Systematic Observation of Physical Activity and Its Contexts

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Overview

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

Ecological Approach to Physical Activity Promotion

- Identifies times and places for PA
- Identifies social & physical resources/barriers
- Identifies policies that hinder/facilitate PA
- Modifies environmental factors to attract people and promote PA opportunities

(Sallis)

What Questions Arise?

- Under what conditions are children most and least active and…
  - Where are they?
  - What are they doing?
  - Who is present?
  - Are there differences among demographic groups?
  - What PA supports or barriers are present?

Systematic Observation

- Method for assessing behavior (PA)
- Simultaneous examination of behavior and physical and social environment
  - location, presence of others, prompts, consequences
- Method, not an instrument

Systematic Observation

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

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

feasibility of Systematic Observation

Observer training required
- Ranges from simple to complex
- 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’ video
Field practice
Field reliabilities with certified assessor
Additional training to prevent observer drift

Video/DVD Information

Content
- Definitions and examples
- Samples with practice codes
- Samples with code delays
- Assessment videos

Availability
- YouTube & ITUNES U (North Carolina State)
- thomckenzie.com

Observation Techniques

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

Use of Video

- Needed for observer training and assessment
  - Include each variable; have diverse examples

- Challenges with video data collection
  - Human subjects considerations
  - Potential subject reactivity
  - Increased costs
  - Avoid mixing live and video data
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. weekends
  - 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)
  - Pedometers

System Validation (2)

- Additional validation
  - Momentary time sampling vs. duration recording
  - Interval length
  - Live vs. video records
  - Persons with delayed mental development or cerebral palsy
  - Ice hockey

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)

Physical Activity Occurs within Specific Environments

- At home (play, work)
- Schools
  - PE Classes; Intramurals; inter-scholastics;
  - Clubs; Free Play/Recess
- Recreation centers (structured, unstructured)
- Parks and trails
- In transport
Home Settings

Home Settings Have Changed!

Increase in electronic media
- access to TVs, DVDs, smart phones
- number of channels, pay TV
- number child focused programs

BEACHES Contexts
(Newer version)

1. Activity Level
   - lying 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)

No Child Left Inside!

McKenzie et al. (2008). Environmental Correlates of Physical Activity in Mexican-American Children at Home (JPAH).

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 Prechoolers at Recess and Home

(N= 351; McKenzie et al., 1992, JBDT)
**Prompts for Physical Activity at Home**

- **Boys**
- **Girls**

![Graph showing percent of intervals for boys and girls across different age groups.](image)

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

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**School Settings**

- **1. Physical Education**
- **2. Recess/free play**

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**“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, AJLM, 2009*

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**SOFIT Categories**

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

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**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 I O N</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1 2 3 4 5</td>
<td>M K F S G O I O N</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1 2 3 4 5</td>
<td>M K F S G O I O N</td>
<td></td>
</tr>
</tbody>
</table>

**Lesson Context:**

- Management
- Knowledge
- Fitness
- Skill Drills
- Game Play
- Free Play
**Lesson Context**

<table>
<thead>
<tr>
<th>Minutes</th>
<th>Free Time</th>
<th>7.2</th>
<th>2.7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Game Play</td>
<td>10.0</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>Skill Drills</td>
<td>1.8</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Fitness</td>
<td>24.4</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Fit Know</td>
<td>0.7</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>Gen Know</td>
<td>19.3</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>Management</td>
<td>27.2</td>
<td>9.3</td>
</tr>
</tbody>
</table>

**MVPA by Lesson Context**

<table>
<thead>
<tr>
<th>Percent Time in MVPA</th>
<th>Fitness</th>
<th>Free Play</th>
<th>Game Play</th>
<th>Skill Drills</th>
<th>Management</th>
<th>Know</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>59.3%</td>
<td>51.9%</td>
<td>50.3%</td>
<td>47.6%</td>
<td>43.1%</td>
<td>5.8%</td>
</tr>
</tbody>
</table>

(N=24 schools; 450 lessons; McKenzie et al., 2000, RQES)

**MVPA Minutes by Gender and Class Type**

- **Boys-only**: 19.2
- **Co-ed**: 16.8
- **Girls-only**: 14.4

N = 9 schools, 298 lessons

**MVPA by Gender and Context**

<table>
<thead>
<tr>
<th>Percent Time in MVPA</th>
<th>Fitness</th>
<th>Free Play</th>
<th>Game Play</th>
<th>Skill Drills</th>
<th>Management</th>
<th>Know</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50.8%</td>
<td>46.3%</td>
<td>50.0%</td>
<td>47.6%</td>
<td>43.1%</td>
<td>5.8%</td>
</tr>
</tbody>
</table>

(N=24 M-SPAN schools; 430 lessons)

**CATCH PE: Short- and Long-Term Effects on MVPA in PE**

- **Baseline**: 30%
- **Year 1**: 45%
- **Year 2**: 50%

- **Follow-up**: 50.8% (Intervention) vs. 46.3% (Control)

(N=96 Elementary Schools; 2650 Lessons; McKenzie et al., Prev Med, 1996; Health Ed & Beh, 2003)

**M-SPAN PE: Effects on Student MVPA Minutes**

- **Baseline**: 14 MPA Min.
- **Year 1**: 18 MPA Min.
- **Year 2**: 20 MPA Min.

(N=24 Schools; 214 Teachers; 1847 Lessons)
### Time in Physical Activity: US Goals vs. Girls’ PE Classes

McKenzie et al., 2006, MSSP
TAAG Baseline; N=36 middle schools, 6 states

#### 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

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**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Before School</th>
<th>Lunch Time</th>
<th>After School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>57.4%</td>
<td>66.4%</td>
<td>51.4%</td>
</tr>
<tr>
<td>Girls</td>
<td>32.2%</td>
<td>68.4%</td>
<td>46.5%</td>
</tr>
</tbody>
</table>

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

**Area Contexts by Leisure Time Period**

<table>
<thead>
<tr>
<th>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>80%</td>
<td>30%</td>
<td>60%</td>
<td>40%</td>
<td>80%</td>
</tr>
<tr>
<td>Lunch</td>
<td>60%</td>
<td>20%</td>
<td>40%</td>
<td>20%</td>
<td>60%</td>
</tr>
<tr>
<td>Before School</td>
<td>40%</td>
<td>10%</td>
<td>30%</td>
<td>10%</td>
<td>40%</td>
</tr>
<tr>
<td>After School</td>
<td>20%</td>
<td>5%</td>
<td>10%</td>
<td>5%</td>
<td>20%</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

**System for Observing Play and Recreation in Communities: SOPARC**

- Developed in 2003
- Validated (2 NIH grants)
- Widely used (translated into four languages)
- Numerous published papers

**BACKGROUND**

- Community parks rarely studied for PA
- Most relies on self-reports
- Little known about park area features and user characteristics
- Minority populations are at health risk, and their PA in parks is rarely studied

**Park Users: Age Categories**

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Percent of Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child</td>
<td>35.5%</td>
</tr>
<tr>
<td>Teen</td>
<td>18.5%</td>
</tr>
<tr>
<td>Adult</td>
<td>49.4%</td>
</tr>
<tr>
<td>Senior</td>
<td>4.7%</td>
</tr>
</tbody>
</table>

N=10,244 people; 165 activity areas; 58 days
Park Users: Gender and Age

- Child: Males 13.3%, Females 9.5%
- Teen: Males 7.9%, Females 5.9%
- Adult: Males 27.9%, Females 22.5%
- Senior: Males 2.2%, Females 2.2%

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

Physical Activity Levels

- Sedentary: Males 65.6%, Females 45.8%
- Walking: Males 18.8%, Females 18.4%
- Vigorous: Males 15.6%

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

Activity Levels by Gender

- Sedentary: Males 62.1%, Females 51.3%
- Walking: Males 19.1%, Females 18.4%
- Vigorous: Males 18.9%

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

Proportion Walking and in Vigorous Activity in 8 Parks

- Algin: % Walking 30%, % Vigorous 28.5%
- Green: % Walking 30%, % Vigorous 20.3%
- Costello: % Walking 30%, % Vigorous 22.9%
- Pecan: % Walking 30%, % Vigorous 23.6%
- Andrews: % Walking 30%, % Vigorous 24.8%
- Van Ness: % Walking 30%, % Vigorous 22.5%
- Evergreen: % Walking 30%, % Vigorous 11.2%
- Wilmington: % Walking 30%, % Vigorous 11%

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

Predicts park use, including:
- Number, gender, PA levels, & age and race/ethnicity groupings

-4 times/day
-4 days (2 weekdays, Sat, & Sun)
Observation Support
Training Materials and Apps

- Observation Protocols (ALR website)
- SOPARC/SOPLAY/SOFIT observer training videos
  - (Downloadable from NC State, ITUNES U)
- SOPARC on-line data entry & summary (RAND)
- iSOPARC App for IPAD (Apple Store)

SOPARC Data Collection Form

iSOPARC App for IPAD—Free on App Store

Advantages of iSOPARC App

- **Digital Counter**
  - 3 different counter modes (includes speech)
  - automatically marks time and location of scans

- **Paperless data collection and storage**
  - no more paper, clock, pen, or mechanical counter
  - no need to transfer data to paper forms
  - re-uses repeated/common data from scan to scan

- **Consistent and Foolproof**
  - timestamp and GPS marked for each scan
  - photos for validation
  - area calculation

- **Easy export**
- **Faster development**

Observing PA and Its Contexts: Take Home Messages

- SOFIT/SOPLAY/SOPARC PA codes have been validated
  - if you modify them, additional validation is needed

- Create your own or modify current systems
  - Determine what you want to know
  - Prioritize—you cannot observe it all
  - Operationalize categories, validate them, test for reliability
  - Coding conventions increase reliability

- Observation techniques differ between systems, and depend upon the research question(s)

Observing PA and Its Contexts: Frequently Asked Topics

- Frequency of Observations
- Reliability
- Generalizability
- Reactivity
- Unit of Analysis
- IRB considerations
Observation Resources (FREE)

- SOFIT/SOPLAY/SOPARC/BEACHES protocols
  - On Active Living Research website

- SOFIT/SOPLAY/SOPARC training videos
  - Thomckenzie.com

- APPS
  - iSOPARC for iPad— from the App Store
  - RAND SOPARC (entry and analysis) www.rand.org/health/surveys_tools/soparc.html