Physical Activity of Children in Preschools

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Outline

- Measurement Methods
  - Direct Observation
  - Accelerometry
- Physical activity levels in Preschools
- Factors associated with physical activity
Children’s Activity and Movement in Preschool Study

Funded by National Institute of Child Health and Human Development (NICHD)
Direct Observation
Assessment of Physical Activity

- Observational System for Recording Physical Activity in Children-Preschool Version (OSRAC-P)
  - Momentary time sampling observation system
  - 5-sec observe interval, then 25-sec record interval for each 30-second observation interval.
  - PA level and activity type, social environment (e.g., initiator of activity, group composition), and nonsocial environment (e.g., child location and activity contexts)

Brown WH et al. RQES 2006; 77(2):167-76
Assessment of Physical Activity

- Physical activity levels
  - Level 1: Stationary
  - Level 2: Stationary with limb movement
  - Level 3: Light activity (slow, easy movement)
  - Level 4: Moderate activity
  - Level 5: Vigorous activity

- Sedentary Category: levels 1 & 2
- Active Category: levels 3, 4, 5
- MVPA Category: levels 4 & 5

Brown WH et al. RQES 2006; 77(2):167-76
Assessment of Physical Activity

- Data collected in 30-minute periods
- Each child observed for 10-12 periods
- Two observational intervals per minute, total of 600-720 intervals per child
- Observation periods randomly chosen, and spread across 10 days

Brown WH et al. RQES 2006; 77(2):167-76
Assessment of Physical Activity

- Observers had extensive training
- Reliability assessed during 12% of total observations
  - Inter-observer agreement (IOA) was good (83%-100%)
  - Kappa scores indicated good inter-observer reliability (0.80-0.95)
  - Mean Kappa for PA level was 0.82
  - Mean IOA was 91%
- INTMAN software with hand-held Dell Axim computers

Brown WH et al. RQES 2006; 77(2):167-76
# Observational System for Recording Physical Activity in Children—Preschool Version

**Categories and Accompanying Codes**

<table>
<thead>
<tr>
<th>Act Level</th>
<th>Act Type</th>
<th>Location</th>
<th>Indoor</th>
<th>Outdoor/Gym</th>
<th>Act Initiator</th>
<th>Group</th>
<th>Prompts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stationary</td>
<td>1 Inside</td>
<td>1 Art</td>
<td>1 Ball/Object</td>
<td>1 Adult</td>
<td>1 Solitary</td>
<td>1 None</td>
</tr>
<tr>
<td>2</td>
<td>Limbs</td>
<td>2 Outside</td>
<td>2 Books/Preacademic</td>
<td>2 Fixed</td>
<td>2 Child</td>
<td>2 1-1 Adult</td>
<td>2 TP-I</td>
</tr>
<tr>
<td>3</td>
<td>Slow-Easy</td>
<td>3 Transition</td>
<td>3 Gross Motor</td>
<td>3 Game</td>
<td>3 Can’t Tell</td>
<td>3 1-1 Peer</td>
<td>3 TP-D</td>
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<tr>
<td>4</td>
<td>Moderate</td>
<td>4 Can’t Tell</td>
<td>4 Group Time</td>
<td>4 Open Space</td>
<td>99 ?</td>
<td>4 Grp-Adult</td>
<td>4 PP-I</td>
</tr>
<tr>
<td>5</td>
<td>Fast</td>
<td>5 Lie Down</td>
<td>5 Large Block</td>
<td>5 Pool</td>
<td>5 Grp-Child</td>
<td>5 PP-D</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Can’t Tell</td>
<td>6 Pull/Push</td>
<td>6 Manipulative</td>
<td>6 Portable</td>
<td>6 Can’t Tell</td>
<td>6 Can’t Tell</td>
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</tr>
<tr>
<td>99 ?</td>
<td>7 R&amp;T</td>
<td>7 Music</td>
<td>7 Sandbox</td>
<td>99 ?</td>
<td>99 ?</td>
<td></td>
<td></td>
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<tr>
<td>8</td>
<td>Ride</td>
<td>8 Nap</td>
<td>8 Snacks</td>
<td>8 SocioProps</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>9</td>
<td>Rock</td>
<td>9 Self Care</td>
<td>9 SocioProps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Roll</td>
<td>10 Snacks</td>
<td>10 TeacArranged</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Run</td>
<td>11 Sociodramatic</td>
<td>11 Time Out</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Sit/Squat</td>
<td>12 TeacArranged</td>
<td>12 Wheel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Stand</td>
<td>13 Time Out</td>
<td>13 Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Swim</td>
<td>14 Transition</td>
<td>14 N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Swing</td>
<td>15 Videos</td>
<td>15 Can’t Tell</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Throw</td>
<td>16 Other</td>
<td>99 ?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Walk</td>
<td>17 N/A</td>
<td>99 ?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Other</td>
<td>18 Can’t Tell</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Can’t Tell</td>
<td>99 ?</td>
<td></td>
<td></td>
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</tbody>
</table>
Accelerometry
Methods

- 30 children between the ages of 3 and 5 from 3 local preschools
- Participants wore the COSMED K4b² indirect calorimetry system, 2 ActiGraph accelerometers, and 2 Actical accelerometers during all activities
Accelerometer Placement
Methods

- Calibration: structured activities including rest, slow walk, brisk walk, and jog
- Cross-validation: Unstructured activities, free-play in the preschool classroom and on the playground
Methods

- Rest and structured activities
  - Laboratory setting
  - Rest: reclined position, watching a movie or cartoons
  - Structured: slow walk (2 mph), brisk walk (3 mph), jog (4 mph)
Methods

- Children were paced around the gym by a researcher for a period of 5 minutes at each speed
  - The children were encouraged to maintain the pace established by the researcher
  - Rest and small incentives were provided between each structured activity
Methods

- Unstructured Activities
  - 20 minutes of play inside and outside at the preschool
  - Self-selected activities, encouraged to participate in a range of intensities
Relationship between Actigraph counts and $\text{VO}_2$ (ml/kg/min)

$\text{VO}_2$ (ml/kg/min) = 10.0714 + 0.02366*(counts/15s)

$r = 0.82$
Directly-observed Physical Activity Levels in Preschool Children

Participants

- 24 preschools in Columbia, SC
  - 12 Commercial
  - 8 Church-based
  - 4 Head Start Programs
- 2 rounds of data collection, separated by 13-19 months
- 438 children (50% male, 59% African American) had complete data

Pate RR et al. *J School Health*, 2008
### Results

#### Percent of Intervals:
- Sedentary: 55.6%
- Limbs: 31.7%
- Light Activity: 8.1%
- Moderate Activity: 0.8%
- Vigorous Activity: 1.8%

Preschoolers were observed in MVPA during **2.6%** of the intervals

Pate RR et al. *J School Health*, s
Physical Activity Levels of Preschoolers

Percent of Intervals

TOTAL

INSIDE ONLY

OUSIDE ONLY

Fast
Moderate
Slow - Easy
Limbs
Sedentary

Percent of Intervals

0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
TOTAL INSIDE ONLY OUSIDE ONLY

Legend:
- Fast
- Moderate
- Slow - Easy
- Limbs
- Sedentary
Other researchers have used direct observation to assess PA levels of young children

PA levels & prompts in young children at recess: A 2-yr study of a bi-ethnic sample

BEACHES; 256 preschoolers; 2 recess periods

Objectively Measured Physical Activity in Children During Preschool Attendance

Pate RR, Dowda M, Pfeiffer KA, McIver KL, Addy C, Brown WH
Participants & Methods

- 20 preschools in Columbia, SC
  - Commercial, church-based, Head Start
  - 2 rounds of data collection, separated by 13-19 months
- 298 children (50% male, 49% African American)
- ActiGraph monitor for 5+ hours per day for 10 weekdays and 1 weekend
- 15-sec intervals
- Cutpoints established from calibration study
- Preschool arrival and departure times

Pate RR et al.
PA During the Preschool Day

![Bar chart showing minutes per hour of Sedentary, Light, and MVPA activity for Males and Females, with * p=.05 and # p<.001 significance levels.]
Other Studies

Other researchers have used accelerometry to assess PA levels of young children

- Kelly LA et al. Arch Dis Child 2006;91:35-38
- Finn et al. J Pediatrics 2002;140:81-85
Fundamental Movement Skills and Habitual PA in Young Children

- 394 preschool children
- 53% male, mean age 4.2 years
- Accelerometers worn for 6 days
  - Sedentary cutpoint $<1100$ counts/minute (Reilly et al. 2003)
  - MVPA cutpoint $>3299$ counts/minute (Puyau et al. 2002).

PA During the Preschool Day

Males less sedentary & more active than girls
Policies and Characteristics of the Preschool Environment and Physical Activity of Young Children

Dowda M, Brown WH, McIver KL, Pfeiffer KA, O’Neill, Addy CL, Pate RR.

*Pediatrics* 2009;123;e261-e266
Participants & Methods

- 299 children wore accelerometers for an average of 8.1 hours/day for 5.5 days during the preschool day.
- 20 Preschool directors were interviewed about preschool policies.
- A researcher completed the Early Childhood Environment Rating Scale-Revised for each preschool to quality.
- For each policy/characteristic, preschools were divided into 2 groups on the basis of whether the policy/characteristic was presumed to promote or not promote PA

Dowda et al.
MVPA min/hour During the Preschool Day

- Larger playgrounds
- Lower use of electronic...
- More portable playground...
- Less fixed playground...
- Quality

Not promote
Promote