Questions to ask before you research natural experiments in transit & physical activity

Illustrations from the Moving Across Places Study (MAPS)

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Overview

- Quick description of the Moving Across Places Study (MAPS) in Salt Lake City, Utah
- Then transportation-related questions you might want to ask
- Then tips from the field
Does a “Complete Street” intervention support increased physical activity?

**Before**
- No TRAX light rail
- No bike lane
- Narrow sidewalk
- 3 lanes, each direction
- No pedestrian lighting
- Overhead power lines

**After (same place)**
- TRAX light rail
- Bike lane
- Wide sidewalk
- 2 lanes, each direction
- Landscaping
- Pedestrian lights
- No overhead power lines
MAPS panel has 536 adults in the North Temple complete street corridor

- To compare
  - Near: exposed to intervention
  - Far: adjacent controls
- At 2 times
  - Time 1 = Pre-street completion
  - Time 2 = Post street completion

Map by GeoStats
Activity & travel measures: GPS (GlobalSat DG-100 data logger) & accelerometry (Actigraph GT3x+)

GPS tracks physical activity locations, especially for travel outdoors where GPS signals reach

Accelerometer measures physical activity intensity
More PA over time for those who begin transit use; less PA for stopping transit

(Brown, et al., AJPH, 2015)

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<thead>
<tr>
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<th>Never</th>
<th>Continued</th>
<th>Discontinued</th>
<th>New</th>
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<tr>
<td>n</td>
<td>393</td>
<td>51</td>
<td>41</td>
<td>52</td>
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<tr>
<td>2013-2012 accelerometer counts per minute (all wear time)</td>
<td></td>
<td></td>
<td></td>
<td>47.81**</td>
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<tr>
<td>11.97</td>
<td>-14.13</td>
<td>-43.12**</td>
<td>47.81**</td>
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**p<.01 Never = control group; contrasts significant, controlling for Age, female, Hispanic, college grad, married, self-reported health, days between measures, temperature differences
Do you need accelerometer measures?

- NHANES self-reported vs. accelerometer-measured PA attainment (Troiano, '08 MSSE)

% meet 150 min.

![Bar chart showing comparison between self-reported and accelerometer-measured physical activity attainment]
Do you need GPS measures?

- If knowing outdoor locations is important

- **Example** (Miller, 2015, H&P):
  - Is more PA in transit neighborhoods due to transit use?
  - Or walking to shops near transit?

- GPS data can tie activities to places or routes
  - Ideal for new infrastructure evaluation
Can you do this in-house?

- GPS & accelerometry data flood in!
  - 3-second readings for GPS; 10-second epochs accelerometers
- We chose GeoStats (Westat) to take advantage of their experience
- Data integration and mode designation takes time
  - No mid-course corrections possible between Time 1 & 2
Will your target intervention increase PA?

- Get to know your possible sites
- We vetoed some prospective rail stops
  - With big park & ride lots
  - Or fenced off transit stations
- You will spend lots of time on your project
  - Find a site that you believe translates your research goals well
How do you select Near vs. Far areas?
(AKA exposed/not exposed; “experimental/control”)

- We had 3 active modes to consider
  - Walk to TRAX light rail
  - Walk for non-transit
  - Bicycling

- We defined Near/Far for walks to light rail, likely to be most popular
  - Several suggested ½ mile distance (∼800M; O’Sullivan, 1996)
  - Some suggested 1km (1000M; Canepa, 2007)
We chose $<1\text{km} = \text{Near}$, which provided similar Near/Far samples.

<table>
<thead>
<tr>
<th>Near &amp; Far not different on:</th>
<th>Nears were:</th>
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<tr>
<td>Gender</td>
<td>Lower income</td>
</tr>
<tr>
<td>Age</td>
<td>Less likely to be married</td>
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<tr>
<td>Hispanic ethnicity</td>
<td>Less likely to be white</td>
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<tr>
<td>Education (coll. grad)</td>
<td>Less likely employed</td>
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<tr>
<td>Education (h.s. grad)</td>
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<tr>
<td>Renter/owner</td>
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<tr>
<td>Years residence</td>
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<tr>
<td>Children in home</td>
<td></td>
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<tr>
<td>Household size</td>
<td></td>
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<td>Student status</td>
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</table>
But even Nears show lots of variability in transit stop access due to layout of area
How much variation is there in walk distances to transit across one line?

- A lot! Calgary walk distances vary 2-fold across stops (O’Sullivan & Morrall, 1996)
  - Reflects sparser transit stop spacing on periphery
How much variation in walk to rail globally? 326m to 1000m+

- Perth: 1000 meters
- Portland & S.F.: 933 meters
- Sydney: 805 meters
- Montreal: 564 meters
- Calgary: 326 meters

Meters Distance Mean or Md
So your choice of Near/Far boundary matters

- If Far set too distant,
  - Near effect could dissipates

- If Far set too close,
  - Near effect may seep into control area

- You define Far to plan your sampling
  - but expect to test multiple distances
Distance effects vary across types of active transport

- What were distance effects for walks to transit?
- Peak within about 300m

![Graph showing the proportion of transit walks in an area vs distance from a complete street.](image)

**Prop. w. transit walks in area**

**Distance from complete street (100ms)**
What were distance effects for non-transit walks?

Non-transit walking falls off less sharply.

Non-transit walkers by distance of complete street from home (in 100 meters)

Distance from complete street (100ms)
Are Near effects a “slam-dunk” in pre-post-walking path studies? No

- Only 3 of 52 path studies reviewed had pre- and post-data (Starnes, 2011)
- And no increase for Near pedestrians in intervention studies (Evenson et al., 2005; Brownson et al., 2004; Merom et al., 2001)
- But proximity to trails was correlated with more use (4 studies)
- We need to tease out correlational vs. longitudinal findings
What special challenges exist for research on new bike lanes?

- **U.S. biking is rare & sporadic**
  - Only 0.6% of commuters bike to work (2008-2012 American Community Survey, McKenzie, 2014)
  - Biking is often not stable over time
    - Only 13% of cyclists biked in past week (Schroeder & Wilbur, 2013)

- **Few studies find hoped for Near effects** (Burbidge & Goulias, 2009; Evenson et al., 2005)
  - Although riders Near a new Sydney path were more likely to use it, they did not increase their biking (Rissel et al., 2015)
What were distance effects for cycling?

- We did not even state a biking Aim
- Good thing!
- This is what we found in our exploratory tests

No strong pattern of proximity to new bike lane and biking
Solution? What other ways can you study biking?

- **Sample only cyclists** (Sydney; Merom, et al., 2003)
  - Near cyclists (<1.5km) reported .24 hr/wk more biking
  - Far (>1.5km) cyclists reported .24 hr less

- **Screen for bike owners** (Portland, Dill et al., 2014)
  - Yielded 40% biking in a week
    - (but no increase among Near cyclists)
What other ways to study biking?

- Study biking abroad where it is common
  - 8/10 studies showing effects for adult cycling & health/weight were from Europe or China (Oja et al., 2011)

- Observe cyclists on new bike paths
  - Increased cyclists counted on improved/better connected bike paths, compared to other sites (CA: Cohen, 2008)
  - Limitation: Is this new biking? Or relocated biking?
Tips from the field: Intervention timing/control problems are rampant!

- **Surprise interventions**—you don’t hear about them ‘til too late
  - We were lucky to hear of a new stop over lunch (Brown & Werner, 2007, 2008, 2009)
  - Alert your network of your interests

- **Stalled interventions**
  - Ex: Busway construction 2-yr delay (Ogilvie, BMCPH, 2010)
  - Can you test in staged phases?
Earlier than expected interventions

- Plan A, MAPS, rail start date a guess
  - Time 1, 2012
  - Rail starts 9/2013
  - Avoid Winter data
  - Time 2, Spring 2014

- Reality: Time 2 follow-up moved up
  - Time 1, 2012
  - Rail starts 4/2013
  - Time 2, Spring 2013
  - Avoid Winter data

- Choose your risks
  - Little exposure time to intervention (Goodman, et al. AJPH, 2014)
  - Or risk participants moving away
Incomplete interventions

- You hire the staff & train the students, then...
- Interventions are cut back
  - e.g., fewer street improvements than promised to encourage older person’s PA (Ward-Thompson, 2014)
Other tips

- Door-to-door recruitment issues
  - A letter from the police chief helped
  - Locked condos/apartments require extra recruitment time
    - Snack table outreach in some
    - Denied access in another
Good resources


References

- Burbidge SK, Goulias KG. Evaluating the impact of neighborhood trail development on active travel behavior and overall physical activity of suburban residents. *Transportation Research Record.* 2009;2135:78-86.