The Effect of School Physical Education Instruction Time on Child Obesity

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Our research questions

→ How does length of physical education (PE) instruction time relate to obesity development for a national cohort of children between 1st and 5th grade?

→ Is PE instruction time more effective in obesity prevention for children with certain characteristics?

- Most prior studies evaluate PE class content changes for schools in a limited geographic area
- One national study evaluating 1-year change (*Datar and Sturm, 2004*)
- We extend on this study

Early Childhood Longitudinal Survey (ECLS-K)

- Base sample is representative of kindergartners across the United States in 1998-1999

- Our panel data consists of three waves

    - spring of 1st, 3rd and 5th grades

- Includes teacher, school administrator, parent and child assessment surveys

- Our 1st grade sample includes 8,930 children in 1,043 schools across 40 states

Key variables

- Outcome measures
  - BMI percentile (continuous)
 - Indicator for overweight (binary)

  Height and weight measured in every round of data collection

- Explanatory measure
  - Hours of PE instruction time per week (continuous)

*"How many **times each week** do children in your class usually have physical education?"*
*"How much **time each day** do children in your class usually spend when they participate in physical education?"*
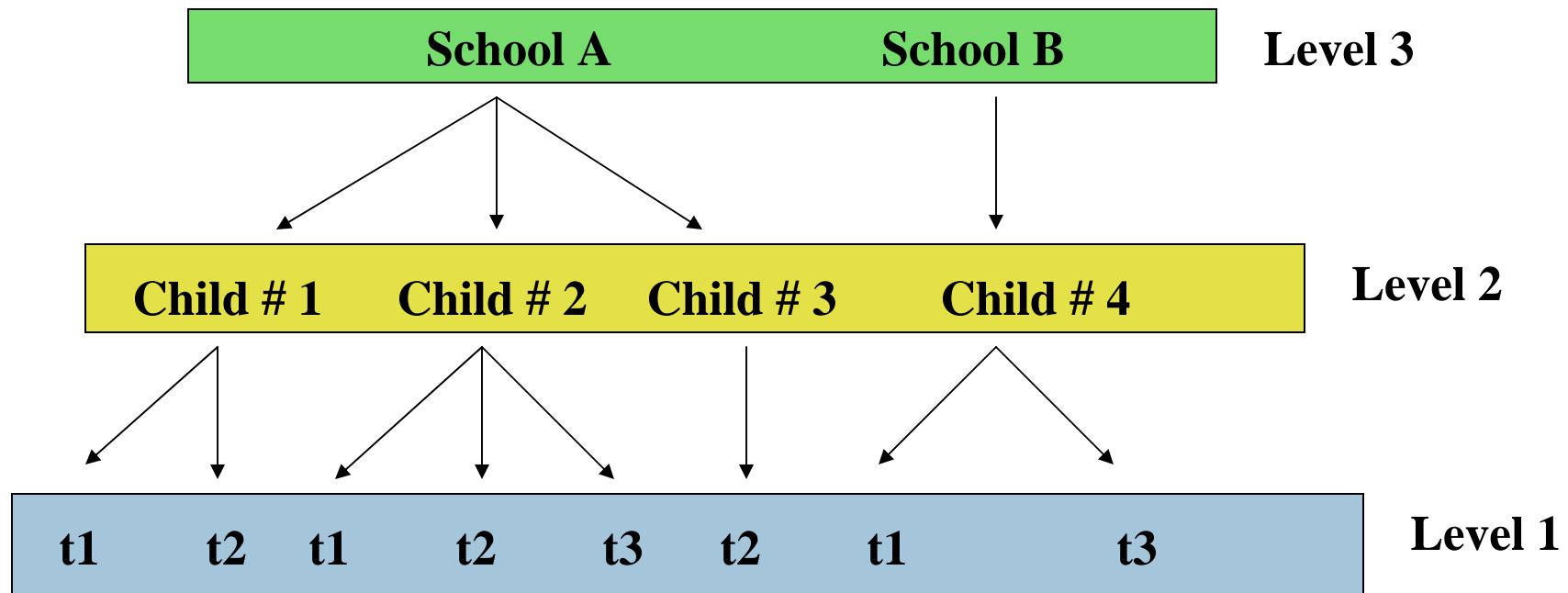
BMI percentile distribution change
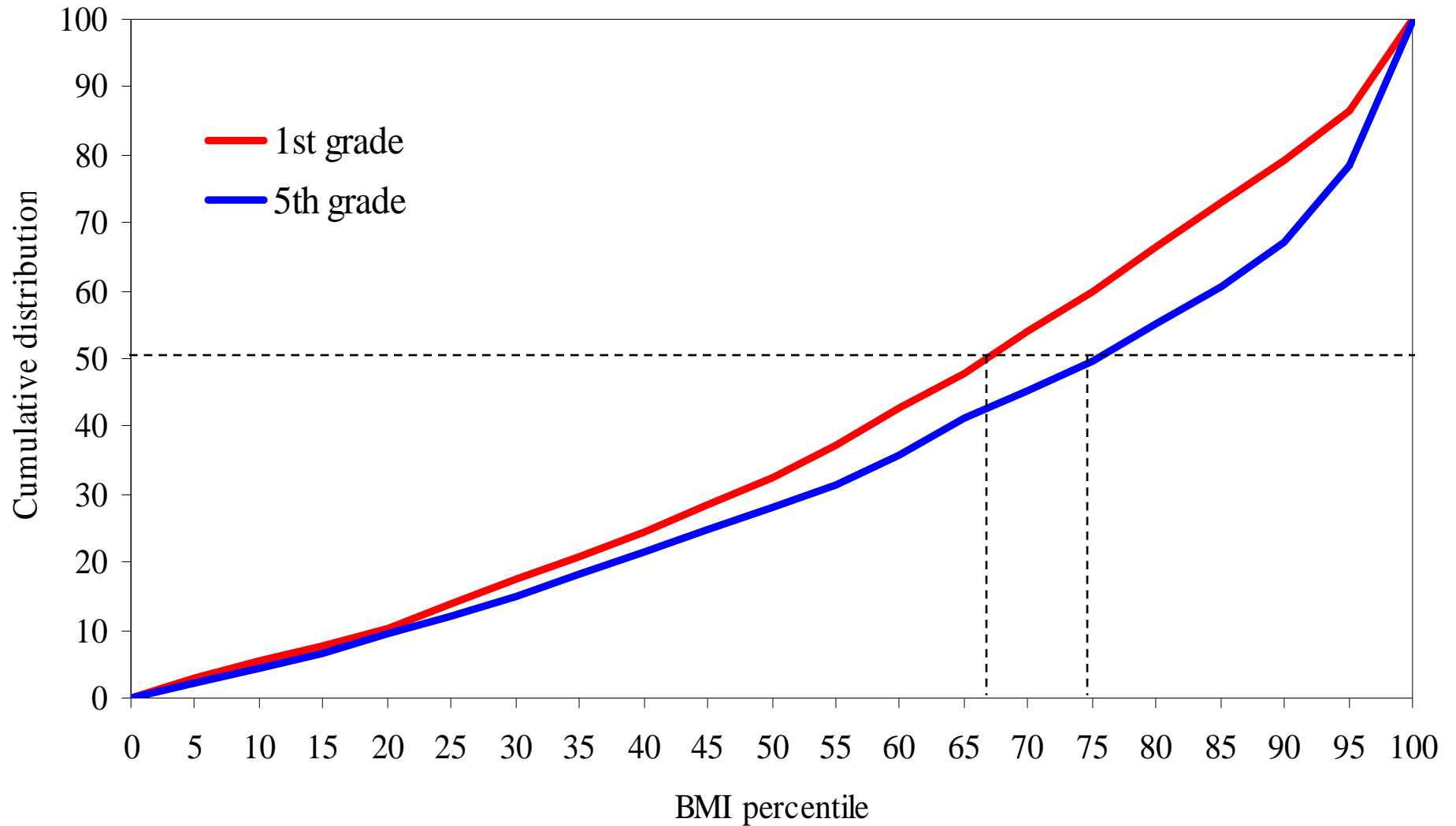
Patterns over time

	1st Grade	3rd Grade	5th Grade
BMI			
Percentile, average	62.1	66.0	67.2
Overweight, %	13.7	18.7	21.4
PE instruction time			
Minutes, average	64.3	68.0	77.1
Children meeting recommended amount, %	6.8	8.8	13.3
Risk Behaviors			
TV hours per week, average	6.3	6.3	6.9
Outside school sports participation, %	65.2	72.1	75.0

Growth curve modeling (1)

- Also known as random coefficients models.
- Motivation is nested structure of data – number of children per school ranges from 1 to 30 with an average of 9.

School A	School B	**Level 3**

| Child # 1 | Child # 2 | Child # 3 | Child # 4 | **Level 2** |

| t1 | t2 | t1 | t2 | t3 | t2 | t1 | t3 | **Level 1** |

Growth curve modeling (2)

○ Not a new statistical method, but a new application.

○ Random intercepts are child and school.

○ Fixed effects include child demographics, child risk behaviors, school characteristics and state dummies.

○ Random slopes tested are PE class length at the school-level and age at the child-level.

○ Fixed effect interactions tested to determine if PE instruction time is *more* effective for children with certain characteristics.

Main findings

○ We find a significant effect for children who do not participate in sports outside school.

    ● These children are more likely to be a minority and from a low-income household.

○ We also find an effect for children who attend urban schools.

○ Similar effects for boys and girls.

○ Possible greater effect for overweight children.

PE instruction time effective for children with no outside sports

	No Outside Sports		Outside Sports	
	#1	#2	#1	#2
Fixed Effects, coefficients				
PE instruction time, hours		-0.56 *		0.62
Male (ref: female)		4.16***		1.8*
TV watched in past week, hours		0.15**		0.21***
School in rural area		7.34*		8.8***
Constant	65.8***	58.3***	63.3***	62.7***
Random Effects, standard errors				
School intercept	6.0	4.9	5.8	4.3
Child intercept	26.1	26.0	25.5	25.6
Child slope	4.4	4.1	4.0	3.9
Measurement intercept	9.2	8.8	9.4	9.1
Log-likelihood	-56,617	-39,403	-55,987	-49,127
ICC-within school	0.05	0.03	0.05	0.03
ICC-within child	0.89	0.90	0.88	0.89

However - we do not find differential effects

PE instruction time has associated level effects on BMI percentile, but does not appear to be *more effective* for certain subgroups.

We *do not* find trajectory slope differences with:

Cross-level interactions with age, gender, outside sports participation and risk behaviors

Same-level interactions with urbanicity and school management type

Random effects

- In the empty model with no fixed effects we find:
  - An ICC of 0.05 for children within schools.
  - An ICC of 0.89 for repeated measurements within a child.
- The addition of fixed effects does not substantially reduce the level of unexplained variation.
- A random slope on age indicates that the growth trajectory of children is age-dependent.

Interpretation

- One hour more of PE instruction time results in -0.56 BMI percentile units between 1st and 5th grade for children who do not participate in sports outside of school.

- This is roughly equivalent to 9% of the average BMI percentile increase between 1st and 5th grade for the sample (5.8 units).

- Similar effects found for males and females.

Conclusions

- PE programs as currently implemented in schools may affect obesity development for some children.

- Length of PE instruction time has a significant negative impact on BMI percentile for children who do not participate in sports outside school.

- However, length of PE instruction time has no effect on the slope of BMI percentile trajectory.

Limitations of our study

○ Length of PE instruction time is only one dimension of quality.

○ Changes to improve other aspects of program quality may improve effectiveness of current time allocation to PE class.

Comments/Questions?