

# The Association between School Siting and Adolescent Active Travel

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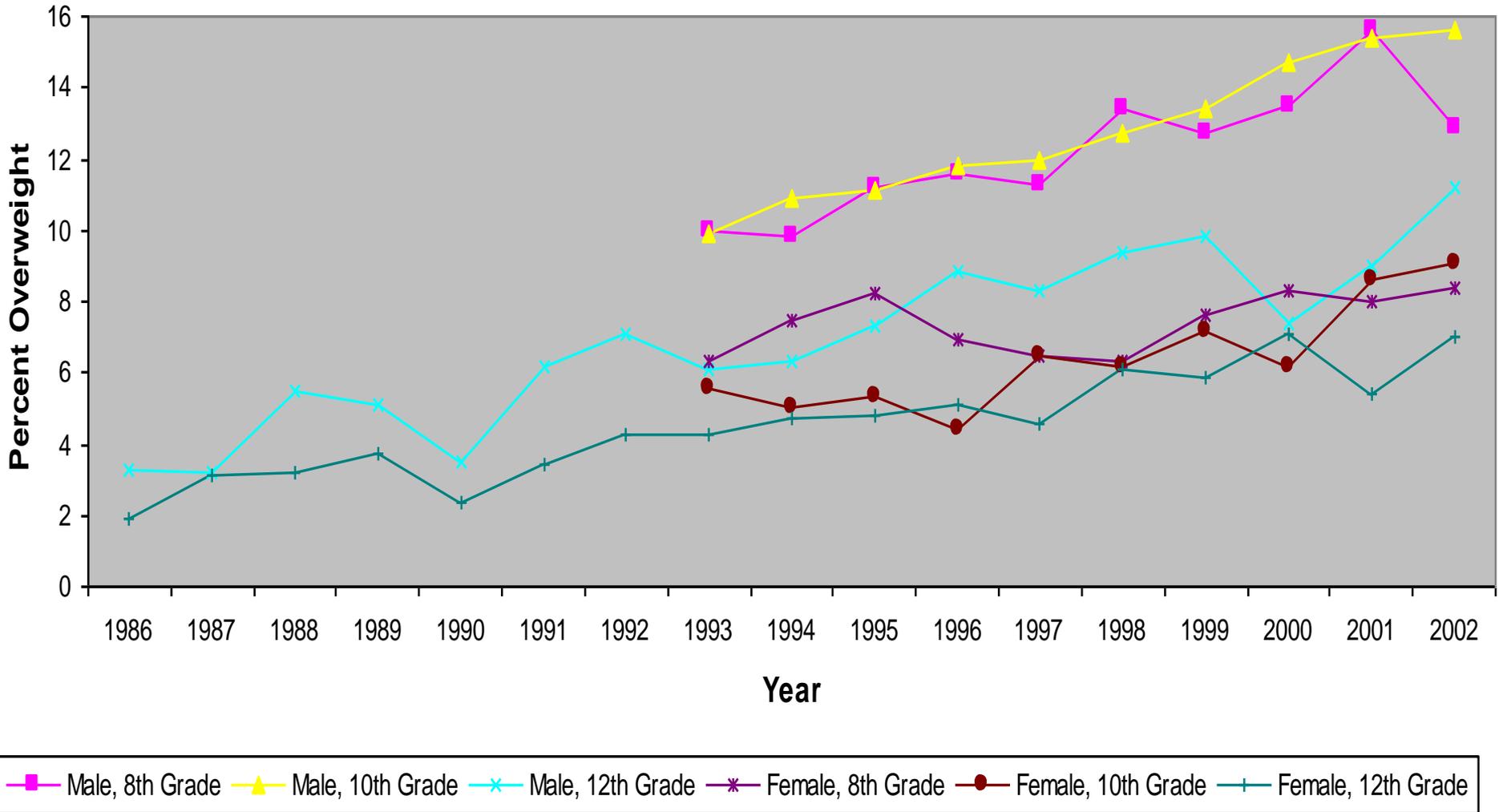
# Background and Significance

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## **Obesity a growing problem in the US**

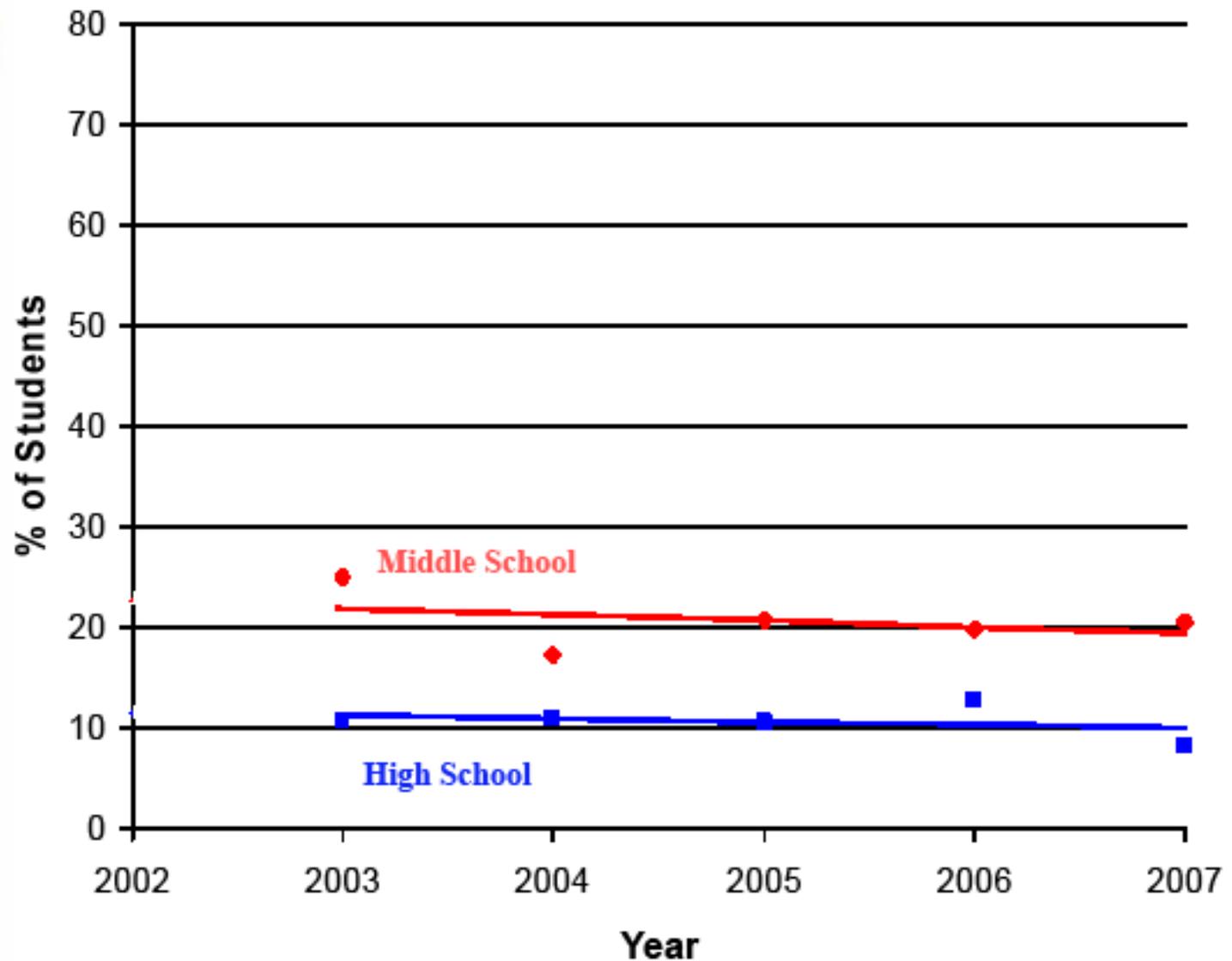
- Results from energy imbalance: intake of calories exceeds expenditure of calories
- Rising rapidly among children and adolescents
  - 2003-04 35% of school-aged children at risk of overweight or overweight (13% overweight)
- Factors contributing to the rise in obesity include:
  - Diet
  - Physical Activity
  - Environment

# Percent Overweight



Source: Johnston, et al., 2003

## Walking or Biking to and from School: Trends Student Participation Rates, 2003-2007



# Barriers to Walking and Biking to School

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-28.2% of schools indicated that no children walk or bike to school.

-27.5% of schools indicated that children were not allowed to bike to schools.

-21.9% of schools indicated that only children in certain grades were allowed to bike to school.

-School too far away and traffic danger were the most often cited perceived barriers followed by lack of sidewalks and crossing guards.

# The Study

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- Although growing, research connecting student travel to characteristics of the built environment is sparse.
- School size, distance to school and safety concerns have been shown to have a negative impact on walking and biking to school.
- Presence of sidewalks, population density, better connected street networks and pedestrian-friendly design characteristics have been shown to have a positive impact on walking and biking to school.
- This study examined the effect of school siting and land development patterns on student active travel.

# The Study

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## **Strengths of the Current Study:**

- Its use of a national sample of adolescents.
- Its use of environmental data collected from the communities in which the youth reside.
- Its ability to simultaneously examine the association of multiple environmental factors.
- Its ability to control for neighborhood income effects.

# Bridging The Gap

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- A collaborative effort to assess the impact of ***policies, programs, and other environmental factors*** on a variety of adolescent health-related behaviors.
- Begun 1997 with a focus on adolescent alcohol, tobacco and other drug use and related outcomes.
- More recently expanded to include youth physical activity, eating practices and weight outcomes.
- Linked to the ongoing, NIDA-funded *Monitoring the Future* study.

# Data and Methods

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- Cross-sectional study using data collected in 2003 from:
  - 1) school administrators (prevalence of students walking and biking to school)
  - 2) 8<sup>th</sup>, 10<sup>th</sup> and 12<sup>th</sup> grade student surveys (23,799 students located in 146 communities)
  - 3) community observational and archival data sources
  
- Communities were determined by the location of separate nationally representative MTF school samples of 8<sup>th</sup>, 10<sup>th</sup> and 12<sup>th</sup> graders.
  
- Community definitions were based on the school enrollment zone.
  - 52% defined using school district map
  - 31% based on student home zip code
  - 17% based on radius around the school

# Outcome Variable

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## **School Administrator Data:**

The primary question used for this study was open-ended and asked “About what percent of [target]-grade students would you estimate walk or bike from home to school on an average school day?”

Sample mean: 16.93 (SD: 24.05)

# Independent Variables

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## **Community observational variables included presence of :**

- Attractive community spaces (trees, flowers, shrubs)
- Bike lanes on roads
- Curbs and sidewalks
- Street lighting around school and in neighborhood
- Traffic density around school and in neighborhood

## **Area Deprivation scale includes measures on presence of :**

- Homeless persons loitering on the street
- Bars on windows
- Dilapidated buildings, unkempt lawns
- Security barriers around residential and retail property
- Teens smoking or drinking
- Vandalism and/or graffiti

**Measure of school size based on total student population**

# Independent Variables

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## **ArcGIS measures include:**

- Population density per sq. mi. for the catchment area
- Intersection density per sq. mi. for the catchment area
- Ratio of higher road classes to local and neighborhood roads (measure of street safety)

## **For 0.25, 0.50, 0.75 and 1.00 mile buffers around school:**

- Ratio of 14-17 year olds to the total population
- Intersection density
- Weighted number of households
- Weighted median household income

**Dichotomous indicator for participation in vigorous exercise most days or more**

# The Association between Built Environmental Measures and Walking and Biking to School

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<b>Variables</b>	<b>Adjusted Coefficients</b>	<b>Std. Error</b>	<b>Z-Score</b>
<b>Vigorous Exercise</b>	<b>-1.46</b>	<b>0.78</b>	<b>-1.85</b>
<b>Attractive Cmty Spaces</b>	<b>-15.17</b>	<b>4.78</b>	<b>-3.17</b>
<b>Residential Traffic</b>	<b>6.49</b>	<b>3.84</b>	<b>1.69</b>
<b>Presence of Sidewalks</b>	<b>12.88</b>	<b>5.85</b>	<b>2.20</b>
<b>Lighting at School</b>	1.23	2.69	0.46
<b>Presence of Bike lanes</b>	2.14	4.98	0.43
<b>Area Deprivation</b>	0.28	1.26	0.22
<b>Intersection Density</b>	<b>0.12</b>	<b>0.06</b>	<b>1.89</b>
<b>Street Safety</b>	3.72	34.21	0.11
<b>Population Density</b>	-0.07	0.11	-0.67
<b>School Size</b>	<b>-0.01</b>	<b>0.00</b>	<b>-2.00</b>

All models control for: average temperature, whether the student has siblings, whether the school is private, grade, gender, race/ethnicity, whether student lives with both parents, neighborhood median household income, father's and mother's level of education (college or more).

# Urban Area



# Suburban Area



# Rural Area



# Sample Means for 1.00 mile Buffer Built Environment Measures

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<b>Variables</b>	<b>Urban Areas (N=65)</b>	<b>Suburban Areas (N=67)</b>	<b>Rural Areas (N=66)</b>
<b>Ratio of 14-17 Year Olds</b>	15.1% (5.2)	17.2% (3.0)	16.9 % (3.9)
<b>Intersection Density</b>	288 (164)	208 (113)	119 (94)
<b>Household Density</b>	10,320 (16,709)	3853 (3618)	949 (943)
<b>Median Household Income</b>	46,187 (22,294)	57,521 (21,467)	38,728 (14,144)

\*Standard deviations in parentheses

# EFFECTS OF BUILT ENVIRONMENT MEASURES AT 0.25, 0.50, 0.75 AND 1.0 MILE BUFFERS ON WALKING AND BIKING TO SCHOOL

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Variables	0.25 mile Buffer	0.50 mile Buffer	0.75 mile Buffer	1.00 mile Buffer
<b>Ratio of 14-17 Year Olds</b>	<b>80.918**</b>	<b>70.043*</b>	<b>67.555*</b>	<b>95.853**</b>
<b>Intersection Density</b>	0.0715	<b>0.085**</b>	<b>0.042**</b>	<b>0.028**</b>
<b>Household Density</b>	0.001	0.000	0.000	0.000
<b>Median Household Income</b>	-0.000	0.000	0.000	0.000
<b>School Size</b>	-0.002	-0.003	-0.004	-0.004

\*\*\*p<.001; \*\*p<.05; \*p<.10.

All models control for: average temperature, whether the student has siblings, whether the school is private, grade, gender, race/ethnicity, whether student lives with both parents, neighborhood median household income, father's and mother's level of education (college or more).

# *Study Limitations*

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- The primary outcome variable was based on responses provided by school administrators rather than the students themselves.
- Use of cross-sectional data and the weakens the ability to make direct causal inferences about whether these environmental measures directly influenced changes in walking and biking to school.
- The area deprivation and other built environmental measures were limited in the amount of information they capture.
- Used self report student physical activity information.
- Have no information on other family/household factors, such as parent PA behavior.
- However, even with these limitations, this study resulted in some important findings, but further exploration of these associations is needed to fully understand the role the built environment has on the prevalence of walking and biking to school.

# *Next Steps*

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## **During the Next 4 Years:**

Resume community data collection activities around 2nd year MTF schools, with focus on assessing the community food environment, physical activity opportunities, local policies, and other community factors potentially relevant to youth healthy eating, physical activity, and obesity.

Will allow us to collect better measures of sidewalks, traffic calming measures, mixed-land use, street connectivity, traffic density, street lighting, area deprivation measures, etc. around a national sample of 8<sup>th</sup>, 10<sup>th</sup> and 12<sup>th</sup> grade schools.