Measuring Physical Activity in Youth with Cerebral Palsy

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Presenter Disclosures

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NO RELATIONSHIPS TO DISCLOSE

OBJECTIVES

- Discuss levels of cerebral palsy (CP) and the impact on physical activity (PA)
- Distinguish among PA dimensions & measures & discuss their importance in health promotion programs for children with CP
- Discuss the importance of PA in health promotion programs for children and youth with CP

BACKGROUND

- CP:
  - Most prevalent physical disability of childhood (1)
  - Nonprogressive neurdevelopmental disorder (1)
  - Postural and movement challenges (1,2)
  - Secondary musculoskeletal problems (1-3)
  - Decreased fitness & PA (2-4)
  - Gross Motor Function Classification System (GMFCS) (5)
- Health Promotion for Children with CP
  - Improve fitness, PA, functional mobility (3,4,6)
  - Intervention effectiveness may require quantitative measures of PA (7-10)

HEALTH PROMOTION

- GMFCS Level (5)
  - Severity of CP
- PA Dimensions (10)
  - Frequency
  - Intensity
  - Type
  - Time
- Child & Family Goals (11)
  - Activity & Participation
- Facilitators & Barriers (12,13)

MEASURING PA in CP

- Qualitative Measures
  - Child Activity, Participation, & Enjoyment Questionnaire (14)
  - PA Questionnaires (15)
- Quantitative Measures
  - Pedometers (16)
  - Accelerometers
    - StepWatch (6)
    - ActiGraph (17)

PURPOSE

- Aim 1: Establish inter-instrument reliability among accelerometers
  - ActiGraph (hips), BodyMedia (arms), StepWatch (ankles)
- Aim 2: Establish criterion validity
  - Accelerometer vs. Oxygen Consumption
- Aim 3: Determine if accelerometers differentiate PA intensity

PA PROTOCOL

- Quiet resting in supine
- Handwriting task
- Wiping table top
- Folding laundry & carrying laundry bag
- Xbox Kinect
  - River Rush/Space Pops
- 6 Minute Walk Test:
  - slow, brisk, & fast paced

MEASURES

- Accelerometry
  - ActiGraph – 1 sec epochs
    - Step & Activity Counts
  - Bodymedia SenseWear – 1 min epoch
    - Steps
  - StepWatch – 3 sec epochs
    - Step Counts
- Indirect Calorimetry
  - Measure oxygen consumption

PARTICIPANTS (n=52)

- 2 clinical sites
- Mean age: 12 years 6 months (SD = 3.3)
- Gender: 28 female (54%); 24 male (46%)

GMFCS	n (%)
GMFCS I	26 (50)
GMFCS II	14 (26.9)
GMFCS III	12 (23.1)

Distribution	n (%)
Hemiplegia	28 (53.8)
Diplegia	21 (40.4)
Quadriplegia	2 (3.8)
Triplegia	1 (1.9)

DATA ANALYSIS

- **Aim 1**
  - **Inter-instrument reliability**
    - Intra-class correlation coefficients (ICC)
- **Aim 2**
  - **Concurrent validity**
    - Spearman Correlation
- **Aim 3**
  - **Determining differences in PA intensity across trials**
    - Friedman Test (nonparametric RM ANOVA)

Results: Inter-instrument Reliability

Model / Variable	ICC	Lower 95% CI	Upper 95% CI
ActiGraph			
Steps	**0.986**	**0.983**	**0.989**
Vertical	**0.985**	**0.982**	**0.987**
Vector Magnitude	**0.981**	**0.978**	**0.984**
BodyMedia			
Steps	**0.940**	**0.929**	**0.950**
METs	**0.805**	**0.772**	**0.834**
StepWatch			
Steps	**0.977**	**0.969**	**0.982**

ICC: Agreement between L & R monitor placement

Results: Concurrent Validity

(n=51)	Spearman
ActiGraph	
Steps L	0.82
Steps R	0.83
Vertical L	0.84
Vertical R	0.83
Vector Magnitude L	0.85
Vector Magnitude R	0.82

Correlations between accelerometry data and VO2 data

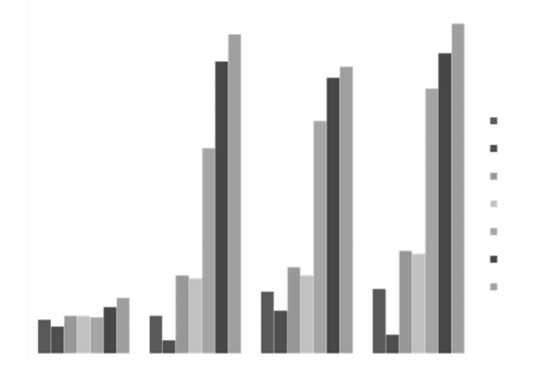
Results: Concurrent Validity

(n=51)	Spearman
BodyMedia	
Steps L	0.73
Steps R	0.75
METs L	0.70
METs R	0.73
StepWatch	
Steps L	0.77
Steps R	0.79

Correlations between accelerometry data & VO2 data

Results: Counts/Minute (Median)

Trial	AG (Counts)	AG (Steps)	BodyMedia (Steps)	StepWatch (Steps)
1	0	0	0	0
2	0	0	0	0
3	65.33	2.92	19.40	5.67
4	20.25	1.08	10.60	1.33
5	295.00	6.37	22.67	9.50
6	119.00	5.12	21.33	9.00
7	365.72	17.28	73.00	23.12
8	680.63	24.25	92.83	26.75
9	1016.53	29.00	103.67	29.75



Results

- All accelerometers showed inter-instrument reliability
  - ActiGraph had slight advantage
- All accelerometers are valid for measuring physical activity intensity
  - ActiGraph & StepWatch showed highest correlations
- All accelerometers were significant in detecting differences in physical activity intensity among most trials
  - BodyMedia - Did not differentiate between chores (table wiping & towel folding) and videogaming (Xbox Kinect) or between different walking speeds.

Discussion and Conclusions

- **Good news!**
  - **Accelerometry may be a valid and reliable measure of PA in children and youth with CP**
- **Choosing accelerometers**
  - **What is your focus?**
    - **ActiGraph: Increase overall PA level and intensity**
    - **StepWatch: Increase walking frequency and duration**
    - **BodyMedia: Increase upper body activity level and intensity**

Future Directions

- Compare accelerometer step counts to "hand counts"
- Examine PA patterns on the subsample of youth who wore ActiGraph GT3x+ accelerometers (n=25)
- Use accelerometers to measure free living PA in youth with CP GMFCS Levels I-III
- Use accelerometers to measure intervention outcome effectiveness

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