What do we know about effects of the neighborhood built environment on physical activity among older adults?

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Disability and Health Partners Meeting
June 15, 2011
Benefits of physical activity for older adults
Current evidence on built environment and physical activity
Brief overview of our work with Nurses’ Health Study
Future research directions
Physical Activity Guidelines for Americans

- First major review of science on benefits of physical activity in over 10 years
- Complements previous recommendations
- Information and guidance on types and amount of physical activity that provide substantial health benefits
Benefits of physical activity

- Decreased risks
  - All-cause mortality
  - Coronary heart disease
  - Type 2 diabetes
  - Stroke
  - High blood pressure
  - Metabolic syndrome
  - Colon and breast cancers

- Promotes psychological well-being

- Weight control
U.S. adults meeting physical activity guidelines, NHANES

Troiano et al., 2008
What is the built environment? IOM definition

- **Land-use patterns**
  - Spatial distribution of human activities

- **Transportation systems**
  - Physical infrastructure and services that provide spatial links or connectivity among activities

- **Design features**
  - Aesthetic, physical, and functional qualities of built environment (e.g., design of buildings and streetscapes)
Environmental correlates of physical activity: older adults

- Proximity of facilities and businesses (King et al. 2005)
- Number of commercial establishments (Nagel et al. 2008)
- Land use mix, street connectivity, density of public transit (Li et al. 2008)
- Composite measure of neighborhood walkability (Berke et al. 2007)
Nurses’ Health Study

- NCI-funded study with older women
- Cross-sectional design
- Transdisciplinary team from Purdue, MIT and Harvard School of Public Health
  - Behavioral science
  - Epidemiology
  - Environmental health
  - Urban planning
  - Geography
Primary aim

Examine associations between objective measures of neighborhood built environment and both physical activity and weight-related outcomes among older women in three states.
Analytic sample

- NHS participants: MA, PA, CA
- Inclusion and exclusion criteria
  - Geocoded home address
  - Completed 2004 NHS questionnaire
  - Complete data on physical activity, BMI, and walking limitations
  - Excluded women unable to walk
Physical activity outcome

- Meeting USDHHS recommendations:
  \[ \geq 500 \text{ MET-minutes/week walking} \]
  - Weekly duration of walking for exercise or walking to work during past year
  - Using reported pace and duration, calculated MET-minutes/week walking
Built environment variables

- Population density: \(\# \text{ persons/km}^2\)
- Intersection density: \(\# \text{ intersections/km of road}\)
- Facility density: \(\# \text{ facilities/km of road}\)
  - Retail
  - Cafes/restaurants
  - Food stores
  - Services
  - Cultural/educational
  - Physical activity facilities
### Population density and odds of meeting PA recommendations

<table>
<thead>
<tr>
<th>Population density percentile</th>
<th>1200m home buffer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20&lt;sup&gt;th&lt;/sup&gt; (REF)</td>
<td>1.00</td>
</tr>
<tr>
<td>21-40&lt;sup&gt;th&lt;/sup&gt;</td>
<td>1.13 (1.02, 1.25)</td>
</tr>
<tr>
<td>41-60&lt;sup&gt;th&lt;/sup&gt;</td>
<td>1.12 (1.01, 1.25)</td>
</tr>
<tr>
<td>61-80&lt;sup&gt;th&lt;/sup&gt;</td>
<td>1.11 (1.00, 1.24)</td>
</tr>
<tr>
<td>81-90&lt;sup&gt;th&lt;/sup&gt;</td>
<td>1.11 (0.97, 1.26)</td>
</tr>
<tr>
<td>91-95&lt;sup&gt;th&lt;/sup&gt;</td>
<td>1.18 (1.00, 1.39)</td>
</tr>
<tr>
<td>96-100&lt;sup&gt;th&lt;/sup&gt;</td>
<td>1.28 (1.09, 1.51)</td>
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</table>
Intersection density and odds of meeting PA recommendations

<table>
<thead>
<tr>
<th># of intersections per km of road</th>
<th>1200m buffer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2 (REF)</td>
<td></td>
</tr>
<tr>
<td>&gt;2-4</td>
<td>1.18 (1.05, 1.34)</td>
</tr>
<tr>
<td>&gt;4-6</td>
<td>1.28 (1.13, 1.45)</td>
</tr>
<tr>
<td>&gt;6-8</td>
<td>1.27 (1.05, 1.53)</td>
</tr>
<tr>
<td>&gt;8-10</td>
<td>1.04 (0.62, 1.75)</td>
</tr>
<tr>
<td>&gt;10</td>
<td>0.40 (0.05, 3.54)</td>
</tr>
</tbody>
</table>
## Facility density and PA, stratified by population density

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>Q6</th>
<th>Q7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All facilities</strong></td>
<td>1.04*</td>
<td>1.13</td>
<td>1.00</td>
<td>1.03</td>
<td>0.99</td>
<td>0.98</td>
<td>1.16*</td>
<td>1.08*</td>
</tr>
<tr>
<td><strong>Retail/stores</strong></td>
<td>1.10*</td>
<td>1.38</td>
<td>0.98</td>
<td>1.04</td>
<td>0.98</td>
<td>0.98</td>
<td>1.36*</td>
<td>1.18*</td>
</tr>
<tr>
<td><strong>Services</strong></td>
<td>1.52*</td>
<td>1.21</td>
<td>0.84</td>
<td>1.29</td>
<td>1.08</td>
<td>0.63</td>
<td>2.17</td>
<td>3.67*</td>
</tr>
<tr>
<td><strong>Cultural/educational</strong></td>
<td>1.15*</td>
<td>1.09</td>
<td>0.92</td>
<td>1.14</td>
<td>0.83</td>
<td>0.81</td>
<td>1.48</td>
<td>1.44*</td>
</tr>
<tr>
<td><strong>Physical activity</strong></td>
<td>1.45</td>
<td>1.39</td>
<td>1.28</td>
<td>0.66</td>
<td>0.78</td>
<td>0.58</td>
<td>15.74*</td>
<td>7.64*</td>
</tr>
<tr>
<td><strong>Restaurants/cafes</strong></td>
<td>1.01*</td>
<td>1.05*</td>
<td>1.01</td>
<td>1.01</td>
<td>1.00</td>
<td>1.00</td>
<td>1.03*</td>
<td>1.01*</td>
</tr>
<tr>
<td><strong>Food stores</strong></td>
<td>1.06*</td>
<td>1.09</td>
<td>1.05</td>
<td>1.06</td>
<td>1.00</td>
<td>1.04</td>
<td>1.18*</td>
<td>1.05</td>
</tr>
</tbody>
</table>

*Significant at $P \leq 0.05$
Conclusions for NHS analyses

- Facility variables showed stronger associations in higher population density areas.
- Intersection density may be a good thing, but only to a point for older adults.
- Findings “generally” consistent with existing literature.
Future directions: built environment research (1)

Integrated GPS and accelerometer monitoring to link environment to physical activity behaviors

Troped et al., AJPM, 2010
Future research directions (2)

- Evaluating “natural experiments”
  - Improvements to pedestrian infrastructure (e.g., sidewalks, crosswalks)
  - Construction of trails
  - Modifications to indoor environments
- Development and testing of interventions that use environmental strategies
Future research directions (3)

- Testing mediators and moderators

Diagram:

- New trails
- PA self-efficacy, PA social support, Perceived built environment
- PA self-efficacy, PA social support, Perceived built environment
- Mod-Vig PA
- Intervention
- Mediators
- Primary outcome

Moderators:
- Demographics,
- Objective/perceived built environment,
- PA self-efficacy,
- PA social support
Acknowledgments

Collaborators
- Francine Laden - HSPH
- Steven J. Melly - HSPH
- Eran Ben-Joseph - MIT
- Robin Puett - USC
- Ellen Cromley

Students
- Heather Whitcomb
- Kosuke Tamura
- Peter James - HSPH

Funding
- NIH - R21 CA125078; P01 CA87969
Thank you!