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The effects of school physical education grants on obesity, fitness, and academic achievement

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ABSTRACT

Objective. Foundations and governments fund a number of programs that provide grants to improve school physical education or other forms of school-based physical activity. The effects of these grant programs are unknown. We evaluate the effects of Texas Fitness Now, a program in which the state of Texas granted $37 million to improve physical education in high-poverty middle schools over the 4 school years from 2007–08 to 2010–11. The stated goals of Texas Fitness Now were to reduce obesity, increase fitness, and raise academic achievement.

Method. We summarize how Texas Fitness Now funds were spent and estimate the impact of Texas Fitness Now using a fixed-effects longitudinal model that exploits changes in schools' eligibility over time. Changes in eligibility occurred when eligibility expanded to new schools after year 2 and when the program was terminated after year 4.

Results. Most Texas Fitness Now funds were spent on sports and fitness equipment. Smaller amounts were spent on anti-obesity curricula. Texas Fitness Now improved strength and flexibility, especially among girls, but it did not improve BMI or academic achievement, and it had mixed effects on aerobic capacity. The fitness benefits were not lost in the year after the program ended, perhaps because schools kept the equipment that they had bought during their years of eligibility.

Conclusion. The results of Texas Fitness Now were typical for an intervention that relied almost exclusively on physical activity. Programs that improve BMI as well as fitness tend to have a more fully developed nutrition component.

Introduction

The effect on obesity of physical education (PE) and other school-based physical activity (PA) is a controversial subject. While medical authorities including the American Heart Association, the Institute of Medicine, and the American Academy of Pediatrics have endorsed using PE and PA to reduce child obesity (Institute of Medicine, 2013; Pate et al., 2006; American Academy of Pediatrics et al., 2006), a recent review in the *New England Journal of Medicine* classified the idea that conventional PE classes can reduce obesity as a "myth" (Casazza et al., 2013, 2014).

Despite endorsing school PA to prevent child obesity, the American Academy of Pediatrics has described interventions that rely on PA alone as "somewhat disappointing to date" (American Academy of Pediatrics et al., 2006). A Cochrane review of child obesity prevention found that out of 11 PA-only interventions, only 1 significantly reduced body mass index (BMI) gains in girls, and none significantly reduced BMI gains in boys (Waters et al., 2013). The average effect of the 11 interventions was significantly better than zero, but the Cochrane review cautioned that the average might be inflated by a publication bias against small studies with disappointing results (Waters et al., 2013). The two largest PA-only interventions had standardized effect sizes of 0.00, suggesting that null results were not due to a lack of statistical power. Interventions that combined PA with dietary changes had better results, reducing BMI growth significantly in 10 trials out of 27 (Waters et al., 2013).

The effects of PA interventions on outcomes other than BMI are somewhat more encouraging. A meta-analysis of PA interventions for obese children found that although PA's "effects on body weight and central obesity [were] inconclusive," on average, PA interventions did improve body composition by reducing percent body fat (Atlantis et al., 2006). PA can also increase strength and cardiovascular fitness (Sallis et al., 1997), producing "fat but fit" (Eisenmann, 2007) children whose blood chemistry and risk of metabolic syndrome are better than those of similarly obese children who are less fit (Eisenmann, 2007; Sung et al., 2002). In addition, PA can increase flexibility, which is impaired in many obese individuals (Gilleard and Smith, 2006).

The effect of PA on academic achievement is also controversial. A recent systematic review concluded that "participation in [PA] is positively related to academic performance" (Singh et al., 2012), but a reanalysis

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of the same data concluded that "physical activity is not related to performance at school" (Hattie and Clinton, 2012). It is true that PA improves cognition, particularly executive function (Tomporowski et al., 2008), and fitter, lighter students tend to have higher grades, test scores, and graduation rates (Crosnoe and Muller, 2004; Crosnoe, 2007; Van Dusen et al., 2011). However, the correlation between fitness and academic achievement is hard to interpret causally, in part because both fitness and achievement are correlated with socioeconomic status (von Hippel and Lynch, 2014). Compared to correlational studies, prospective studies of PA interventions suggest much smaller benefits for academic achievement, and some PA interventions have not improved achievement at all (Tomporowski et al., 2008).

PA grant programs and Texas Fitness Now

While much of the literature has focused on specific PA interventions, it is just as important to understand the effects of broader PA policies. At the level of state government, the most common policy is to mandate the amount of time that children must spend in PE. PE time mandates can reduce obesity in elementary school, but only one-third of elementary schools comply with their states' PE time mandates (Cawley et al., 2013). PE time mandates have not reduced obesity in high school (Cawley et al., 2007).

In this article, we evaluate a different policy, namely grant programs which provide schools with funds to improve PE or other aspects of school PA. Unlike PE time mandates, PA grant programs are voluntary and offer schools autonomy as well as financial incentives for participation. As a result, PA grant programs may attract fuller, more enthusiastic participation than unfunded PE time mandates. In addition, schools often use PA grant programs to defray the costs associated with particular PA interventions or curricula (SPARK, 2009a; Office of Safe and Drug-Free Schools, 2010).

In this article, we evaluate a 4-year, $37 million PA grant program called Texas Fitness Now (TFN), which while active was the second-largest government PA grant program in the US, second only to the federal government's Carol M. White Physical Education Program (PEP) (U.S. Department of Education, 2013). TFN was authorized in 2007 by the Texas legislature and ran for 4 years, from the 2007–08 school year through the 2010–11 school year, before being terminated in the recession-crimped budget passed in 2011.

The goals of TFN, according to the legislation authorizing it, were to "[reduce] childhood obesity and Type II diabetes in school districts that have proportionately high numbers of economically disadvantaged [ED] students" (Legislative Reference Library, 2007), where ED means that the student qualified for public assistance such as school meal subsidies. Further goals, according to the Texas Comptroller and the Texas Education Agency (TEA), were to "decrease body fat, increase strength and endurance…prevent exercise-related injuries" (Combs and Texas Education Agency, 2007), and "improve academic achievement" (Combs and Texas Education Agency, 2010), since "through increased fitness, students' cognitive ability will improve" (Combs and Texas Education Agency, 2007)

In years 1–2, TFN eligibility was limited to schools whose students were at least 75% ED. In years 3–4, eligibility expanded to schools whose students were at least 60% ED. In all years, eligibility was limited to schools serving 6th, 7th, or 8th graders, except for schools in the disciplinary and juvenile justice systems.

The total budget for TFN was $10 million per year in years 1–2 and $8.5 million per year in years 3–4—a total of $37 million over 4 years. In years 1 and 2, eligible schools could apply to TEA for annual grants of $1,500 plus $32 for each 6th–8th grader. In years 3 and 4, schools that had not previously participated could apply for annual grants of $1,500 plus $28 per 6th–8th grader, while schools that had previously participated could receive a continuing annual grant of $1,000 plus $11 per 6th–8th grader.

TFN grants may seem small compared to other health or education spending, but they are very large compared to other spending on PE. The median discretionary PE budget for US middle schools in 2009 was just $900 (National Association for Sport and Physical Education, 2009), while the average TFN grant in 2009 was $15,500 per school (Texas Education Agency, 2011). TFN grants were large enough to pay for evidence-based obesity interventions; for example, the Planet Health intervention costs $14 per student (Cawley, 2007)—less than half of the initial TFN allocation. In a TEA survey, at least 93% of schools reported that TFN grants were adequate to achieve the program's goals (Texas Education Agency, 2011).

Schools had flexibility in applying for TFN grants, but applications had to include detailed budgets devoted 75% to PA and 25% to nutrition and had to outline plans to improve obesity and other fitness measures by 5%. In addition, TFN grant recipients had to agree to more stringent requirements than other Texas middle schools (Combs and Texas Education Agency, 2010; Combs, 2008). TFN grant recipients had to require 6 semesters of PE, while other middle schools could require just 4. TFN grant recipients had to assess fitness at both the start and end of the school year, while other middle schools only assessed fitness at the end. TFN grants were limited to new initiatives that would "supplement…and not supplant" existing PE programs (Combs and Texas Education Agency, 2010). A TEA survey found that compliance with grant conditions rose by about 10% between years 1 and 2. By year 2, 90% of TFN middle schools required 6 semesters of PE, and 93% were testing fitness twice per year (Texas Education Agency, 2011).

Methods

Data

We assembled publicly available annual data for all 4 years of TFN and the first year after termination. For each school and year, the data summarized demographics including the percentage of each school's students who were ED, as well as indicators for whether each school was eligible for TFN, and whether it participated. Because of TFN's eligibility requirements, we limited the data to middle schools that were not in the disciplinary or juvenile justice systems and that only enrolled students in 6th, 7th, or 8th grade.

We also obtained all the TFN grant proposals approved in year 3, which was the year with the highest level of TFN participation. These proposals contained budgets which broke TFN spending into standard categories. Some proposals named items that the district would purchase for participating schools, as well as specific anti-obesity curricula which we coded using keywords.

Dependent variables: Fitness and achievement

Starting in 2007–08 (year 1 of our study), Texas required all middle schools to administer the FitnessGram assessment (Human Kinetics, 2013) every spring. Using FitnessGram, schools had to assess at least one measure of body composition, one measure of aerobic capacity, one measure of flexibility, and three measures of strength. To assess body composition, 89% of schools chose BMI (the alternative was skinfold thickness). To assess strength, 91–92% of schools chose pushups, curlups, and trunk lifts. To assess flexibility, 68% of schools chose the shoulder stretch and 46% chose the sit and reach (some chose both). To assess aerobic capacity, 47% of schools chose the mile run and 62% chose the progressive aerobic cardiovascular endurance run (PACER), "a paced, 20-meter shuttle run that increases in intensity as time progresses" (Texas Education Agency, 2012).

On each component, the FitnessGram classifies students as being inside or outside a "healthy fitness zone" (HFZ) whose definition varies by gender and age. The HFZ for aerobic capacity is associated with high maximal oxygen consumption (VO_{2max}) and low risk of metabolic syndrome (Welk et al., 2011a; Cureton and Warren, 1990). The HFZ for BMI is associated with having low percent body fat (Laurson et al., 2011), which in turn is associated with reduced cardiovascular risk factors including systolic blood pressure, HDL cholesterol, triglycerides, C-reactive protein, insulin, and fasting glucose (Going et al., 2011). The HFZs for strength and flexibility have not changed since 1992, but for BMI and aerobic capacity, the boundaries of the HFZ were revised in 2011 (year 4 of our study), and the area outside the HFZ was broken into subcategories indicating "some risk" and "high risk" (Welk et al., 2011b).