Interdisciplinary Approaches to Physical Activity: Built Environment Research and Translation to Policy

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For ACCORDS. UC Denver
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Outline

• Application of ecological models to physical activity
• Macro-environments
• Micro-environments
• Multiple pathways to research translation
• Evidence of impact on science, policy, practice
• Become an advocate
Deaths attributed to 19 leading factors, by country income level, 2004

- High blood pressure
- Tobacco use
- High blood glucose
- Physical inactivity
- Overweight and obesity
- High cholesterol
- Unsafe sex
- Alcohol use
- Childhood underweight
- Indoor smoke from solid fuels
- Unsafe water, sanitation, hygiene
- Low fruit and vegetable intake
- Suboptimal breastfeeding
- Urban outdoor air pollution
- Occupational risks
- Vitamin A deficiency
- Zinc deficiency
- Unsafe health-care injections
- Iron deficiency

Mortality in thousands (total: 58.8 million)
How Did We Become Inactive?

• **Sleep**

• **Leisure**

• **Occupation**

• **Transportation**

• **Household**
An Ecological Model of Health Behavior

- Policy Context
- Physical Environment
- Social/Cultural
- Individual Biological Psychological Skills

Reach
Permanence
Elements of An Active Living Community

Community Design Destinations

School & Worksite

Transportation System

Home

Park & Rec
21st century global health challenges related to urban design & transport

- Chronic disease
- Depression
- Road traffic injuries
- Air pollution
- Chronic noise
- Social isolation
- Personal safety and fear of crime
- Health inequities
MACRO level:
Cities Can be Designed to Move People or to Move Cars
The Neighborhood Quality of Life (NQLS) Study: The Link Between Neighborhood Design and Physical Activity 2001-2005

James Sallis, Ph.D.
Brian Saelens, Ph.D.
Lawrence Frank, Ph.D.
And team
NQLS Neighborhood Categories

Socioeconomic Status

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>High</th>
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<tbody>
<tr>
<td>Low</td>
<td>4 per city</td>
<td>4 per city</td>
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<tr>
<td>High</td>
<td>4 per city</td>
<td>4 per city</td>
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</tbody>
</table>
Methods

Neighborhood Quality of Life Study (NQLS)
• King County-Seattle, WA and Baltimore-Washington DC regions
• 32 neighborhoods represented hi/lo walkability and hi/lo income
• n=2199 adults
• Survey + accelerometer measures of PA
• Survey + GIS measures of environments
Accelerometer-based MVPA Min/day in Walkability-by-Income Quadrants

Walkability: $p = .0002$
Income: $p = .36$
Walkability X Income: $p = .57$

* Adjusted for neighborhood clustering, gender, age, education, ethnicity, # motor vehicles/adult in household, site, marital status, number of people in household, and length of time at current address.
Estimated Public Health Impact of Walkability

• 50 minutes per week = 2 miles per week
• 2 miles per week = 100 miles per year
• 100 miles per year = 10,000 kcal per year
• 10,000 kcal per year = 2.9 pounds/1.3 kg
• More than the average adult weight gain per year in the U.S.
Percent Overweight or Obese (BMI $\geq$ 25) in Walkability-by-Income Quadrants

Walkability: $p = .007$
Income: $p = .081$
Walkability X Income: $p = .26$

* Adjusted for neighborhood clustering, gender, age, education, ethnicity, # motor vehicles/adult in household, site, marital status, number of people in household, and length of time at current address.
Driving Minutes Per Week in Walkability-by-Education Quadrants

Walkability: $p = .001$
Education: $p = .86$
Walkability X Educ: $p = .35$

* Adjusted for age, sex, ethnicity, whether or not the participant had a child living in the home
Built environments across the lifespan

• In our US studies, design of cities is related to active transportation and total physical activity among
  – Children
  – Adolescents
  – Adults
  – Older adults

• Design of cities is related to BMI among
  – Children
  – Adults
  – Older adults
• Encourage environment and policy research on physical activity worldwide
• Develop & encourage use of common measures and methods
• Coordinate international studies
  – IPEN Adult, funded by NCI
  – IPEN Adolescent, funded by NHLBI
• Communicate findings to decision makers
Physical activity in relation to urban environments in 14 cities worldwide: a cross-sectional study

James F. Sallis, Ester Cerin, Terry L. Conway, Marc A. Adams, Lawrence D. Frank, Michael Pratt, Deborah Salvo, Jasper Schipperijn, Graham Smith, Kelli L. Cain, Rachel Davey, Jacqueline Kerr, Poh-Chin Lai, Josef Midtø, Rodrigo Reis, Olga L. Sarmiento, Grant Schofield, Jens Troelsen, Delfien Van Dyck, Ilse De Bourdeaudhuij, Neville Owen

Summary

Background Physical inactivity is a global pandemic responsible for over 5 million deaths annually through its effects on multiple non-communicable diseases. We aimed to document how objectively measured attributes of the urban environment are related to objectively measured physical activity, in an international sample of adults.

Published in The Lancet. April 2016
Belgium, Denmark, Czech Republic, UK, Spain

12 IPEN Adult Countries
IPEN Adult: GIS Walkability Index
9 SDs
## Results: Environmental Attributes + MVPA Min/Week

<table>
<thead>
<tr>
<th>GIS-based Environmental Variable</th>
<th>Final adjusted model</th>
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<tbody>
<tr>
<td>Net residential density 1km</td>
<td>***</td>
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<tr>
<td>Intersection density 1km</td>
<td>NS</td>
</tr>
<tr>
<td>Mixed land use 1km (retail &amp; civic)</td>
<td>NS</td>
</tr>
<tr>
<td>Public transit density 1km</td>
<td>*</td>
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<tr>
<td>Number of parks 0.5km</td>
<td>*</td>
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</tbody>
</table>
Comparing MVPA by Lowest & Highest Cities on Environmental Variables

• Adults living in the most activity-friendly cities did 68-89 more minutes of MVPA per week compared to those in the least activity-friendly cities.

• A commentary estimated that 2 million deaths per year could be prevented if every adult lived in activity-supportive communities.
Adjusted Neighborhood-Level Diabetes Incidence Among an Urban Population Aged 30 to 64 Years, by Walkability Quintile. Fiscal Year 2001-2012

Data sources: Ontario Diabetes Database and Registered Persons Database. Study areas include London, Ottawa, Toronto, Hamilton, and surrounding communities. N = 2,775,781 in 2001 and 2,906,539 in 2012; yearly median (range): quintile 1, 641,307 (553,144-670,082); quintile 2, 573,943 (555,943-596,845); quintile 3, 537,596 (528,913-560,935); quintile 4, 556,765 (539,137-575,020); and quintile 5, 585,166 (568,646-615,816). Median neighborhood population (IQR): quintile 1, 551 (420-644); quintile 2, 561 (441-747); quintile 3, 533 (435-728); quintile 4, 513 (451-701); and quintile 5, 521 (441-747). Rates represent modeled diabetes incidence by neighborhood, based on all dissemination areas in a given quintile. Error bars indicate 95% CIs around incidence. Disseminated area-level models were adjusted for age, sex, area-level income, and area-level ethnicity. Lines were smoothed with the SAS Proc LOESS method. Fiscal year runs from April 1 to March 31 of the next year.
MICRO level:
Design of streetscapes matters
Importance of Micro-Scale Environments

• Many studies show walkability and land use attributes are related to walking and health
  – Mixed use, density, connectivity
• Research on “micro-scale” attributes is limited, and results are not consistent
  – Sidewalks, crossings, street trees, bike facilities
• But micro-scale features are easier to modify
• Many micro-scale measures, but they are not often used
  – Too long, difficult to score, hard to interpret
  – Length is a barrier to use of measures in practice
MAPS-Mini

• **15-item**, evidence-based tool designed for practitioners and advocates

• Developed from 120-item original MAPS

• Items were selected based on:
  – Correlations with physical activity
  – Guidelines and recommendations
  – Modifiability within realistic budgets & time frames

• Requires minimal training and free to use
How do MAPS-Mini scores relate to active transportation? ADJUSTED

<table>
<thead>
<tr>
<th>MAPS Mini Score</th>
<th>Children</th>
<th>Adolescents</th>
<th>Adults</th>
<th>Seniors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Segments</td>
<td></td>
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<td></td>
<td>N/A</td>
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<tr>
<td>Public Parks</td>
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<tr>
<td>Transit Stops</td>
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<td>Street Lights</td>
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<tr>
<td>Benches</td>
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<tr>
<td>Building Maintenance</td>
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<tr>
<td>Absence of Graffiti</td>
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</tr>
<tr>
<td>Sidewalk</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Buffer</td>
<td></td>
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<tr>
<td>Tree, Awning Coverage</td>
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<tr>
<td>Absence of Trip Hazards</td>
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<td></td>
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<tr>
<td>Marked Crosswalk</td>
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<tr>
<td>Curb Cuts</td>
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<td>Crossing Signal</td>
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<tr>
<td>GRAND SCORE</td>
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<tr>
<td>GRAND SCORE (for Active Transport)</td>
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</tbody>
</table>
Dose-response of MAPS-Mini total scores and active transport Frequency for 4 age groups
Urban design, transport, and health

“Systematic designing of cities to enhance health through active transport promises to be a powerful strategy for improvements in population health on a permanent basis.”
Research is Not Easy to Put into Practice
Evidence about urban design and health is accumulating

**Biggest Challenge** is translating it into urban planning and transport policy

How to improve research translation

1. Conduct policy-relevant research
2. Use research methods relevant to policy-makers
3. Actively disseminate findings
4. Engage in advocacy
What kinds of evidence do policy makers value?

• Petticrew conducted interviews with decision makers about research.
• They said researchers did not understand the policy-making process, especially time constraints and how political pressure outweighs evidence.
• Stories and case studies are more compelling than rigorous studies.
• They valued evaluations of real-world interventions—natural experiments.
• Cost and cost-effectiveness analyses were high priorities.
• Decision makers called for research that was designed to assist them in making decisions.

• J Epidemiol Community Health 2004; 58: 811–16.
Pathways to Research Translation

Researchers

Public Opinion

EVIDENCE
* Quality
* Relevance

Policy Makers
Gov’t, NGOs

Business, Consumers

Practitioners

Sallis. Translational Behavioral Medicine, 2019
Pathways to Research Translation

**EVIDENCE**
*Quality*
*Relevance*

**Researchers**
- Social media
- Lay summary
- Press release
- Publish
- Present

**Public Opinion**
- Op-ed
- Briefs
- Knowledge Broker
- Relationships

**Policy Makers**
- Gov’t, NGOs
- Start-up
- License
- Consult

**Business, Consumers**
- Briefs
- Guidelines
- Webinars
- Consult

**Practitioners**
- Sallis. Translational Behavioral Medicine, 2019
My Ask: Take a Step Toward Research Translation

• Communicate your research through lay summary, press release, op-ed, letter to editor, social media
• Join a local or national advocacy group & share your research
• Develop relationship with knowledge broker
• Develop relationship with a decision maker
  – Elected rep, agency staff, corporate leader
• CALL your US Senator and Representative in support of NIH and science in general. They will notice
Physical Activity in Urban Areas

Evidence from International Study Highlights Need for More Walkable Neighborhoods

Introduction
Physical inactivity has been linked to diabetes, heart disease, and some cancers. It is a global problem, estimated to account for more than 5 million deaths per year worldwide. Adults tend to be more physically active when they live in areas that have higher density of people, and are near shops, services, restaurants, public transit, and parks, compared to residents of less-walkable areas. But the evidence showing the link between walkable features (the built environment) and physical activity has not always been consistent.
Resources at www.activelivingresearch.org
Public Health Impact
Physical Activity: Built Environment Approaches Combining Transportation System Interventions with Land Use and Environmental Design

<table>
<thead>
<tr>
<th>Built Environment Approaches in Combination by Intervention Type</th>
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<tbody>
<tr>
<td><strong>Pedestrian and Bicycle Transportation System Intervention Component</strong></td>
</tr>
<tr>
<td>- Street pattern design and connectivity</td>
</tr>
<tr>
<td>- Pedestrian infrastructure</td>
</tr>
<tr>
<td>- Bicycle infrastructure</td>
</tr>
<tr>
<td>- Public transit infrastructure and access</td>
</tr>
<tr>
<td><strong>Land Use and Environmental Design Intervention Component</strong></td>
</tr>
<tr>
<td>- Mixed land use</td>
</tr>
<tr>
<td>- Increasing residential density</td>
</tr>
<tr>
<td>- Proximity to community or neighborhood destinations</td>
</tr>
<tr>
<td>- Parks and recreational facility access</td>
</tr>
</tbody>
</table>
Cross-Sector Impact: Transport
Leveraging the power of ULI’s global networks to shape *projects and places* in ways that improve the health of *people and communities*.
As the U.S. population ages and people stay healthy and active longer, communities must adapt.

The AARP Network of Age-Friendly Communities helps participating communities become great places for all ages by adopting such features as safe, walkable streets; better housing and transportation options; access to key services; and opportunities for residents to participate in community activities.

Well-designed, livable communities promote health and sustain economic growth, and they make for happier, healthier residents — of all ages.

The AARP Network of Age-Friendly Communities is an affiliate of the AARP Livable Communities program.
What Can I Do?

• “White coat” effect is also powerful outside of the clinic and hospital
• Health care professionals can be credible and powerful advocates for active, healthy communities

• **LEARN.** See resources at
  - www.activelivingresearch.org
  - http://sallis.ucsd.edu

• **JOIN.** Walk Denver, Bike Denver
• **SPEAK UP.** City Council, DRCOG, Local planning groups.
Caution: Income Disparities in Environments
Summary of microscale disparities

- Low-income and high racial/ethnic minority neighborhoods had aesthetic and social features that made them less pedestrian-friendly.
- Pedestrian features varied greatly between and within (residential versus retail) cities.
- Given each city’s unique pedestrian environment, local streetscape audits are necessary to determine how to best allocate resources to address disparities in pedestrian environments.