

Not



Your Father's

PE



**Obesity,
exercise,
and the role
of schools**

American children are gaining weight at an alarming rate. Since the 1960s, according to the Centers for Disease Control and Prevention (CDC), the percentage of American six- to eleven-year-olds who fall into the CDC's highest weight classification for children has almost quadrupled. The fraction of adolescents in this category, called "overweight" by CDC rather than "obese" in an attempt to avoid stigmatizing children, has skyrocketed from 4.5 percent to 15.5 percent (see Figure 1).

What may not be as well known is that physical education (PE) requirements in schools have been shrinking at the same time that the waistlines of America's school children have been expanding. From 1991 to 2003, the percentage of high-school students enrolled in daily PE classes in America plummeted, from 42 percent to 28 percent. Sounds like simple math: less time in gym class plus increasingly easy access to snack food and soda in school equals more youth obesity.

The solution seems straightforward. Medical, public health, and education organizations, including the President's Council on Physical Fitness and Sports, the Department of Health and Human Services, the Department of Education, the National Association of State Boards of Education, and the American Academy of Pediatrics have all called for

students to spend more time in PE classes. In 2005 alone, legislatures in 44 states introduced bills to increase or reform school physical education. Alabama proposed hiring an additional 289 PE teachers in each of the subsequent 2 years. Kentucky, like several other states, would require 30 minutes of PE a day for its students. Maryland decided to hire a full-time state director of physical education.

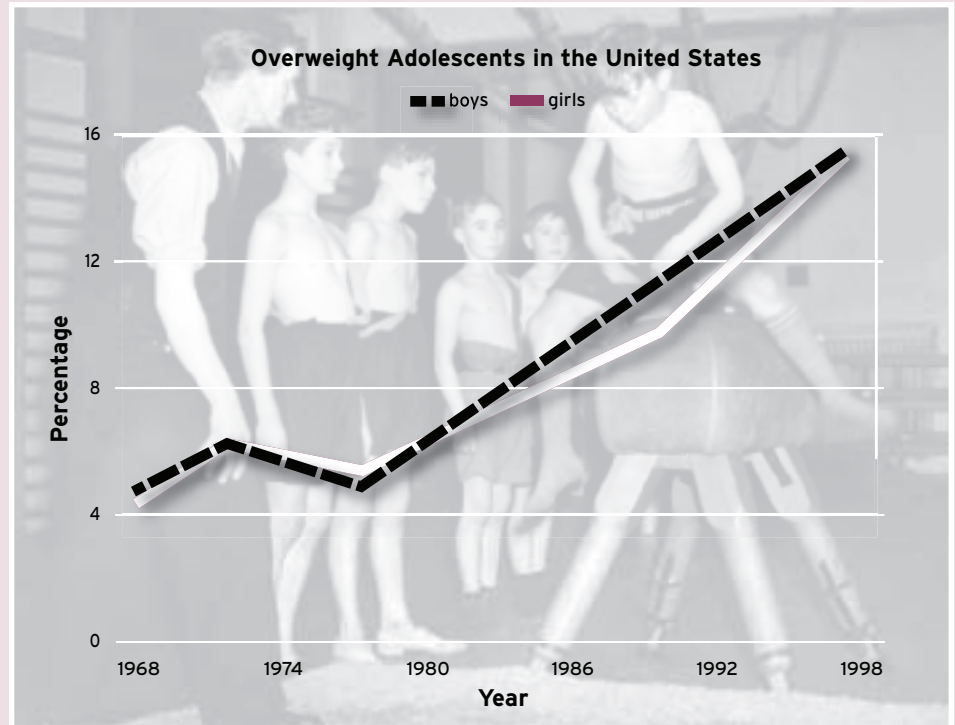
Jumping through Hoops and Caveats

Requiring more PE seems like a logical response to the childhood obesity epidemic, but will mandating more time in

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Growing Out While Growing Up (Figure 1)

The percentage of America's adolescents who are overweight has more than tripled since the late 1960s.



Note: According to the Centers for Disease Control and Prevention (CDC), an "overweight" individual has a body mass index (BMI) at or above the 95th percentile of the CDC's sex-specific BMI growth chart. The point estimates on the graph are the result of surveys administered over the following periods: 1966-70, 1971-74, 1976-80, 1988-94, and 1999-2000.

SOURCE: Centers for Disease Control and Prevention, National Center for Health Statistics, "Health, United States, 2003"

BY JOHN CAWLEY, CHAD MEYERHOEFER, AND DAVID NEWHOUSE

gym classes actually result in more exercise for kids? Will it help them lose weight? Surprisingly, studying the relationships between PE classes and actual physical activity presents some research challenges, as does judging the connections between PE and student weight.

To begin, requiring more PE does not mean that students actually spend more time in the gym. According to a 2000 study by sports researchers Ken Hardman and Joe Marshall, an estimated 26 percent of PE classes in the United States today fail to comply with state regulations. And even when schools do play by the rules, gym classes may do little to promote exercise. The U.S. Department of Education has criticized PE for too often consisting of “roll out the balls and let them play,” unstructured and unmotivated class time involving little vigorous activity. One study of a county in Texas found that elementary-school students are vigorously active only 3 minutes and 24 seconds per 40-minute PE class. (See “Don’t Sweat It,” *features*, p. 30.)

Even that may exaggerate the impact of a physical education program, as students may circumvent the best intentions of state lawmakers. PE classes may generate an increase in exercise at the moment the class is held, for instance, but students may decide to exercise less at other times during the school week. And even if overall exercise levels jump upward, that will not lead to weight loss if students increase their caloric consumption. Evaluations of innovative PE curricula designed to encourage exercise suggest that PE classes do increase physical activity but have no noticeable effect on student

of time students spend exercising in PE class. Then we looked at how much that increase in PE exercise time affects the levels of overall physical activity and the weight of high-school students. Our results in a nutshell: when states raise their PE requirements, girls become more active, as indicated by their reports of the total number of minutes per week they say they are exercising vigorously. There is no similar effect on boys.

When it comes to less-vigorous physical activity, however, increased PE exercise actually *decreases* the number of days in which girls report light physical activity. Apparently, when girls exercise in class, they become more sedentary during the discretionary hours of their week. Unfortunately, this propensity occurs predominantly among girls who are less active in the first place. Perhaps because PE has so little impact on physical activity, we found little effect on weight loss or the likelihood of obesity, as measured by the BMI, which is derived by dividing weight (in kilograms) by height (in meters) squared. The only suggestion of an effect is among the most-sedentary girls, and the evidence there is weak at best.

Those are the main findings. To obtain them was more complicated than it might seem, simply because studying the relationships between PE, physical activity, and weight is complex. Students can be thin, active, and engaged in their physical education, but figuring out which of these attributes came first is another matter. Or students can be couch potatoes, overweight, and laggards in the gym, but exactly



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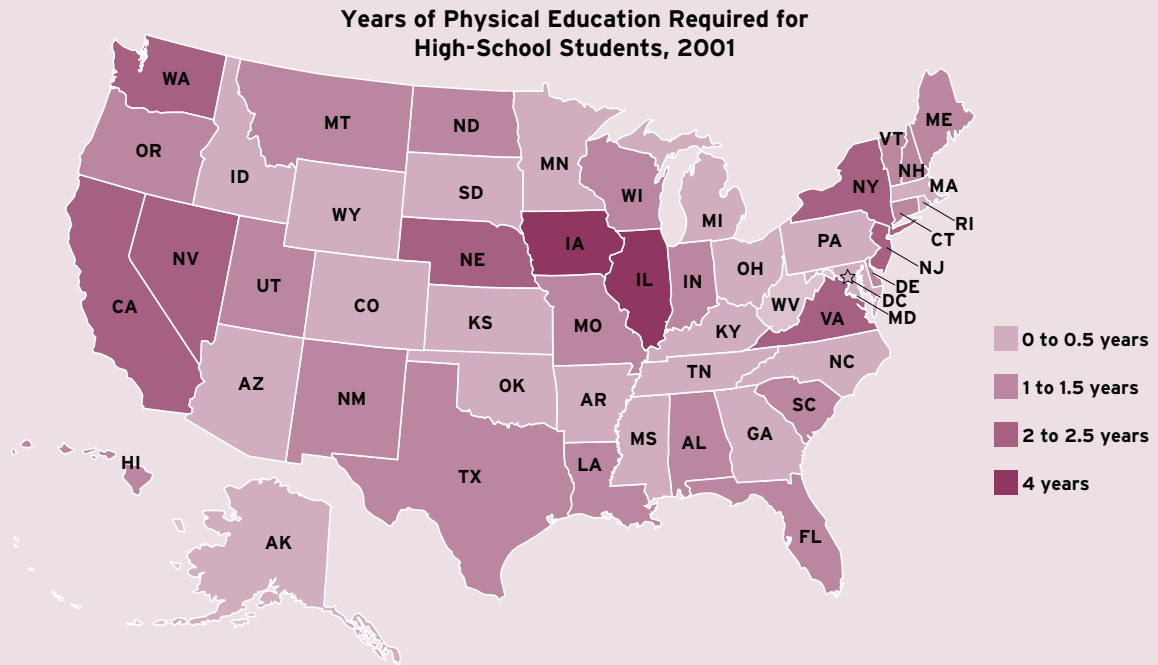
weight. Still, relatively little research has systematically examined how much PE (as it is currently constituted) contributes to weight loss or lowers the risk of obesity, and what little research there is finds no association between PE and weight loss and obesity.

To investigate the matter further, we examined how differences in state requirements for PE affect the amount

what caused the obesity may be quite unclear. If physically active students of healthy weight enjoy PE and elect to take extra PE classes, we will likely find a correlation between PE and healthy weight, even if extra PE has no impact on weight. Similarly, if the school offers more, and higher-quality, PE classes, and if the students living in those districts come from advantaged homes and are healthier as a result,

Regulating Exercise (Figure 2)

Different states, distinctive mandates.



Note: The physical education requirement data are normalized to reflect years of instruction, and requirements corresponding to health education are excluded.
 SOURCE: National Association for Sport and Physical Education, “Shape of the Nation Report,” 2001

then one could find, once again, a correlation between PE and healthy weight.

One can try to get around these problems by looking at changes in school or district physical-education requirements. But once again, one could be led astray by any simple analysis that ignores the possibility that schools and districts raise PE requirements in response to high obesity rates. Unless one took this possibility into account, tougher PE rules would appear to make students gain weight.

Making the Target Stand Still

We address these research problems by using a measure of PE time that is beyond the control of students and individual districts and schools: state laws that mandate minimal PE requirements. Information on state laws was gathered from “The Shape of the Nation Report” (SONR), a 2001 survey of all states and the District of Columbia conducted by the National Association for Sport and Physical Education. The purpose of SONR was to document the state man-

dates for, and availability of, physical education programs at each school level in every state. Only about 40 percent of the states have a requirement stated in minutes of PE instruction. Among those that do, the average requirement is slightly over 40 minutes per day. Other states have unit or credit requirements that mandate a certain amount of coursework in PE, but the number of “course minutes” equating to a unit of instruction varies. We standardized the data so that one unit of PE has the same meaning across states. After standardization, the amount of PE required by state varied from 0 (no requirement) to 4 years in half-year increments (see Figure 2).

Next, we used the standardized units to study the link between the amount of time children spend exercising in PE class and their overall activity levels and weight. We obtained information on student physical activity and weight by taking advantage of the student data available from the Youth Risk Behavior Surveillance System (YRBSS), a nationally representative survey of high-school students (grades 9–12) that was established by the CDC to monitor the prevalence of risky

youth behaviors, including those relating to physical activity and obesity. The YRBSS has been conducted biennially since 1991. We combined the YRBSS data from the 1999, 2001, and 2003 surveys, the years for which the study asked about weight and height. The result is a sample of almost 37,000 high school students containing information on PE time, exercise, height, and weight.

The YRBSS asks students two questions about PE: the number of days per week that the student has PE class and the number of minutes per class that the child is actually engaged in sports or other exercise. Since the latter question asks students to report minutes in one of several intervals, we multiply the number of days per week the student has PE class by the midpoint of the interval to calculate the total active time in PE class per week. (We also recalculated active PE time per week using the lowest number of minutes in each interval instead of the midpoint. This change did not affect our findings on physical activity or weight.)

In general, estimated active time in PE class is low, with an average reported level of 16 minutes per day and only 2 minutes per day for the median student. Median active time is low because many school districts only require PE for one or two years of high school, many schools offer PE class fewer than five days per week, and many PE classes fail to provide much actual exercise.

Our three measures of physical activity are those chosen by the CDC to monitor progress toward the goals of their Healthy People 2010 campaign. The YRBSS asks how many days out of the past seven respondents participated in three different types of exercise: 1) at least 20 minutes of vigorous exercise (activities that made the student sweat or breathe hard); 2) at least 30 minutes of light activity; and 3) strength-building exercise (no minimum number of minutes). These questions cover all exercise and activity, whether in or out of PE class; as a result, we measure the impact of PE on total activity.

We study two outcomes concerning student weight: BMI and whether or not the student is classified by the CDC, according to their BMI, as obese.

When dealing with self-reported data, there is always the risk that survey respondents will misreport, accidentally or intentionally. To determine the extent of reporting error in weight among high-school students, researchers at the CDC surveyed high-school students and collected data on both self-reported and measured weight and height. They found that self-reported values of height and weight were highly correlated with their measured values (0.90 and 0.93, respectively), but students did tend to overreport their height and underreport their weight. The average student overreported height by 2.7 inches and underreported weight by 3.5 pounds, resulting in an underreported BMI of 2.6 units. However, this tendency to underreport will only disguise a true effect of PE

on weight if students who live in states with lower PE requirements underreport their weight by a larger amount. Since there is no reason to believe that, we consider the self-reports to be acceptably accurate measures of student height and weight.

A limitation of the YRBSS data is that we are unable to separate private school from public school students. This is relevant because public schools are legally bound to comply with state regulations concerning physical education, but private schools are not. However, it should be kept in mind that 90 percent of all students in the United States attend public schools.

Asking the Right Questions

We pursued three main lines of inquiry in order to find out what happens when states require students to spend more class time in the school gym or on the athletic fields:

1. Do students living in states with higher PE credit requirements spend more time physically active in PE class than those living in states with lower PE credit requirements?
2. Does this additional active PE time improve overall levels of physical activity?
3. Does this additional active PE time lead to lower weight, as measured by BMI?

To measure the impact of state-mandated PE requirements, we compared the self-reported PE activity times, overall physical activity levels, and BMI of students who are subject to state PE requirements. We also accounted for the students' age, gender, and race/ethnicity, as well as the region in which they live, in order to isolate the effect of PE requirements from other factors that may be correlated with activity, body weight, and obesity.

Since states choose their PE policies, it is possible that those with high rates of youth obesity enact higher PE requirements. If this were the case, we would actually see a positive relationship between PE requirements and BMI. In an effort to identify this relationship if it did occur, we account for the prevalence of obesity in the state among adults.

We also address the concern that we will see a false negative relationship between PE and weight if wealthier states have lower rates of obesity and higher PE requirements. To account for the possible influence of state socioeconomic status, we control for state per capita income, the percentage of the state population with a bachelor's degree or higher, and the percentage of the state's children participating in the National School Lunch Program (NSLP). We also include two additional, more-focused measures of the resources made available for education in a state: average teacher salary and average pupil-teacher ratio.

More PE time = More exercise. Maybe.

When an additional unit of PE is required, which translates roughly into an extra 200 minutes per week, boys report they spend 7.6 minutes more per week actually exercising or playing sports in gym class. However, that additional time spent exercising in school did not result in clear improvements in students' overall levels of physical activity. Boys report no increase in the number of days they engaged in vigorous, light, or strength-training exercise.

The effect of increasing PE requirements on girls is slightly larger; requiring an additional unit adds 8 minutes and 6 seconds per week of exercise in PE. One possible explanation for the gender difference is that girls are less likely to take PE as an elective, so their amount of PE time is more readily affected by minimum course requirements. That additional 8 minutes and 6 seconds in active PE time seems to have some more general

The reason for the reduction in light activity days among girls? We suspect that girls may be offsetting the additional amount of PE exercise by decreasing physical activity outside of class. Girls may have a target amount of time they wish to spend physically active. If they are required to spend more time exercising in PE, they may respond by cutting back on discretionary light activities outside of school.

It is not clear, however, why this substitution exists only for light activity and not for vigorous exercise or strength-building activities. Perhaps this pattern of behavior is a result of different effects of state requirements on physically active girls as compared to their relatively sedentary classmates.

We identified the sedentary and more-active girls by turning to the YRBSS question that asked each student whether they participate in team sports. While this is not a perfect measure of a girl's tendency to be active, we consider it to be at least a



When additional PE is required, boys report no increase in the number of days they engaged in exercise. Girls report a small increase in the number of days they are engaged in vigorous exercise.

payoff, even when one takes into account what happens outside school, as it results in a small increase in the number of days per week girls report they are engaged in vigorous exercise.

An extra 100 minutes of active PE time raises the number of days with vigorous exercise reported by girls by 1.2 days. Put another way, for girls to spend an additional day with at least 20 minutes of vigorous exercise requires an extra 83 minutes of active PE time per week, or roughly 17 minutes per school day. This 17 minutes is not simply extra PE class time; it's extra PE class time *spent being physically active*.

However, these positive impacts are accompanied by offsetting effects. An extra 100 minutes of PE exercise per week causes a *decrease* of 0.75 days with light activity among girls. In other words, one *less* day with light activity is reported for every 133 additional minutes of PE exercise (or 27 additional minutes of PE exercise per school day). There appears to be no effect of additional active PE time on frequency of strength-training activity among girls.

rough indicator. Consistent with our expectations, offsetting behavior is evident only for girls who do not play team sports. Among these girls, an extra 100 minutes of active PE time results in 1.6 fewer days with light exercise.

All this still leaves us wondering why PE requirements make a difference for the more-vigorous physical activity for girls but not for boys. Just as minimum PE requirements may have different effects on students with different initial overall activity levels, additional PE may affect girls more than boys because girls on average engage in less strenuous exercise and fewer strength-building activities than boys. For example, the average number of days per week with vigorous exercise is 3.0 for girls and 4.2 for boys. The average number of days with strength-building activity is 2.4 for girls and 3.5 for boys. This difference in overall activity levels means that the same amount of PE time represents a bigger fraction of girls' total physical activity.

Overall, the evidence on whether exercise in PE promotes exercise for girls is mixed. When required by state law to attend



Our results cast doubt on the effectiveness of education reforms that merely increase the time spent suited up for gym class.

more gym classes, adolescent girls, unlike their male counterparts, do engage in vigorous physical activity more often, but engage in light exercise less.

Quantity and Quality

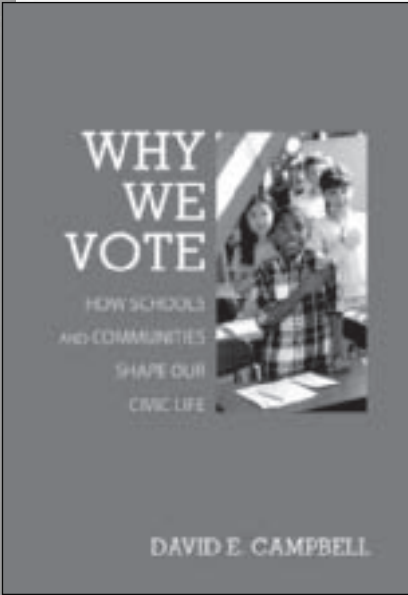
The results of our study suggest that the effect of increased state PE requirements is mixed at best. Although we found no effect on boys' overall physical activity or weight, increased active PE time does raise the number of days that girls report at least 20 minutes of vigorous exercise. The improvement for girls is important because these types of exercise have significant health benefits, even aside from weight loss. Yet the positive effect on girls' behavior is tempered by a decrease in the number of days girls engage in 30 minutes or more of light physical activity. This offsetting behavior is most promi-

nent among girls who are not otherwise active in team sports. The results, combined with the lack of a clear effect of PE on BMI or obesity among adolescent youth, lead us to doubt the effectiveness of education reforms that merely target time spent suited up for gym class.

It is possible that some of the additional PE time that students classified as devoted to exercise or sport was, in fact, relatively sedentary. If this is what explains the lack of association between active PE time and most measures of physical activity and obesity among boys and girls, then improvements to the PE curriculum should precede mandated increases in PE time. Some of the organizations that have called for more PE time qualified their recommendation by stating that there should be an increase in "quality" PE, in addition to more time in PE, but as yet there is no agreed-upon, scientifically determined "ideal" PE curriculum.

Even if PE curricula are strengthened to include more vigorous exercise, the effects will be reduced if students become more sedentary during their discretionary time, the net effect being that weight may remain unaffected. Public health officials and educators should consider ways to reduce or eliminate such offsetting behavior.

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Why We Vote

How Schools and Communities Shape Our Civic Life

DAVID E. CAMPBELL

Why We Vote demonstrates that our communities shape our civic and political engagement, and that schools are especially significant communities for fostering strong civic norms. David E. Campbell maintains that a sense of civic duty springs not only from one's current social environment, but also from one's early influences. The degree to which people feel a sense of civic obligation stems, in part, from their adolescent experience. Being raised and thus socialized in a community with strong civic norms leads people to be civically engaged in adulthood. Campbell demonstrates how the civic norms within one's high school impact individuals' civic involvement—even a decade and a half after those individuals have graduated.

Efforts within America's high schools to enhance young people's sense of civic responsibility could have a participatory payoff in years to come, the book concludes.

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