

Assessment of the Relationship Between Physical Fitness and Student Academic and Non-Academic Outcomes for 2014–15 and 2015–16

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What We Studied

In 2015, the United States Congress replaced the “No Child Left Behind Elementary and Secondary Act” with the Every Student Succeeds Act (ESSA) (P.L. 114-95), which identifies health and physical education as key components of a well-rounded education (Cooper, Greenberg, Castelli, Barton, Martin & Morrow, 2016). This followed a national trend of state legislators adopting legislation to target childhood obesity through statewide physical education and physical activity initiatives (Boehmer, Brownson, Haire-Joshu, & Dreisinger, 2007). As part of this initiative, the Texas Education Agency (TEA) uses FitnessGram® to assess student health. This assessment and reporting software program allows school districts to gather and report students’ physical fitness data to the TEA. All Texas students in grades 3-12 enrolled in a physical education course or substitute activity must be assessed once annually using the FitnessGram® assessment instrument. This instrument consists of six Health Fitness Zones (HFZs), which are different aspects of health where students are assessed as being in the HFZ or not. This provides a rich data source to explore questions about the relationship between physical fitness and academic and non-academic outcomes.

Studies examining the impact of physical fitness on student academic achievement are generally consistent with the Cooper Institute’s findings in Texas and report significant associations between physical fitness and student achievement (Bass, Brown, Laursen & Coleman, 2013; Blom, Alvarez, Zhang & Kolbo, 2011; Lambourne et al., 2013; Wittberg et al., 2012; Van Dusen et al., 2011). For instance, recent research shows that the Aerobic Capacity component of fitness is the strongest predictor of student academic performance (Castelli, Hillman, Buck and Erwin, 2007; Rauner et al., 2013). Various studies have found evidence for associations between physical fitness and achievement, particularly for Math achievement (Chomitz et al., 2009; Eveland-Sayers et al., 2009; Lambourne et al., 2009; Van Dusen et al., 2011).

The relationships between fitness and non-academic student outcomes (e.g., absenteeism and disciplinary action) have not been as extensively explored or published, and the results are generally mixed. Some studies have reported a dose-response relationship between an increase in physical fitness and a decrease in school absenteeism (Blom et al., 2011; D’Agostino, 2016). A robust body of literature indicates that physical fitness is inversely related to obesity (Jin and Jones-Smith, 2015; Nikolaidis, 2013; Rauner et al., 2013; Torrijos-Niño et al., 2014). Furthermore, in line with the current study’s use of a multivariate analysis, research indicates that BMI is negatively associated with academic achievement (Castelli et al., 2007; Chomitz et al., 2009). Several studies suggest that students who participate in school meal programs are less fit than students who do not participate (Blom et al., 2011; Jin & Jones-Smith, 2015; London & Castrechini, 2009).

In this study, we build upon this existing research by using multi-level regression models to explore the relationship between being in a HFZ and academic and non-academic outcomes. Specifically, the following research questions are addressed:

1. Is there a relationship between HFZ attainment and STAAR performance?
2. Is there a relationship between HFZ attainment and student attendance?
3. Is there a relationship between HFZ attainment and obesity?
4. Is there a relationship between HFZ attainment and disciplinary problems?
5. Is there a relationship between HFZ attainment and student participation in school meal programs?

How We Analyzed the Data

Multivariate statistical models controlled for differences in key student characteristics (e.g., demographic characteristics, socioeconomic status, prior academic achievement, prior attendance and disciplinary issues, populations of interest such as English Language Learner [ELL] or special education), and school-level characteristics (e.g., school size, percentage of economically disadvantaged students enrolled) and estimated the effect of being in a HFZ with various student outcomes. In order to adjust for prior fitness in evaluating the associations between fitness and outcomes, we included a lagged dependent variable (the value a student had on the outcome measure in the year prior to the year being analyzed) in most of the models. Additionally, we estimate models assessing the relationship between changes in fitness levels and changes in academic and non-academic outcomes. The main findings from these analyses are as follows.

What We Discovered

Relationship Between STAAR Results and FitnessGram® HFZ Status

- Being in the Aerobic Capacity HFZ was associated with a 1.35 percentage point increase in STAAR mathematics percentile ranking for male students in 2014–15 and a 1.17 percentage point increase in STAAR mathematics percentile ranking for female students in 2014–15. While directionally similar, the estimated effect was smaller in 2015–16 for both male and female students.
- For both male and female students, the next two FitnessGram® measures with the strongest relationship to STAAR mathematics percentile rankings were Abdominal Strength and Flexibility.
- Being in the Aerobic Capacity HFZ was associated with a 0.92 percentage point increase in STAAR reading percentile ranking for male students in 2014–15 and a 1.07 percentage point increase in STAAR reading percentile ranking for female students in 2014–15. In contrast to the findings for STAAR mathematics, being in the HFZ had a stronger association with reading results for female students than for male students.
- Similar to the results for math, the next two FitnessGram® measures with the strongest relationship to STAAR reading percentile rankings were Abdominal Strength and Flexibility.
- The association between STAAR mathematics and STAAR reading percentile rankings and being in the Aerobic Capacity and Abdominal Strength HFZs was much stronger for high school students than middle school and elementary school students. For example, being a male high school student in the Aerobic Capacity HFZ was associated with a 2.4 and 2.7 percentage point increase for STAAR mathematics (in 2014–15 and 2015–16, respectively) and nearly two percentage points for STAAR reading (for both years). This is compared to associations between 1 and 1.4 percentage point increases for elementary and middle school students. The same trend held for high school females, except the association was stronger for reading than math.
- Improved fitness on Aerobic Capacity for male and female students between 2014–15 and 2015–16 was associated with increases in the percentile ranking in 2015–16 STAAR mathematics of approximately one percentage point. Improved fitness on Abdominal Strength was associated with about a three-quarter percentage point increase in STAAR mathematics percentile rank. Impacts on STAAR reading were more modest.

Relationship Between Attendance and FitnessGram® HFZ Status

- Being in the HFZ for each of the FitnessGram® measures was associated with higher attendance rates; however, the associations for all measures except Aerobic Capacity were relatively weak.
- Being in the Aerobic Capacity HFZ was associated with a 0.27 to 0.30 percentage point increase in a male student's attendance rate and a 0.28 to 0.32 percentage point increase in a female student's attendance rate.
- Improved fitness on Aerobic Capacity for male and female students between 2014–15 and 2015–16 was associated with higher attendance rates (+0.15 percentage points for both male and female students). Changes in HFZ status for other measures were not associated with meaningful differences in regular school day attendance.
- While these impacts may seem small in magnitude, it is important to remember that attendance rates average approximately 96 percent across the state so there is very little room to improve on this outcome measure.
- Similar to the findings for STAAR mathematics and STAAR reading, the relationship between HFZ attainment and student attendance rates tended to be stronger at the high school level, particularly for the Abdominal Strength and Trunk Extensor Strength measures.

Relationship Between Obesity Metrics and FitnessGram® HFZ Status

- Being in the HFZ for Aerobic Capacity is associated with an increased likelihood that a male student will be in the Body Composition HFZ (typically measured by BMI) of 13 percentage points and an increased likelihood that a female student will be in the Body Composition HFZ of 11 percentage points.
- None of the other fitness metrics were related to Body Composition in a meaningful way.

Relationship Between Disciplinary Referrals and FitnessGram® HFZ Status

- Achieving Aerobic Capacity, Abdominal Strength, and Flexibility HFZ status and having an ISS and OSS referral in a particular school year were negatively correlated with the number of in-school suspensions (ISS) and out-of-school suspension (OSS) discipline referrals.
- For both male and female students, being in the Aerobic Capacity HFZ reduced the likelihood of having an ISS or OSS referral by 0.8 to 1.5 percentage points. The strength of the impact was substantively lower for other fitness metrics.

Relationship Between Eligibility for Free or Reduced Priced Lunch and FitnessGram® HFZ Status

- Being economically disadvantaged is negatively associated with the likelihood of meeting the threshold for HFZ for all of the FitnessGram® measures. However, the strongest associations for both male and female students are in the Aerobic Capacity HFZ where being economically disadvantaged decreases the likelihood of males being in the HFZ for this measure by 1.6 percentage points and females by 4.6 percentage points.
- For all of the fitness measures examined in this analysis, the size of the estimated effect was substantially larger for female students than male students.

Policy Recommendations/Implications

These results suggest that students who are more physically fit, particularly in aerobic capacity experience higher test scores and attendance and lower incidence of disciplinary actions. There are a variety of implications from this. First, as has been found elsewhere in the literature, students who are more fit, on average perform better than their peers on standardized tests. This suggests that efforts to incorporate physical education and well-being into the school system has merit. It suggests that schools may benefit from students who are healthier and that cutting physical education to create more time to study for tests could involve a trade-off.

Second, we find evidence that higher fitness is statistically associated with higher attendance and lower disciplinary incident rates. Many existing studies have not shown this relationship to be significant or do not have the individual-level data to make these comparisons. Since improved fitness in several areas of health (HFZs) are protective of student attendance and discipline issues, this implies that having more fit students also helps keep students in class where they can learn, reduce disruptions, and reduce school costs associated with lower attendance (e.g., loss of attendance allotment money) and higher student exclusionary placements.

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