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

Genevieve Dunton, Ph.D, MPH
Yue Liao, MPH
Estela Almanza, MPH
Michael Jerrett, Ph.D
Donna Spruijt-Metz, M.A., Ph.D
Mary Ann Pentz, Ph.D
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

Dunton et al., in press, MSSE
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)
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
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.
Model 1: Results of Multinomial Logistic Regression Predicting Land Use Type of Joint Behavior

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<tbody>
<tr>
<td>Child Age</td>
<td>1.00 (5)</td>
<td>.98 (5)</td>
<td>1.12 (5)</td>
<td>1.18 (5)</td>
</tr>
<tr>
<td>Child Sex</td>
<td>0.63 (5)</td>
<td>1.12 (5)</td>
<td>0.95 (5)</td>
<td>0.56 (5)</td>
</tr>
<tr>
<td>Child BMI</td>
<td>3.45 (10)***</td>
<td>1.76 (10)</td>
<td>2.79 (10)</td>
<td>1.01 (10)</td>
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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

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<tr>
<td></td>
<td>1.42 (5)</td>
<td>1.67 (5)</td>
<td>0.61 (5)</td>
<td>2.13 (5)</td>
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<tr>
<td>Parent Sex</td>
<td>1.11 (5)</td>
<td>Singular</td>
<td>8.60*** (5)</td>
<td>1.19 (5)</td>
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<tr>
<td>Parent BMI</td>
<td>3.27*** (10)</td>
<td>2.20 (10)</td>
<td>3.09 (10)</td>
<td>1.02 (10)</td>
</tr>
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</table>

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

Predicted Probability

- Normal weight
- Overweight
- Obese

Residential | Open Space | Commercial | Education | Facilities | Other
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)
• 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.
Acknowledgments

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