Characteristics of School Campuses and Youth Physical Activity

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Funding by the Robert Wood Johnson Foundation Active Living Research
Background

• Increasing overweight among youth
• Promoting lifestyle activity a strategy for obesity prevention (IOM Report, 2005)
• Small, accumulated differences in physical activity may contribute to greater energy expenditure
  – E.g. Walk to school: 8-14 extra minutes MVPA from 8-9am than car users- Cooper et al, 2003
• Schools as an influential environment for youth
Framework for Environmental influences on Physical Activity

Personal Factors

Social/ Organizational Factors

Physical Activity

Physical Environmental Factors

Spatial Scale
- Urban design
- Site selection and design
- Building design
- Building element design

Zimring, AJPM 2005
School Physical Environments: Spatial Scale

- Site selection and design
  - Location, size, fields, play space, parking
- Building design
  - Size, interior spaces for physical activity
School Physical Environments: Spatial Scale

- **Site selection and design**
  - Location, size, fields, play space, parking
- **Building design**
  - Size, interior spaces for physical activity
- **Evidence from the literature**
  - Sallis, 2001 - For girls - size of activity space was positively related to PA participation
  - Students were more active in areas with more improvements such as courts / supervision
Study Background

• Planet Health Study (1995-1997)
• 10 Middle Schools in 4 communities in Massachusetts
• Survey data and TriTrac-R3D activity monitor data (1997)
• 1 or 2, 4-day monitoring sessions
• 248 students, 58% Male, Age: 13.7 years
• Race/Ethnicity: 56% white, 11% Black, 14% Hispanic, 11% Asian
Developing Objective Measures of School Physical Environments Using GIS

- Obtain relevant data from sources (Federal, State, Local Private)
- Orthophotos from 1995 and 2001
Developing Objective Measures of School Physical Environments Using GIS

- Obtain relevant data from sources
- Orthophotos from 1995 and 2001
- Parcel and Building Footprints
Developing Objective Measures of School Physical Environments Using GIS

- Obtain relevant data from sources
- Use queries to select local features
Developing Objective Measures of School Physical Environments

- Obtain relevant data from sources
- Use queries to select local features
- Screen digitize to represent local features
Developing Objective Measures of School Physical Environments Using GIS

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Developing Objective Measures of School Physical Environments Using GIS

- Obtain relevant data from sources
- Use queries to select local features
- Screen digitize to represent local features
- Calculate attributes and create dataset
- Verify with site visit and interview
School Characteristics

• Campus area/student 8.8-143.7m²
• Building area/student 12.1-24.7m²
• Play area/student 0.4-58.9m²
Data Analysis Methods

- Outcome - average (log) vector magnitude for 15 minute interval during school day (N=16,578)
- Covariates include age, sex, race/ethnicity, BMI, days of PE, day of week and time of day
- SAS Proc Mixed - data clustered within school, individual, and day
- Repeated = time of day, Type = power spatial covariance
- Separate models for each school environmental characteristic
Estimated Vector Magnitude Over the School Day

Vector Magnitude

Time
<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>SE</th>
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<tbody>
<tr>
<td>Intercept</td>
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<tr>
<td>BMI</td>
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<tr>
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<tr>
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<td>Campus Area/Student</td>
<td>0.2244***</td>
<td>0.05832</td>
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</table>

Referent variables are male, white, Monday, and 12:00-12:14; models include 15-minute time of day indicators that are not shown here.

*p<0.05, **p<0.01, ***p<0.001

SE- Standard Error
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</table>

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<tr>
<td>School Building Area/Student</td>
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<td>0.9235</td>
</tr>
</tbody>
</table>

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Conclusions

• Larger campuses, schools, and play areas per enrolled student are associated with increased physical activity in middle school students.

• An approximate increase in 20-30% in average vector magnitude in this sample of schools.

• Translates into approximately 34 Kcals/day or ~ 2 miles/week of walking.
Potential Mechanisms

• Instrumental physical activity (walking to and from classes, cafeteria)
• Space to move around (at recess, in between classes)
• Other potential factors (school programming, supervision, equipment)
Summary

• Schools differ in their physical characteristics
• Larger campuses, schools, and play areas per enrolled student are associated with increased physical activity in middle school students
  – 20% increase in average vector magnitude or 2 miles per week of walking
• There is room for further study
• Methods are quite replicable
• Implications for policy and design practice
Thank You......
What influences school site and construction standards?

- Congestion, traffic
- Available land
- Enrollment trends in a district/area
- Program requirements
- Condition of existing facilities
- Plans for local/community use
- Community concerns about equity, educational outcomes
- $$\text{EPA, 2003; Perkins, 2001}$$
<table>
<thead>
<tr>
<th>State Regulations or Recommendations</th>
<th>Massachusetts</th>
<th>California</th>
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<tbody>
<tr>
<td>Size standards for Site Selection</td>
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<tr>
<td>Guidelines for Site selection</td>
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<td>Size standards for school building</td>
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<tr>
<td>Standards for Play area</td>
<td>No</td>
<td>Yes</td>
</tr>
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</table>
Size standards for school building

- Massachusetts
- **Sort of...** no more than 135 square feet/student for $$$
- Only one of our schools met this criteria (130.5 square feet/student)

- California
- **Yes-** 80 square feet/student minimum

167 sq feet/student general architectural guidelines for middle schools
Standards for Play area

- Massachusetts - No
- California - Yes
- 4-8.5 acres for our range of school enrollment (16,187-34,398 m²)
- 3 schools in our sample meet this standard (suburban areas)