Transit and Physical Activity Studies: Design and Measures Considerations From the TRAC Study

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Objectives

• Rationale for interest in transit and PA
  – Prior physical activity links to public transportation

• Cross-sectional evidence
  – Related threats to conclusions about physical activity

• TRAC study design (NIH R01 HL091881)
  – Case/control selection
  – Measures
Fig. 2. Hypothetical model of walking trips associated with transit use.
Walking Trips to/from Transit

FIGURE 1—Total daily walking trip times to and from transit: United States, 2009 National Household Travel Survey.

Median = 21 minutes walking

Freeland 2013 AJPH
Different Design Options

- Research design options (cross-sectional)
  - Compare transit users versus non-users
    - In overall physical activity
    - In transit-specific physical activity
    - In person-day level examining both overall and specific transit-specific

- Threats to conclusions
  - Self-selection bias
    - Third variable confounding
  - Substitution
    - Being active through public transportation may substitute for other physical activity
      - Measuring both global and transit-specific physical activity
Differences in Daily PA minutes by Transit Usage

- Unadjusted
- Adj + high BE
- Adj + low BE

Legend:
- Non-transit user
- Infrequent transit user (<50%)
- Frequent transit user (>50%)

Source: Lachapelle 2011 J Phy Act Health
Transit Frequency and Type of Walking/PA

Minutes per day

- Not transit user: 0 minutes
- Low transit use (<30% of days): 2.3 minutes
- Medium transit use (31-59% of days): 6.5 minutes
- High transit use (60+% of days): 14.8 minutes

Red: Transit walking
Orange: Non transit walking
Yellow: Non-walking PA

Saelens 2014 AJPH
Baseline Transit-Related Physical Activity

- Non-walking PA
- Walking (not transit-related)
- Walking (transit-related)

<table>
<thead>
<tr>
<th>Category</th>
<th>Minutes per day</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-transit users</td>
<td>21.5 (SD=23.9)</td>
<td></td>
</tr>
<tr>
<td>Walking (not transit-related)</td>
<td>15.9 (SD=19.1)</td>
<td></td>
</tr>
<tr>
<td>Walking (transit-related)</td>
<td>22.1 (SD=23.7)</td>
<td></td>
</tr>
<tr>
<td>Transit users (transit days)</td>
<td>24.6 (SD=24.9)</td>
<td></td>
</tr>
<tr>
<td>Transit users (non-transit days)</td>
<td>12.2 (SD=20.0)</td>
<td></td>
</tr>
</tbody>
</table>

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Rissel Evidence Review

• 27 studies
• Between 8-33 minutes of physical activity associated with public transport (several studies 12-15 minutes)
• 10-29% of population met 30+ minutes of daily physical activity (recommended) just by public transport-related walking

Rissel 2012 Int J Environ Res Public Health
Travel Assessment and Community - TRAC Project

• A natural experiment in which an environment changed (light rail line opening)
  – Addresses some concern about residential self-selection confounding
  – Relative to a demographically and built environment matched sample
  – Examine behavior change in response to environmental change (temporality)

• Use the best possible set of methods to assess physical activity and context

• Multiple similar assessments
  – Baseline (during the 1 year prior to LRT opening)
  – Post 1 (1-2 years after LRT opened)
  – Post 2 (3-4 years after LRT opened)
TRAC Recruitment

- Group-matched **cohort** design
  - ‘Cases’ – adults living < 1 mile from (future) LRT station
  - ‘Controls’ – adults in county living >1 mile from (future) LRT station
- Additional eligibility
  - ≥ 18 years old
  - Able to walk outside home
  - English-speaking or willing to speak through interpreter
  - Living at this residence for > 1 year (and residence built > 3 years ago) and no current intentions to move
  - Contacted via public record information (address/phone)

Moudon et al. 2009
<table>
<thead>
<tr>
<th></th>
<th>Control (n=354)</th>
<th>Case (n=353)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>51 (13)</td>
<td>52 (13)</td>
</tr>
<tr>
<td><strong>Male (%)</strong></td>
<td>37%</td>
<td>40%</td>
</tr>
<tr>
<td><strong>Household income (median)</strong></td>
<td>60-69K</td>
<td>60-69K</td>
</tr>
<tr>
<td><strong>Race/ethnicity (% non-Hispanic white)</strong></td>
<td>87%</td>
<td>76%</td>
</tr>
<tr>
<td><strong>Employed (%)</strong></td>
<td>68%</td>
<td>63%</td>
</tr>
<tr>
<td><strong>Single person household (%)</strong></td>
<td>39%</td>
<td>42%</td>
</tr>
<tr>
<td><strong>Daily physical activity minutes (1000+ cpm, continuous)</strong></td>
<td>83 (39)</td>
<td>83 (37)</td>
</tr>
<tr>
<td><strong>Daily MVPA minutes (1952+ cpm, continuous)</strong></td>
<td>41 (27)</td>
<td>41 (25)</td>
</tr>
<tr>
<td><strong>Daily walking minutes (in bouts)</strong></td>
<td>25.7 (24.9)</td>
<td>30.4 (35.1)</td>
</tr>
<tr>
<td><strong>Daily transit-related walking minutes (in bouts)</strong></td>
<td>2.9 (7)</td>
<td>3.0 (7.8)</td>
</tr>
<tr>
<td><strong>Transit use (trips)</strong></td>
<td>2.8 (5.2)</td>
<td>2.8 (5.6)</td>
</tr>
<tr>
<td>- No trips</td>
<td>61%</td>
<td>57%</td>
</tr>
<tr>
<td>- 1-5 trips</td>
<td>21%</td>
<td>25%</td>
</tr>
<tr>
<td>- 6+ trips</td>
<td>18%</td>
<td>18%</td>
</tr>
</tbody>
</table>
TRAC ‘participant neighborhood’ summary

• Participant’s neighborhood defined as area within a ½-mile radius of residence, containing 539 acres; about a 10-minute walk

• Land use
  – 6.3 dwelling units per acre (range: 1 – 30)
  – 5.3 jobs per acre (range: 0 – 272)
  – 16 acres of parkland (range: 0 – 220)

• Food & beverage destinations
  – 1 supermarket (range: 0 – 5)
  – 3 traditional restaurants (range: 0 – 120)
  – 3 fast-food restaurants (range: 0 – 26)
  – 4 coffee shops (range: 0 – 92)

• Transportation
  – 16 miles of streets, excluding freeways (range: 5.4 – 23)
  – 176 intersections (range: 47 – 342)
  – 0 miles of off-street trails (0 – 1.5 miles)
TRAC Participant Flow By Condition

Enrolled
N=723

Baseline
N=354 Controls with travel data
N=353 Cases with travel data

1-2 years later
N=288 Controls non-movers with travel data
N=293 Cases non-movers with travel data

3-4 years later
N=264 Controls non-movers with travel data
N=261 Cases non-movers with travel data
Sampling, Recruitment, Retention: Lessons Learned

• Engage built environment experts to ‘match’ as best as possible

• If possible, find alternatives to marketing/public records information to augment recruiting
  – That retains random sampling
  – Considering your research question

• Incentivize (creatively)!

• Double or triple anticipated recruitment time line (start early)
TRAC Methods

- Three time points (baseline, near post, far post)
- Individual participant tracked by month/season, not duration since last assessed
- Demographic/attitudinal/psychosocial survey
- Device-based and trip report integration (for 7 days) to measure physical activity
  - Accelerometer
  - Portable GPS
  - Travel log (place-based)
Comparison of Self-Report and Integrated Objective

- U.S. Self-report
  - Walking: 28.0%
  - Other moderate: 22.0%
  - Vigorous: 50.0%

- TRAC baseline sample Integrated objective
  - Walking: 58.5%
  - Other moderate: 37.1%
  - Vigorous: 1.1%
Measures: Lessons Learned

• Cross-measure integration was helpful in obtaining better precision and more information (type, context, etc)
• Carefully examine data even beyond descriptive analysis
  – Know limitations your devices
  – On-going vigilance from staff
• Need a better way to distinguish utilitarian versus recreational walking
Other Considerations

• Transit users versus non-users
  – Switch to light rail transit versus not switching
  – Examine impacts on movers into ‘intervention’ area

• Changes in built environment or other aspects of transportation system
Further Analyses: Reconsider ‘Caseness’?

Walking near LRT station

Minutes per day

0-0.25 miles
0.25 - 0.50 miles
0.50 - 0.75 miles

Overall daily walking

0-0.25 miles
0.25 - 0.50 miles
0.50 - 0.75 miles

Baseline
Post 1

0
0.25
0.50
0.75 miles

0
10
20
30
40
50
60
70
80
90
100

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Citations


