

# The Association between Neighborhood Physical Activity Supports and Youth Physical Activity, Overweight and BMI

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# The Study

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- There is growing evidence on the connection between the built environment, physical activity and obesity.
- Little research exists on how the built environment affects youth physical activity and overweight at the national level.
- It is important to determine whether certain aspects of the built environment have differing effects on adolescents compared to previously documented effects on adults.
- This study examined the association between the level of physical activity friendliness of the built environment and adolescent physical activity, overweight and Body Mass Index (BMI).

# The Study Cont'd.

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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.

# The Study Cont'd.

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## **The specific hypotheses tested were:**

- 1) Increased local area physical activity-related settings and opportunities are associated with higher levels of adolescent physical activity and lower levels of overweight and BMI.
- 2) More compact neighborhoods are associated with higher levels of adolescent physical activity and lower levels of overweight and BMI.
- 3) Higher levels of safety measures are associated with increased physical activity and lower levels of overweight and BMI.

# Data

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- ▶ Data are from two primary sources: 1) the ImpacTeen Project, a component of Bridging the Gap, conducted by the University of Illinois at Chicago's Institute for Health Research and Policy and funded by The Robert Wood Johnson Foundation, and 2) the Monitoring the Future (MtF) study, conducted by the University of Michigan's Institute for Social Research and funded by the National Institute on Drug Abuse (NIDA).
- ▶ Selection of ImpacTeen communities was determined by the location of MtF's separate nationally representative school samples of 8<sup>th</sup> and 10<sup>th</sup> graders.
- ▶ The study covers three years, 2001 — 2003, in which students were administered surveys that included questions on self-reported physical activity measures and self-reported information on student height and weight. (30,435 students in total located in 312 communities).
- ▶ For each school, a catchment area, or community, was defined, reflecting the area from which the school draws its students, or the school enrollment zone.

# Outcome Variables

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**Constructed four outcome variables:**

**1. Measure of frequent participation in physical activity for 8<sup>th</sup> and 10<sup>th</sup> Graders.**

PA participation is based on responses to the MTF question “how often do you actively participate in sports, athletics or exercising?”

**2. Measure of Vigorous Exercise for 8<sup>th</sup> and 10<sup>th</sup> Graders.**

Vigorous exercise is based on responses to the MTF question “how often do you exercise vigorously (jogging, swimming, calisthenics, or any other active sports)?”

**3. Measure of BMI for 8<sup>th</sup> and 10<sup>th</sup> Graders.**

Individuals' body weight status was classified based on BMI for children and teens using the 2000 CDC Growth Chart. BMI ( $=\text{weight}(\text{kg})/\text{height}(\text{m})^2$ ).

**4. Measure of Prevalence of Overweight for 8<sup>th</sup> and 10<sup>th</sup> Graders.**

Overweight is a dichotomous measure equal to 1 if BMI was classified as BMI  $\geq$  age-sex-specific 95<sup>th</sup> percentile.

# Independent Variables

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## **Constructed 5 Independent Environmental Variables:**

1. Area Deprivation Scale—is the summation of dichotomous measures on the presence of: 1) homeless persons loitering on streets; 2) bars on windows; 3) dilapidated buildings, unkempt lawns; 4) security barriers around residential and retail property; 5) teens smoking or drinking; and, 6) vandalism and/or graffiti.
2. Outdoor PA Settings Scale—is the summation of dichotomous measures on the presence of: 1) sports areas (baseball diamonds, basketball and tennis courts, soccer fields, etc.); 2) parks/green spaces, playgrounds; 3) public pools/beaches; and, 4) bike paths/lanes.
3. Commercial PA facilities—Dun & Bradstreet business list data on variety of paid physical activity related outlets, i.e., physical fitness facilities, memberships sports and recreation clubs, and dance studios/schools/halls. Matched at the school zip code, summed, and divided by population times 10,000 (availability per 10,000 capita).
4. Student Perception of Safety—is based on a MTF question about how safe students feel going to and from school. The measure represents the proportion of students who answered some days, most days and every day to feeling unsafe.
5. County Sprawl Index—includes dimensions of residential density and street accessibility (developed by Ewing, et al., 2003).

# Analysis

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- Analyses were run in Stata V8. LOGISTIC was used for the dichotomous PA and overweight measures, REGRESS was used for the BMI measure. The complex multi-stage sample design was accounted for by using sampling weights to adjust for differential selection probabilities, and adjusting for clustering by catchment area to compute robust standard errors.
- To assess the magnitude of the association between the built environment and youth physical activity, overweight and BMI, predicted probabilities were calculated for the logistic and OLS regression models by separately setting the environmental variables at varying levels, holding all other independent variables at their mean.
- All analyses controlled for year of data collection, grade, gender, race/ethnicity, whether the student lived with both parents, students' total weekly income (earned and unearned, such as allowance), whether the student worked, parental education (college or more), mother's work status (did not work, worked part-time, worked full-time), region of the country, whether the school was private vs. public, and neighborhood wealth effects by including a catchment area measure of median household income.



# Summary Statistics

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	Mean	Standard Deviation	Range	Sample N
<b>Outcome Variables</b>				
Vigorous Exercise	0.66	0.47	0 – 1	8,618
PA Participation	0.56	0.49	0 – 1	13,182
Overweight	0.11	0.32	0 – 1	12,870
Body Mass Index	22.00	4.57	9.99 – 56.32	13,063
<b>Explanatory Variables</b>				
Area Deprivation Scale	1.89	1.71	0 – 6	30,435
Outdoor PA Settings Scale	2.41	1.02	0 – 4	30,435
Commercial PA Facilities	4.20	2.95	0 – 24.46	30,435
Student Perception of Safety	0.13	0.09	0 – 0.56	30,435
County Sprawl Index	110.42	33.72	72.01 – 352.07	30,435
<b>Neighborhood Control Variable</b>				
Median Household Income	50,208	17,700	17,889 – 137,324	30,435

# Results of the Association between Environmental Measures and PA and Overweight

Independent Variables	Vigorous Exercise			PA Participation			Overweight		
	OR	95% CI		OR	95% CI		OR	95% CI	
Area Deprivation Scale	0.972	0.932	1.014	*0.962	0.923	1.002	<b>1.070</b>	<b>1.019</b>	<b>1.123</b>
Outdoor PA Settings Scale	0.992	0.936	1.051	1.047	0.982	1.116	*0.938	0.868	1.013
Commercial PA Facilities	<b>1.031</b>	<b>1.012</b>	<b>1.051</b>	*1.022	0.999	1.045	0.985	0.957	1.015
Student Perception of Safety	<b>0.299</b>	<b>0.133</b>	<b>0.673</b>	0.571	0.206	1.583	1.083	0.394	2.979
County Sprawl Index	1.001	0.999	1.003	<b>0.997</b>	<b>0.995</b>	<b>0.999</b>	<b>0.997</b>	<b>0.993</b>	<b>1.000</b>
Median Household Income	1.000	0.996	1.004	1.002	0.998	1.006	<b>0.994</b>	<b>0.988</b>	<b>0.999</b>
South	0.867	0.721	1.043	0.989	0.833	1.174	1.021	0.819	1.272
Midwest	<b>0.763</b>	<b>0.630</b>	<b>0.924</b>	<b>1.269</b>	<b>1.031</b>	<b>1.562</b>	1.131	0.891	1.434
Northeast	<b>0.698</b>	<b>0.560</b>	<b>0.870</b>	<b>1.239</b>	<b>1.005</b>	<b>1.528</b>	1.089	0.846	1.404
African American	<b>0.826</b>	<b>0.695</b>	<b>0.982</b>	1.169	0.974	1.404	<b>1.392</b>	<b>1.129</b>	<b>1.717</b>
Asian	<b>0.681</b>	<b>0.526</b>	<b>0.883</b>	<b>0.612</b>	<b>0.477</b>	<b>0.785</b>	0.718	0.481	1.071
Hispanic	0.844	0.705	1.011	0.872	0.752	1.011	<b>1.668</b>	<b>1.335</b>	<b>2.084</b>
Other Race	1.037	0.813	1.324	<b>0.757</b>	<b>0.631</b>	<b>0.907</b>	<b>1.578</b>	<b>1.221</b>	<b>2.041</b>
Private School	<b>1.319</b>	<b>1.050</b>	<b>1.657</b>	<b>2.187</b>	<b>1.717</b>	<b>2.785</b>	0.894	0.674	1.186
Grade 10	<b>0.713</b>	<b>0.631</b>	<b>0.806</b>	<b>0.764</b>	<b>0.675</b>	<b>0.864</b>	1.086	0.937	1.260
Lives Both Parents	<b>1.265</b>	<b>1.095</b>	<b>1.462</b>	<b>1.337</b>	<b>1.219</b>	<b>1.467</b>	<b>0.791</b>	<b>0.670</b>	<b>0.933</b>
Male	<b>1.591</b>	<b>1.418</b>	<b>1.785</b>	<b>1.261</b>	<b>1.154</b>	<b>1.378</b>	<b>2.178</b>	<b>1.853</b>	<b>2.560</b>
Parental Education	<b>1.545</b>	<b>1.367</b>	<b>1.746</b>	<b>1.570</b>	<b>1.388</b>	<b>1.776</b>	0.872	0.739	1.028
Mother Part-time Job	1.112	0.937	1.320	<b>1.161</b>	<b>1.011</b>	<b>1.333</b>	<b>0.713</b>	<b>0.554</b>	<b>0.918</b>
Mother Full-time Job	1.100	0.964	1.256	<b>1.258</b>	<b>1.113</b>	<b>1.421</b>	1.069	0.893	1.280
Student Works	<b>1.169</b>	<b>1.036</b>	<b>1.319</b>	1.014	0.909	1.132	1.039	0.882	1.224
Weekly Student Income	1.000	0.998	1.002	<b>1.003</b>	<b>1.001</b>	<b>1.006</b>	1.000	0.998	1.003

# Results of the Association between Environmental Measures and BMI

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<b>Body Mass Index</b>			
<b>Independent Variables</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>Z-Score</b>
Area Deprivation Scale	<b>0.070</b>	<b>0.036</b>	<b>1.93</b>
Outdoor PA Settings Scale	-0.017	0.056	-0.30
Commercial PA Facilities	-0.005	0.018	-0.25
Student Perception of Safety	0.131	0.636	0.21
County Sprawl Index	<b>-0.005</b>	<b>0.002</b>	<b>-2.93</b>
Median Household Income	<b>-0.011</b>	<b>0.003</b>	<b>-3.31</b>
South	0.195	0.155	1.26
Midwest	<b>0.356</b>	<b>0.147</b>	<b>2.42</b>
Northeast	<b>0.389</b>	<b>0.156</b>	<b>2.50</b>
African American	<b>1.070</b>	<b>0.152</b>	<b>7.04</b>
Asian	<b>-0.545</b>	<b>0.222</b>	<b>-2.45</b>
Hispanic	<b>1.157</b>	<b>0.207</b>	<b>5.59</b>
Other Race	<b>0.563</b>	<b>0.200</b>	<b>2.81</b>
Private School	<b>-0.370</b>	<b>0.161</b>	<b>-2.31</b>
Grade 10	<b>1.337</b>	<b>0.101</b>	<b>13.21</b>
Lives Both Parents	<b>-0.460</b>	<b>0.133</b>	<b>-3.46</b>
Male	<b>0.724</b>	<b>0.098</b>	<b>7.43</b>
Parental Education	-0.128	0.108	-1.18
Mother Part-time Job	<b>-0.412</b>	<b>0.145</b>	<b>-2.85</b>
Mother Full-time Job	0.134	0.125	1.08
Student Works	-0.007	0.115	-0.06
Weekly Student Income	0.003	0.002	1.29

# Results of Predicted Probability Models

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**Purpose**: to examine the impact of environmental measures on youth physical activity, overweight and BMI using the estimates from our final models.

Predicted the probability of the impact on PA and weight if catchment areas had:

- No presence of area deprivation
- Presence of all four outdoor physical activity settings
- An average of 10 commercial PA facilities per 10,000 capita
- An average of 20 commercial PA facilities per 10,000 capita
- No students who perceived feeling unsafe going to and from school
- A county sprawl score of 75 (e.g., Person County, NC (Durham))
- A county sprawl score of 200 (e.g., San Francisco County, CA)
- A country sprawl score of 250 (e.g., Bronx County, NY)

# Results of Predicted Probabilities

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Independent Variables	Vigorous Exercise	PA Participation	Overweight	BMI
Area Deprivation=0		+2.6%	-9.9%	-0.06%
Outdoor PA Settings=4			-7.9%	
Commercial PA Facilities=10	+4.8%	+4.6%		
Commercial PA Facilities=20	+13.7%	+13.5%		
Student Perception of Safety=0	+4.4%			
County Sprawl Index=75		+3.5%		
County Sprawl Index=200			-21.7%	-1.8%
County Sprawl Index=250			-33.6%	-2.9%
<b>Total Effect</b>	17.9%	20.3%	40.5%	-3.5%

# *Key Findings*

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Results partially support our original hypotheses and existing evidence:

- Increased local area PA settings and opportunities were associated with higher levels of adolescent PA and lower prevalence of overweight.
- Higher levels of area deprivation and lower perceptions of neighborhood safety were associated with decreased PA and higher prevalence of overweight and BMI scores.
- More compact neighborhoods were associated with lower prevalence of overweight and lower BMI scores.

Contrary to our original hypotheses:

- We found no association between PA settings and BMI.
- We found no association between outdoor PA settings and increased physical activity.
- More compact neighborhoods were associated with decreased PA participation.

## *Study Limitations*

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- Use of cross-sectional data weakens the ability to make direct causal inferences about whether these environmental measures directly influenced changes in PA and weight.
- The area deprivation and outdoor PA settings measures were limited in the amount of information they capture.
- Used self report student physical activity and height and weight 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 youth PA and weight.