Direct Observation of Physical Activity and Its Contexts

Seeing Is Believing, ALR 101

Thom McKenzie, Ph.D.
Professor Emeritus, School of Exercise and Nutritional Sciences
San Diego State University

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Overview

- Background
- Research Issues
- Practical Issues
- Examples: Micro environments

Peaceful Playgrounds
Physical Activity Measures

- **Accelerometers**
  - CALTRAC, CSA/Actigraph

- **Self-reports**
  - Interviews or questionnaires
  - (e.g., PAR, SAPAC)

- **Proxy measures**
  - (e.g., heart rate monitors; doubly labeled water)

- **Direct observation**
  - BEACHES, SOFIT, SOPLAY, SOPARC, SOCARP
Systematic Observation

- Direct method for assessing physical activity
- Permits simultaneous examination of physical and social environment
  - (location, presence of others, prompts, consequences)
- History
  - (Bullen ‘54; 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 Sources of Error
- Reactivity
- Instrument Decay/Observer Drift
  (Unintended changes in interpretation over time)
Aventuras para Niños
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
Observation Techniques

- Frequency
- Duration (including latency)
- Time sampling/interval recording
  - Momentary time sampling
  - Partial interval recording
  - Whole interval recording
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)
Observation Systems

- Designed for specific purpose
  - BEACHES, SOFIT, SOCARP (individuals)
  - SOPLAY, SOPARC (groups)

- Key ingredients
  - Behavior categories
  - Observation protocols (e.g., pacing)
  - Coding conventions
Observation Systems

- **BEACHES**
  - Individual children at home and elsewhere

- **SOFIT**
  - PE and instructional classes

- **SOPLAY**
  - Group behavior at leisure at school

- **SOPARC**
  - Group behavior in parks and communities
  - Includes age and race/ethnicity groupings

- **SOCARP**
  - Individuals on playgrounds
  - Includes group size, activity type, and social interactions
Methodological Considerations (1)

- Validity of codes
- Observer training
- Reliability measures
- Observer drift/instrument decay
- Recalibration
  - “Gold-standard” videotapes
System Validation (1)

- **Activity codes:**
  - heart rates, VO2max, accelerometers, pedometers

- **Example:**
  - SOFIT/SOPLAY
    - heart rates (lab and field; ages 4-17)
    - accelerometer (elementary school PE, recess)
    - pedometers (PE)
Estimated Energy Expenditure

Kcal/kg/min

<table>
<thead>
<tr>
<th>Activity</th>
<th>Kcal/kg/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lying Down</td>
<td>0.029</td>
</tr>
<tr>
<td>Sit</td>
<td>0.047</td>
</tr>
<tr>
<td>Stand</td>
<td>0.051</td>
</tr>
<tr>
<td>Walk</td>
<td>0.096</td>
</tr>
<tr>
<td>Vigorous</td>
<td>0.144</td>
</tr>
</tbody>
</table>

Sedentary
Reliability

**Consistency:**

degree to which independent, trained observers produce the same results when simultaneously observing:

- the same events
- using the same coding definitions, procedures, and conventions
Observer Variability

- **Within Observer**
  - Examined using videotape technology during training and recalibration

- **Between observers**
  - Called interobserver agreement or reliability
  - Reported in different ways:
    - Interval by Interval (I-I)
    - Kappa (controls for chance agreement)
    - Intraclass correlations
Methodological Considerations (2)

➢ Sampling Adequacy

- Time periods (e.g., seasonality)
  - More than weather and temperature
- Time of day
- Week days vs. weekend days
- Enough teachers, students, parks
Physical Activity Data

- Typically summarized as:
  - Activity time in levels (minutes, hours)
  - Proportion of time (% of lesson or practice)
  - Estimated energy expenditure (kilocalories, METS)
  - Number of people
  - Proportion in activity levels
Physical Activity Occurs within Specific Environments

- In transport
- At home (play, work)
- Recreation (structured, unstructured)
- Sports (Youth, Senior)

Schools

- PE Classes; Intramurals; Interscholastics;
- Clubs; Free Play
Environment

➤ Social

➤ Physical
When to Use Observational Assessments

- Formative
- Process
- Outcome
Home

Settings
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)

(McKenzie et al., 1991, JABA, 24, 141-151)
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., *JPAH*, 2008
School Settings

PE Classes; Recess; Intramurals; Inter-scholastics; Clubs; Free Play
SOFIT Categories

- **Physical Activity**
  - Lying Down, Sitting, Standing, Walking, Vigorous

- **Lesson Context**
  - Management, Knowledge, Fitness, Skill Drills, Game Play, Other

- **Instructor Behavior/Interactions**
SOFIT Entry Form
Abbreviated

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

N=24 schools; 430 lessons; McKenzie et al, 2000, RQES
MVPA by Gender and Context

N=24 schools; 430 lessons; McKenzie et al., 2000, RQES
CATCH PE: Short- and Long-Term Effects on MVPA in PE

(N=96 Elementary Schools; 2650 Lessons; McKenzie et al., Prev Med, 1996; Health Ed & Beh, 2003)
If You Build It, Will They Come?

If They Come, Will They Be Active?
SOPLAY Categories

➢ Physical Activity
  ▪ (Sedentary, Walking, Very Active)

➢ 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
- Simultaneous entries for relevant PERSON and ENVIRONMENTAL characteristics
SOPLAY/SOPARC

Transitory Area Characteristics Assessed

- Accessible
- Usable
- Supervised
- Organized
- Equipped
McKenzie School-7 Activity Areas

1. Activity Area 2
2. Arcade
3. Gym
4. Activity Area
5. Pool
6. Activity Area
7. Weights

- Food vending
- Community Classrooms
- Library
- Bike storage
- Parking
Percent of School Population in Activity Areas

N=24 M-SPAN schools; 151 areas
(McKenzie et al., 2000, Preventive Medicine)
Percent in Activity Areas

N=24 M-SPAN schools; 151 areas
(McKenzie et al., 2000, Preventive Medicine)
MVPA by Gender

N=24 M-SPAN schools; 151 areas
(McKenzie et al., 2000, Preventive Med)

* = p<.01
Community Settings

Parks and Recreation Centers
SOPARC
System for Observing Play and Recreation in Communities
T. McKenzie & D. Cohen
San Diego State University & RAND Corporation

(McKenzie et al., JPAH, 2006)
PURPOSES

- Interest in health disparities
- Developed and assessed tool for studying PA and associated variables in community settings
- Used system in multi-ethnic communities to study park areas and characteristics of users, including their PA
Leavitt Park--OPEN Project

Justice Myron E. Leavitt Family Park

Legend

- Target Zone
- Trail observation point
- Observation point

37 Target Areas
-mostly sports

2100 E. St. Louis Ave.
MRC 10.13.09
First Study-Los Angeles

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

(McKenzie et al., *JPAH*, 2006)
Reliability Measures

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

AREA CHARACTERISTICS
- Accessibility, 98%; 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 CHARACTERISTICSTICS (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

N=8 Parks; 165 Activity Areas; 4511 Visits
% Activity Areas Occupied

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percent Occupied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track</td>
<td>73</td>
</tr>
<tr>
<td>Basketball</td>
<td>63</td>
</tr>
<tr>
<td>Gymnasium</td>
<td>60</td>
</tr>
<tr>
<td>Playground</td>
<td>59</td>
</tr>
<tr>
<td>Picnic</td>
<td>58</td>
</tr>
<tr>
<td>Baseball</td>
<td>38</td>
</tr>
<tr>
<td>Handball</td>
<td>37</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>36</td>
</tr>
<tr>
<td>Fields</td>
<td>32</td>
</tr>
<tr>
<td>Volleyball</td>
<td>21</td>
</tr>
</tbody>
</table>
Areas with Most MVPA

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percent in MVPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field</td>
<td>33.7</td>
</tr>
<tr>
<td>Volleyball</td>
<td>32.5</td>
</tr>
<tr>
<td>Tennis</td>
<td>32.4</td>
</tr>
<tr>
<td>Basketball</td>
<td>31.7</td>
</tr>
<tr>
<td>Gym Equip</td>
<td>30.7</td>
</tr>
<tr>
<td>Playground</td>
<td>25.7</td>
</tr>
</tbody>
</table>
Park Users: Age Categories

N=16,244 people; 165 activity areas; 56 days

Percent of Users

<table>
<thead>
<tr>
<th>Category</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child</td>
<td>33.5</td>
</tr>
<tr>
<td>Teen</td>
<td>18.5</td>
</tr>
<tr>
<td>Adult</td>
<td>43.4</td>
</tr>
<tr>
<td>Senior</td>
<td>4.7</td>
</tr>
</tbody>
</table>
Park Users: Gender and Age

N=16,244 people; 165 activity areas; 56 days
Physical Activity Levels

<table>
<thead>
<tr>
<th>Activity Level</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary</td>
<td>65.6</td>
</tr>
<tr>
<td>Walking</td>
<td>18.8</td>
</tr>
<tr>
<td>Vigorous</td>
<td>15.6</td>
</tr>
</tbody>
</table>

N=16,048 people; 165 activity areas; 56 days
Activity Levels by Gender

N=16,048 people; 165 activity areas; 56 days
Most Common Activities: Percent of Park Users

- Playground: 8.0%
- Soccer: 9.0%
- Spectating: 13.0%
- Basketball: 15.0%
- Sit/picnic: 22.0%

N=16,244 people; 165 activity areas; 56 days
% Park Users by Activity Type

- Unorganized: 45.5% Males, 26.4% Females
- Organized: 8.5% Males, 6.0% Females
- Spectators: 7.7% Males, 5.9% Females

N=16,189 people; 165 activity areas; 56 days
METS by Activity Type

N=16,189 people; 165 activity areas; 56 days
Proportion Walking and in Vigorous Activity in 8 Parks

N=16,048 people; 165 activity areas; 56 days
METS Expended Per Resident Within One Mile of Park

**METS (index)**

- Wilmington: 0.34
- Evergreen: 0.23
- Van Ness: 0.08
- Andrews: 0.19
- Pecan: 0.1
- Costello: 0.27
- Green: 0.09
- Algin: 0.2

N=16,048 people; 165 activity areas; 56 days
METS Expended in Park Per Resident Within One Mile

METS (index)

Wilmington: Females 0.2, Males 0.49
Evergreen: Females 0.16, Males 0.29
Van Ness: Females 0.03, Males 0.14
Andrews: Females 0.14, Males 0.26
Pecan: Females 0.1, Males 0.1
Costello: Females 0.26, Males 0.28
Green: Females 0.05, Males 0.12
Algin: Females 0.1, Males 0.31

N=16,048 people; 165 activity areas; 56 days
System for Observing Physical Activity & Recreation in Natural Areas (SOPARNA)

World Wilderness Congress
Mérida, Yucatan, MEXICO

Thomas L. McKenzie, Ph.D.*
Vinod Sasidharan, Ph.D.* & Deborah Chavez, Ph.D.**

*San Diego State University, **USDA Forest Service, Pacific Southwest Research Station
Review

- Background
- Research Issues
- Practical Issues
- Examples: Micro environments
THANK YOU!

tmckenzie@sdsu.edu