Systematic Observation of Physical Activity and Its Contexts

Thom McKenzie, Ph.D.
Professor Emeritus, San Diego State University
(tmckenzie@sdsu.edu)

Monica Lounsbery, Ph.D.
Professor, University of Nevada, Las Vegas
(monica.lounsbery@unlv.edu)

Overview

- Background
- Research Issues
- Practical Issues
- Examples:
  - Home, School, & Park environments

Systematic Observation

- Direct method for assessing physical activity
- Permits simultaneous examination of physical and social environment
  - (location, presence of others, prompts, consequences)
- History
  - (Bullen '64; Hovell '78)
- Method, not an instrument

Systematic Observation

- Advantages
  - Direct and objective measure
  - High internal validity
  - Assesses contextual variables
    - (e.g., social and physical environment)
  - Suitable for aquatic environments
  - Low participant (i.e., subject) burden
  - Results understood by practitioners

Systematic Observation

- Disadvantages
  - Expense (observer time)
  - Accessibility to all locations
  - Potential subject reactivity

Feasibility of Direct Observation

- Training required
  - Depends upon complexity of system (number of activity and contextual codes)
- Time for measurement
  - Real time plus travel
  - Data entry
  - Recording and playback if video is used
Observer Training

- Memorize codes
- Directed practice using video segments
- Assessments using ‘gold standard’
- Field practice
- Field reliabilities with certified assessor
- Additional training to prevent observer drift

DVD Information

- Content
  - Definitions and examples
  - Samples with practice codes
  - Samples with code delays
  - Assessment videos
- Availability
  - E-mail request to ALR

Observation Techniques

- Frequency
- Duration (including latency)
- Time sampling/interval recording
  - Momentary time sampling—SOPLAY & SOPARC
  - Partial interval recording
  - Whole interval recording

Observation Systems

- Designed for specific purpose
  - (BEACHES, SOFIT, SOPLAY, SOPARC, SOCARP)
- Key ingredients
  - Behavior categories
  - Observation protocols (e.g., pacing)
  - Coding conventions

Observation Systems -Individual Behavior-

- SOFIT
  - PE and instructional classes
- SOCARP
  - Individuals on playgrounds
  - Includes group size, activity type, and social interactions
- BEACHES
  - Individual children at home and elsewhere

Interval Recording

- Typically short observe/record intervals (6-10 seconds)
- Codes entered during ‘record’ intervals
- Activity codes vary among systems
  - 5 codes; BEACHES and CARS
  - 14 posture codes with 3 levels each (Bailey, ’95)
Pacing Observations
Entering Data
- Duration (Computer; each key is toggle switch)
- Interval
  - Computer
  - Audiotape tape/CD/MP3/iPOD
- Data entry
  - Computer
  - Hand score
  - Form
  - Scantron

Observation Systems
-Areas and Facilities-
- SOPLAY
  - Group behavior at leisure at school
- SOPARC
  - Group behavior in parks and communities
  - Includes age and race/ethnicity groupings
- SOPARNA
  - Group behavior in wilderness areas
  - Includes group size, activity modes

Methodological Considerations (1)
- Validity of codes
- Observer training
- Reliability measures
- Observer drift/instrument decay
- Recalibration
  - "Gold-standard" videotapes

Methodological Considerations (2)
- Sampling Adequacy
  - Time periods (e.g., seasonality)
    - More than weather and temperature
  - Time of day
  - Week days vs. week ends
  - Enough teachers, students, parks

System Validation (1)
- Activity codes:
  - heart rates, VO2max, accelerometers
- Example:
  - SOFIT/SOPLAY Activity Codes
    - heart rates (lab and field; ages 4-17)
    - accelerometer (PE and recess)

Observer Variability
- Within Observer
  - Examined using video technology during training and recalibration
- Between observers
  - Called interobserver agreement or reliability
  - Reported in different ways:
    - Kappa (controls for chance agreement)
    - Interval by Interval (I-I)
    - Intraclass correlations
Physical Activity Data

- Typically summarized as:
  - Activity time in levels (minutes, hours)
  - Proportion of time (% of lesson or practice)
  - Estimated energy expenditure (kilocalories, METS)
  - Counts (e.g., steps taken)

BEACHES Contexts
(Newer version)

- 1. Activity Level
  - (lie down, sit, stand, walk, vigorous)
- 2. Physical Location
  - (e.g., inside home, outside)
- 3. People Present
  - (e.g., parents, sibling, others)
- 4. Behavior Motivated
  - PA; Sedentary
- 5. Motivator
  - (Adult; Child)
- 6. Views Media
  - (No; Yes)
- 7. Eats
  - (No; Yes)

RESULTS: Physical Activity at Home

- OVERALL: Children were
  - Indoors 78% of the time
  - Sedentary 74% of the time
  - Vigorous only 11% of time

- REDUCED ACTIVITY ASSOCIATED WITH:
  - Being indoors (p<.001)
  - Parents being present (p<.004)
  - Time viewing media (p<.001)
  - Time ingesting food (p<.05)

McKenzie et al., 2008, AJPH

MVPA of Preschoolers at RECESS and HOME

- Percent MVPA
- Boys-recess vs. Boys-home
- Girls-recess vs. Girls-home

Prompts for Physical Activity at Home

- Percent of intervals
- Boys vs. Girls

N=291 children; Elder et al., JDPB, 1998
*total verbal and physical prompts from adults and peers
School Settings

1. Physical Education
2. Recess/free play

"If Exercise is Medicine, PE is the Pill Not Taken"

Lack of regulation (policy, accountability)
- Dosage (frequency, duration, intensity)
- Prescriber (training)
- Content (appropriateness, sound)
- Delivery (palatable)

McKenzie & Lounsbery, *AJHM*, 2009

SOFIT Categories

- Physical Activity
  - Lying Down, Sitting, Standing, Walking, Vigorous
- Lesson Context
  - Management, Knowledge, Fitness, Skill Drills, Game Play, Other
- Instructor Behavior

SOFIT Entry Form

Abbreviated

<table>
<thead>
<tr>
<th>Activity</th>
<th>Context</th>
<th>Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1 2 3 4 5</td>
<td>M K F S G O</td>
<td>I O N</td>
</tr>
<tr>
<td>2 1 2 3 4 5</td>
<td>M K F S G O</td>
<td>I O N</td>
</tr>
<tr>
<td>3 1 2 3 4 5</td>
<td>M K F S G O</td>
<td>I O N</td>
</tr>
</tbody>
</table>

M-SPAN PE: Effects on Student MVPA Minutes

N=24 Schools; 214 Teachers; 1847 Lessons
**MVPA by Gender and Context**

- **Percent Time in MVPA**
  - MVPA: Moderate to Vigorous Physical Activity
  - **Gender Comparison**:
    - Boys: 70%
    - Girls: 65%

**Time in Physical Activity: US Goals vs. Girls’ PE Classes**

- **Minutes Per Week**
  - US Goal: 420
  - Middle School PE: 400

**SOPLAY Categories**

- **Physical Activity**
  - (Sedentary, Walking, Vigorous)
- **Area Contexts**
  - (Accessible, Usable, Equipped, Supervised, Organized)
- **Other Contexts**
  - (Time, Temperature, Predominant Activity/Sport)

**SOPLAY**

- McKenzie et al., 2000, Preventive Medicine
- Observers scan target areas and record activity intensity of each person
- Three levels: sedentary, walking, and vigorous
- Levels validated via heart rates enable energy expenditure in area to be estimated
- Simultaneous entries for relevant environmental characteristics

**Percent of School Population in Activity Areas**

- **Percent of Students**
  - Before School: 4.2%
  - Lunch Time: 19.1%
  - After School: 1.9%

**Percent in Activity Areas**

- **Percent of Students**
  - Before School: 6.6%
  - Lunch Time: 7.9%
  - After School: 2.0%

* = p<.001
### MVPA by Gender

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before School</td>
<td>57.4</td>
<td>51.4</td>
</tr>
<tr>
<td>Lunch Time</td>
<td>64.5</td>
<td>60.4</td>
</tr>
<tr>
<td>After School</td>
<td>51.4</td>
<td>60.5</td>
</tr>
</tbody>
</table>

* p<.01

N=24 M-SPAN schools; 181 areas

(McKenzie et al., 2009, Preventive Med)

### Area Contexts by Leisure Time Period

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Usable</th>
<th>Accessible</th>
<th>Supervised</th>
<th>Equipped</th>
<th>Organized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recess</td>
<td>100</td>
<td>80</td>
<td>60</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Lunch</td>
<td>80</td>
<td>60</td>
<td>40</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Before School</td>
<td>60</td>
<td>40</td>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>After School</td>
<td>40</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

N=10 Hong Kong Schools; 65 Activity Areas

(Sit, McKenzie, et al., 2010, HK Gov Report)

### Community Settings

- Parks and Recreation Centers

### Data Sources

- Direct Observation (SOPARC)
  - (System For Observing Play and Active Recreation in Communities)
  - N=16,224 park users
- Interviews of Park Users
  - N=713 adults
- Interviews of Area Residents
  - N=605 adults from randomly selected homes >2 miles
- US 2000 Census

### Methods

- **LOCATION**
  - 8 neighborhoods in Los Angeles with:
    - High household poverty (X=35%; range=16-55%)
    - High % of minority groups (2000 census)
      - Latino, range=16-55%
      - African-American, range =0-88%
Observation Methods

PARKS
- 8 parks in multi-ethnic communities
- Size: Range=3.4-16.0 acres; Mean = 7.8 acres
- 165 Target Areas: Range/park =17-27; Mean =20.6

DATA COLLECTION
- 8 assessors trained systematically
- 56 clement days (7 in each park)
- 4 one-hour periods/day (7:30AM; 11:30AM; 3:30PM; 6:30PM)
- 4511 area visits

SOPARC Categories
- User Physical Activity Levels
  - (Sedentary, Walking, Vigorous)
- User Characteristics
  - (Gender, Age, Race/Ethnicity)
- User Activity Modes
  - (e.g., soccer, picnicking)
- Area Contexts
  - (Accessible, Usable, Equipped, Supervised, Organized)
- Other Contexts
  - (Day, Time, Temperature)

Reliability Measures

BACKGROUND
- Observer-pairs conducted 472 simultaneous measures in 125 activity areas in 6 parks

AREA CHARACTERISTICS
- Accessibility, 95%; Usability, 94%; Supervised, 97%; Organized, 97%; Equipped, 99%

NUMBER COUNT FOR AREA
- Correlation=.99 for both females and males
- % Agreement= 92% females, 89% males

PEOPLE CHARACTERISTICS (Overall)
- Age Grouping: Females, 95%; Males, 97%
- Ethnic/Race Grouping: Females, 99%; Males, 99%
- Physical Activity Level: Females, 90%; Males, 88%

Characteristics of Activity Areas

Proportion of Observations
Activity Areas Occupied

Park Users: Gender and Age
Activity Levels by Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Sedentary</th>
<th>Walking</th>
<th>Vigorous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>62.1%</td>
<td>19.1%</td>
<td>10.2%</td>
</tr>
<tr>
<td>Females</td>
<td>77.3%</td>
<td>18.4%</td>
<td>12.4%</td>
</tr>
</tbody>
</table>

N=16,048 people; 165 activity areas; 56 days

Proportion Walking and in Vigorous Activity in 8 Parks

<table>
<thead>
<tr>
<th>Park</th>
<th>% Walking</th>
<th>% Vigorous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algin</td>
<td>20.3%</td>
<td>11.2%</td>
</tr>
<tr>
<td>Green</td>
<td>12.9%</td>
<td>23.6%</td>
</tr>
<tr>
<td>Costello</td>
<td>18.5%</td>
<td>13.2%</td>
</tr>
<tr>
<td>Pecan</td>
<td>22.9%</td>
<td>23.6%</td>
</tr>
<tr>
<td>Andrews</td>
<td>18.5%</td>
<td>24.8%</td>
</tr>
<tr>
<td>Van Ness</td>
<td>17.2%</td>
<td>16.6%</td>
</tr>
<tr>
<td>Evergreen</td>
<td>30%</td>
<td>45%</td>
</tr>
<tr>
<td>Wilmington</td>
<td>28.5%</td>
<td>60%</td>
</tr>
</tbody>
</table>

N=16,048 people; 165 activity areas; 56 days

-4 times/day
-4 days (2 weekdays, Sat, & Sun)
Predicts park use, including:
Number, gender, PA levels, & age and race/ethnicity groupings