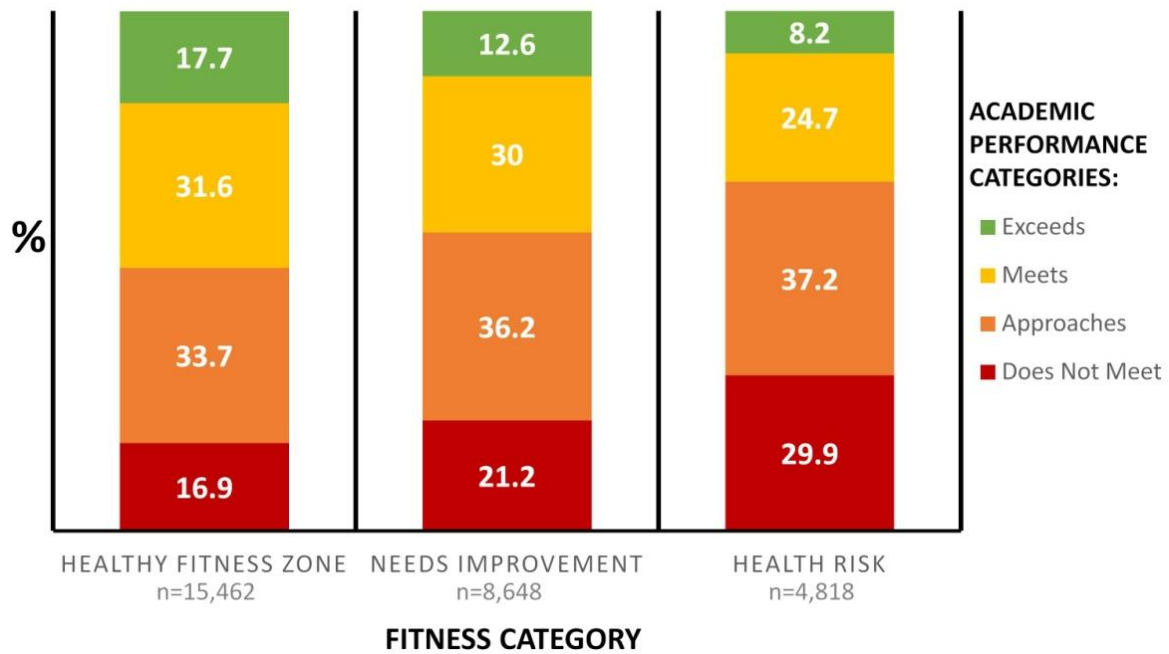


Figure 10b. Associations between cardiorespiratory fitness and English language arts academic test performance among 8th grade students in South Carolina.

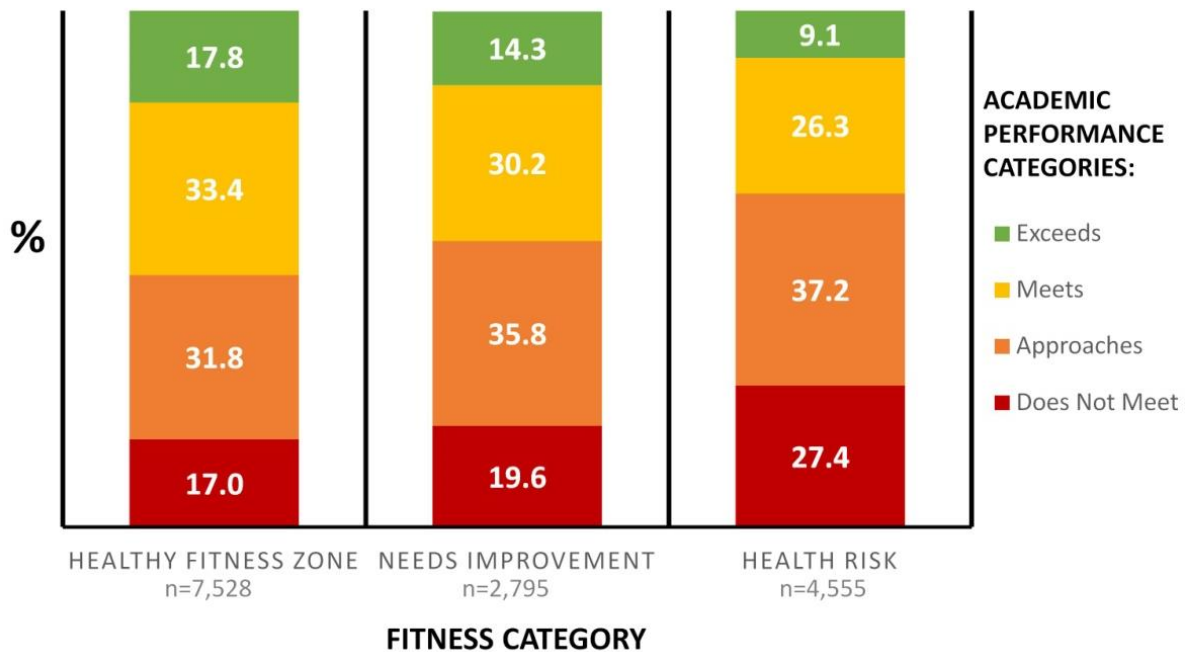


Figure 10c. Associations between cardiorespiratory fitness and English language arts academic test performance among high school students in South Carolina.

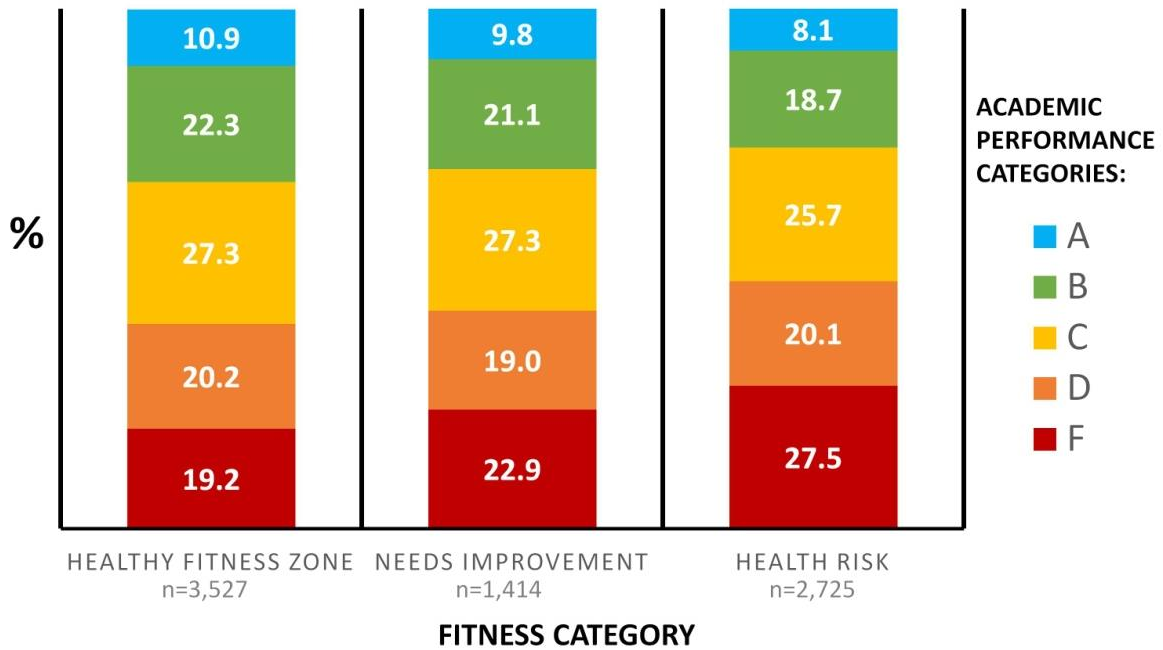


Figure 10d. Associations between cardiorespiratory fitness and mathematics academic test performance among 5th grade students in South Carolina.

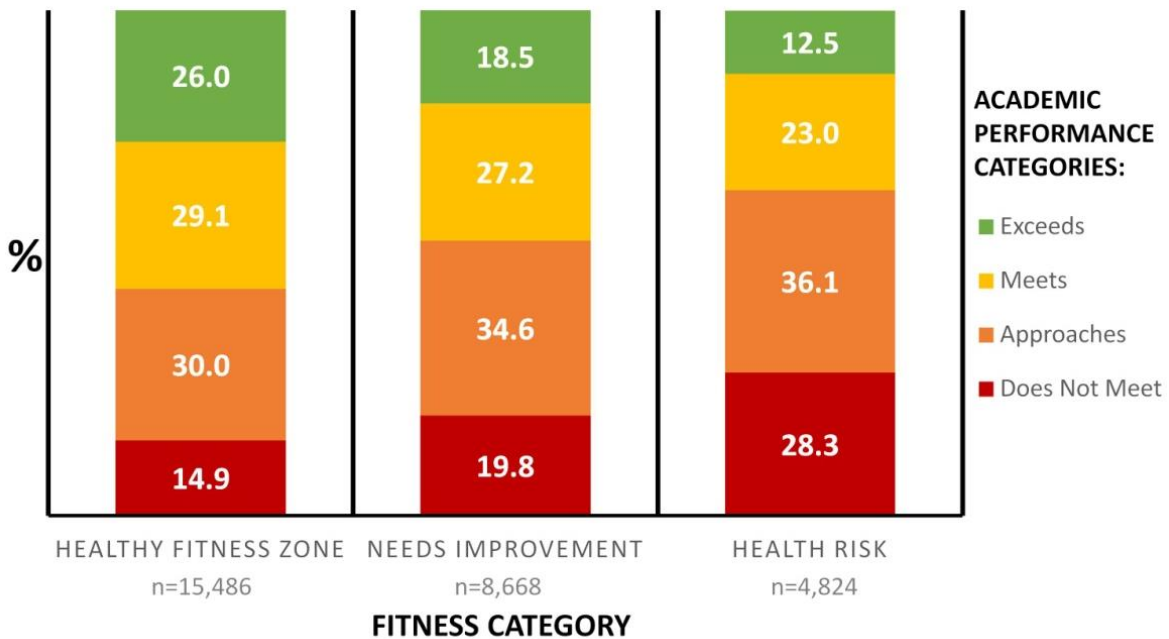


Figure 10e. Associations between cardiorespiratory fitness and mathematics academic test performance among 8th grade students in South Carolina.

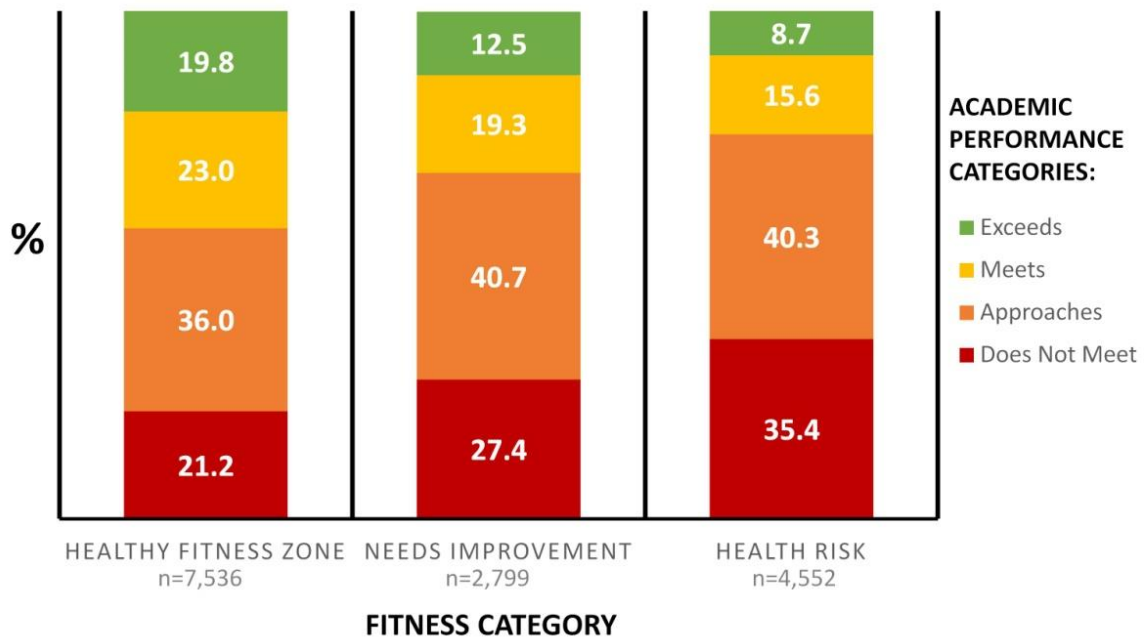
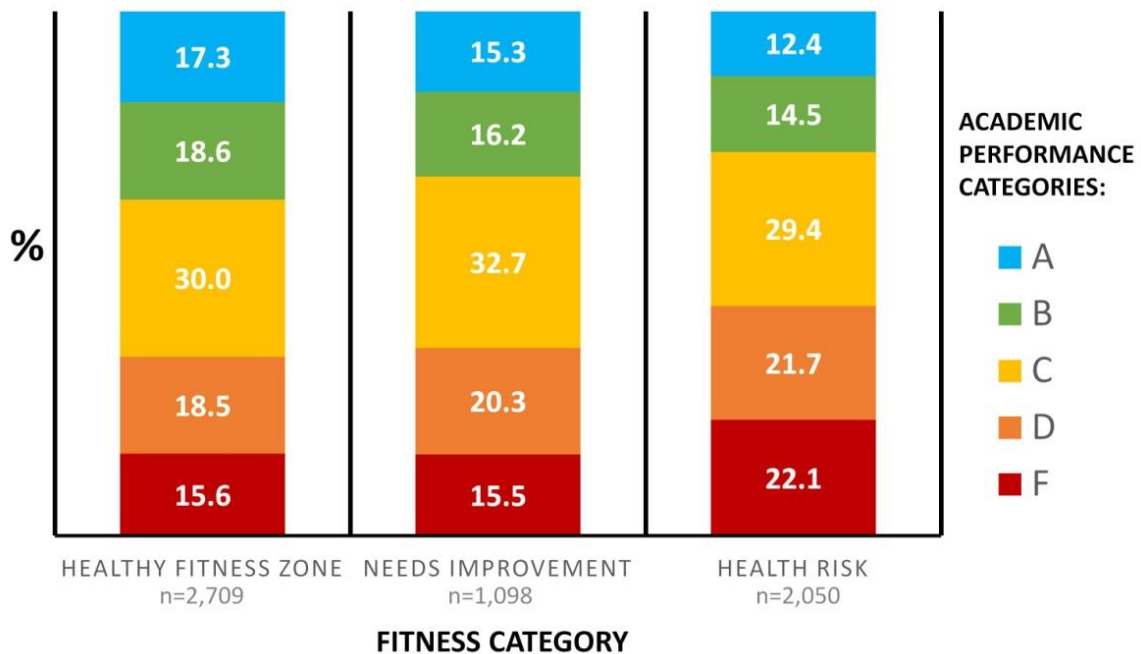


Figure 10e. Associations between cardiorespiratory fitness and mathematics academic test performance among high school students in South Carolina.



Key Findings and Conclusions

A key finding of the examination of cardiorespiratory fitness and academic performance was that better cardiorespiratory fitness was consistently associated with better academic performance (Figures 10a-10f).

The following patterns were observed:

- Compared to students scoring the Needs Improvement and Health Risk categories, a higher percentage of students in the Healthy Fitness Zone for cardiorespiratory fitness exceeded or met academic performance standards in English language arts.
- Similarly, a higher percentage of students in the Healthy Fitness Zone for cardiorespiratory fitness exceeded or met academic performance standards in mathematics compared to students scoring in the other Fitness Zone categories.
- The observed pattern between cardiorespiratory fitness and academic performance was similar across each grade level examined.
- Additional comparisons by sex, race/ethnicity, and region are available in the appendix.

APPENDIX

Appendix A. Sample Distribution

Figure 1. Number of schools and schools districts participating in South Carolina FitnessGram project by DHEC health district during school year 2015-2016.

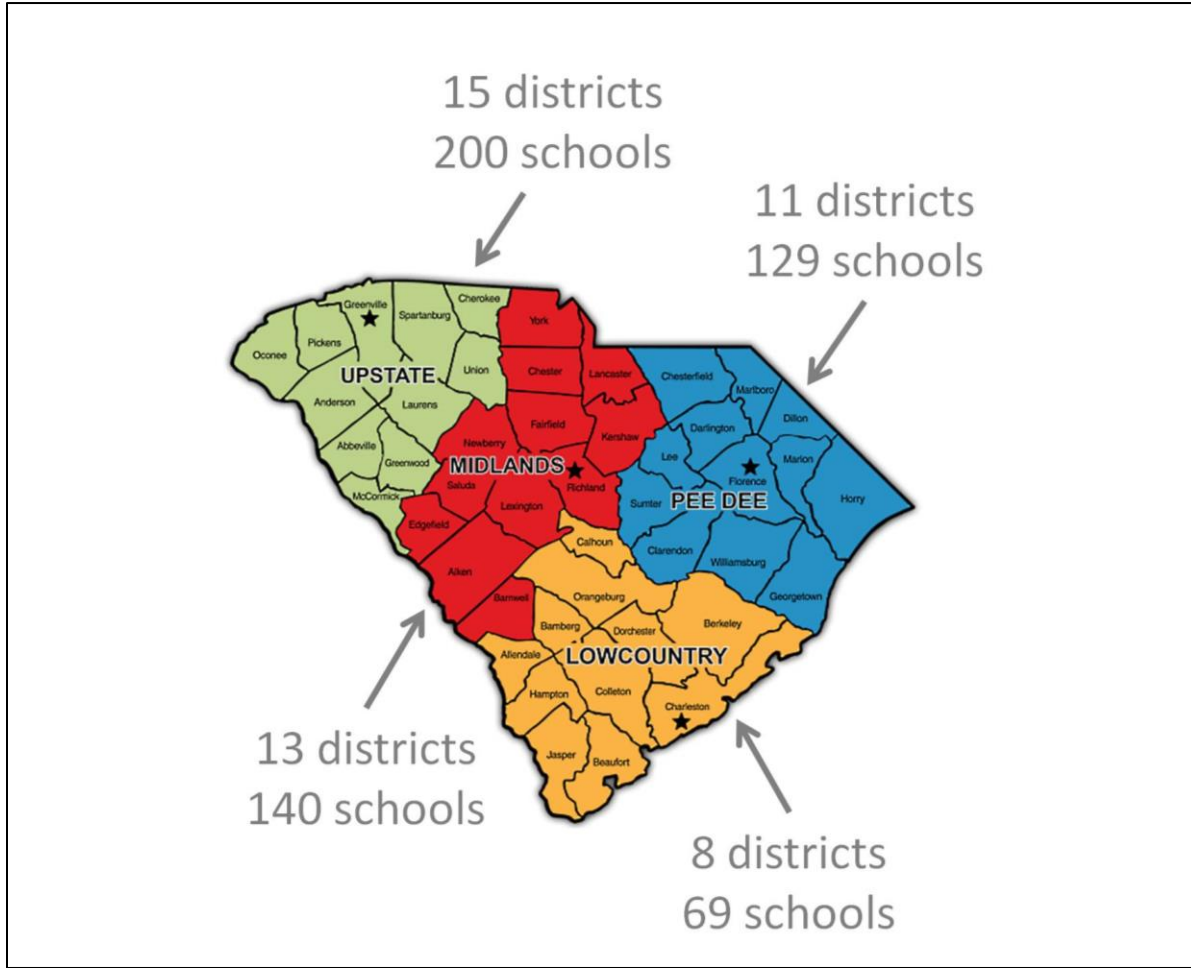


Table 1. Number of students, schools, and schools districts participating in South Carolina FitnessGram project by DHEC health district during school year 2015-2016.

Health Region	Districts (n)	Schools (n)	Students
Low Country	8	69	10,540
Midlands	13	140	18,342
Pee Dee	11	129	15,245
Upstate	15	200	38,050
TOTAL	47	538	82,177

Table 2. Number of students and schools participating in South Carolina FitnessGram project by school district and DHEC health district during school year 2015-2016

Region	District	Schools (n)	Students (n)
LOW COUNTRY	Bamberg School District 1	1	48
	Beaufort Co School District	21	3,220
	Charleston Co School District	20	1,877
	Dorchester Co School Dist 2	20	5,010
	Hampton Co School District 1	3	178
	Hampton Co School District 2	1	68
	Jasper Co School District	2	129
	Orangeburg School District 4	1	10
	Total	69	10,540
MIDLANDS	Barnwell School District 45	4	614
	Chester Co School District	4	602
	Clover School District 2	7	640
	Fairfield Co School District	3	168
	Kershaw Co School District	10	1,304
	Lancaster Co School District	15	1,770
	Lexington Co School District	24	3,258
	Newberry Co School District	10	1,232
	Richland Co School District	29	5,325
	Rock Hill School Dist 3	22	2,117
	Saluda Co School District 1	3	327
	Williston School District 29	2	141
	York School District 1	7	844
	Total	140	18,342
PEE DEE	Chesterfield Co School District	13	1,357
	Clarendon School District 1	3	56
	Clarendon School District 3	2	415
	Darlington Co School District	11	988
	Florence School District 1	14	2,147
	Georgetown Co School District	18	2,076
	Horry Co School District	34	4,613
	Marion County School Dist	3	253
	Marlboro Co School District	7	538
	Sumter School District	21	2,605

	Williamsburg Co School District	3	197
	Total	129	15,245
UPSTATE	Abbeville Co School District	2	126
	Anderson School District 1	13	1,940
	Anderson School District 2	6	541
	Anderson School District 3	5	430
	Anderson School District 4	4	479
	Anderson School District 5	9	1,550
	Cherokee Co School District	12	976
	Greenville Co School District	35	16,767
	Greenwood School District 50	13	1,892
	Laurens Co School District 5	9	1,136
	Mccormick Co School District	3	170
	Pickens Co School District	21	2,911
	Spartanburg School District	58	8,149
	Union Co School District	8	803
	Ware Shoals School District	2	180
		Total	200

Appendix B. Summary Tables for FitnessGram Results

Table 1. Summary of South Carolina FitnessGram Scores; Males & Females, School Year 2015-2016

Variable	Total (n=85,810)		Grade							
			2 nd Grade (n=20,224)		5 th Grade (n=32,196)		8 th Grade (n=17,271)		High School (n=16,119)	
	n	Mean, SD	n	Mean, SD	n	Mean, SD	n	Mean, SD	n	Mean, SD
Age (mean, SD)	85,810	11.4 (2.7)	20,224	7.7 (0.5)	32,196	10.7 (0.6)	17,271	13.7 (0.6)	16,119	15.0 (0.9)
Race/Ethnicity (%)	82,444									
American Indian (I)	258	0.3%	84	0.4%	110	0.4%	36	0.2%	28	0.2%
Asian (A)	1,221	1.5%	237	1.2%	507	1.6%	260	1.6%	217	1.4%
Black or African American (B)	24,835	30.1%	6,162	31.8%	8,870	28.6%	4,866	29.1%	4,937	32.1%
Hispanic or Latino (H)	8,027	9.7%	2,046	10.6%	3,019	9.8%	1,648	9.9%	1,314	8.6%
Hawaiian or Pacific Islander (P)	120	0.2%	37	0.2%	48	0.2%	18	0.1%	17	0.1%
White (W)	45,106	54.7%	10,006	51.6%	17,322	55.9%	9,328	55.9%	8,450	55.0%
Other/Unknown (M)	2,794	3.4%	791	4.1%	1,070	3.5%	533	3.2%	400	2.6%
Other/Unknown (?)	83	0.1%	31	0.2%	32	0.1%	14	0.1%	6	0.04%
Height, ft (mean, SD)	69,499	4.9 (0.5)	19,322	4.2 (0.2)	25,697	4.8 (0.3)	12,650	5.4 (0.3)	11,830	5.5 (0.3)
Height, cm (mean, SD)	69,499	148.3 (16.5)	19,322	129.1 (6.9)	25,697	146.6 (8.5)	12,650	163.5 (8.6)	11,830	166.9 (9.1)
Weight, lbs (mean, SD)	69,499	105.2 (43.5)	19,322	66.6 (17.7)	25,697	99.1 (30.5)	12,650	137.1 (37.7)	11,830	147.6 (41.0)
Weight, kg (mean, SD)	69,499	47.7 (19.7)	19,322	30.2 (8.0)	25,697	45.0 (13.8)	12,650	62.2 (17.1)	11,830	66.9 (18.6)
Body Mass Index (FitnessGram)										
BMI (mean, SD)	67,252	20.8 (5.4)	19,322	17.8 (3.7)	24,858	20.6 (5.0)	12,002	23.0 (5.6)	11,070	23.8 (5.9)
% Healthy Fitness Zone	39,771	59.1%	12,203	63.2%	14,039	56.5%	6,904	57.5%	6,629	59.9%
% Needs Improvement	11,315	16.6%	2,936	15.2%	4,289	17.3%	2,123	17.7%	1,783	16.1%
% Needs Improvement – Health Risk	13,686	20.4%	3,366	17.4%	5,487	22.1%	2,569	21.4%	2,264	20.5%
% Very Lean	2,660	4.0%	817	4.2%	1,043	4.2%	406	3.4%	394	3.6%
Body Mass Index (CDC program)										
BMI (mean, SD)	69,500	20.9 (5.5)	19,322	18.0 (3.7)	25,697	20.7 (5.0)	12,650	23.1 (5.6)	11,830	23.9 (6.0)
Normal	42,542	61.2%	12,502	64.7%	15,134	58.9%	7,531	59.5%	7,375	62.3%

Overweight	11,950	17.2%	3,110	16.1%	4,547	17.8%	2,337	18.5%	1,955	16.5%
Obese	15,008	21.6%	3,710	19.2%	6,016	23.4%	2,782	22.0%	2,500	16.7%
Cardiorespiratory Fitness										
Estimated VO ₂ max (mean, SD)	57,800	41.9 (6.4)	--	--	29,269	41.8 (5.1)	15,108	42.2 (7.4)	13,423	41.6 (7.7)
% Healthy Fitness Zone	29,503	51.0%	--	--	15,614	53.4%	7,611	50.4%	6,278	46.8%
% Needs Improvement	13,924	23.1%	--	--	8,749	29.9%	2,837	18.8%	2,338	17.4%
% Needs Improvement – Health Risk	14,275	24.7%	--	--	4,902	16.8%	4,657	30.8%	4,716	35.1%
% Incomplete (missing height/weight)	87	0.2%	--	--	2	0.01%	1	0.01%	84	0.6%
% Incomplete	11	0.02%	--	--	2	0.01%	2	0.01%	7	0.1%
Mile - Estimated VO ₂ max (mean, SD)	2,401	44.0 (6.2)	--	--	559	45.4 (5.4)	324	44.5 (6.2)	1,518	43.4 (6.4)
Pacer - Estimated VO ₂ max (mean, SD)	55,280	41.8 (6.4)	--	--	28,710	41.8 (5.1)	14,763	42.2 (7.4)	11,807	41.3 (7.8)
Walk - Estimated VO ₂ max (mean, SD)	119	43.2 (12.6)	--	--	--	--	21	52.2 (19.8)	98	41.2 (9.6)
Upper Body Strength/Endurance										
Push Ups (mean, SD)	56,498	11.1 (8.5)	--	--	27,604	9.0 (7.2)	14,707	12.6 (7.8)	12,615	12.8 (8.0)
% Healthy Fitness Zone	32,493	58.1%	--	--	15,056	54.5%	9,368	63.7%	7,540	59.8%
% Needs Improvement	23,391	41.8%	--	--	12,525	45.4%	5,323	36.2%	5,054	40.1%
% Incomplete	60	0.1%	--	--	24	0.1%	16	0.1%	20	0.2%
% Exempt	1	0.0%	--	--	0	0.0%	0	0.0%	1	0.01%
Modified Pull Up (mean, SD)	998	4.4 (4.8)	--	--	277	1.5 (2.8)	553	5.6 (4.7)	168	5.2 (5.8)
% Healthy Fitness Zone	378	37.9%	--	--	39	14.1%	271	49.0%	68	40.5%
% Needs Improvement	620	62.1%	--	--	238	85.9%	282	51.0%	100	59.5%
% Incomplete	0	0.0%	--	--	0	0.0%	0	0.0%	0	0.0%
% Exempt	0	0.0%	--	--	0	0.0%	0	0.0%	0	0.0%
Flexed Arm Hang (mean, SD)	1591	6.7 (9.5)	--	--	1,285	6.7 (9.4)	233	6.3 (9.6)	4	14.5 (7.4)
% Healthy Fitness Zone	933	58.6%	--	--	737	57.4%	142	60.9%	4	0.4%
% Needs Improvement	532	33.4%	--	--	431	33.5%	82	35.2%	0	0.0%
% Incomplete	115	7.2%	--	--	106	8.3%	9	3.9%	0	0.0%
% Exempt	11	0.7%	--	--	11	0.9%	0	0.9%	0	0.0%

Upper Body Strength HFZ										
% Healthy Fitness Zone	33,518	49.9%	--	--	15,591	52.0%	9,652	61.2%	7,719	55.3%
% Needs Improvement	23,556	35.1%	--	--	12,737	42.5%	5,289	33.6%	5,033	36.1%
% Incomplete	9,504	14.2%	--	--	1,390	4.6%	656	4.2%	1,059	7.6%
% Exempt	577	0.9%	--	--	267	0.9%	167	1.1%	137	1.0%
Abdominal Strength/Endurance										
Curl Ups (mean, SD)	58,583	27.5 (19.8)	--	--	28,029	22.2 (18.0)	15,855	34.2 (21.1)	13,528	31.7 (18.4)
% Healthy Fitness Zone	41,099	70.2%	--	--	18,132	64.7%	11,836	74.7%	10,325	76.3%
% Needs Improvement	17,419	29.7%	--	--	9,869	35.2%	3,993	25.2%	3,192	23.6%
% Incomplete	64	0.1%	--	--	28	0.1%	26	0.2%	10	0.1%
% Exempt	1	0.0%	--	--	0	0.0%	0	0.0%	1	0.01%
Trunk Extensor Strength										
Trunk Lift (mean, SD)	43,571	10.0 (2.3)	--	--	22,181	9.9 (2.2)	11,208	10.2 (2.2)	9,217	10.3 (2.3)
% Healthy Fitness Zone	33,417	76.7%	--	--	16,533	74.5%	8,748	78.1%	7,253	78.7%
% Needs Improvement	10,111	23.2%	--	--	5,637	25.4%	2,460	22.0%	1,932	21.0%
% Incomplete	43	0.1%	--	--	11	0.1%	0	0.0%	32	0.4%
% Exempt	0	0.0%	--	--	0	0.0%	0	0.0%	0	0.0%
Flexibility										
Sit and Reach, Left (mean, SD)	55,135	9.7 (2.5)	--	--	25,985	9.2 (2.5)	15,095	9.9 (2.6)	12,996	10.3 (2.3)
Sit and Reach, Right (mean, SD)	54,532	9.7 (2.5)	--	--	25,586	9.3 (2.5)	15,004	9.9 (2.5)	12,888	10.4 (2.3)
% Healthy Fitness Zone	38,138	57.3%	--	--	16,632	57.9%	11,272	70.1%	9,457	67.6%
% Needs Improvement	16,162	24.3%	--	--	8,852	30.8%	3,657	22.7%	3,377	24.1%
% Incomplete	11,810	17.8%	--	--	3,027	10.5%	1,057	6.6%	1,069	7.6%
% Exempt	422	0.6%	--	--	218	0.8%	99	0.6%	85	0.6%
Shoulder Stretch										
Shoulder Stretch, Right (mean, SD)	4,265	0.8 (0.4)	--	--	2,744	0.9 (0.3)	377	0.9 (0.3)	1,022	0.8 (0.4)
Shoulder Stretch, Left (mean, SD)	4,280	0.8 (0.4)	--	--	2,752	0.8 (0.4)	379	0.8 (0.4)	1,027	0.8 (0.4)
% Healthy Fitness Zone	3,264	51.5%	--	--	2,132	57.0%	308	59.2%	762	55.1%
% Needs Improvement	998	15.7%	--	--	609	16.3%	69	13.3%	260	18.8%

% Incomplete	2,054	32.4%	--	--	984	26.3%	137	26.4%	355	26.6%
% Exempt	27	0.4%	--	--	14	0.4%	6	1.2%	7	0.5%
Flexibility HFZ										
% Healthy Fitness Zone	993	58.6%	--	--	737	57.4%	142	60.9%	4	100.0%
% Needs Improvement	532	33.4%	--	--	431	33.5%	82	35.2%	0	0.0%
% Incomplete	115	7.2%	--	--	106	8.3%	9	3.9%	0	0.0%
% Exempt	11	0.7%	--	--	11	0.9%	0	0.0%	0	0.0%

Table 2. Summary of South Carolina FitnessGram Scores; Females, School Year 2015-2016

Variable	Total (n=42,092)		Grade							
			2 nd Grade (n=9,990)		5 th Grade (n=15,918)		8 th Grade (n=8,217)		High School (n=7,967)	
	n	Mean, SD	n	Mean, SD	n	Mean, SD	n	Mean, SD	n	Mean, SD
Age (mean, SD)	42,092	11.3 (2.7)	9,990	7.7 (0.5)	15,918	10.6 (0.5)	8,217	13.6 (0.6)	7,967	14.9 (0.9)
Race/Ethnicity (%)										
American Indian (I)	124	0.3%	40	32.3%	55	44.4%	15	12.1%	14	11.3%
Asian (A)	629	1.6%	133	21.1%	260	41.3%	131	20.8%	105	16.7%
Black or African American (B)	12,289	30.4%	3,117	25.4%	4,484	36.5%	2,338	19.0%	2,350	19.1%
Hispanic or Latino (H)	3,832	9.5%	954	10.0%	1,482	9.7%	760	9.6%	636	16.6%
Hawaiian or Pacific Islander (P)	51	0.1%	18	35.3%	20	39.2%	6	11.8%	7	0.1%
White (W)	22,062	54.6%	4,907	22.2%	8,467	38.4%	4,417	20.0%	4,271	19.4%
Other/Unknown (M)	1,417	3.5%	392	27.7%	544	38.4%	275	19.4%	206	14.5%
Other/Unknown (?)	40	0.1%	14	35.0%	16	40.0%	6	0.1%	4	0.1%
Height, ft (mean, SD)	34,166	4.8 (0.5)	9,519	4.2 (0.2)	12,646	4.8 (0.3)	6,120	5.3 (0.2)	5,881	5.3 (0.2)
Height, cm (mean, SD)	34,166	146.9 (14.9)	9,519	128.8 (7.0)	12,646	147.3 (8.7)	6,120	160.3 (6.8)	5,881	161.8 (7.0)
Weight, lbs (mean, SD)	34,166	104.4 (41.7)	9,519	66.7 (18.2)	12,646	101.3 (31.5)	6,120	134.8 (36.3)	5,881	140.6 (38.3)
Weight, kg (mean, SD)	34,166	47.4 (18.9)	9,519	30.3 (8.3)	12,646	45.9 (14.2)	6,120	61.1 (16.5)	5,881	63.8 (17.4)
Body Mass Index (FitnessGram)										
BMI (mean, SD)	33,072	21.0 (5.6)	9,519	17.9 (3.8)	12,646	20.8 (5.1)	6,120	23.6 (5.9)	5,881	24.2 (6.1)
% Healthy Fitness Zone	19,430	58.8%	5,922	62.2%	6,959	56.9%	3,258	56.0%	3,291	59.7%
% Needs Improvement	5,837	17.7%	1,500	15.8%	2,192	17.9%	1,161	20.0%	984	17.9%
% Needs Improvement – Health Risk	6666	20.2%	1,685	17.7%	2,626	21.5%	1,257	21.6%	1,098	19.9%
% Very Lean	1,139	3.4%	412	4.3%	488	3.7%	142	2.4%	137	2.5%
Body Mass Index (CDC program)										
BMI (mean, SD)	34,166	21.2 (5.7)	9,519	18.1 (3.8)	12,646	20.9 (5.2)	6,120	23.7 (5.9)	5,881	24.3 (6.1)
Normal	20,622	60.4%	6,098	64.1%	7,432	58.8%	3,496	57.1%	3,596	61.2%

Overweight	6,218	18.2%	1,563	16.4%	2,329	18.4%	1,265	20.7%	1,061	18.0%
Obese	7,326	21.4%	1,858	19.5%	2,885	22.8%	1,359	22.2%	1,224	20.8%
Cardiorespiratory Fitness										
Estimated VO ₂ max (mean, SD)	28,026	39.9 (5.0)	--	--	14,377	40.7 (4.2)	7,097	39.6 (5.8)	6,552	38.4 (5.5)
% Healthy Fitness Zone	12,034	42.9%	--	--	6,553	45.6%	2,924	41.2%	2,557	39.0%
% Needs Improvement	8,400	30.0%	--	--	5,155	35.9%	1,802	26.4%	1,443	22.0%
% Needs Improvement – Health Risk	7,551	26.9%	--	--	2,666	18.5%	2,368	33.4%	2,517	38.4%
% Incomplete (missing height/weight)	35	0.1%	--	--	2	0.1%	1	0.0%	32	0.5%
% Incomplete	6	0.0%	--	--	1	0.0%	2	0.0%	3	0.1%
Mile - Estimated VO ₂ max (mean, SD)	1,009	40.8 (4.9)	--	--	225	43.0 (4.40)	131	40.8 (5.2)	653	40.0 (4.7)
Pacer - Estimated VO ₂ max (mean, SD)	26,954	39.9 (5.0)	--	--	14,152	40.7 (4.2)	6,956	39.6 (5.7)	5,846	38.2 (5.6)
Walk - Estimated VO ₂ max (mean, SD)	63	38.0 (10.1)	--	--	131	40.8 (5.2)	10	41.0 (4.7)	53	37.6 (6.4)
Upper Body Strength/Endurance										
Push Ups (mean, SD)	27,503	8.5 (6.7)	--	--	13,645	7.5 (6.5)	6,968	9.9 (6.8)	6,403	9.5 (6.7)
% Healthy Fitness Zone	15,514	56.4%	--	--	6,554	48.0%	4,617	66.3%	4,133	64.6%
% Needs Improvement	11,959	43.5%	--	--	7,082	51.9%	2,344	33.6%	2,256	35.2%
% Incomplete	30	0.1%	--	--	9	0.1%	7	0.1%	14	0.2%
Modified Pull Up (mean, SD)	482	2.8 (3.4)	--	--	141	1.2 (2.3)	244	3.6 (3.9)	97	3.1 (2.7)
% Healthy Fitness Zone	182	37.8%	--	--	22	15.6%	112	45.9%	48	49.5%
% Needs Improvement	300	62.2%	--	--	119	84.4%	132	54.1%	49	50.5%
Flexed Arm Hang (mean, SD)	764	5.1 (8.2)	--	--	634	5.3 (8.3)	98	3.2 (6.8)	1	15.0 (-)
% Healthy Fitness Zone	477	62.4%	--	--	385	60.7%	66	67.4%	1	0.0%
% Needs Improvement	230	30.1%	--	--	194	30.6%	30	30.6%	0	0.0%
% Incomplete	51	6.7%	--	--	49	7.7%	2	2.0%	0	0.0%
% Exempt	6	0.8%	--	--	6	1.0%	0	0.0%	0	0.0%
Upper Body Strength HFZ										

% Healthy Fitness Zone	15,861	48.3%	--	--	6,771	45.7%	4,697	62.8%	4,173	60.4%
% Needs Improvement	12,057	36.7%	--	--	7,207	48.6%	2,329	31.1%	2,238	32.4%
% Incomplete	4,625	14.1%	--	--	705	4.8%	366	4.9%	424	6.1%
% Exempt	308	0.9%	--	--	142	1.0%	92	1.2%	74	1.1%
Abdominal Strength/Endurance										
Curl Ups (mean, SD)	28,638	24.6 (18.4)	--	--	13,820	21.0 (17.4)	7,515	29.1 (19.5)	6,742	27.6 (17.3)
% Healthy Fitness Zone	19,589	68.4%	--	--	8,670	62.7%	5,450	72.5%	5,080	75.4%
% Needs Improvement	9,014	31.5%	--	--	5,139	37.2%	2,048	27.3%	1,655	25.6%
% Incomplete	35	0.1%	--	--	11	0.1%	17	0.2%	7	0.1%
Trunk Extensor Strength										
Trunk Lift (mean, SD)	21,388	10.2 (2.2)	--	--	10,916	10.1 (2.2)	5,248	10.3 (2.2)	4,742	10.4 (2.2)
% Healthy Fitness Zone	16,955	79.3%	--	--	8,469	77.6%	4,210	80.2%	3,831	80.8%
% Needs Improvement	4,406	20.6%	--	--	2,442	22.4%	1,038	19.8%	889	18.8%
% Incomplete	27	0.1%	--	--	5	0.1%	0	0.0%	22	0.5%
Flexibility										
Sit and Reach, Left (mean, SD)	27,030	10.4 (2.2)	--	--	12,848	10.0 (2.2)	7,179	10.8 (2.1)	6,485	10.9 (1.9)
Sit and Reach, Right (mean, SD)	26,736	10.5 (2.1)	--	--	12,647	10.0 (2.2)	7,138	10.8 (2.0)	6,435	11.0 (1.9)
% Healthy Fitness Zone	18,610	57.2%	--	--	8,341	58.9%	5,501	72.0%	4,378	63.2%
% Needs Improvement	8,005	24.6%	--	--	4,254	30.0%	1,600	20.9%	2,025	29.2%
% Incomplete	5,711	17.6%	--	--	1,469	10.4%	494	6.5%	487	7.0%
% Exempt	198	0.6%	--	--	105	0.7%	49	0.6%	37	0.5%
Shoulder Stretch, Right (mean, SD)										
Shoulder Stretch, Right (mean, SD)	2,091	0.9 (0.3)	--	--	1,353	0.9 (0.3)	191	0.9 (0.3)	477	0.9 (0.3)
Shoulder Stretch, Left (mean, SD)										
Shoulder Stretch, Left (mean, SD)	2,098	0.9 (0.3)	--	--	1,357	0.9 (0.3)	191	0.9 (0.3)	480	0.9 (0.4)
% Healthy Fitness Zone	1,709	57.4%	--	--	1,124	61.0%	158	55.4%	383	57.2%
% Needs Improvement	380	12.1%	--	--	227	12.3%	33	11.6%	94	14.0%
% Incomplete	1,036	33.0%	--	--	484	26.3%	88	30.9%	190	28.4%
% Exempt	18	0.6%	--	--	9	0.5%	6	2.1%	3	0.5%

Flexibility HFZ										
% Healthy Fitness Zone	477	62.4%	--	--	385	60.7%	66	67.4%	1	100.0%
% Needs Improvement	230	30.1%	--	--	194	30.6%	30	30.6%	0	0.0%
% Incomplete	51	6.7%	--	--	49	7.7%	2	2.0%	0	0.0%
% Exempt	6	0.8%	--	--	6	1.0%	0	0.0%	0	0.0%

Table 3. Summary of South Carolina FitnessGram Scores; Males, School Year 2015-2016

Variable	Total (n=43,718)		Grade							
			2 nd Grade (n=10,234)		5 th Grade (n=16,278)		8 th Grade (n=9,054)		High School (n=8,152)	
	n	Mean, SD	n	Mean, SD	n	Mean, SD	n	Mean, SD	n	Mean, SD
Age (mean, SD)	43,718	11.4 (2.7)	10,234	7.8 (0.5)	16,278	10.7 (0.6)	9,054	13.7 (0.6)	8,152	15.1 (1.0)
Race/Ethnicity (%)										
American Indian (I)	134	0.3%	44	32.8%	55	41.0%	21	15.7%	14	10.5%
Asian (A)	592	1.4%	104	17.6%	247	41.7%	129	21.8%	112	18.9%
Black or African American (B)	12,546	29.9%	3,045	17.8%	4,386	28.0%	2,528	20.2%	2,587	20.6%
Hispanic or Latino (H)	4,195	10.0%	1,092	24.3%	1,537	36.6%	888	21.2%	678	16.2%
Hawaiian or Pacific Islander (P)	69	0.2%	19	27.5%	28	40.6%	12	17.4%	10	14.5%
White (W)	23,044	54.9%	5,099	22.1%	8,855	38.4%	4,911	21.3%	4,179	18.1%
Other/Unknown (M)	1,377	3.3%	399	29.0%	526	38.2%	258	18.7%	194	14.1%
Other/Unknown (?)	43	0.1%	17	39.5%	16	37.2%	8	18.6%	2	4.7%
Height, ft (mean, SD)	35,333	4.9 (0.6)	9,803	4.2 (0.2)	13,051	4.8 (0.3)	6,530	5.5 (0.3)	5,949	5.6 (0.3)
Height, cm (mean, SD)	35,333	149.6 (17.8)	9,803	129.5 (6.8)	13,051	146.0 (8.2)	6,530	166.5 (9.0)	5,949	171.9 (9.0)
Weight, lbs (mean, SD)	35,333	106.1 (45.2)	9,803	66.5 (17.2)	13,051	97.0 (29.4)	6,530	139.3 (38.7)	5,949	154.5 (42.4)
Weight, kg (mean, SD)	35,333	48.1 (20.5)	9,803	30.2 (7.8)	13,051	44.0 (13.3)	6,530	63.2 (17.6)	5,949	70.1 (19.2)
Body Mass Index (FitnessGram)										
BMI (mean, SD)	34,180	20.5 (5.3)	9,803	17.7 (3.6)	12,633	20.3 (4.9)	6,184	22.5 (5.4)	5,560	23.5 (5.8)
% Healthy Fitness Zone	1,521	59.5%	6,281	64.1%	7,080	56.0%	3,646	59.0%	3,338	60.0%
% Needs Improvement	20,345	15.5%	1,436	14.6%	2,097	16.6%	962	15.6%	799	14.4%
% Needs Improvement – Health Risk	5,294	20.5%	1,681	17.2%	2,861	22.7%	1,312	21.2%	1,166	21.0%
% Very Lean	7,020	4.5%	405	4.1%	595	4.7%	264	4.3%	257	4.6%
Body Mass Index (CDC program)										
BMI (mean, SD)	35,333	20.6 (5.3)	9,803	17.8 (3.6)	13,051	20.4 (4.9)	6,530	22.6 (5.4)	5,949	23.6 (5.8)
Normal	21,920	62.0%	6,404	65.3%	7,702	59.0%	4,035	61.8%	3,779	63.5%

Overweight	5,731	16.2%	1,547	15.8%	2,218	17.0%	1,072	16.4%	894	15.0%
Obese	7,682	21.7%	1,852	18.9%	3,131	24.0%	1,423	21.8%	1,276	21.5%
Cardiorespiratory Fitness										
Estimated VO ₂ max (mean, SD)	29,774	43.7 (7.0)	--	--	14,892	42.9 (5.7)	8,011	44.6 (7.9)	6,871	44.6 (8.2)
% Healthy Fitness Zone	17,469	58.7%	--	--	9,061	60.8%	4,687	58.5%	3,721	54.2%
% Needs Improvement	895	18.6%	--	--	3,594	24.1%	1,035	12.9%	895	13.0%
% Needs Improvement – Health Risk	6,724	32.0%	--	--	2,236	15.0%	2,289	28.6%	2,199	32.0%
% Incomplete (missing height/weight)	52	0.8%	--	--	0	0.0%	0	0.0%	52	0.8%
% Incomplete	5	0.1%	--	--	1	0.0%	0	0.0%	4	0.1%
Mile - Estimated VO ₂ max (mean, SD)	1,392	46.4 (6.0)	--	--	334	47.0 (5.5)	193	46.9 (5.6)	865	46.0 (6.3)
Pacer - Estimated VO ₂ max (mean, SD)	28,582	43.6 (7.0)	--	--	14,569	42.8 (5.7)	7,807	44.5 (7.9)	5,961	44.4 (8.4)
Walk - Estimated VO ₂ max (mean, SD)	56	48.7 (13.0)	--	--	0	--	11	62.1 (12.6)	45	45.5 (10.9)
Upper Body Strength/Endurance										
Push Ups (mean, SD)	28,442	12.9 (8.1)	--	--	13,959	10.4 (7.6)	7,739	15.0 (7.7)	6,212	16.2 (7.7)
% Healthy Fitness Zone	16,979	59.7%	--	--	8,502	60.9%	4,751	61.4%	3,407	54.9%
% Needs Improvement	11,432	40.2%	--	--	5,442	39.0%	2,979	38.5%	2,798	45.0%
% Incomplete	30	0.1%	--	--	15	0.1%	9	0.1%	6	0.1%
% Exempt	1	0.0%	--	--	0	0.0%	0	0.0%	1	0.0%
Modified Pull Up (mean, SD)	516	5.9 (5.4)	--	--	136	1.9 (3.2)	309	7.1 (4.7)	71	8.2 (7.4)
% Healthy Fitness Zone	196	38.0%	--	--	17	12.5%	159	51.5%	20	28.2%
% Needs Improvement	320	62.0%	--	--	119	87.5%	150	48.5%	51	71.8%
Flexed Arm Hang (mean, SD)	827	8.1 (10.3)	--	--	651	8.1 (10.2)	135	8.6 (10.6)	3	14.3 (9.1)
% Healthy Fitness Zone	456	55.1%	--	--	13	4.3%	0	0.0%	0	0.0%
% Needs Improvement	302	36.5%	--	--	237	78.5%	57	89.1%	5	100.0%
% Incomplete	64	7.7%	--	--	52	17.2%	7	10.9%	0	0.0%
% Exempt	5	0.6%	--	--	0	0.0%	0	0.0%	0	0.0%
Upper Body Strength HFZ										

% Healthy Fitness Zone	17,657	51.5%	--	--	8,820	58.2%	4,955	59.8%	3,546	50.4%
% Needs Improvement	11,499	33.5%	--	--	5,530	36.5%	2,960	35.8%	2,795	39.7%
% Incomplete	4,879	14.2%	--	--	685	4.5%	290	3.5%	635	9.0%
% Exempt	269	0.8%	--	--	125	0.8%	75	0.9%	63	0.9%
Abdominal Strength/Endurance										
Curl Ups (mean, SD)	29,945	30.3 (20.6)	--	--	14,209	23.4 (18.5)	8,340	38.8 (21.4)	6,786	35.7 (18.6)
% Healthy Fitness Zone	21,510	71.8%	--	--	9,462	66.6%	6,386	76.6%	5,245	77.3%
% Needs Improvement	8,405	28.1%	--	--	4,730	33.3%	1,945	23.3%	1,537	5.1%
% Incomplete	29	0.1%	--	--	17	0.1%	9	0.1%	3	0.0%
% Exempt	1	0.0%	--	--	0	0.0%	0	0.0%	1	0.0%
Trunk Extensor Strength										
Trunk Lift (mean, SD)	22,183	9.9 (2.3)	--	--	11,265	9.7 (2.3)	5,960	10.1 (2.3)	4,475	10.1 (2.3)
% Healthy Fitness Zone	16,462	74.2%	--	--	8,064	71.6%	4,538	76.1%	3,422	76.5%
% Needs Improvement	5,705	25.7%	--	--	3,195	28.4%	1,422	23.9%	1,043	23.3%
% Incomplete	16	0.1%	--	--	6	0.1%	0	0.0%	10	0.2%
Flexibility										
Sit and Reach, Left (mean, SD)	28,105	9.0 (2.6)	--	--	13,137	8.5 (2.5)	7,916	9.1 (2.7)	6,511	9.7 (2.4)
Sit and Reach, Right (mean, SD)	27,796	9.0 (2.6)	--	--	12,939	8.6 (2.5)	7,866	9.2 (2.7)	6,453	9.7 (2.5)
% Healthy Fitness Zone	19,528	57.4%	--	--	8,291	56.9%	5,771	68.4%	5,079	71.9%
% Needs Improvement	8,157	24.0%	--	--	4,598	31.6%	2,057	24.4%	1,352	19.2%
% Incomplete	6,099	17.9%	--	--	1,558	10.7%	563	6.7%	582	8.2%
% Exempt	224	0.7%	--	--	113	0.8%	50	0.6%	48	0.7%
Shoulder Stretch, Right (mean, SD)	2,174	0.8 (0.4)	--	--	1,391	0.8 (0.4)	186	0.9 (0.3)	545	0.8 (0.4)
Shoulder Stretch, Left (mean, SD)	2,182	0.8 (0.4)	--	--	1,395	0.8 (0.4)	188	0.8 (0.4)	547	0.8 (0.4)
% Healthy Fitness Zone	1,555	48.6%	--	--	1,008	53.2%	150	63.8%	379	53.1%
% Needs Improvement	618	19.3%	--	--	382	20.2%	36	15.3%	166	23.3%
% Incomplete	1,018	31.8%	--	--	500	26.4%	49	20.9%	165	23.1%
% Exempt	9	0.3%	--	--	5	0.3%	0	0.0%	4	0.6%

Flexibility HFZ										
% Healthy Fitness Zone	456	55.1%	--	--	352	54.1%	76	56.3%	3	100.0%
% Needs Improvement	302	36.5%	--	--	237	36.4%	52	38.5%	0	0.0%
% Incomplete	64	7.7%	--	--	57	8.8%	7	5.2%	0	0.0%
% Exempt	5	0.6%	--	--	5	0.8%	0	0.0%	0	0.0%

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	* * * * * *	* * * * * *
BMI HFZ by grade	2/5 2/8 2/9 5/8 5/9 8/9	* * * NS * *	* * * * * NS
BMI by Race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	* * * * * NS	* * * * * NS
BMI HFZ by Race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	NS * * * * *	* NS * * * NS
BMI by region	LC/M LC/PD LC/UPS M/PD M/UPS PD/UPS	* * * NS NS NS	* * * NS NS *
BMI HFZ by region	LC/M LC/PD LC/UPS M/PD M/UPS PD/UPS	* * * NS * *	* * * * NS *

HFZ=Health Fitness Zone; LC=Low Country; M=Midlands; PD=Pee Dee; UPS=Up State

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 * NS NS *
CRF HFZ by Race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	* * * * * NS	* * * NS NS NS
CRF by region	LC/M LC/PD LC/UPS M/PD M/UPS PD/UPS	* * * * NS NS	* * * * NS *
CRF HFZ by region	LC/M LC/PD LC/UPS M/PD M/UPS PD/UPS	* * * * NS NS	* * * NS NS *

HFZ=Health Fitness Zone; LC=Low Country; M=Midlands; PD=Pee Dee; UPS=Up State

Table 3. Upper Body Strength- 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	*	*
HFZ by grade	5/8	*	NS
	5/9	*	*
	8/9	*	*
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	*	*
	Black / White	*	*
	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 region	LC/M	NS	*
	LC/PD	*	*
	LC/UPS	*	*
	M/PD	*	*
	M/UPS	*	*
	PD/UPS	*	*
Pushup HFZ by region	LC/M	NS	NS
	LC/PD	*	*
	LC/UPS	*	NS
	M/PD	*	*
	M/UPS	*	NS
	PD/UPS	*	*

HFZ=Health Fitness Zone; LC=Low Country; M=Midlands; PD=Pee Dee; UPS=Up State

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
HFZ by grade	5/8 5/9 8/9	* * NS	* * NS
By Weight status	Normal/Overweight Normal/Obese Overweight/Obese	NS * NS	* * NS
HFZ by Weight status	Normal/Overweight Normal/Obese Overweight/Obese	* * NS	* * NS
By race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	* * * * * *	* * * * * NS
HFZ by race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	* * * * * *	* * * * * NS
By region	LC/M LC/PD LC/UPS M/PD M/UPS PD/UPS	* * * * * *	* * NS * * *
HFZ by region	LC/M LC/PD LC/UPS M/PD M/UPS PD/UPS	* * * * * NS	* * * * * NS

HFZ=Health Fitness Zone; LC=Low Country; M=Midlands; PD=Pee Dee; UPS=Up State

Table 5. Flexibility – 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	*		*	
		L	R	L	R
By Weight status	Normal/Overweight	NS	NS	*	*
	Normal/Obese	*	*	*	*
	Overweight/Obese	*	*	*	*
HFZ by Weight status	Normal/Overweight	NS		*	
	Normal/Obese	*		*	
	Overweight/Obese	*		*	
		L	R	L	R
By race	Black/Hispanic	*	*	NS	NS
	Black/ Other	*	*	NS	NS
	Black / White	*	*	*	*
	Hispanic / Other	*	*	NS	NS
	Hispanic/White	*	*	NS	NS
	Other/White	NS	NS	*	*
HFZ by race	Black/Hispanic	NS		NS	
	Black/ Other	*		NS	
	Black / White	*		*	
	Hispanic / Other	*		NS	
	Hispanic/White	*		*	
	Other/White	NS		*	
		L	R	L	R
By region	LC/M	*	*	*	*
	LC/PD	*	*	*	*
	LC/UPS	*	*	*	*
	M/PD	*	NS	*	*
	M/UPS	*	*	*	*
	PD/UPS	*	*	NS	NS
HFZ by region	LC/M	*		*	
	LC/PD	*		*	
	LC/UPS	*		*	
	M/PD	NS		NS	
	M/UPS	*		*	
	PD/UPS	*		*	

HFZ=Health Fitness Zone; LC=Low Country; M=Midlands; PD=Pee Dee; UPS=Up State; 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
BMI 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	* * *	* * *
BMI by Race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	* * * * * NS	NS * * * * NS
HFZ by Race	Black/Hispanic Black/ Other Black / White Hispanic / Other Hispanic/White Other/White	* * * * * NS	NS * * * * NS
BMI by region	LC/M LC/PD LC/UPS M/PD M/UPS PD/UPS	* * * NS * *	NS * * * * *
HFZ by region	LC/M LC/PD LC/UPS M/PD M/UPS PD/UPS	* * NS NS * *	* * NS NS * *

HFZ=Health Fitness Zone; LC=Low Country; M=Midlands; PD=Pee Dee; UPS=Up State;

Appendix D. Summary Tables for FitnessGram and Academic Results

Table 1. Associations between cardiorespiratory fitness and English language arts academic test performance among 5th grade students in South Carolina, School Year 2015-2016.

Sample	Cardiorespiratory Fitness Healthy Fitness Zone Category	Academic Performance Category			
		Does Not Meet	Approaches	Meets	Exceeds
Overall n=28928	Healthy Fitness Zone 15462/ 53.5%	2619 /16.9%	5215 /33.7%	4886 /31.6%	2742/ 17.7%
	Needs Improvement 8648/ 29.9%	1836/ 21.2%	3134 /36.2%	2593/30.0%	1085/ 12.6%
	Needs Improvement – Health Risk 4818/ 16.7%	1438/29.9%	1794 /37.2%	1192/24.7%	394 / 8.2%
Gender					
Females n=14218	Healthy Fitness Zone 6487 /45.6%	793 / 12.2%	2088/ 32.2%	2195 / 33.8%	1411 / 21.8%
	Needs Improvement 5101 / 35.9%	867 / 17.0%	1832 / 35.9%	1663 / 32.6%	739 / 15.5%
	Needs Improvement – Health Risk 2630/ 18.5%	637 / 24.2%	1042 / 39.6%	705 / 26.8%	246 / 9.4%
Males n=14710	Healthy Fitness Zone 8975 /61.01	1826 / 20.4%	3127 / 34.8%	2691 / 30.0%	1331 / 14.8%
	Needs Improvement 3547/ 24.1%	969 / 27.3%	1302 / 36.7%	930 / 26.2%	346 / 9.8%
	Needs Improvement – Health Risk 2188/ 14.9%	801 / 36.6%	752 / 34.4%	487 / 22.2%	148 /6.8%
Race/Ethnicity					
Non-Hispanic White n=15752	Healthy Fitness Zone 8872/56.3%	885/10.0%	2635/29.7%	3258/36.7%	2094/23.6%
	Needs Improvement 4554/28.9%	634/13.9%	1520/33.4%	1618/35.5%	782/17.2%
	Needs Improvement – Health Risk 2326/14.8%	486/20.9%	828/35.6%	722/31.0%	290/12.5%

Non-Hispanic Black n=7860	Healthy Fitness Zone 3711/47.2%	1205/32.5%	1539/41.5%	789/21.3%	178/4.8%
	Needs Improvement 2440/31.0%	814/33.4%	1010/41.4%	516/21.2%	100/4.1%
	Needs Improvement – Health Risk 1709/21.7%	713/41.7%	676/39.6%	282/16.5%	38/2.2%
Hispanic n=2739	Healthy Fitness Zone 1436/52.4%	353/24.6%	573/39.9%	375/26.1%	135/9.4%
	Needs Improvement 879/32.1%	250/28.4%	357/40.6%	201/22.9%	71/8.1%
	Needs Improvement – Health Risk 424/14/5%	146/34.4%	167/39.4%	87/20.5%	24/5.7%
Other n=1594	Healthy Fitness Zone 876/55.0%	109/12.4%	304/34.7%	274/31.3%	189/21.6%
	Needs Improvement 489/30.7%	92/18.8%	159/32.5%	151/30.9%	87/17.8%
	Needs Improvement – Health Risk 229/14.4%	58/25.3%	82/35.8%	65/28.4%	24/10.5%
Health District					
Low Country n=3778	Healthy Fitness Zone 2309/61.1%	273/11.8%	571/24.7%	840/36.4%	625/27.1%
	Needs Improvement 945/25.0%	142/15.0%	328/34.7%	316/33.4%	159/16.8%
	Needs Improvement – Health Risk 524/13.9%	135/25.8%	199/38.0%	133/25.4%	57/10.9%
Midlands n=6894	Healthy Fitness Zone 3510/50.9%	639/18.2%	1233/35.1%	1069/30.5%	569/16.2%
	Needs Improvement 2159/31.4%	477/22.1%	801/37.1%	645/29.9%	236/10.9%
	Needs Improvement – Health Risk 1225/17.8%	376/30.7%	434/35.4%	323/26.4%	92/7.5%
Pee Dee n=5519	Healthy Fitness Zone 3035/55.0%	626/20.6%	1130/37.2%	880/29.0%	399/13.2%
	Needs Improvement 1515/27.5%	395/26.1%	558/36.8%	395/26.1%	167/11.0%

	Needs Improvement – Health Risk 969/17.6%	335/34.6%	366/37.8%	197/20.3%	71/7.3%
Upstate n=10522	Healthy Fitness Zone 5397/51.3%	872/16.2%	1875/34.7%	1708/31.7%	942/17.5%
	Needs Improvement 3353/31.9%	679/20.3%	1190/35.5%	1042/31.1%	442/13.2%
	Needs Improvement – Health Risk 1772/16.8%	495/27.3%	663/37.4%	460/26.0%	154/8.7%

Table 2. Associations between cardiorespiratory fitness and mathematics academic test performance among 5th grade students in South Carolina, School Year 2015-2016.

Sample	Cardiorespiratory Fitness Healthy Fitness Zone Category	Academic Performance Category			
		Does Not Meet	Approaches	Meets	Exceeds
Overall n=28978	Healthy Fitness Zone 15486/53.4%	2307/14.9%	4646/30.0%	4503/29.1%	4030/26.0%
	Needs Improvement 8668/29.9%	1713/19.8%	2999/34.6%	2355/27.2%	1601/18.5%
	Needs Improvement – Health Risk 4824/16.7%	1367/28.3%	1743/36.1%	1110/23.0%	604/12.5%
Gender					
Females n=14237	Healthy Fitness Zone 6498/45.6%	822/12.7%	1980/30.5%	2063/31.8%	1633/25.1%
	Needs Improvement 5108/35.9%	917/18.0%	1773/34.7%	1501/29.4%	917/18.0%
	Needs Improvement – Health Risk 2631/18.5%	655/24.9%	1028/39.1%	636/24.2%	312/11.9%
Males n=14741	Healthy Fitness Zone 8988/61.0%	1485/16.5%	2666/27.2%	2440/27.2%	2397/26.7%
	Needs Improvement 3560/24.1%	796/22.4%	1226/34.4%	854/24.0%	684/19.2%
	Needs Improvement – Health Risk 2193/14.9%	712/32.5%	715/32.6%	474/21.6%	292/13.3%
Race/Ethnicity					
Non-Hispanic White N=15755	Healthy Fitness Zone 8843/56.3%	784/8.8%	2261/25.5%	2822/31.8%	3006/33.9%
	Needs Improvement 4555/28.9%	603/13.2%	1382/30.3%	1421/31.2%	1149/25.2%
	Needs Improvement – Health Risk 2327/14.8%	452/19.4%	795/34.2%	646/27.8%	434/18.7%
Non-Hispanic Black n=7862	Healthy Fitness Zone 3711/47.2%	1075/29.0%	1480/39.9%	834/22.5%	322/8.7%
	Needs Improvement 2442/31.1%	788/32.3%	1013/41.5%	508/20.8%	133/5.5%

	Needs Improvement – Health Risk 1709/21.7%	698/40.8%	651/38.1%	288/16.9%	72/4.2%
Hispanic n=2739	Healthy Fitness Zone 1436/52.4%	276/19.2%	503/35.0%	427/29.7%	230/16.0%
	Needs Improvement 880/32.1%	191/21.7%	348/39.6%	221/25.1%	120/13.6%
	Needs Improvement – Health Risk 423/15.4%	120/28.4%	172/40.7%	92/21.8%	39/9.2%
Other n=1595	Healthy Fitness Zone 876/54.9%	94/10.7%	252/28.8%	248/28.3%	282/32.2%
	Needs Improvement 490/30.7%	77/15.7%	155/31.6%	116/23.7%	142/29.0%
	Needs Improvement – Health Risk 229/14/4%	60/26.2%	77/33.6%	51/22.3%	41/17.9%
Health District					
Low Country n=3782	Healthy Fitness Zone 2312/61.1%	229/9.9%	531/23.0%	682/29.5%	870/37.6%
	Needs Improvement 946/25.0%	156/16.5%	291/30.8%	270/28.5%	229/24.2%
	Needs Improvement – Health Risk 524/13.9%	150/28/6%	177/33.8%	118/22.5%	79/15.1%
Midlands n=6904	Healthy Fitness Zone 3516/50.9%	576/16.4%	1079/30.7%	999/28.4%	862/24.5%
	Needs Improvement 2162/31.3%	441/20.4%	751/34.7%	614/28.4%	356/16.5%
	Needs Improvement – Health Risk 1226/17.8%	325/26.5%	449/36.6%	296/24.1%	156/12/7%
Pee Dee n=5527	Healthy Fitness Zone 3039/55.0%	525/17.3%	1004/33.0%	897/25.5%	613/20.2%
	Needs Improvement 1515/27.5%	322/21.2%	592/39.0%	347/22.9%	257/16.9%
	Needs Improvement – Health Risk 970/17.6%	312/32.2%	346/35.7%	202/20.8%	110/11.3%
Upstate n=10540	Healthy Fitness Zone 5405/51.3%	775/14.3%	1667/30.8%	1591/29.4%	1372/25.4%

	Needs Improvement 3361/31.9%	630/18.7%	1131/33.7%	944/28.1%	656/19.5%
	Needs Improvement – Health Risk 1774/16.8%	470/26.5%	639/36.0%	433/24.4%	232/13.1%

Table 3. Associations between weight status and English language arts academic test performance among 5th grade students in South Carolina, School Year 2015-2016.

Sample	Weight Status Healthy Fitness Zone Category	Academic Performance Category			
		Does Not Meet	Approaches	Meets	Exceeds
Overall n=23554	Healthy Fitness Zone 13879/58.9%	2635/19.9%	4743/34.2%	4243/30.6%	2258/16.3%
	Needs Improvement 4246/18.0%	888/20.9%	1569/37.0%	1268/29.9%	521/12.3%
	Needs Improvement – Health Risk 5429/23.1%	1316/24.2%	2098/38.6%	1477/27.2%	538/9.9%
Gender					
Females n=11653	Healthy Fitness Zone 6889/59.1%	1026/15.9%	2317/33.6%	2252/32.7%	1294/18.8%
	Needs Improvement 2168/18.6%	369/17.0%	799/36.9%	704/32.5%	296/13.7%
	Needs Improvement – Health Risk 2596/22.3%	528/20.3%	1052/40.5%	737/28.4%	279/10.8%
Males n=11901	Healthy Fitness Zone 6990/58.7%	1609/23.0%	2426/34.7%	1991/28.5%	964/13.8%
	Needs Improvement 2078/17.5%	519/25.0%	770/37.1%	564/27.1%	225/10.8%
	Needs Improvement – Health Risk 2833/23.8%	788/27.8%	1046/36.9%	740/26.1%	259/9.1%
Race/Ethnicity					
Non-Hispanic White n=12539	Healthy Fitness Zone 7906/63.1%	930/11.8%	2419/30.6%	2845/36.0%	1712/21.7%
	Needs Improvement 2195/17.5%	295/13.4%	731/33.3%	786/35.8%	383/17.5%
	Needs Improvement – Health Risk 2438/19.4%	346/14.2%	893/36.6%	832/34.1%	367/15.1%
Non-Hispanic Black n=6640	Healthy Fitness Zone 3548/53.4%	1230/34.7%	1464/41.3%	707/19.9%	147/4.1%
	Needs Improvement 1210/18.2%	407/33.6%	503/41.6%	253/20.9%	47/3.9%

	Needs Improvement – Health Risk 1882/28.3%	671/35.7%	768/40.8%	364/19.3%	79/4.2%
Hispanic n=2279	Healthy Fitness Zone 1098/48.2%	295/26.9%	434/39.5%	262/23.9%	107/9.7%
	Needs Improvement 486/21.3%	125/25.7%	207/42.6%	116/23.9%	38/7.8%
	Needs Improvement – Health Risk 695/30.5%	209/30.1%	286/41.2%	159/22.9%	41/5.9%
Other n=1297	Healthy Fitness Zone 801/61.8%	113/14.1%	276/34.5%	242/30.2%	170/21.1%
	Needs Improvement 206/15.9%	34/16.5%	80/38.8%	66/32.0%	26/12.6%
	Needs Improvement – Health Risk 290/22.4%	62/21.4%	109/37.6%	83/28.6%	36/12.4%
Health District					
Low Country n=3301	Healthy Fitness Zone 2144/65.0%	284/13.3%	575/26.8%	757/35.3%	528/24.6%
	Needs Improvement 586/17.8%	105/17.9%	191/32.6%	190/32.4%	100/17.1%
	Needs Improvement – Health Risk 571/17.3%	107/18.7%	223/39.1%	173/30.3%	68/11.9%
Midlands n=5058	Healthy Fitness Zone 2954/58.4%	599/20.3%	1082/36.6%	867/29.4%	406/13.7%
	Needs Improvement 944/18.7%	212/22.5%	365/38.7%	255/27.0%	112/11.9%
	Needs Improvement – Health Risk 1160/22.9%	305/26.3%	420/36.2%	337/29.1%	98/8.5%
Pee Dee n=5020	Healthy Fitness Zone 2769/55.2%	663/23.9%	1018/36.8%	761/27.5%	327/11.8%
	Needs Improvement 908/18.1%	236/26.0%	348/38.3%	235/25.9%	89/9.8%
	Needs Improvement – Health Risk 1343/26.8%	377/28.1%	534/39.8%	313/23.3%	119/8.9%
Upstate n=9143	Healthy Fitness Zone 5429/59.4%	961/17.7%	1861/34.3%	1681/31.0%	926/17.1%

	Needs Improvement 1622/17.7%	298/18.4%	588/36.3%	528/32.6%	208/12.8%
	Needs Improvement – Health Risk 2092/22.9%	463/22.1%	811/38.8%	586/28.0%	232/11.1%

Table 4. Associations between weight status and mathematics academic test performance among 5th grade students in South Carolina, School Year 2015-2016.

Sample	Weight Status Healthy Fitness Zone Category	Academic Performance Category			
		Does Not Meet	Approaches	Meets	Exceeds
Overall n=23593	Healthy Fitness Zone 13902/58.9%	2418/17.4%	4393/31.6%	3913/28.2%	3178/22.9%
	Needs Improvement 4254/18.0%	861/20.2%	1427/33.5%	1157/27.2%	809/19.0%
	Needs Improvement – Health Risk 5437/23.0%	1194/22.0%	1970/36.2%	1402/25.8%	871/16.0%
Gender					
Females n=11671	Healthy Fitness Zone 6900/59.1%	1085/15.7%	2227/32.3%	2115/30.7%	1473/21.4%
	Needs Improvement 2172/18.6%	403/18.6%	769/35.4%	624/28.7%	376/17.3%
	Needs Improvement – Health Risk 2599/22.3%	547/21.1%	994/38.3%	697/26.8%	361/13.9%
Males n=11922	Healthy Fitness Zone 7002/58.7%	1333/19.0%	2166/30.9%	1998/25.7%	1705/24.4%
	Needs Improvement 2082/17.5%	458/22.0%	658/31.6%	533/25.6%	433/20.8%
	Needs Improvement – Health Risk 2838/23.8%	647/22.8%	976/34.4%	705/24.8%	510/18.0%
Race/Ethnicity					
Non-Hispanic White N=12542	Healthy Fitness Zone 7907/63.0%	844/10.7%	2149/27.2%	2527/32.0%	2387/30.2%
	Needs Improvement 2196/17.5%	286/13.0%	661/30.1%	654/29.8%	595/27.1%
	Needs Improvement – Health Risk 2439/19.5%	330/13.5%	795/32.6%	736/30.2%	578/23.7%
Non-Hispanic Black n=6641	Healthy Fitness Zone 3550/53.5%	1142/32.2%	1446.40.7%	738/20.8%	224/6.3%
	Needs Improvement 1209/18.2%	426/35.2%	445/36.8%	259/21.4%	79/6.5%

	Needs Improvement – Health Risk 1882/28,3%	621/33.0%	761/40.4%	378/20.1%	122/6.5%
Hispanic n=2279	Healthy Fitness Zone 1099/48.2%	248/22.6%	404/36.8%	281/25.6%	166/15.1%
	Needs Improvement 486/21.3%	86/17.7%	199/41.0%	145/29.8%	56/11.5%
	Needs Improvement – Health Risk 694/30.5%	160/23.1%	262/37.8%	181/26.1%	91/13.1%
Other n=1298	Healthy Fitness Zone 801/61.7%	103/12.9%	240/30.0%	210/26.2%	248/31.0%
	Needs Improvement 207/16.0%	35/16.9%	66/31.9%	58/28.0%	48/23.2%
	Needs Improvement – Health Risk 290/22.3%	54/18.6%	99/34.1%	74/25.5%	63/21.7%
Health District					
Low Country n=3306	Healthy Fitness Zone 2146/64/9%	285/13.3%	533/24.8%	598/27.9%	730/34.0%
	Needs Improvement 588/17.8%	97/20.0%	174/29.6%	173/29.4%	144/25.5%
	Needs Improvement – Health Risk 572/17.3%	104/18.2%	191/33.4%	157/27.5%	120/21.0%
Midlands n=5065	Healthy Fitness Zone 2957/58.4%	555/18.8%	971/32.8%	839/28.4%	592/20.0%
	Needs Improvement 947/18.7%	211/22.3%	320/33.8%	265/28.0%	151/16.0%
	Needs Improvement – Health Risk 1161/22.9%	244/21.0%	439/37.8%	298/25.7%	180/15.5%
Pee Dee n=5027	Healthy Fitness Zone 2775/55.2%	557/20.1%	964/34.7%	762/27.5%	492/17.7%
	Needs Improvement 908/18.1%	213/23.5%	341/37.6%	211/23.2%	143/15.8%
	Needs Improvement – Health Risk 1344/26.7%	328/24.4%	523/38.9%	314/23.4%	179/13.3%
Upstate n=9160	Healthy Fitness Zone 5441/59.4%	889/16.3%	1707/31.4%	1568/28.8%	1277/23.5%

	Needs Improvement 1625/17.7%	294/18.1%	526/32.4%	453/27.9%	352/21.7%
	Needs Improvement – Health Risk 2094/22.9%	448/21.4%	714/34.1%	578/27.6%	354/16.9%

Table 5. Associations between cardiorespiratory fitness and English language arts academic test performance among 8th grade students in South Carolina, School Year 2015-2016.

Sample	Cardiorespiratory Fitness Healthy Fitness Zone Category	Academic Performance Category			
		Does Not Meet	Approaches	Meets	Exceeds
Overall n=14878	Healthy Fitness Zone 7528/50.6%	1277 /17.0%	2393/ 31.9%	2515 / 33.4%	1343/17.8%
	Needs Improvement 2795/18.8%	549/19.6%	1001/35.8%	845/30.2%	400/14.3%
	Needs Improvement – Health Risk 4555/30.6%	1246/27.4%	1696/37.2%	1198/26.3%	514/9.1%
Gender					
Females n=7012	Healthy Fitness Zone 2898/41.3%	284/9.8%	819/28.3%	1114/38.4%	681/23.5%
	Needs Improvement 1780/25.4%	248/13.9%	624/35.1%	597/33.5%	311/17.5%
	Needs Improvement – Health Risk 2334/33/3%	509/21.8%	904/38.7%	698/29.9%	223/9.6%
Males n=7866	Healthy Fitness Zone 4630/58.9%	993/21.5%	1574/34.0%	1401/30.3%	662/14.3%
	Needs Improvement 1015/12.9%	301/29.7%	377/37.1%	248/24.4%	89/8.8%
	Needs Improvement – Health Risk 2221/28.2%	737/33.2%	792/35.7%	500/22.5%	192/8.6%
Race/Ethnicity					
Non-Hispanic White n=8184	Healthy Fitness Zone 4444/54.3%	419/9.4%	1269/28.6%	1708/38.4%	1048/23.6%
	Needs Improvement 1510/18.5%	186/12.3%	481/31.9%	538/35.6%	305/20.2%
	Needs Improvement – Health Risk 2230/27.3%	423/19.0%	779/34.9%	716/32.1%	312/14.0%
Non-Hispanic Black n=4131	Healthy Fitness Zone 1792/43.4%	595/33.2%	737/41.4%	369/20.6%	91/5.1%
	Needs Improvement 778/18.8%	233/30.0%	342/44.0%	162/20.8%	41/5.3%

	Needs Improvement – Health Risk 1561/37.8%	609/39.0%	629/40.3%	282/18.1%	41/2.6%
Hispanic n=1367	Healthy Fitness Zone 652/47.7%	166/25.5%	225/34.5%	195/29.9%	66/10.1%
	Needs Improvement 301/22.0%	81/26.9%	114/37.9%	78/25.9%	28/9.3%
	Needs Improvement – Health Risk 414/30.3%	122/29.5%	172/41.6%	91/22.0%	29/7.0%
Other n=742	Healthy Fitness Zone 395/53.2%	57/14.4%	105/26.6%	139/35.2%	94/23.8%
	Needs Improvement 128/17.3%	27/21.1%	42/32.8%	41/32.0%	18/14.1%
	Needs Improvement – Health Risk 219/29.5%	68/31.1%	62/28.3%	67/30.6%	22/10.1%
Health District					
Low Country n=1308	Healthy Fitness Zone 697/53.3%	99/14.2%	171/24.5%	247/35.4%	180/25.8%
	Needs Improvement 275/21.0%	56/20.4%	90/32.7%	86/31.3%	43/15.6%
	Needs Improvement – Health Risk 336/25.7%	98/29.2%	128/38.1%	79/23.5%	31/9.2%
Midlands n=2771	Healthy Fitness Zone 1355/48.%	309/22.8%	479/35.4%	392/28.9%	175/12.9%
	Needs Improvement 543/19.6%	117/21.6%	216/39.8%	160/29.5%	50/9.2%
	Needs Improvement – Health Risk 873/51.5%	248/28.4%	339/38.8%	214/24.5%	72/8.3%
Pee Dee n=1834	Healthy Fitness Zone 867/47.3%	212/24.5%	287/33.1%	252/29.1%	116/13.4%
	Needs Improvement 282/15.4%	72/25.5%	101/35.8%	80/28.4%	29/10.3%
	Needs Improvement – Health Risk 686/37.4%	184/26.9%	271/39.6%	169/24.7%	61/8.9%
Upstate n=8027	Healthy Fitness Zone 4150/51.7%	570/13.7%	1291/31.1%	1494/36.0%	795/19.2%

	Needs Improvement 1555/19.4%	273/17.6%	545/35.1%	482/31.0%	255/16.4%
	Needs Improvement – Health Risk 2322/28.9%	608/26.2%	847/36.5%	649/28.0%	218/9.4%

Table 6. Associations between cardiorespiratory fitness and mathematics academic test performance among 8th grade students in South Carolina, School Year 2015-2016.

Sample	Cardiorespiratory Fitness Healthy Fitness Zone Category	Academic Performance Category			
		Does Not Meet	Approaches	Meets	Exceeds
Overall n=14887	Healthy Fitness Zone 7536/50.6%	1599/21.2%	2710/36.0%	1733/23.0%	1494/19.8%
	Needs Improvement 2799/18.8%	767/27.4%	1140/40.7%	541/19.3%	351/12.5%
	Needs Improvement – Health Risk 4552/30.6%	1612/40.5%	1833/40.3%	710/15.6%	397/8.7%
Gender					
Females n=7013	Healthy Fitness Zone 2899/31.3%	462/15.9%	1053/36.3%	774/26.7%	610/21.0%
	Needs Improvement 1782/25.4%	422/23.7%	747/41.9%	386/21.7%	227/12.7%
	Needs Improvement – Health Risk 2332/33.3%	764/32.8%	1008/43.2%	381/16.3%	179/7.7%
Males n=7874	Healthy Fitness Zone 4637/58.9%	1137/24.6%	1657/35.7%	959/20.7%	884/19.1%
	Needs Improvement 1017/12.9%	345/33.9%	393/38.6%	155/15.2%	124/12.2%
	Needs Improvement – Health Risk 2220/28.2%	848/38.2%	825/37.2%	329/14.8%	218/9.8%
Race/Ethnicity					
Non-Hispanic White N=8182	Healthy Fitness Zone 4445/54.3%	590/13.1%	1492/33.6%	1213/27.3%	1160/26.1%
	Needs Improvement 1512/18.5%	296/19.6%	588/38.9%	370/24.5%	258/17.1%
	Needs Improvement – Health Risk 2225/27.2%	569/25.6%	875/39.3%	479/21.5%	302/13.6%
Non-Hispanic Black n=4132	Healthy Fitness Zone 1794/43.4%	728/40.6%	740/41.3%	246/13.7%	80/4.5%
	Needs Improvement 779/18.9%	311/39.9%	344/44.2%	83/10.7%	41/5.3%

	Needs Improvement – Health Risk 1559/37.7%	775/49.7%	633/40.6%	116/7.4%	35/2.3%
Hispanic n=1367	Healthy Fitness Zone 652/47.7%	182/27.9%	253/38.8%	126/19.3%	91/14.0%
	Needs Improvement 301/22.0%	104/34.6%	125/41.5%	47/15.6%	25/8.3%
	Needs Improvement – Health Risk 414/30.3%	152/36.7%	179/43.2%	61/14.7%	22/5/3%
Other n=742	Healthy Fitness Zone 395/53.2%	64/16.2%	129/32.7%	83/21.0%	119/30.1%
	Needs Improvement 128/17.3%	30/23.4%	49/38.3%	29/22.7%	20/15.6%
	Needs Improvement – Health Risk 219/29.5%	69/31.5%	89/40.6%	37/16.9%	24/11.0%
Health District					
Low Country n=1307	Healthy Fitness Zone 698/53.4%	108/15.5%	223/32.0%	162/23.2%	205/29.4%
	Needs Improvement 276/21.1%	58/21.0%	130/47.1%	51/18.5%	37/13.4%
	Needs Improvement – Health Risk 333/25.5%	119/35.7%	138/41.1%	51/15.3%	25/7.5%
Midlands n=2769	Healthy Fitness Zone 1354/48.9%	367/27.1%	539/39.8%	271/20.0%	177/13.1%
	Needs Improvement 544/19.7%	173/31.8%	228/41.9%	88/16.2%	55/10.1%
	Needs Improvement – Health Risk 871/31.5%	337/38.7%	354/40.6%	122/14.0%	58/6.7%
Pee Dee n=1835	Healthy Fitness Zone 867/47.3%	245/28.3%	299/34.5%	197/22.7%	126/14.5%
	Needs Improvement 282/15.4%	74/26.2%	118/41.8%	51/18.1%	39/13.8%
	Needs Improvement – Health Risk 686/37.4%	229/33.4%	293/42.7%	104/15.2%	60/8.8%
Upstate n=8037	Healthy Fitness Zone 4157/51.7%	769/18.5%	1477/35.5%	1011/24.3%	900/21.7%

	Needs Improvement 1556/19.4%	414/26.6%	618/39.7%	321/20.6%	203/13.1%
	Needs Improvement – Health Risk 2324/28.9%	806/34.7%	917/39.5%	378/16.3%	223/9.6%

Table 7. Associations between weight status and English language arts academic test performance among 8th grade students in South Carolina, School Year 2015-2016.

Sample	Weight Status Healthy Fitness Zone Category	Academic Performance Category			
		Does Not Meet	Approaches	Meets	Exceeds
Overall n=11416	Healthy Fitness Zone 6807/59.9%	1309/19.2%	2270/33.4%	2169/31.9%	1060/15.6%
	Needs Improvement 2080/18.2%	420/20.2%	744/35.8%	638/30.7%	278/13.4%
	Needs Improvement – Health Risk 2529/22.2%	621/24.6%	972/38.4%	713/28.2%	223/8.8%
Gender					
Females n=5607	Healthy Fitness Zone 3224/57.5%	412/12.8%	1055/35.7%	1150/35.7%	607/18.8%
	Needs Improvement 1140/20.3%	169/14.8%	395/34.7%	393/34.5%	183/16.1%
	Needs Improvement – Health Risk 1243/22.2%	236/19.0%	480/38.6%	407/32.7%	120/9.7%
Males n=5809	Healthy Fitness Zone 3583/61.7%	897/25.0%	1215/33.9%	1018/28.4%	453/12.6%
	Needs Improvement 940/16.2%	251/26.7%	349/37.1%	245/26.1%	95/10.1%
	Needs Improvement – Health Risk 1286/22.15%	385/29.9%	492/38.3%	306/23.8%	103/8.0%
Race/Ethnicity					
Non-Hispanic White n=6134	Healthy Fitness Zone 3923/64.0%	426/10.9%	1202/30.6%	1482/37.8%	813/20.7%
	Needs Improvement 1051/17.1%	125/11.9%	317/30.2%	402/38.3%	207/19.7%
	Needs Improvement – Health Risk 1160/18.9%	200/17.2%	427/36.8%	379/32.7%	154/13.3%
Non-Hispanic Black n=3209	Healthy Fitness Zone 1794/55.9%	628/35.0%	733/40.9%	343/19.1%	90/5.0%
	Needs Improvement 589/18.4%	189/32.1%	262/44.5%	115/19.5%	23/3.9%

	Needs Improvement – Health Risk 826/25.7%	280/33.9%	339/41.0%	181/21.9%	26/3.2%
Hispanic n=1173	Healthy Fitness Zone 558/47.6%	154/28.0%	201/36.0%	150/26.9%	53/9.5%
	Needs Improvement 279/23.8%	78/28.0%	106/38.0%	69/24.7%	26/9.3%
	Needs Improvement – Health Risk 336/28.6%	95/28.3%	138/41.1%	80/23.8%	23/6.9%
Other n=549	Healthy Fitness Zone 316/57.6%	62/19.6%	77/24.4%	104/23.1%	73/23.1%
	Needs Improvement 98/17.9%	16/16.3%	38/38.8%	29/29.6%	15/15.3%
	Needs Improvement – Health Risk 135.24,6%	34/25.2%	40/29.6%	47/34.8%	14/10.4%
Health District					
Low Country n=839	Healthy Fitness Zone 523/62.3%	103/19.7%	140/26.8%	172/20.7%	108/20.7%
	Needs Improvement 146/17.4%	32/21.9%	56/38.4%	36/24.7%	22/15.1%
	Needs Improvement – Health Risk 170/20.3%	60/35.3%	57/33.5%	42/24.7%	11/6.5%
Midlands n=2586	Healthy Fitness Zone 1529/59.1%	353/23.1%	567/37.15	423/27.7%	186/12.2%
	Needs Improvement 469/18.1%	118/25.2%	168/35.8%	141/30.1%	42/9.0%
	Needs Improvement – Health Risk 588/22.7%	136/23.1%	241/41.0%	167/28.4%	44/22.7%
Pee Dee n=1559	Healthy Fitness Zone 935/60.0%	245/26.2%	337/36.0%	258/27.6%	95/10.2%
	Needs Improvement 283/18.2%	64/22.6%	105/37.1%	76/26.9%	38/13.4%
	Needs Improvement – Health Risk 341/21.9%	94/27.6%	127/37.2%	98/28.7%	22/6.5%k
Upstate n=5902	Healthy Fitness Zone 3524/59.7%	536/15.2%	1118/31.7%	1238/35.1%	632/17.9%

	Needs Improvement 1087/18.4%	183/16.8%	375/34.5%	364/33.5%	165/15.2%
	Needs Improvement – Health Risk 1291/21.9%	284/22.0%	499/38.7%	375/29.1%	133/10.3%

Table 8. Associations between weight status and mathematics academic test performance among 5th grade students in South Carolina, School Year 2015-2016.

Sample	Weight Status Healthy Fitness Zone Category	Academic Performance Category			
		Does Not Meet	Approaches	Meets	Exceeds
Overall n=11421	Healthy Fitness Zone 6816/59.7%	1699/24.9%	2590/38.0%	1416/20.8%	1111/16.3%
	Needs Improvement 2078/18.2%	578/27.8%	809/38.9%	417/20.1%	274/13.2%
	Needs Improvement – Health Risk 2527/22.1%	817/32.3%	994/39.3%	48/18.1%	258/10.2%
Gender					
Females n=6606	Healthy Fitness Zone 3228/57.6%	680/21.1%	1280/39.7%	756/23.4%	512/15.9%
	Needs Improvement 1138/20.3%	270/23.7%	467/41.0%	259/22.8%	142/12.5%
	Needs Improvement – Health Risk 1240/22.1%	372/30.0%	521/42.0%	230/18.6%	117/15.2%
Males n=5813	Healthy Fitness Zone 3588/61.7%	1019/28.4%	1310/36.5%	660/18.4%	599/16.7%
	Needs Improvement 940/16.2%	308/32.8%	342/36.4%	158/16.8%	132/14.0%
	Needs Improvement – Health Risk 1287/22.1%	445/34.6%	473/36.8%	228/17.7%	141/11.0%
Race/Ethnicity					
Non-Hispanic White n=6131	Healthy Fitness Zone 3925/64.0%	647/16.5%	1429/36.4%	1001/25.5%	848/21.6%
	Needs Improvement 1049/17.1%	189/18.0%	366/34.9%	290/27.7%	204/19.5%
	Needs Improvement – Health Risk 1157/18.9%	278/24.0%	438/37.9%	265/22.9%	176/15.2%
Non-Hispanic Black n=3209	Healthy Fitness Zone 1792/55.8%	767/42.8%	750/41.9%	195/10.9%	80/4.5%
	Needs Improvement 589/18.4%	261/44.3%	246/41.8%	63/10.7%	19/3.2%

	Needs Improvement – Health Risk 828/25.8%	364/44.0%	339/41.0%	93/11.2%	32/3.9%
Hispanic n=1173	Healthy Fitness Zone 558/47.6%	168/30.1%	218/39.1%	103/18.5%	69/12.4%
	Needs Improvement 279/23.8%	91/32.6%	126/45.2%	37/13.3%	25/9.0%
	Needs Improvement – Health Risk 336/28.6%	117/34.8%	138/41.1%	56/16.7%	25/7.4%
Other n=549	Healthy Fitness Zone 316/57/6%	66/20.9%	98/21.0%	69/21.8%	83/26.3%
	Needs Improvement 98/17.9%	22/22.5%	43/43.9%	15/15.35	18/18.4%
	Needs Improvement – Health Risk 135/24.6%	37/27.4%	50/37.0%	29/21.5%	19/14.1%
Health District					
Low Country n=839	Healthy Fitness Zone 524/62.5%	116/22.1%	204/38.9%	100/19.1%	104/62.9%
	Needs Improvement 145/17.3%	49/33.8%	57/39.3%	19/13.1%	20/13.8%
	Needs Improvement – Health Risk 170/20.3%	65/38.2%	67/39.4%	26/15.3%	12/7.1%
Midlands n=2584	Healthy Fitness Zone 1525/59.0%	438/28.7%	626/41.1%	281/18.4%	180/11.8%
	Needs Improvement 469/18.2%	157/33.5%	184/39.2%	83/17.7%	45/9.6%
	Needs Improvement – Health Risk 590/22.8%	190/32.2%	258/43.7%	102/17.3%	40/6.8%
Pee Dee n=1560	Healthy Fitness Zone 937/60.1%	281/30.0%	365/39.0%	184/19.6%	107/11.4%
	Needs Improvement 283/18.1%	77/27.2%	114/40.3%	59/20.9%	33/11.7%
	Needs Improvement – Health Risk 340/21.8%	125/36.8%	125/36.8%	59/17.4%	31/9.1%
Upstate n=5908	Healthy Fitness Zone 3533/59.8%	782/22.1%	1270/36.0%	805/22.8%	676/19.1%

	Needs Improvement 1086/18.4%	260/23.9%	423/39.0%	239/22.0%	164/15.1%
	Needs Improvement – Health Risk 1289/21.8%	387/30.0%	495/38.4%	248/19.2%	159/12.3%