

# Physical Education's Potential Impact on Overweight Based on Energy Expenditure

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# Overall Study Goal

To assess the **potential** and **reality** of physical education in helping to control for child and adolescent overweight and obesity

**Note:** Study is limited to only energy expenditure during lesson time

# Background

- Child/adolescent overweight/obesity is a serious public health issue
- Schools are important venues for physical activity (PA), especially during PE
- IOM and others recommend PE daily (30 min elementary; 45 min secondary)
- IOM and others recommend at least 50% MVPA during lessons
- Most school PE falls short of this frequency, duration, and intensity

## Background contd.

- Policies for PE across the US are diverse and limited
- Only 19 of 50 states reported policies for specific PE frequency and duration
- Lesson frequency and length, MVPA%, and steps/min have all been used to quantify PE policy
- But these metrics do not readily reveal the potential of PE to have a public health impact on overweight and obesity

## General Procedures

We quantified the potential 10-year caloric impact of PE on estimated energy expenditure (EE) of individuals and classes under conditions (i.e., frequency, duration, class size) recommended by:

- (a) professional organizations (i.e., NASPE)
- (b) the 19 states with policies for mandated PE minutes,
- (c) and with children having no PE at all

# Methods

## Sample

- Estimated EE for elementary, middle, and high schools (grades 1–6, 7–8, & 9–10)
- Calculated EE for hypothetical boys and girls between ages 6 and 15

## Estimations based on:

- NASPE Guidelines for PE time (min/week =150 elementary, 225 secondary)
- State averages ( $N=19$ ; *Shape of the Nation Report 2012*)
- Reviews of research on PA intensity in PE (Fairclough & Stratton, 2005, 2006)



# Methods: Calculation Components

- *PE duration and frequency.* To reduce confusion among state policies, we calculated a common metric (i.e., min/day). Annual dosage = 180 days
- *PA Intensity.* 3.15 METs for mean intensity in PE and 1.4 METS for equivalent time in classrooms (no PE)
- *Class Size.* NASPE recommendations (i.e., no more than 25, 30, and 35 students at elementary, middle, and HS levels, respectively)
- *Body Mass.* Nationally representative values of mean body mass, independent of height, from USDHHS anthropometric reference data. Estimated EE using year-by-year 50<sup>th</sup> percentile mass values for boys and girls between ages 6 (1<sup>st</sup> grade) and 15 (10<sup>th</sup> grade)
- *Class-level calculations.* Assumed a 1:1 ratio of boys to girls, and used a mean mass by grade level value.

# Methods: Calculation Formulae

$$\begin{aligned} \text{Annual Individual Estimated EE (kcal/student/yr)} = & \\ & \text{Intensity (MET)} \times \\ & \text{Mass (kg)} \times \\ & \text{Duration (lesson min/day)} \times \\ & \text{Frequency (days of school instruction/yr)} \end{aligned}$$

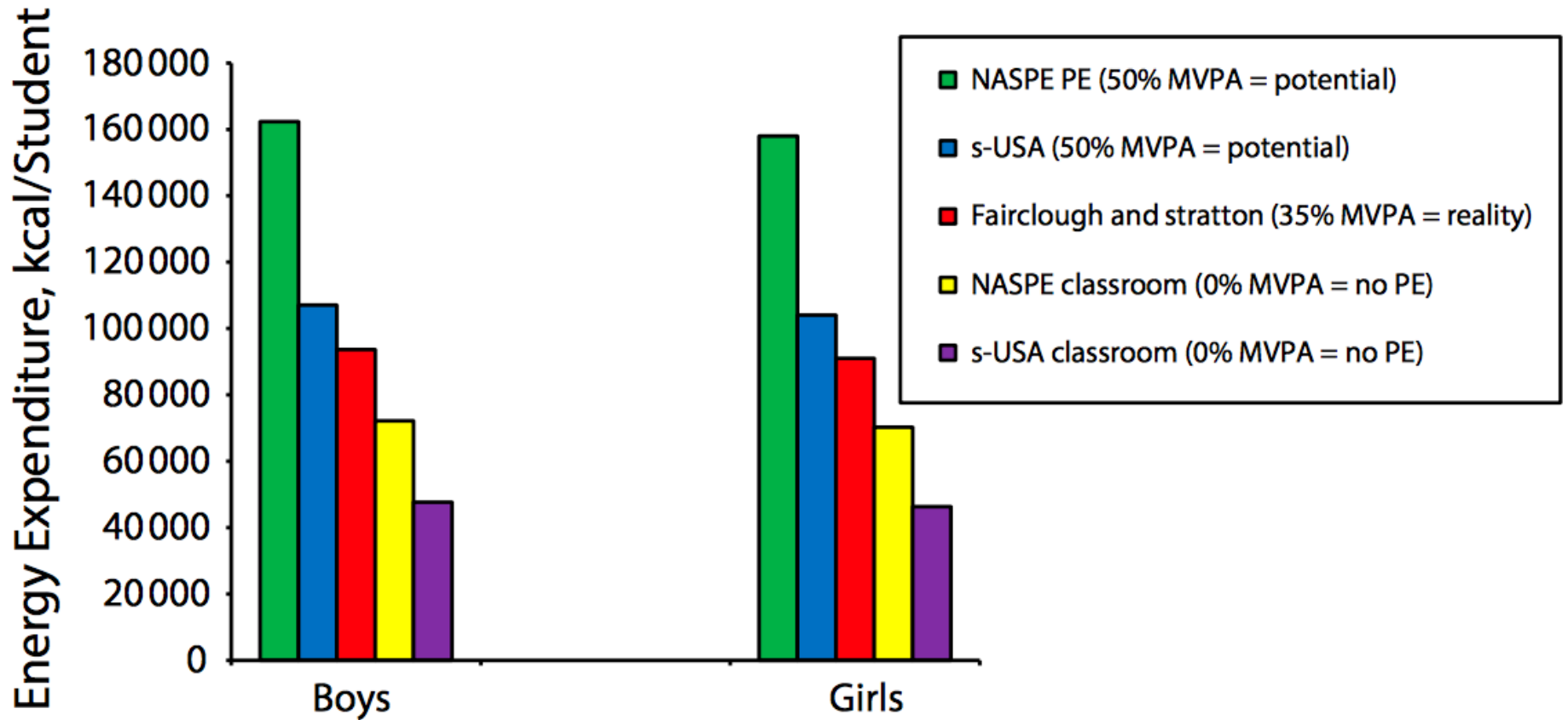
$$\begin{aligned} \text{Annual Class Estimated EE (kcal/class/yr)} = & \\ & \text{Intensity (MET)} \times \\ & \text{Mass (} M \text{ kg}_{\text{class}} \text{)} \times \\ & \text{Duration (lesson min/day)} \times \\ & \text{Frequency (days of school instruction/yr)} \times \\ & \text{Class size (} M \text{ number of students/class)} \end{aligned}$$



# Results

- Large variability in EE by gender, school level, states, and PE policy conditions
- **Potential:** EE by children in elementary, middle, and high schools following NASPE guidelines exceeds schools following state recommendations by 1.56, 1.64, and 1.38 times, respectively.
- **Reality:** EE estimates from objective studies is only 56-66% of NASPE and state policy recommendations.

	Elementary School		Middle School		High School	
	PE time (min/day) <i>M</i>	EE	PE time (min/day) <i>M</i>	EE	PE time (min/day) <i>M</i>	EE
<b>NASPE</b>	30.0	1 466 758	45.0	1 402 049	45.0	1 926 701
<b>Alabama</b>	30.0	1 466 758	50.0	1 557 883	—	—
<b>Arkansas</b>	12.0	586 703	12.0	373 880	—	—
<b>California</b>	20.0	977 839	40.0	1 246 266	40.0	1 712 624
<b>Florida</b>	30.0	1 466 758	—	—	—	—
<b>Hawaii</b>	6.0	293 352	—	—	40.0	1 712 624
<b>Iowa</b>	—	—	—	—	9.0	338 156
<b>Louisiana</b>	30.0	1 466 758	30.0	934 700	—	—
<b>Mississippi</b>	10.0	488 919	10.0	311 567	—	—
<b>Missouri</b>	10.0	488 919	9.0	280 410	—	—
<b>Montana</b>	—	—	45.0	1 402 049	45.0	1 926 701
<b>New Jersey</b>	30.0	1 466 758	30.0	934 700	30.0	1 284 468
<b>New York</b>	24.0	1 173 407	19.0	591 976	18.0	676 312
<b>North Dakota</b>	23.8	1 163 628	9.0	280 410	—	—
<b>Oklahoma</b>	12.0	586 703	—	—	—	—
<b>Rhode Island</b>	20.0	977 839	20.0	623 133	20.0	856 312
<b>South Carolina</b>	12.0	586 703	—	—	—	—
<b>Utah</b>	—	—	45.0	1 402 049	45.0	1 926 701
<b>Washington</b>	20.0	977 839	20.0	623 133	—	—
<b>West Virginia</b>	18.0	880 055	45.0	1 402 049	45.0	1 926 701
<b>State Sample</b>						
<b>Mean</b>	19.2	940 559	27.4	854 586	32.4	1 373 400
<b>SE</b>	2.0	100 454	4.1	126 696	4.6	203 495



*Note.* EE = energy expenditure; MVPA = moderate-to-vigorous physical activity; NASPE = National Association for Sport and Physical Education; PE = physical education; s-USA = state policy guidelines.

**FIGURE 2—Cumulative (grades 1–10) estimated EE during PE lessons and equivalent classroom time according to NASPE recommendations and average state guidelines: United States, May 2014.**

## Discussion/Implications

- Even using conservative estimates, PE has great potential for helping to control for child overweight, especially at dosages recommended by NASPE and some states
- Limited PE policies and lack of accountability for schools interfere with this potential.
- Need for implementing state and district policies for PE dosage and to have surveillance systems to ensure accountability

## For Additional Information

Kahan, D. & McKenzie, T. L. (2015, in press).  
The potential and reality of physical education in  
controlling overweight and obesity. *American  
Journal of Public Health*, 105(4), April.

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