Fitness in South Carolina Youth During the COVID Pandemic

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Background and Purpose

The SC FitnessGram project is a statewide effort, initiated during the 2016-17 school year, to evaluate and ultimately improve health-related fitness among public school students in South Carolina. The findings from this project support planning and implementation of evidence-based programs and policies, across multiple sectors, to improve health-related fitness among school-age youth.

The project involves aggregation of health-related fitness data from public schools using a statewide FitnessGram software system. FitnessGram is the most widely used fitness test protocol in U.S. schools, and it is completed annually by over 10 million children nationwide. All South Carolina public school districts serving grades K-12 are eligible to participate and all but a few do so. Fitness testing, which includes six health-related fitness items, and height and weight measurement are completed by physical education (PE) teachers for students in grades 5, 8 and in the high school PE course required for graduation. Only height and weight are measured for second grade students.

Since the beginning of the effort, statewide administration of the FitnessGram protocol has continued on an annual basis including during the COVID pandemic, and data at the time of this report are currently available through the 2021-22 school year. While overall student participation in FitnessGram was reduced during the pandemic, in some school districts participation remained high. The availability of data from those districts provided the opportunity to assess student performance on FitnessGram during the school years that were most affected by the pandemic. Further, it was possible to compare those data with data collected during school years prior to the pandemic and since the schools returned to normal scheduling after the pandemic.

COVID and Its Impact on SC Schools, Teachers, and Students

School Closures and State Policies. The COVID pandemic produced a major disruption to the operation of South Carolina's schools. On March 15, 2020, Governor Henry McMaster, by executive order, directed the closure of all public schools and authorized school personnel to provide virtual instruction and distance learning. This directive was extended through the end of the 2019-20 school year. During the 2020-21 school year most school districts operated on a hybrid model, returning to in-person instruction with a virtual option. School health providers during the 2020-2021 and 2021-2022 school years focused on COVID testing, contact tracing, and quarantining. With some exceptions, guidance to the schools from DHEC was consistent with CDC recommendations. In the Fall of 2020, Superintendent of Education Molly Spearman issued multiple waivers, one of which suspended the requirement that fitness tests be administered to students in 2nd, 5th, 8th and high school grades. School sports programs, having been suspended in the Spring of 2020, were resumed

in the Fall of 2020 with a great deal of attention given to social distancing by participants including athletes, coaches, and fans.

Impact on Physical Education. During the spring of the 2020-21 school year, the SC FitnessGram Evaluation Team conducted an online survey of South Carolina PE teachers in districts participating in SC FitnessGram. Email invitations were sent to 1,762 PE teachers from participating districts, and 587 (33%) responded to the survey. Due to the impact of the COVID pandemic on school operations, the teachers reported delivering PE in multiple formats. Most indicated they provided in-person and online (hybrid) instruction to the same students during the 2020-21 school year (61%); 33% had students taking PE in-person only, and 12% had students online only. Instructional challenges for all modes of delivery were noted including those related to adhering to physical distancing and cross-contamination guidelines (70%). Lack of instructional time due to adjusted schedules was noted by 31% of those responding. Additional barriers included interruptions to instructional delivery (34%) and a lack of administrative support (6%). Teachers indicated students spent less time in moderate-to-vigorous physical activity in PE (69%) than prior to the pandemic. Additionally, teachers reported that physical activity opportunities including walking clubs, after-school physical activities, classroom physical activities, and interscholastic sports were less available than pre-pandemic.

Mitigation Efforts by DHEC. During the period of the pandemic, the SC FitnessGram Coordinator and other staff members of DHEC's Division of Nutrition, Physical Activity and Obesity Prevention (DNPAO) were in regular contact with SC FitnessGram district coordinators and PE teachers. School personnel were provided with professional development materials created by the Cooper Institute, the organization that manages FitnessGram at the national level. These materials included guidance for safe administration of the FitnessGram test protocol in the school setting and when children were at home. Also, the Cooper Institute's guidelines for student self-assessment of fitness were disseminated. Further, DNPAO partnered with the Cooper Institute, U.S. Games and the SC Alliance for Health, Physical Education, Recreation and Dance in providing PE teachers across the state with a series of four free webinars addressing topics related to adaptation of PE classes and FitnessGram to the restrictions imposed by the pandemic.

Study Design

This study employed a "panel" design in which comparisons were made across cross-sectional samples of FitnessGram participants for each of the school years between 2016-17 and 2021-22. Comparisons were made for cardiorespiratory fitness, expressed as the percentage of students achieving the Healthy Fitness Zone, a criterion-referenced standard prescribed by the national FitnessGram program. Weight status was assessed by measurement of Body Mass Index (BMI) expressed as a percentage of students in the normal weight category based on CDC growth charts. Comparisons across school years were conducted separately for boys and girls at each grade level.

Sources of Data

The FitnessGram test is administered by PE teachers while students are in PE classes in schools in participating school districts. Test results and other student data are entered by teachers into a data management system that routes data to the SC Department of Education which creates a statewide FitnessGram database for each school year. Those databases are made available to the University of South Carolina which produces an annual report based on the statewide data. In the pre-pandemic 2018-19 school year, 64 school districts across the state of South Carolina provided FitnessGram data. During the COVID pandemic, 53 school districts continued their participation in 2019-20 and 52 school districts in 2020-21. However, in some districts the pandemic resulted in a marked decrease in student participation. In 21 school districts the number of student participants remained high during the pandemic, and this study is based on the data provided by those districts. Demographic characteristics of students providing FitnessGram data from those 21 "responsive" school districts are summarized in Table 1. Summary data are provided for school years 2016-17 to 2021-22.

Data Analysis

Key variables for analysis were, for the total sample and for sex-specific cells, the percentage of students scoring in the Healthy Fitness Zone for cardiorespiratory fitness and in the normal weight category for weight status. For each variable, comparisons were made across six years of data using logistic regression modeling in SAS (Proc Glimmix). Comparisons for the full sample were adjusted for sex, grade, race/ethnicity, poverty status, and month of data collection. Sex-specific analyses were adjusted for grade, race/ethnicity, poverty status and month of data collection.

Table 1. Demographic Characteristics of Children from 21 Responsive School Districts in South Carolina: FitnessGram, 2016-17 to 2021-22 School Years

Year	Total n	Grade				Sex		Race/Ethnicity				Poverty	
		2nd grade	5th grade	8th grade	High School	Boys	Girls	White	Black	Hispanic	Other	% Yes	% No
2021/2022	48154	24%	35%	22%	19%	51%	49%	50%	29%	14%	7%	58%	42%
2020/2021	26876	26%	34%	23%	16%	53%	47%	59%	22%	12%	7%	56%	43%
2019/2020	43063	23%	36%	22%	20%	51%	49%	53%	27%	13%	7%	55%	45%
2018/2019	66749	27%	33%	22%	18%	52%	48%	54%	28%	12%	7%	55%	45%
2017/2018	56999	26%	36%	22%	16%	52%	48%	55%	27%	11%	6%	56%	44%
2016/2017	43063	26%	34%	21%	19%	52%	48%	55%	29%	9%	7%	52%	47%

CARDIORESPIRATORY FITNESS

Background

Cardiorespiratory fitness refers to a person's ability to perform large-muscle, whole-body physical activity for extended periods of time. Cardiorespiratory fitness depends on the functional capacity of the body's cardiovascular, respiratory, and muscular systems. 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.

Measurement

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. Most students completing the FitnessGram protocol in South Carolina completed the PACER test. 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.

Findings

The findings for cardiorespiratory fitness are summarized in Table 2 and depicted in Figures 1A, 1B, and 1C.

- For the total school year samples, the percentage of students in the Healthy Fitness Zone was stable at 51-53% for the four school years between 2016-17 and 2019-20.
- During the 2020-21 and 2021-22 school years this percentage was markedly reduced to 44-45%. This pattern is shown in Figure 1A.
- Sex-specific analyses showed similar year-to-year patterns in boys and girls, although the percentage of girls in the Healthy Fitness Zone was consistently (and markedly) lower than in boys.
- The percentage of students in the Healthy Fitness Zone decreased by approximately 7% between the 2019-20 and 2020-21 school years, and this level was seen in both boys and girls. This reduced percentage was sustained in the 2021-22 school year.

Table 2. Cardiorespiratory Fitness – Percent of Children in Healthy Fitness Zone, Total Samples and Demographic Sub-Groups

Year	Total	Boys				Girls				Poverty	
	N %	Total	5th grade	8th grade	High School	Total	5th grade	8th grade	High School	% Yes	% No
2021/2022	32453 44%	51%	55%	48%	46%	36%	41%	29%	36%	36%	56%
2020/2021	16449 45%	51%	53%	50%	47%	38%	41%	36%	35%	37%	54%
2019/2020	29213 51%	58%	57%	59%	60%	43%	45%	41%	43%	43%	61%
2018/2019	44428 53%	60%	60%	61%	57%	46%	48%	42%	46%	45%	63%
2017/2018	38411 52%	59%	60%	60%	58%	43%	46%	41%	40%	44%	61%
2016/2017	29320 53%	61%	61%	61%	57%	44%	48%	38%	43%	45%	62%

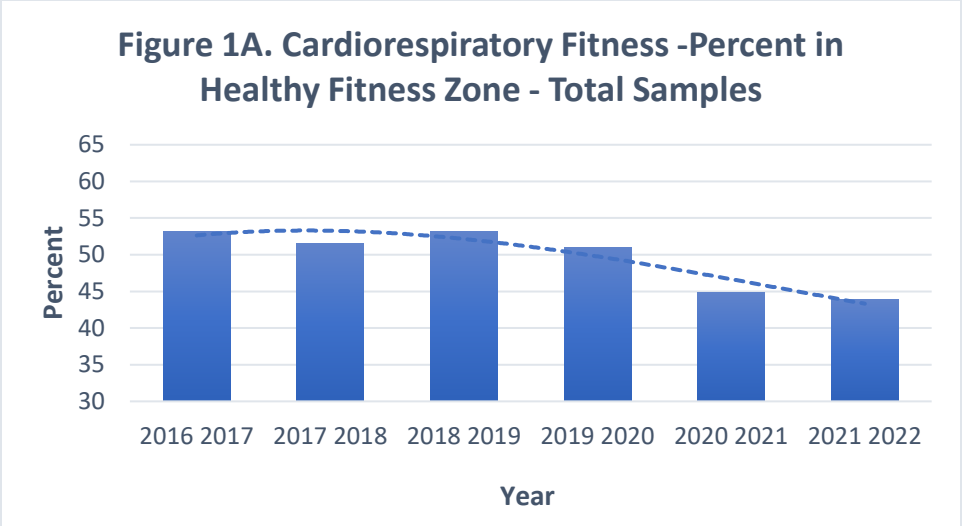
Figure 1A. Cardiorespiratory Fitness -Percent in Healthy Fitness Zone - Total Samples
Percent
65
60
55
50
45
40
35
30
2016 2017
2017 2018
2018 2019
2019 2020
2020 2021
2021 2022
Year

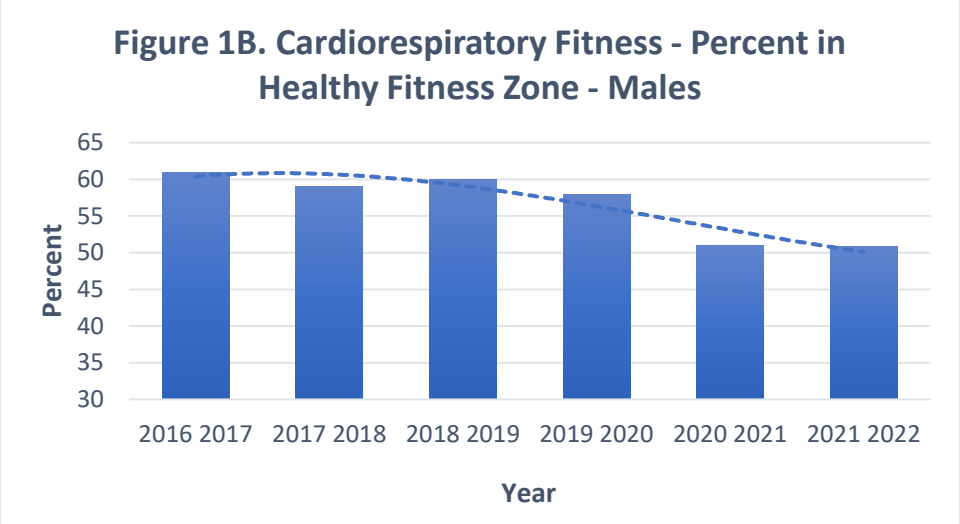
Figure 1B. Cardiorespiratory Fitness - Percent in Healthy Fitness Zone - Males
Percent
65
60
55
50
45
40
35
30
2016 2017
2017 2018
2018 2019
2019 2020
2020 2021
2021 2022
Year

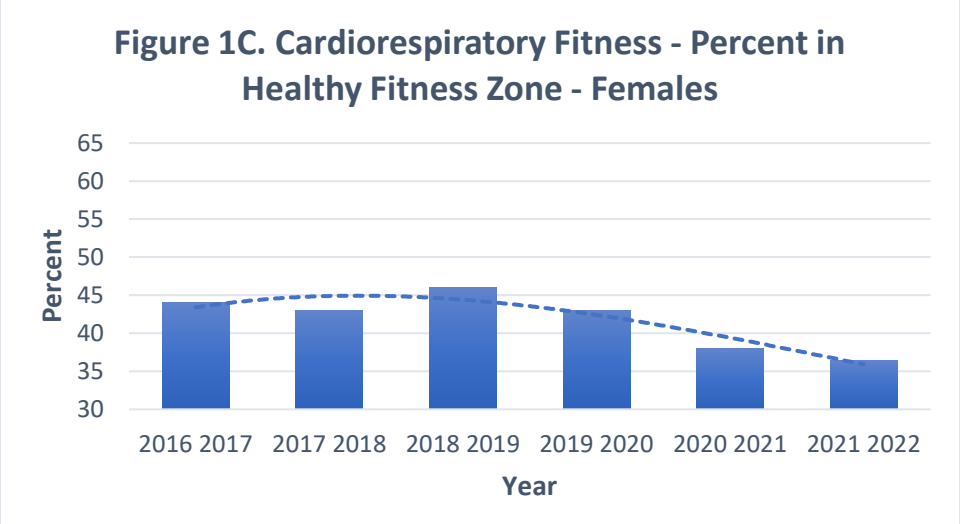
Figure 1C. Cardiorespiratory Fitness - Percent in Healthy Fitness Zone - Females
Percent
65
60
55
50
45
40
35
30
2016 2017
2017 2018
2018 2019
2019 2020
2020 2021
2021 2022
Year

WEIGHT STATUS

Background

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

Measurement

For SC FitnessGram, 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 = weight (kg) / height (m2). For youth, BMI is typically reported as a percentile (range: 0-100) relative to other individuals of the same sex and age. Using CDC growth charts, each student's age- and sex-specific BMI percentile was determined and then categorized into one of the following weight status categories: Healthy Weight (normal weight = $<85^{th}$ percentile), Overweight (overweight = 85^{th} percentile to $<95^{th}$ percentile), and Obese (obese = $\geq 95^{th}$ percentile).

Findings

The findings for weight status are summarized in Table 3 and depicted in Figures 2A, 2B, and 2C.

- For the total school year samples, the percentage of students in the Healthy Weight category was stable at approximately 64% for the 2016-17, 2017-18 and 2018-19 school years.
- In the 2019-20 school year this percentage was modestly (but not significantly) decreased to 62%.
- During the 2020-21 school year the percentage of students in the Healthy Weight category was significantly reduced to 58%, and the percentage remained at essentially the same level (59%) in the 2021-22 school year. This pattern is shown in Figure 2A.
- Sex-specific analyses showed similar patterns for boys and girls (Table 3 and Figures 2B and 2C). That is, the percentages of boys and girls in the Healthy Weight category were stable across the four school years between 2016-17 and 2019-20 but reduced in the 2020-21 and 2021-22 school years.
- The percentage of students in the Healthy Weight category decreased by approximately 4% between the 2019-20 and 2020- 21 school years, and this pattern was seen in both boys and girls. This reduced percentage was sustained in the 2021-22 school year.

Table 3. Weight Status – Percent of Children in Healthy Weight Category, Total Samples and Demographic Sub-Groups

Year	Total	Boys					Girls					Poverty	
	N %	Total	2nd grade	5th grade	8th grade	High School	Total	2nd grade	5th grade	8th grade	High School	% Yes	% No
2021/2022	40975 60%	60%	65%	57%	57%	61%	59%	63%	58%	57%	60%	54%	67%
2020/2021	22556 59%	57%	61%	54%	57%	56%	60%	63%	56%	60%	61%	53%	66%
2019/2020	36615 63%	63%	69%	59%	62%	65%	62%	68%	60%	58%	61%	57%	70%
2018/2019	59656 65%	65%	70%	61%	65%	65%	64%	69%	61%	60%	64%	59%	71%
2017/2018	52834 64%	65%	70%	60%	63%	65%	64%	70%	62%	61%	63%	60%	71%
2016/2017	38249 64%	65%	68%	62%	64%	66%	64%	69%	62%	60%	64%	60%	69%

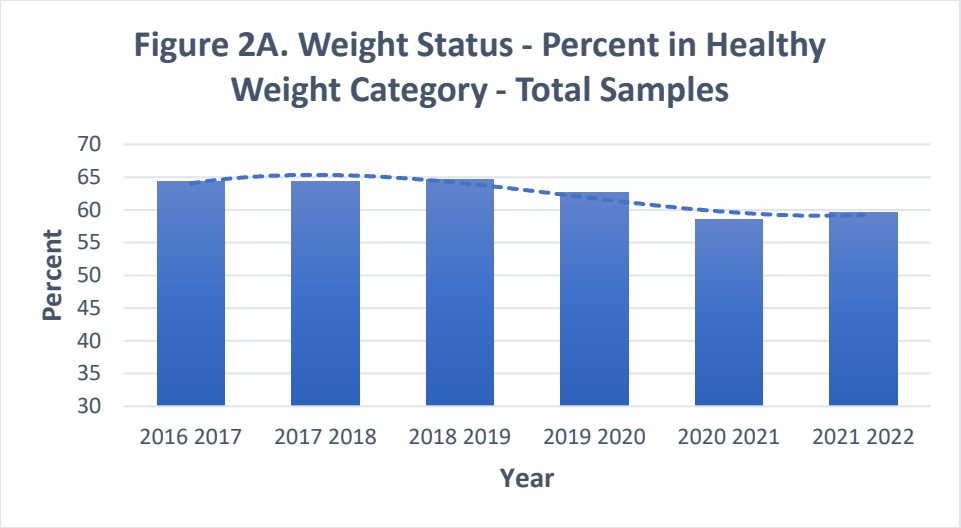
Figure 2A. Weight Status - Percent in Healthy Weight Category - Total Samples
70
65
60
55
50
45
40
35
30
Percent
2016 2017
2017 2018
2018 2019
2019 2020
2020 2021
2021 2022
Year

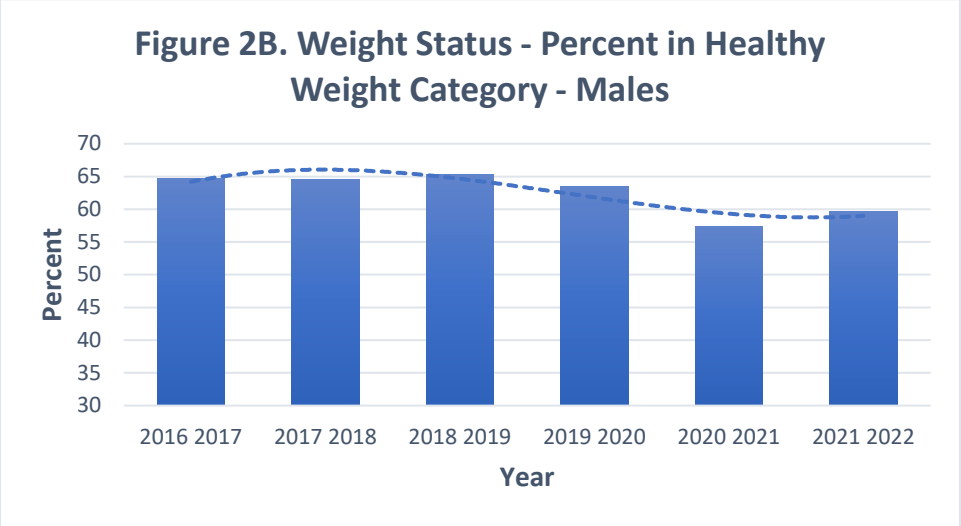
Figure 2B. Weight Status - Percent in Healthy Weight Category - Males
70
65
60
55
50
45
40
35
30
Percent
2016 2017
2017 2018
2018 2019
2019 2020
2020 2021
2021 2022
Year

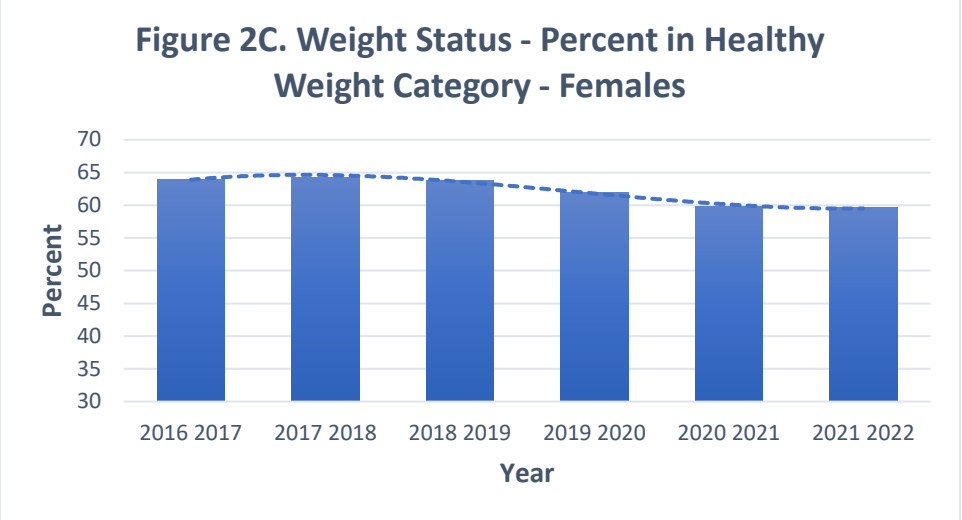
Figure 2C. Weight Status - Percent in Healthy Weight Category - Females
70
65
60
55
50
45
40
35
30
Percent
2016 2017
2017 2018
2018 2019
2019 2020
2020 2021
2021 2022
Year

Conclusions and Applications

Major Findings. The major finding of the study presented in this report is that, for both cardiorespiratory fitness and weight status, a smaller percentage of students met recommended health-related fitness standards during the school years immediately following onset of the COVID pandemic than during the years preceding the pandemic.

For cardiorespiratory fitness, prior to the pandemic, approximately 60% of boys and 45% of girls attained the Healthy Fitness Zone, but during the years immediately following onset of the pandemic, these percentages decreased to approximately 50% and 36% for boys and girls, respectively. Similar patterns were seen at each grade level and in students in both poverty groups.

For weight status, in the pre-pandemic school years, approximately 65% of both boys and girls achieved the Healthy Weight category, but in the years immediately following onset of the pandemic, these percentages decreased to approximately 59% in both sexes. Similar patterns were seen at each grade level and in students in both poverty groups.

The overall conclusion of this study is that the COVID pandemic was associated with a reduction in students' fitness levels as reflected by measures of cardiorespiratory fitness and weight status. Since both cardiorespiratory fitness and weight status are known to be influenced by physical activity behavior, it is likely that the changes in fitness seen in this study were the result of reduced student physical activity during the school years that were most influenced by the pandemic. Such decreases in physical activity, which have been reported in other studies, were likely due to many students missing school-based physical activity opportunities such as physical education and school sports. It is also likely that students' participation in home-based outdoor activities and community-based physical activity programs was restricted during the pandemic.

Limitations. The findings of this study should be interpreted with consideration of the limitations associated with the design of the investigation. Cross-sectional samples were compared across school years, and such comparisons are common in public health research. However, in this case the number of school districts and students providing FitnessGram data was reduced during the years influenced by COVID. Therefore, in this study, data were included only for 21 districts that provided data for significant numbers of students during the COVID-influenced years. Nonetheless, it should be noted that the number of students providing data in these districts was reduced from pre-COVID years. Therefore, it is possible that the findings of this study were influenced by a response bias.

Recommendations. The findings of this study highlight the negative influence of a major societal disruption, in this case an infectious disease pandemic, on the health-related fitness of children and youth. It seems likely that these effects were related to reduced physical activity, and that these reductions were secondary to students' reduced exposure to school-based

physical activity as well as reduced physical activity in community and home settings. Accordingly, it is recommended that, in responding to future societal disruptions, public agencies prioritize provision of services that will enable children and youth to participate in physical activity at levels that prevent loss of cardiorespiratory fitness and excessive weight gain. The following actions are recommended:

- Maintain in-person school attendance and provision of normal physical education and school sports programs within the limitations imposed by prevailing public health guidelines.
- If schools transition to remote instruction, include physical education and other opportunities for physical activity in the curriculum that is delivered remotely.
- Maintain community-based youth sport and other physical activity programs for youth with modifications made in accordance with prevailing public health.
- Maintain school and community-based outdoor recreational spaces for affordable and accessible opportunities for daily physical activity.
- Provide parents with strategies that can be used to provide children with physical activity in the home setting.
- Visit https://dph.sc.gov/fitnessgram to access annual SC FitnessGram data reports and to learn more on how to put these recommendations into action.