Measurement of Physical Activity and Participation of Children who are Wheelchair Users: Actigraph and Global Positioning System (GPS)

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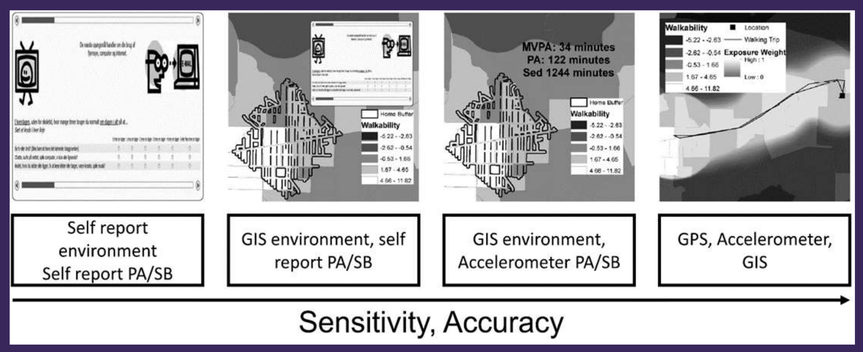
BACKGROUND

- Children with disabilities are more restricted in their participation in leisure, recreational, and sport physical activity (PA) than average developing peers. Improving their participation in PA in the home, school, and community is an important outcome of rehabilitation interventions.[1]
- Participation is influenced by factors related to the child, family, and environment. The environment might be more amenable to change compared to the child's health conditions and sometimes functioning abilities.[2]
- Improvements in the measurement of participation in physical activity and the influences of the environment are needed.
- Combination of accelerometry, global positioning systems (GPS), travel diary, and geographic information systems (GIS) provides a new innovative opportunity to quantitatively measure a child's participation in physical activity in natural, real-life settings and contribute to the understanding of the environmental facilitators and barriers that might impact that participation.[3]

PURPOSE

- Determine the feasibility of a novel combination of accelerometry, GPS, travel diary, and GIS to objectively quantify and compare amount and location of participation in physical activity of children who use wheelchairs.
- Explore the mapping of this combined data to describe environmental facilitators and barriers that may influence the participation in physical activity of children who use wheelchairs.

FRAMEWORK[4]



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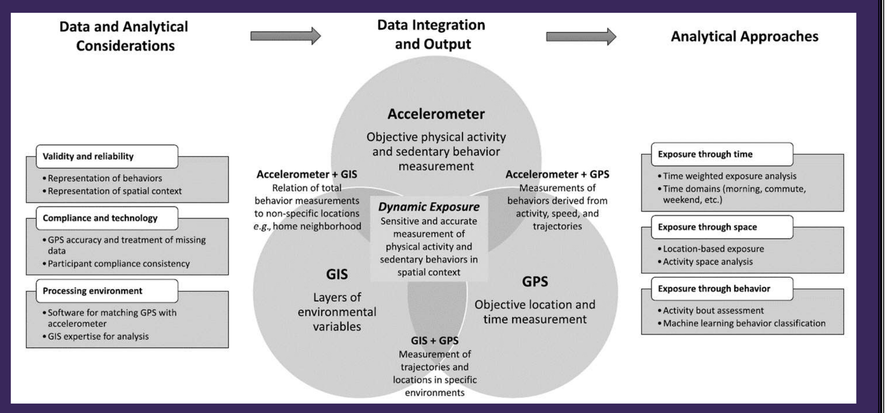

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PARTICIPANTS

Case Series:

1. Sport Wheelchair User (SWC)
   10 yo M (Amb in home, Loftstrands)
2. Manual Wheelchair User (MWC)
   12 yo M (Walker in home)
3. Power Wheelchair User (PWC)
   8 yo F (Crawls)
4. Dependent Wheelchair User (DWC)
   6 yo F (Pushed by caregiver)

METHODS/MATERIALS

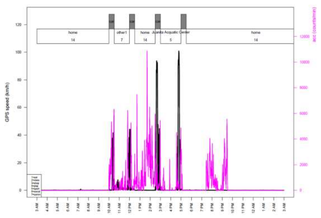
Accelerometer: GT3X Actigraph[5]

1. Worn on dominant wrist
2. All waking hours for 7 days
3. Records temporally indexed body movement (PA) in three planes as activity counts
4. Activity levels based on counts/min[6]
   - Sedentary physical activity (SPA) < 100 counts/min
   - Light physical activity (LPA) 100 – 2296 counts/min
   - Moderate to vigorous physical activity (MVPA) > 2296 counts/min

GPS: Qstarz Q-1000xt[7]

1. Worn on ankle
2. All waking hours for 7 days
3. Records time and location of movement of child: GPS points
4. Accuracy ~ 3 meters in any direction

LifeLog[8]: Synchronized Actigraph, GPS, and travel diary data quantifies duration and intensity of PA by location.



Travel Diary: Child and/or Parent Report Child/Parent-reported travel diary describes types and locations of participation in physical activity during daily life.

RESULTS

Graphs show time spent in different locations (home vs. community) and different PA levels (S = sedentary; L = low, MV = moderate-to-vigorous)

Time spent across physical activity levels

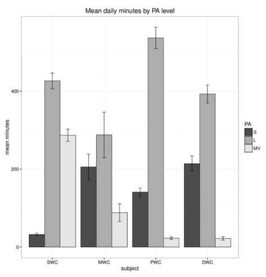
- Mean daily minutes of MVPA for the SWC is higher than that of the DWC. SWC and MWC spent more time in higher activity levels than did PWC and DWC.

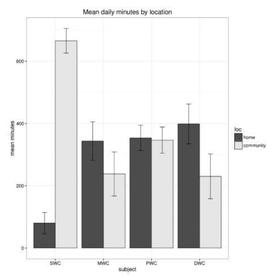
Time spent in the home compared to in the community

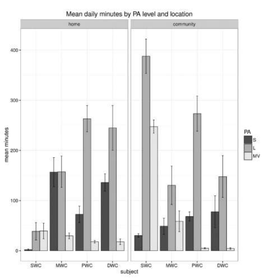
- SWC spent more mean daily minutes of time in the community versus home. In contrast, DWC spent more mean daily minutes of time in her home versus community.

Time spent by physical activity level and Location

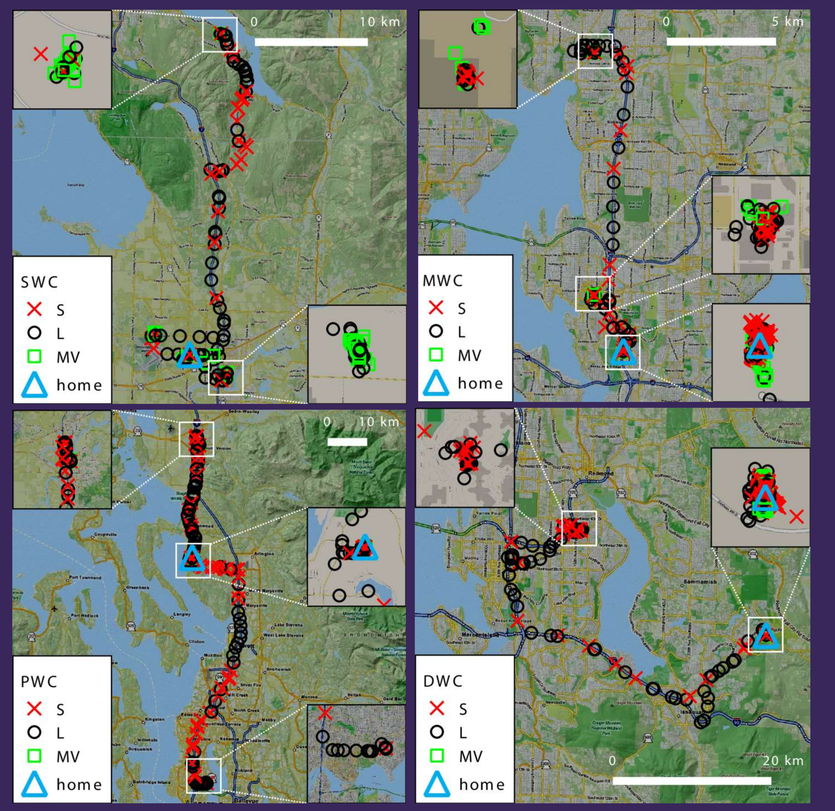
- SWC spent more time in higher PA levels in the community versus home
- MWC spent more time in lower PA levels at home versus community
- PWC's home and community activity patterns were similar
- DWC's home and community activity distributions were similar, but with relatively more time spent at home







Daily maps of travel with GPS points and PA levels with travel diaries show:
SWC - 4 episodes MVPA - home, school, PT clinic, fairgrounds
MWC - 3 episodes MVPA - home, school, and sports center
PWC - 2 episodes MVPA - home and hippotherapy clinic
DWC - 1 episode MVPA - home



DISCUSSION/CONCLUSIONS

- Maps capture ***where*** and ***when*** different activities and PA levels occur. Future work will explore patterns by wheelchair use.
- SWC and MWC have greater numbers of MVPA episodes in a variety of settings (home, school, and community) whereas PWC and DWC have fewer MVPA episodes that take place primarily at or close to home.
- Combination of Actigraph, GPS, GIS, and travel diary has potential to provide rich objective data to quantify participation in PA within daily life of a child who uses a wheelchair.
- Appears sensitive to differentiating PA levels for different wheelchair users.
- Mapping of combined data has potential for description of environmental factors that may influence participation in PA.
- Information derived with this novel measurement approach has potential to inform interventions to optimize PA/participation in children who use wheelchairs.
- Further work is warranted to validate this novel methodology to other measures of physical activity and participation.

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ACKNOWLEDGMENTS

Walter C. and Anita C. Stolov Research Fund
Urban Form Lab, UW, Seattle, WA
OnTrack funded by Patient Centered Outcomes Research Institute #5321