Using audit tools for active living research

Kristen Day, Ph.D.
Polytechnic Institute of New York University
Research on active living

• Often tests hypotheses about relationships between
  – physical environment
    • actual and/or perceived
  and
  – health outcomes
    • physical activity levels, BMI, etc.
Need ways to measure features of actual built environments

• Have tools to measure physical activity

• Measures of perceived environment may differ from measures of actual environment
  – Examples?
Audit tools: Objectives

• Systematic observation of actual physical environment
  – Presence, qualities of environmental features potentially linked to physical activity (PA)
    • E.g., street pattern; #, quality of public spaces

• Sample hypotheses

Photo: Hamilton Baille Associates, 2006
When to use audit tools

- Audit tools = time consuming
  - Primary data collection
  - Sampling, collecting, entering data

- Other forms of data collection may = less labor intensive
  - E.g., GIS, aerial photo data on environmental features
Consider audit tools when:

- Data not available through remote means for your sites
  - E.g., sidewalk width, location of street trees
- Features better assessed in person
  - E.g., architectural character, presence of litter
- Have inexpensive method to collect audit data
  - E.g., student assistants
Audit tools for other purposes

• Some tools = for local decision making
  – Not designed for research

• May be:
  – Inappropriate for research
  – Unknown reliability
Overview of audit tools

• Usually collect data in-person
• Walk, drive through setting
  – Neighborhood, park, trail
• Systematically code characteristics of environment
  – Using standardized form

Photo: Town of Chapel Hill, 2008
Street segment

- Typical unit of observation
- = 2 facing sides of street block or trail
- Some places don’t work for segments
  - Not linear

Sample segments:
Suburban neighborhood
Segments typically sampled

• Usually too many to include all
  – Depends on setting

E.g., SR2S study, So. Cal

• 15 neighborhoods
  - 1/2 mile each, around school
• 5–109 segments
• Average = 47 segments
Format

• Paper form
  + Inexpensive
  Easy to implement & use
  One page: easiest
  – Separate data collection, entry

• Personal Desktop Assistant (PDA)
  *PalmPilot, tablet PC*
  + No separate data entry
  Screens out incorrect entries
Current audit tools for research

• Lit review on research tools for active living [Brownson, Hoehner, Day, Forsyth, & Sallis, AJPM, 2009, 36 (4S), S99–S123]

• Identified 20 tools for in-person observation of physical environment for ALR
  – Peer-reviewed publications
  – Report reliability

• 14 published since 2005
  – Most = relatively new
  – Many supported by ALR/Robert Wood Johnson Foundation
• Settings
  – Community (16)
  – Parks (2)
  – Trails (1)
  – Workplaces (1)

• Specific populations
  – Seniors (1)
  – People with disabilities (1)
  – African Americans (1)
• Focus within PA
  – Walking = most common
  – Bicycling (2)

• Tools vary in:
  – Level of detail (14 to 712 items)
  – Domains covered
    • Most tools = land use, streets & traffic, sidewalks, bicycling facilities, public space/amenities, building characteristics, parking, maintenance, safety
    • Few tools = some features, e.g., presence of dogs, noise levels, etc.
• Reliability
  – Most reliable = land use, street characteristics
  – Less reliable = more subjective
    • physical disorder, tidiness, safety features

• For information: www.activelivingresearch.org/resources/research/toolsandmeasures
  Links to:
  – Publications
  – Instruments
  – Codebooks
Sample audit tools

- SPACES
- Measurement Instrument for Urban Design Qualities
- BRAT-DO (parks)
- PEAT (trails)
- Irvine-Minnesota Inventory
SPACES

• One of earliest audit tools (2002)
• One page, paper form
• Developed in Australia
  – PEDS, Clifton et al, modifies SPACES for North America


Photo: www.charlessturt.sa.gov.au/
SPACES (cont.)

• 51 items*

• Focus:
  – Walking & cycling surface
  – Street assessment
  – Overall community assessment

• Reliability measured as Kappa statistic:
  – 48/67 items have $K \geq 4$

# of items observed is reported differently for each tool. Here, # of items = total # of discrete items recorded for each segment or unit of analysis, excluding identifying information (observer #, segment #, etc.).
Measurement Instrument for Urban Design Qualities

• Focus: actual experience of how urban streetscape is perceived while walking
  – Imageability
  – Visual enclosure
  – Human scale
  – Transparency
  – Complexity

Example: Imageability

Streets filled with people, many signs, and strong landmarks make Times Square in New York City a very imageable place.

Few pedestrians, no street activity like outdoor dining, and no features that serve as landmarks make this street hardly distinguishable from others, and thus not imageable.

Visual enclosure  

Human scale
Measurement Urban Design (cont.)

• One page, paper form

• 27 items
  – 20 minutes/segment

• Reliability measured by intraclass correlation coefficients (.4–.6 ICCs = moderate agreement)
  – Visual enclosure (.585)
  – Human scale (.508)
  – Complexity (.508)
  – Transparency (.499)
  – Imageability (.494)
  – Tidiness (.421)
BRAT-DO (Bedimo-Rung Assessment Tools-Direct Observation)

• Focus on parks:
  – Features
  – Conditions
  – Access
  – Aesthetics
  – Safety

• Includes post-hurricane measurements of park damage

New Orleans City Park after Hurricane Katrina. Photo: farm2.static.flickr.com/
BRAT-DO (cont.)

• 135 items

• Unit of analysis = activity area in park
  – Also measures surrounding neighborhood

• Reliability measured as % items with ≥ 70% agreement between 2 raters
  – Safety (100%)
  – Features (97.6%)
  – Access (96.8%)
  – Conditions (91.4%)
  – Aesthetics (87.5%)
Path Environment Audit Tool (PEAT)

- 93 items
  - Modeled on SPACES

- Focus on trail:
  - Design
  - Use
  - Maintenance


Photo: www.fes.uwaterloo.ca/cooljobs/abbotts02b.html
PEAT (cont.)

• Format:
  – Tablet PC or PDA
  – GPS unit

• Reliability
  – 15/16 primary amenity items \( \geq 0.49 \)
    (“moderate”, mean K statistic)
    • e.g., presence of lights, signs etc.
  – All amenities = observed agreement \( \geq 81\% \)
  – Reliability for design, maintenance = fair
Irvine-Minnesota Inventory (IMI)

• Focus = urban design features tied to aesthetics, vitality, etc.
  – Especially relevant for features tied to walking.

• Research team: Marlon Boarnet, Mariela Alfonzo (UC Irvine); Ann Forsyth (U Minnesota)


IMI (cont.)

- 176 items

- Focus:
  - Accessibility
  - Pleasurability
  - Safety from traffic (human comfort)
  - Safety from crime

IMI (cont.)

- Designed for wide range of types of places
- Questions about entire place AND segments
- Has version for non-linear ("area") type places (office parks, campuses, etc.)
IMI (cont.)

- Reliability measured as % of items with > 80% agreement between raters.
  - 77% agreement w/ 3 raters in California; 99% agreement w/ 2 raters in Minnesota
  - Final instrument = only reliable items

Photo: www.activeforlife.info
Developing the inventory

- Literature review—relevant features?
- Three focus groups to add items to inventory
- Expert panel review
- Field test—fit to many settings
Field testing the inventory

- Tested in 27 different urban/suburban/small town/rural settings, most in Southern California
- Revised instrument to fit features of these environments

The inventory

• 4 domains (overlap)
  – Accessibility (62 items)
  – Pleasurability (56 items)
  – Perceived safety from crime (15 items)
  – Perceived safety from traffic (31 items)

• Quantitative, mostly objective measurements
Examples

Is there a buffer between sidewalk and street (for example, parked cars, landscaped buffer strip, etc.)?
___ Yes ___ No ___ NA

Are there abandoned buildings or lots on this segment?
___ Some/A lot ___ Few ___ None ___ N/A (no buildings)

How much of the segment has blank walls or buildings with blank walls?
___ Some/A lot ___ Little ___ None ___ N/A
Protocol for data collection

- Select settings
  - Mark boundaries on map that shows all street segments for settings
- Identify segments
- Train observers (2 per setting)
- Sample segments
- Conduct in-person observations
  - Walk/drive setting
  - Observe each segment in sample, mark items
- Data collection: 3–4 hrs./setting
  - For sample of 15–20 segments/setting
Selecting sites

• Politically defined settings
  – E.g., existing neighborhoods

• Settings defined around a point
  – E.g., 1/2 mile surrounding school or subject’s home

• Census tracts
  – E.g., choose census blocks or tracts based on criteria linked to hypotheses
Sampling segments

• Purposeful
  – Select segments to include rare but important uses in setting (e.g., park, corner store, etc.)
  – Beginning at segment #1, include in sample if differs from previous segment on:
    • Land use
    • Presence of sidewalk network
    • Presence of barriers
    • Whether looks like “nice place to walk”
  – Include segment if skipped last 3 segments
Sampling (cont.)

• Randomly sample segments in site
  – Use GIS street database or other source
    • Yields representative sample with known probabilities of selection
    • Allows better calculation of sampling weights, proper inferences
Sampling (cont.)

• # of segments/setting varies
  – Size, age, street pattern of setting

Santa Ana, CA  Malibu, CA
Sampling (cont.)

- Team leader walks/drives setting and marks segment boundaries on a map
  - Boundaries typically defined by intersections
  - Boundaries may appear clear on map, but be less clear “in person”
  - Apply consistent rule of thumb for deciding boundaries (e.g., at T intersection, segment extends to the middle of the street)

- Team leader confirms which segments fall within setting
Exercise

(1) What hypotheses are you testing in your study?

(2) What aspects of the built environment are important to measure, for your study?
   • Specific qualities—safety, accessibility, etc.?
   • Features tied to specific types of physical activity?
   • Features tied to specific kinds of places—suburban, New Urbanist, etc.?

(3) How will you select sites/settings and why?
Training: IMI

• Review: IMI = 2 formats
  – Microsoft ACCESS/ Tablet PC
  – Paper form (using today)

• In person observation
  – + 5 questions using GIS
    • Appendix A, Codebook
    • Density of origins, density of destinations, Intersection pattern (= avg. block size), street width, street length
    • Can skip if not using GIS
To Begin, You Need

- 2 observers
- Paper forms/clipboards
  OR
  Tablet PC’s w/ ACCESS, IMI
- Codebook
- IMI Training powerpoint
- Detailed map of setting
  - All streets marked
- GIS program (if using)
  - Street map, census geography layer
- STAT transfer, SPSS or equivalent
Identify settings

- Tied to your research question, hypotheses
- Mark boundaries of settings on map

Setting = neighborhood surrounding elementary school. Boundaries = 1/4 mile radius from school.
Determine if you have linear or non-linear settings

• Linear:
  – Organized by street network or equivalent
  – Made up of segments
  – MOST SETTINGS ARE LINEAR!
• Non-linear (area):
  – Not readily understood in terms of segments
    • E.g., campuses - face inwards, not consistently intersected by streets
• Define each setting
• If BOTH linear & non-Linear, use non-linear (area) form of IMI (Appendix B)

Example:
Whitworth College, WA.
Identify segments

- Team leader travels through setting in advance
- Mark segment boundaries on map
  - Less clear in person than on map
  - Typically, boundary = intersection
  - Keep blocks intact
  - Use consistent rule of thumb for defining
  - Add any missing segments to map
  - Number all segments
  - Confirm which segments = inside setting
Sampling segments

• Observe sample of segments
• Team leader selects sample in advance
• Team leader gives observers list of segment #'s to observe
• Choose sampling strategy
  – Random
    • For representative sample, known probabilities
    • Use GIS street database to select
  – Purposeful
    • Better when have few settings
    • So don’t overlook critical features for PA
Purposeful sampling

• Team leader starts on one segment, observes
• Moves to next adjacent segment
• Answers 4 questions:
  – Similar land uses?
  – Similar sidewalk network?
  – Similar barriers?
  – Similar in whether a “nice place to walk”?
Purposeful sampling (cont.)

- If no difference, skip segment.
  - Go to next adjacent segment
  - Ask same questions
- Only skip up to 3 segments in a row
  - Must include 4th segment in sample
Doing observations

• Top of form:
  – Date
  – Observer #
  – Segment # (automatic on ACCESS)

• Observers observe separately
  – For reliability

• 1 Response per item
Setting & segment level observations

• Most questions = segment level

• At end of observing a setting, complete 4 questions, whole setting
  – Overall character
Training observers

• Goal = comprehension, reliability

• Training protocol
  – 2 classroom sessions (2 hrs/ea.)
    (1) Purpose of study, overview of procedures
    (2) Doing observations
  – 2 field training sessions (2 hrs/ea.)
    Observe together, discuss, observe independently, discuss, retrain

• Training Powerpoint