

Locations of Joint Activity in Parent-Child Pairs Based on Accelerometer and GPS Monitoring



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Parental Influences on Children's Physical Activity



- Physically active parents are more likely to have physically active children (Eriksson et al 2008; Wagner et al., 2004).
- Parental social support (watching/supervising activities, offering encouragement, discussing benefits) has a positive effect on child PA (Beet et al., 2010).
- Parental modeling of PA associated with greater maintenance of PA in girls (Davison et al., 2009).

How Much Physical Activity Do Parents and Children Perform Together?

- Joint MVPA (M = 2.4, SD = 4.1) minutes per day
Joint sed. behav. (M = 92.9, SD = 40.1) minutes per day
- 10.3% of children's MVPA occurred with a parent
46.5% of children's sed. behav. occurred with a parent
- Missed opportunities
 - Children performed 10.0 minutes per day of MVPA with a sedentary parent nearby
 - Adults performed 4.6 minutes per day of MVPA with a sedentary child nearby

Current Study: Where does joint activity take place?

Examined the locations of joint physical activity and sedentary behavior in parent-child pairs who both wore an accelerometer and Global Positioning Systems (GPS) device over the same 7-day period.



Research Objectives

- To classify the locations of joint parent-child physical activity and sedentary behavior according to primary land use type (e.g., residential, commercial, open space)
- To determine whether the locations of joint parent-child physical activity and sedentary behavior vary by age, gender, and weight status of the child and parent.

Participants

- Parent-child pairs
- Ages 8-14 years
- Residents of San Bernardino County, CA
- Children: 52.2% female. Parents: 87.6% female
- Children: 43.0% Hispanic, 26.1% Caucasian, 9.3% Asian, 3.8% African-American, 17.9% Other
- Children: 15.5% overweight and 20.7% obese. Parents: 41.4% overweight and 31.7% obese
- 26.5% Annual household income < \$30,000.

Objective Data Collection

GPS and Accelerometer (ACC) Monitoring Devices



GPS Logger GlobalSat BT 335

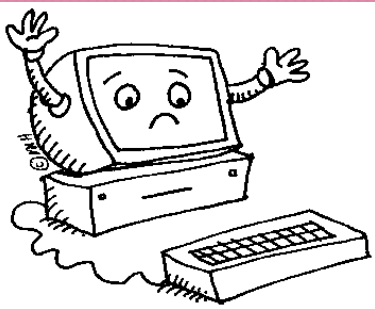
- Date & Time
- Location (Latitude, Longitude)
- Speed



Accelerometer ActiGraph GT2M

- Date & Time
- Activity Counts (index for activity)

GPS-ACC collected every 30 seconds for 7 days (except when bathing, swimming, or sleeping)



Data Cleaning

Prior to analyses, the following records were removed for both members of the pair:

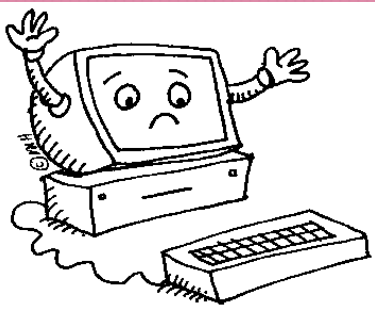
- **Overnight hours:** 11pm-5am
- **School/day time** 8am-3pm on weekdays
- **Motorized transport:** GPS speeds > 32 kph
- **ACC Global Outliers:** Activity > 16,383 counts
- **GPS Global Outliers:** GPS speeds > 169 kph
- **ACC Non-Wear:** > 1 hour zero activity counts



Sufficient Data Inclusion Criteria

- **Valid Weekday** = Minimum 2 hours of matched available GPS/ACC data points for the pair.
- **Valid Weekend day** = Minimum of 4 hours of matched available GPS/ACC data points for the pair.
- **Valid Pair** = Minimum 2 valid days (weekday or weekend day).

Of the 363 parent-child pairs participating in the study, 291 parent-child pairs met these criteria.

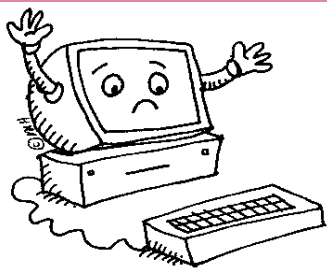


Data Coding

- **Activity levels** were classified as sedentary or moderate-to-vigorous physical activity (MVPA) using established thresholds for the accelerometer.
- **Linear distance** between the parent and child calculated using geographic coordinates from the GPS.
- **Joint behavior** was defined as taking place at the same time and in the same location (< 50m. apart).

Land Use Information

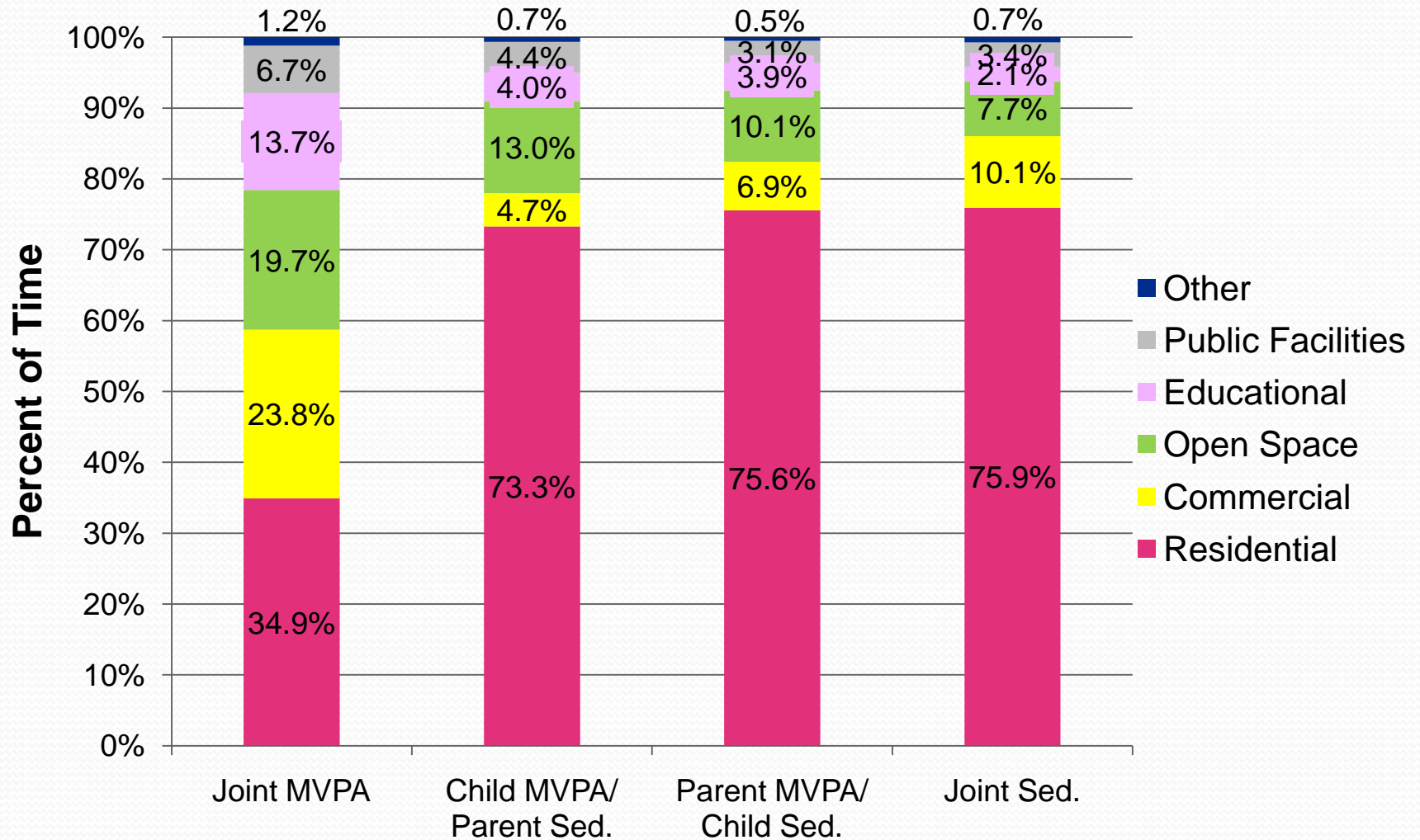
- GPS data points for joint parent-child epochs given land use classification in Geographic Information Systems (GIS) using Southern California Association of Governments (SCAGS) database
- Land Use Categories
 - **Residential** (e.g., houses, apartments, condos)
 - **Commercial** (e.g., retail, restaurants, office use, manufacturing).
 - **Open Space** (e.g., vacant lots, parks, golf courses, gardens, beaches)
 - **Educational** (e.g., schools and school grounds)
 - **Public Facilities** (e.g., community centers, churches, libraries)
 - **Other** (e.g., military, mixed uses, airports, freeways, roads, utilities)



Data Analysis

- Generalized Estimating Equations (GEE) multinomial logistic regressions adjusted the SE's for the clustering of observations within each pair.
- Do parent and child characteristics predict the likelihood of joint parent-child behavior occurring in a particular land use type vs. residential land use?
- Model 1: child's gender, age, BMI, income, Hispanic.
Model 2: parent's gender, age, BMI, income, Hispanic
- Level of analysis was the 30-sec. epoch.

Joint Activity by Land Use Type

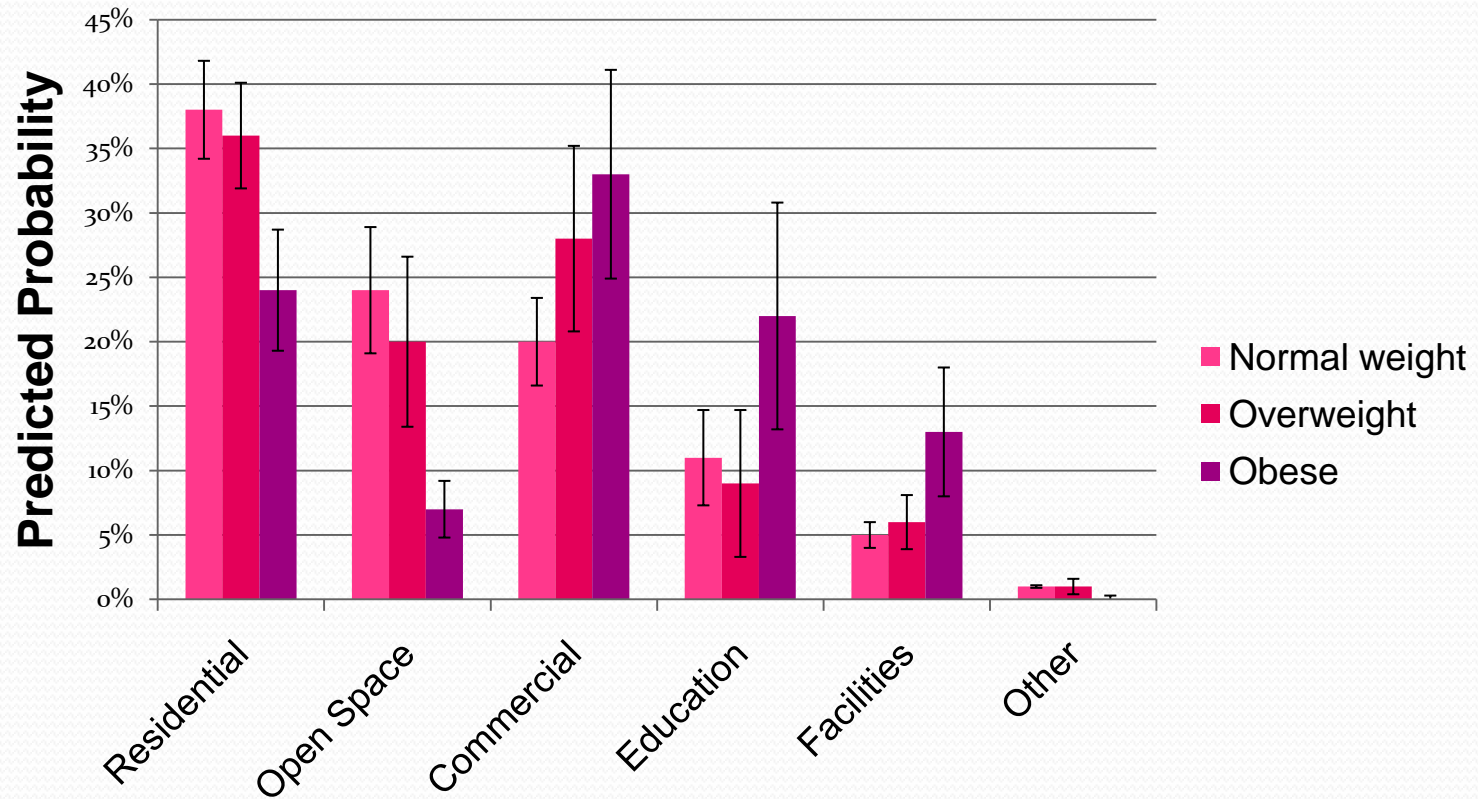


Model 1: Results of Multinomial Logistic Regression Predicting Land Use Type of Joint Behavior

	Joint MVPA	Child MVPA/ Parent Sed.	Parent MVPA/ Child Sed.	Joint Sed.
	Adj. Wald F (df)	Adj. Wald F (df)	Adj. Wald F (df)	Adj. Wald F (df)
Child Age	1.00 (5)	.98 (5)	1.12 (5)	1.18 (5)
Child Sex	0.63 (5)	1.12 (5)	0.95 (5)	0.56 (5)
Child BMI	3.45 (10) ^{***}	1.76 (10)	2.79 (10)	1.01 (10)

All models control for annual household income and ethnicity (Hispanic vs. non-Hispanic). Ref group = Residential. ***p < .001. Only differences between land use types with at least 5% of that type of joint behavior are indicated.

Land Use Type of Joint MVPA by Child BMI

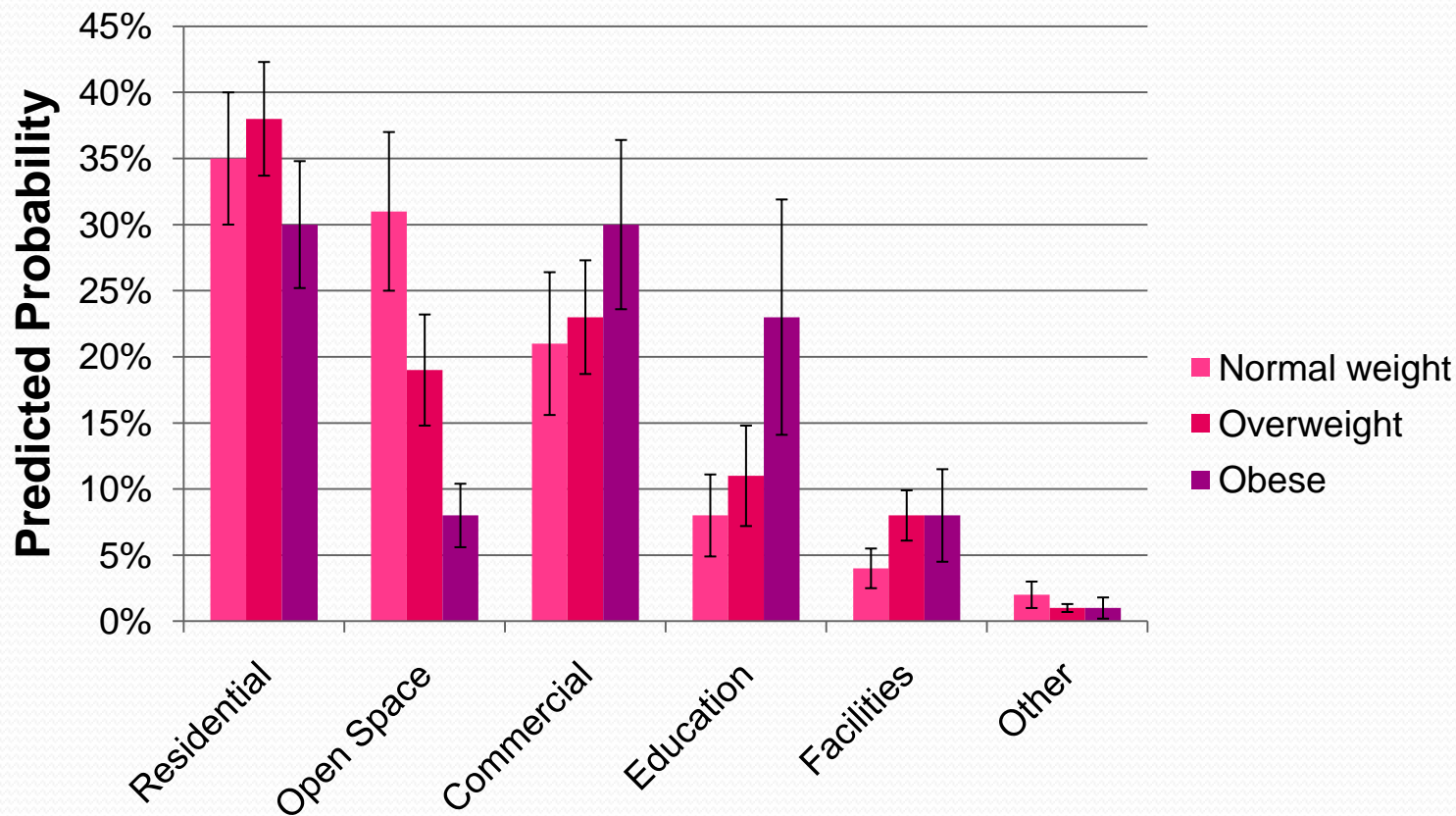


Model 2: Results of Multinomial Logistic Regression Predicting Land Use Type of Joint Behavior

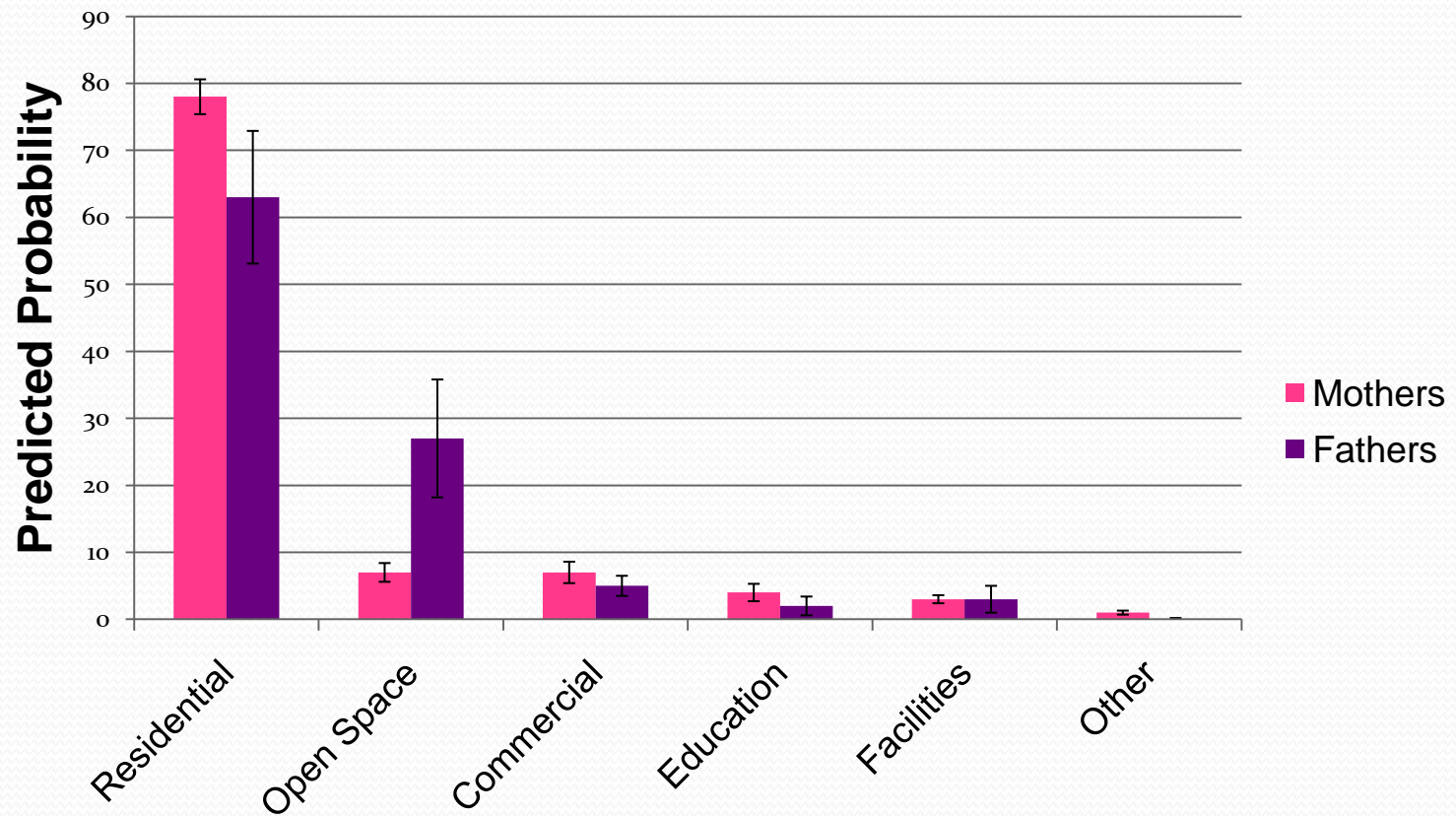
	Joint MVPA	Child MVPA/ Parent Sed.	Parent MVPA/ Child Sed.	Joint Sed.
	Adj. Wald F (df)	Adj. Wald F (df)	Adj. Wald F (df)	Adj. Wald F (df)
Parent Age	1.42 (5)	1.67 (5)	0.61 (5)	2.13 (5)
Parent Sex	1.11 (5)	Singular	8.60*** (5)	1.19 (5)
Parent BMI	3.27*** (10)	2.20 (10)	3.09 (10)	1.02 (10)

All models control for annual household income and ethnicity (Hispanic vs. non-Hispanic). Ref group = Residential.***p < .001. Only differences within land use types with at least 5% of that type of joint behavior are indicated.

Use of Open Space for Joint MVPA by Parent BMI



Land Use Type of Parent MVPA/Child Sed. by Parent Sex



Conclusions

- A third of joint MVPA occurs in residential locations, but substantial amounts also occur in commercial locations (24%) and in open spaces (20%).
- Most of child MVPA accompanied by parent sed. behavior occurs at home (not open spaces).
- Almost 8 minutes of joint sed. behavior per day occurs in open spaces (x 7 days a week = almost 60 more minutes of MVPA per week)

Conclusions (Continued)

- Normal weight and overweight (vs. obese) children engage in more MVPA with parents at home and open spaces.
- Normal weight and overweight (vs. obese) parents engage in more MVPA with children in open spaces.
- Mothers (vs. fathers) engage in more MVPA at home when children are sedentary nearby.



Limitations

- Did not capture joint activity performed with the other parent not participating in the study.
- Greater GPS measurement error and missing data is expected with indoor compared to outdoor wear.
- Children with a higher BMI were more likely to be excluded due to insufficient data.
- Land use of activity taking place on sidewalks could be misclassified.

Future Directions

- Examine more fine-grained location types for joint MVPA and sedentary behaviors (e.g., home, gym/health club).
- Examine association of vegetation density (NDVI) with joint parent-child activity levels at those locations.



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