

Children's Neighborhoods in Relation to Physical Activity Outside of School



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Introduction



- **Physical Activity Guidelines for children**
 - Engage in ≥ 60 minutes of moderate-to-vigorous physical activity (MVPA)
- USDHHS, 2008
- **42% of children (6-11 years) meet MVPA guidelines**
- Troiano et al. 2008
- **Children 6-11 years old**
 - Most MVPA takes place in out-of-school settings
- Long et al. 2013
- **Neighborhood attributes may influence out-of school MVPA**
- Sallis et al. 2009

Introduction



- Neighborhood (perceived) environment features in relation to (objectively measured) physical activity in children

- What are ‘neighborhood environment features’?
 - ✦ Neighborhood Design (walkability)
 - ✦ Transportation (safety, access, facilities)
 - ✦ Social environment (safety)
 - ✦ Recreation (parks, other facilities)

- Ding et al. 2011

- How can we characterize neighborhoods?

- Statistical Interactions
- Environmental Indices (walkability)
- Confirmatory Factor Analysis
- Latent Profile Analysis (LPA) ?

- Carlson et al. 2012

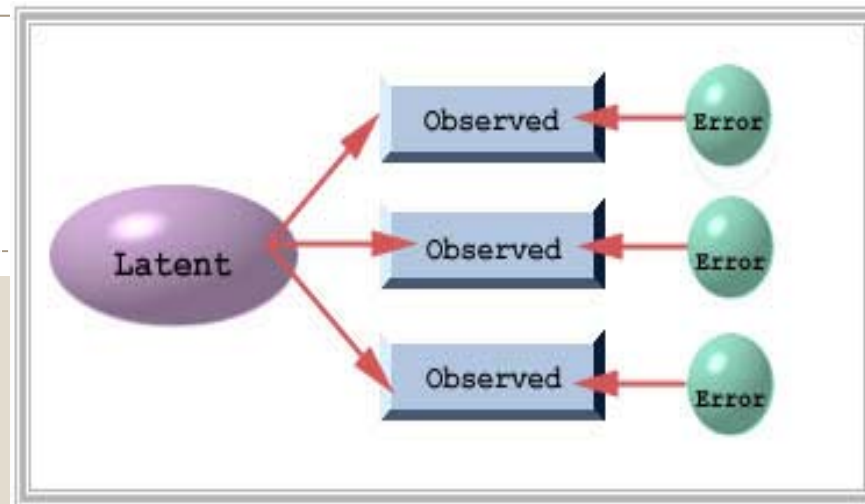
- Frank et al. 2010

- Cerin et al. 2009

- Norman et al. 2010

Introduction/ Purpose

- **Latent Profile Analysis (LPA)**
 - Factor analysis = Variable-centered
 - ✦ Subgroups of variables (items)
 - LPA = Person-centered
 - ✦ Subgroups of people
 - Identifying subgroups based on shared response patterns across survey items
 - Person's pattern of responses to set of items is matched to a profile using probabilities (closest match)
- **Objective 1:**
 - Explore patterns underlying parent self-reported neighborhood characteristics in San Diego and Seattle regions using LPA
- **Objective 2:**
 - Examine differences in children's out-of-school MVPA across empirically derived profiles



Methods



- **Neighborhood Impact on Kids (PI: Brian Saelens et al.)**
 - Original study examined neighborhood, family, and individual factors related to body mass, physical activity, and nutrition behaviors
- **High/low physical activity and nutrition environments**
 - Defined by census block groups → maximized variation
 - Households with children 6-11 years old randomly selected
 - ✦ One child per household
 - ✦ Eligible if:
 - Able to engage in at least moderate-intensity physical activity
 - Not have underlying medical conditions associated with obesity
 - Not be actively involved in medical treatment that has substantive impact on growth
- **757 consenting families**

Methods - Variables



- **Neighborhood Environment Walkability Scale (NEWS)**

- Completed by the parent – Likert-type scale

- Residential Density
- Land-use Mix Diversity
- Land-use Mix Access
- Street Connectivity
- Transit Access
- Aesthetics
- Traffic Safety
- Crime Safety
- Pedestrian Facilities
- Parks
- Recreation Facilities

Methods - Variables



- **Physical Activity (accelerometer)**
 - MVPA partitioned between in-school and out-of-school using place logs (completed by parent)
 - ✦ Actigraph (GT1M) ≥ 14 days
 - ✦ Valid day ≥ 10 hours of wear time
 - ✦ School/Out-of-School
 - Out-of-school MVPA minutes
= Total MVPA minutes – In-School MVPA minutes

Methods



- **674 children with NEWS and MVPA**
 - Sample used to derive profiles and examine MVPA associations
- **Data Analysis**
 - Latent profile analysis
 - ✦ Output unique (neighborhood) profiles with z-scores from NEWS item responses
 - Mixed models regression controlling for covariates and design
 - ✦ Out-of-school MVPA → Profiles and covariates

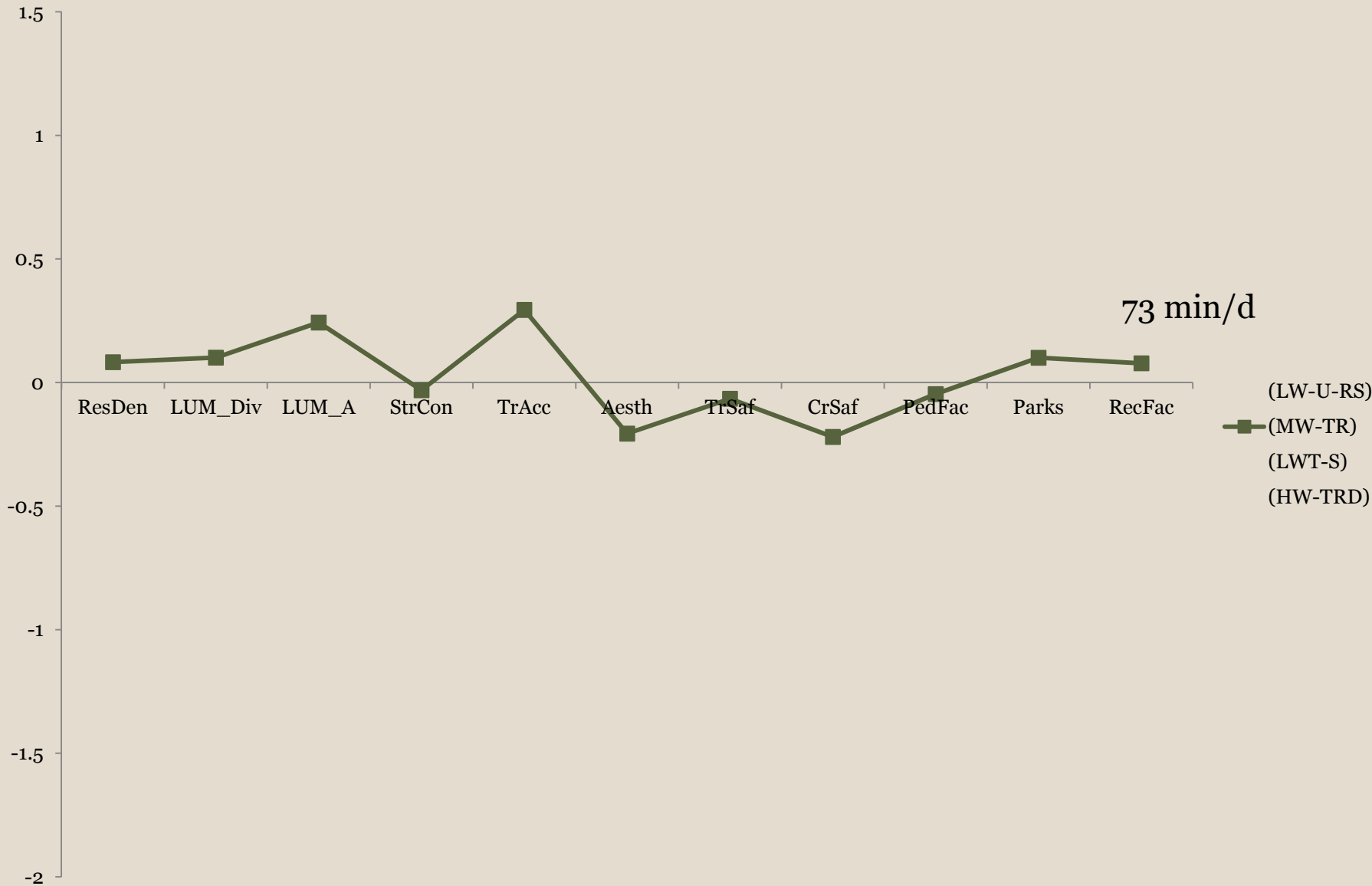
Table 1. Participant Demographics and Characteristics in San Diego and Seattle Regions

	San Diego County, CA			King County/Seattle		
<hr/>						
Parent	n			n		
Sex (% female)	309	86.4		369	85.9	
Age (years)	305	41.4	(6.2)	364	41.7	(5.5)
Household Income (\$/year - median)	298	80,000-89,000		361	>\$100,000	
Education (% at least college degree)	303	59.4		363	76.3	
Number of Vehicles	305	2.5	(1.1)	361	2.4	(0.9)
Number of Drivers	304	2.1	(0.6)	362	2.1	(0.5)
Marital Status (% married or living w/partner)	304	92.1		364	96.2	
Number of People in Household	305	4.5	(1.1)	364	4.5	(0.9)
BMI (kg/m ²)	308	23.7	(5.6)	369	26.8	(5.9)
Years Living at Current Address	305	8.2	(5.0)	364	8.4	(5.1)
<hr/>						
Children						
Sex (% women)	309	49.2		369	50.4	
Age (years)	309	9.3	(1.6)	369	8.9	(1.5)
Race/Ethnicity (% nonwhite)	309	17.2		369	16.8	
BMI (kg/m ²)	308			366		
Overweight (% ≥ 85th % tile)		28.2		89	24.1	
Obese (% ≥ 95th % tile)		12.9		34	9.2	

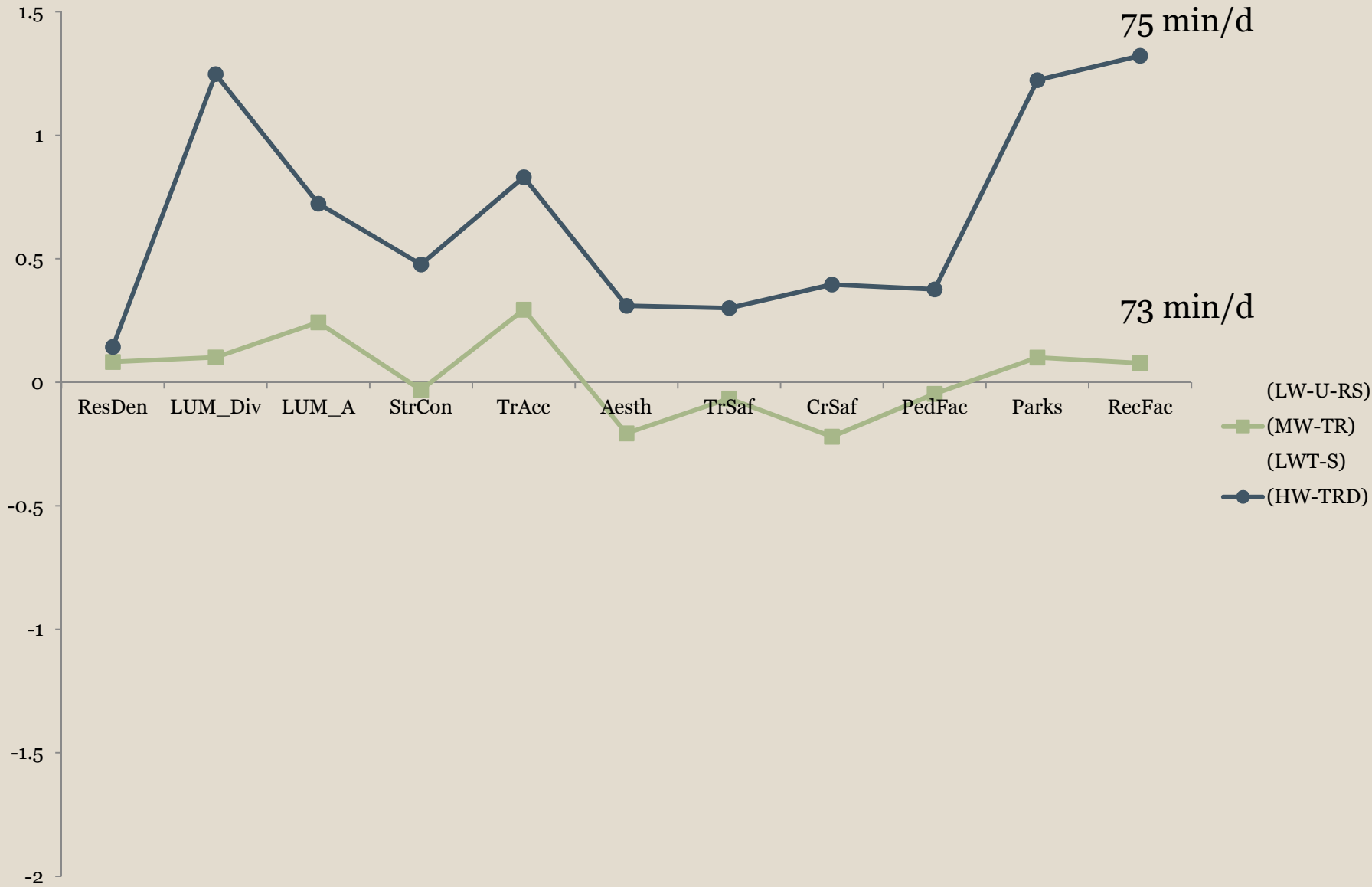
Values shown are means (standard deviations) unless noted otherwise

MVPA on valid 10 hour wear time day only

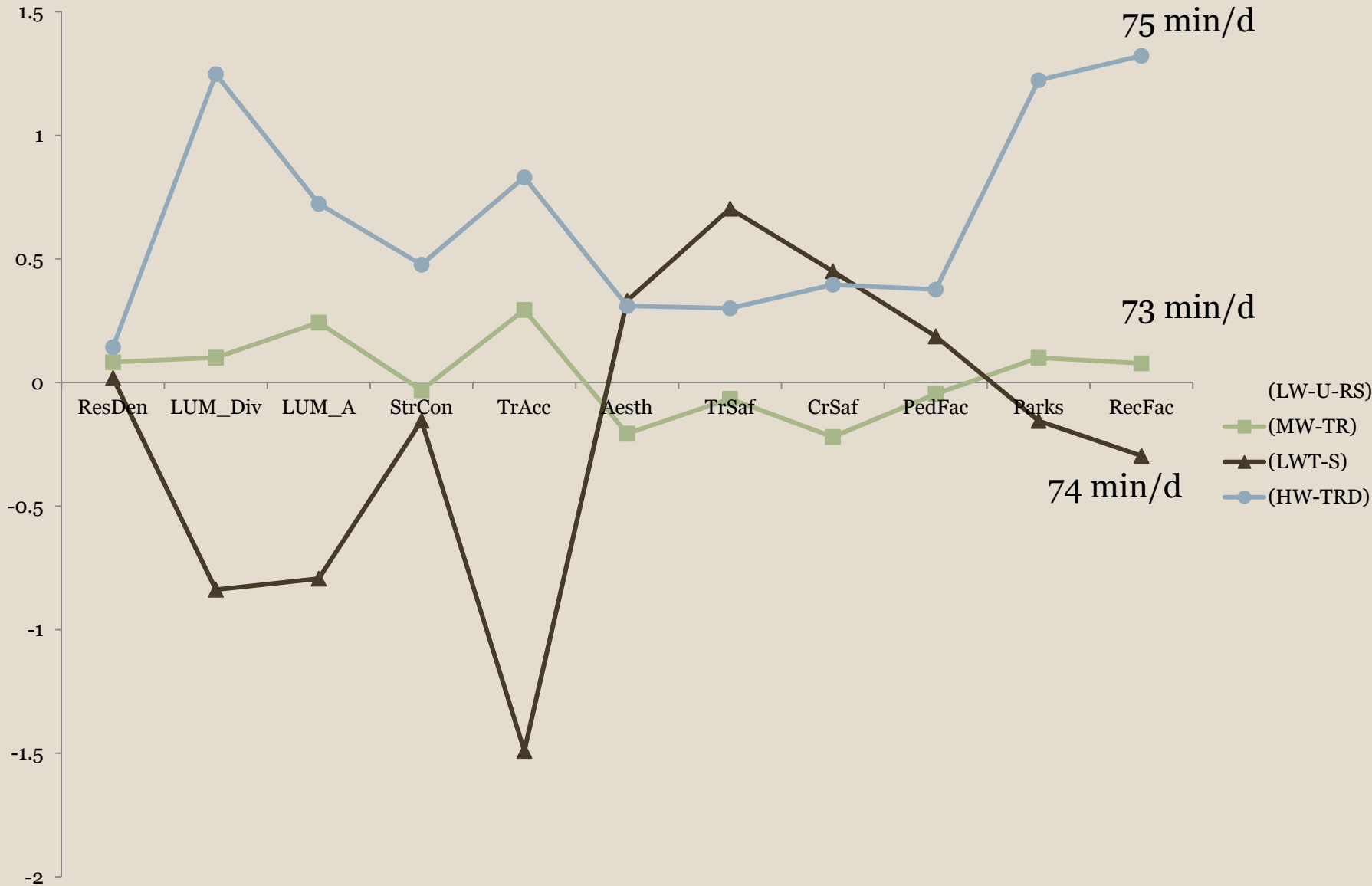
San Diego Neighborhood Profiles with Adjusted Out-of-School MVPA



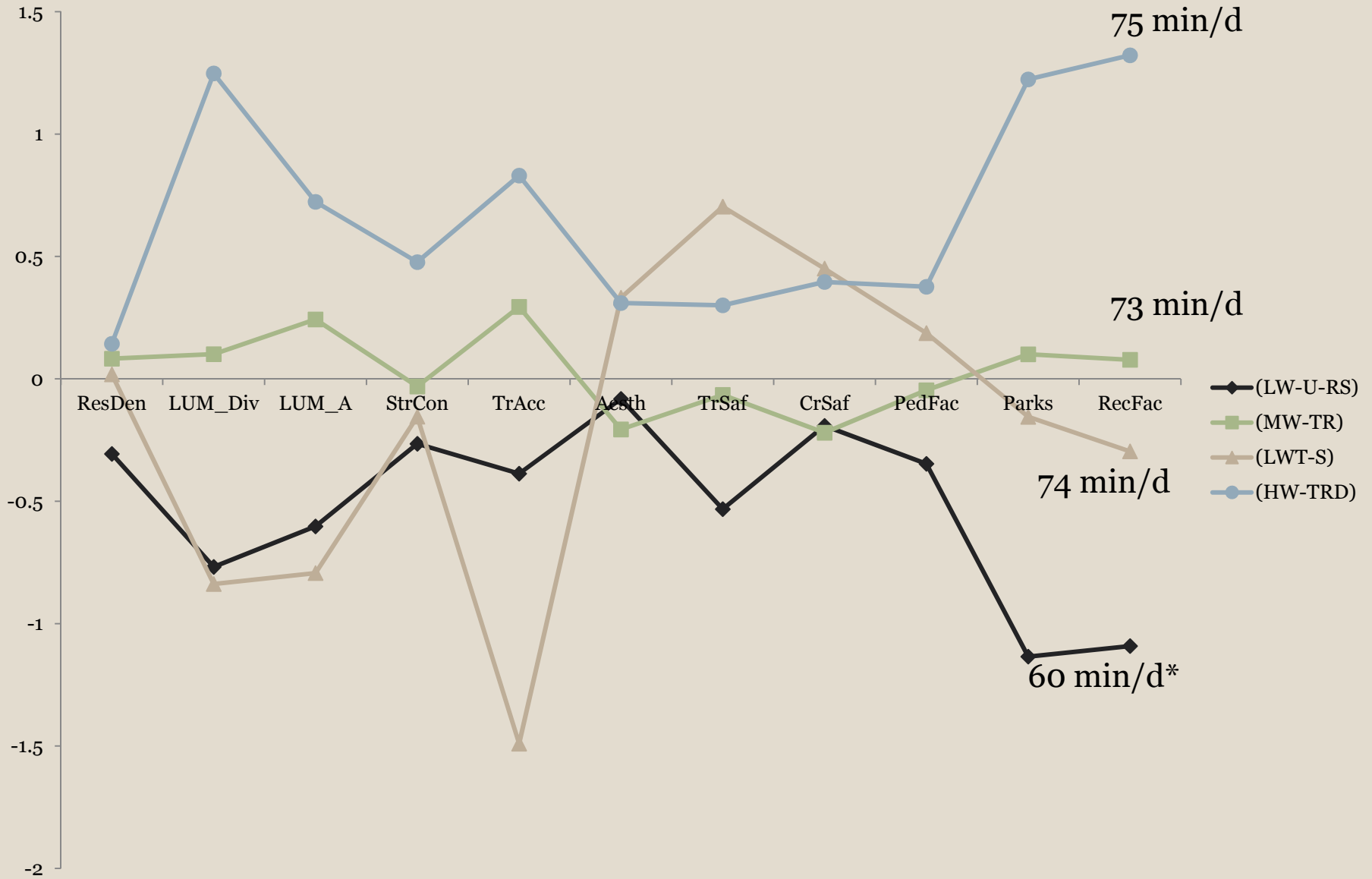
San Diego Neighborhood Profiles with Adjusted Out-of-School MVPA



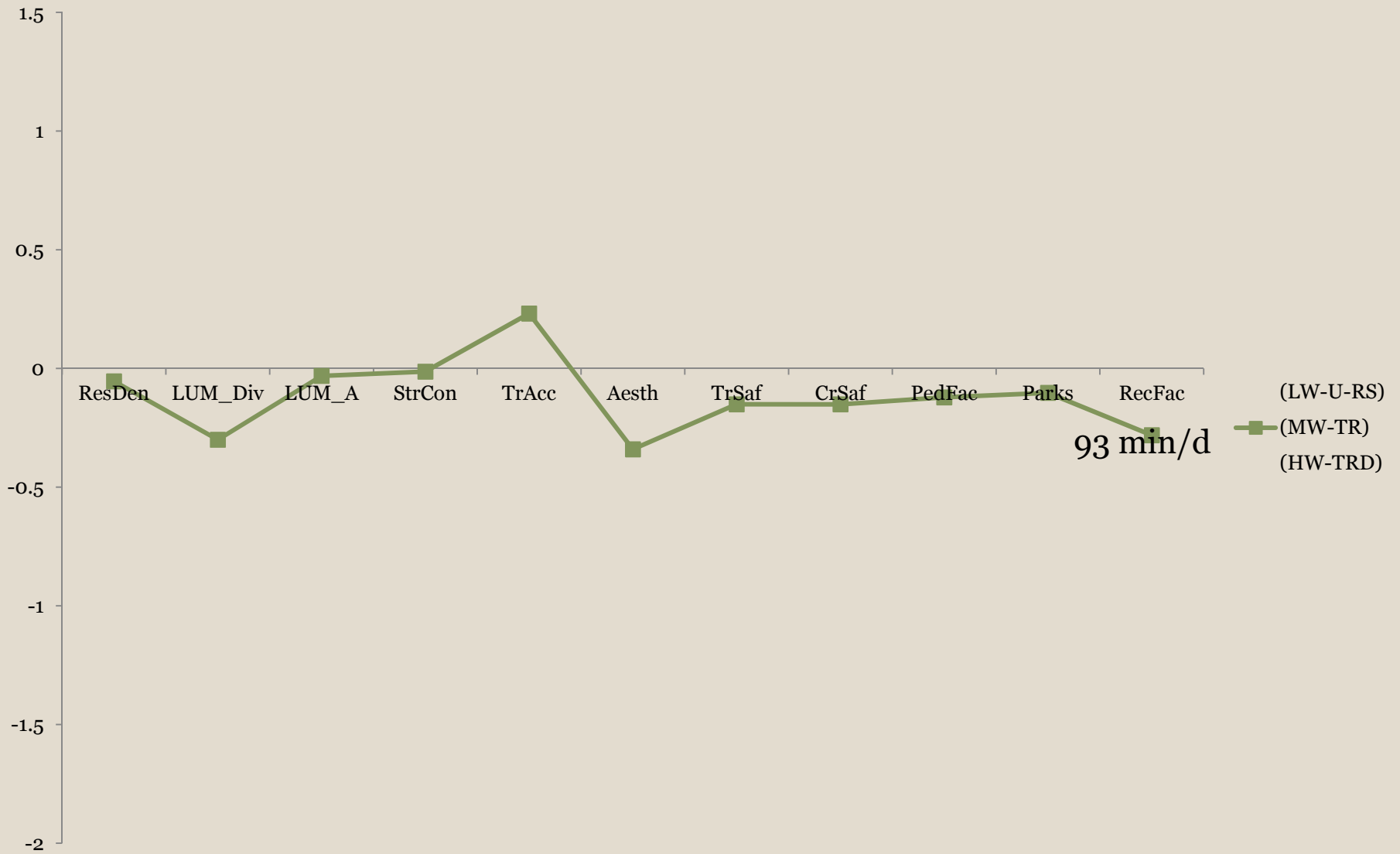
San Diego Neighborhood Profiles with Adjusted Out-of-School MVPA



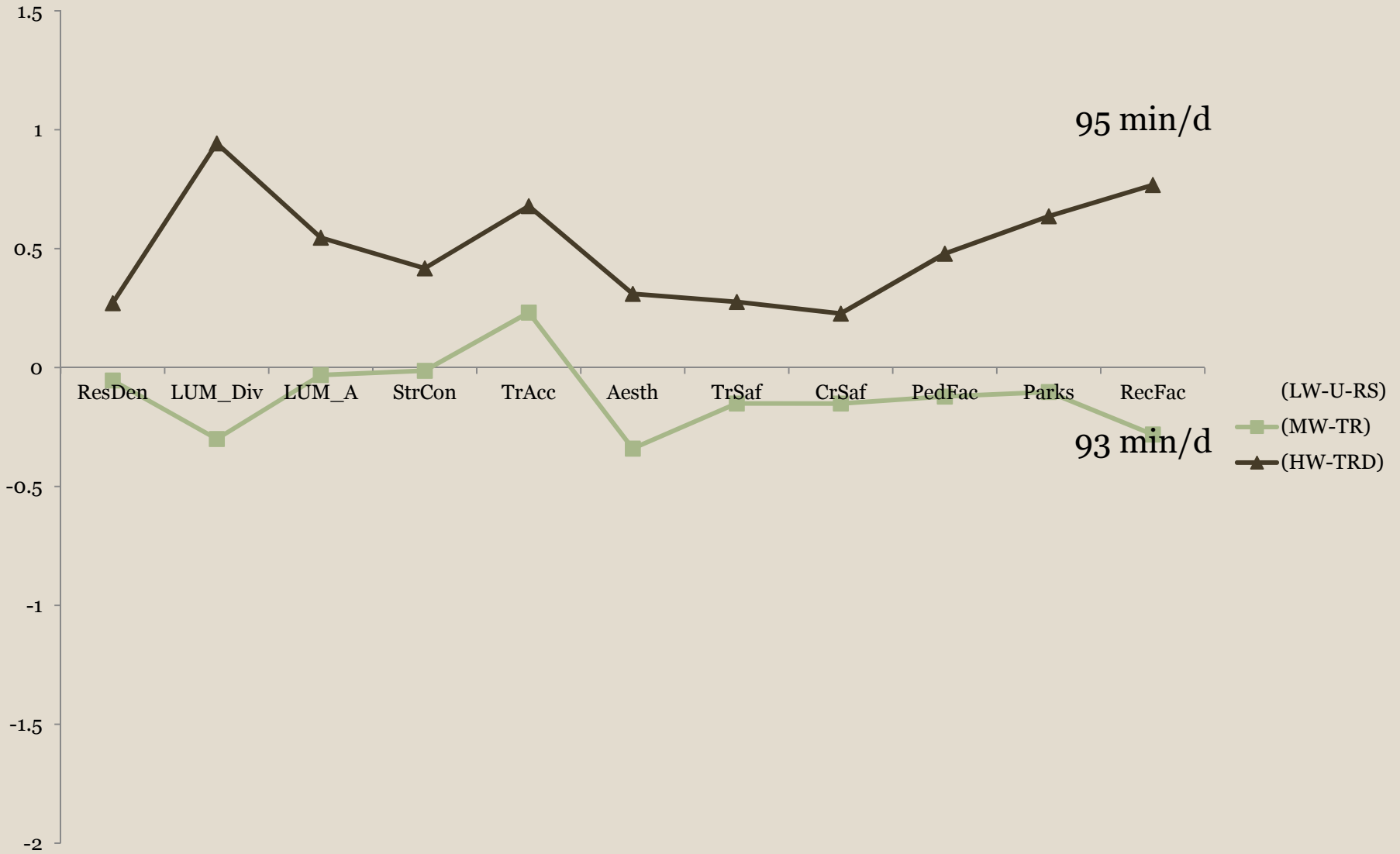
San Diego Neighborhood Profiles with Adjusted Out-of-School MVPA



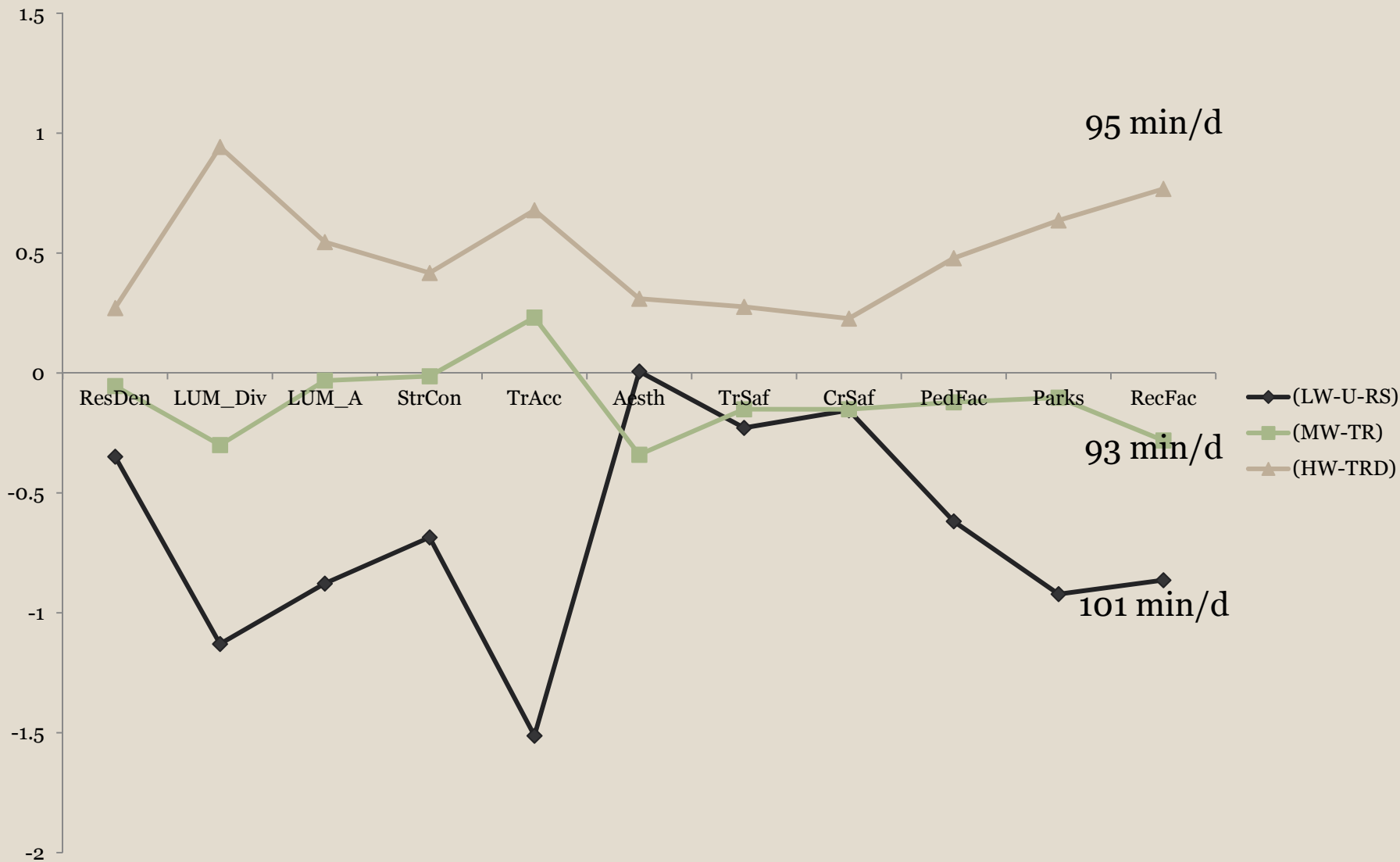
Seattle Neighborhood Profiles with Adjusted Out-of-School MVPA



Seattle Neighborhood Profiles with Adjusted Out-of-School MVPA



Seattle Neighborhood Profiles with Adjusted Out-of-School MVPA



Conclusions



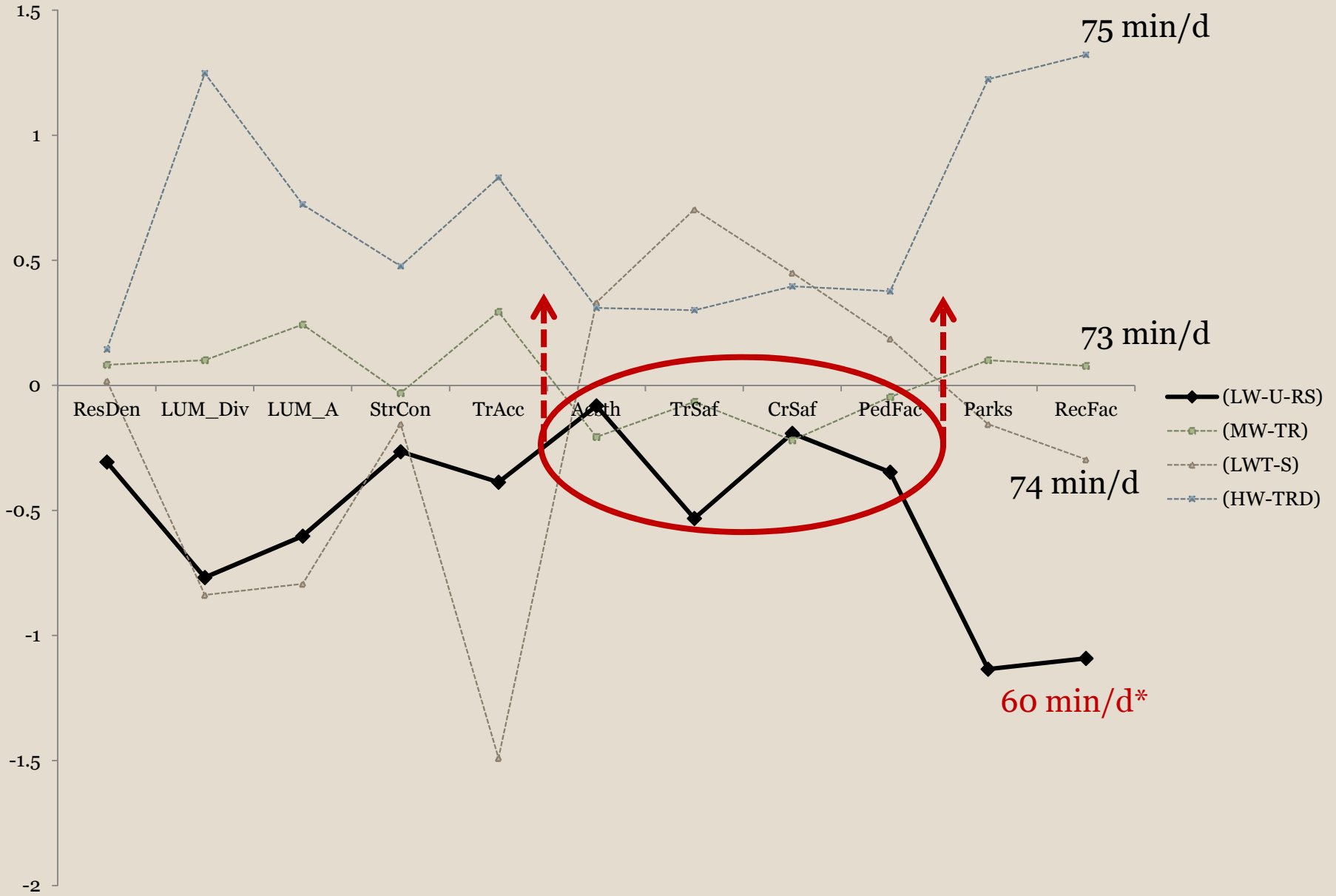
- In general, profiles were similar between regions
 - Unique aspects within regions – Why?
 - ✦ Individual perception of the neighborhood
 - ✦ Region-specific perception – relative to location and history
 - ✦ NEWS offers more information than walkability or activity friendly
 - Addition of aesthetics and safety
- Neighborhood characteristics may play a key role in out-of-school physical activity
 - Could promote or hinder MVPA
 - Important influence when considering child physical activity

Discussion Points

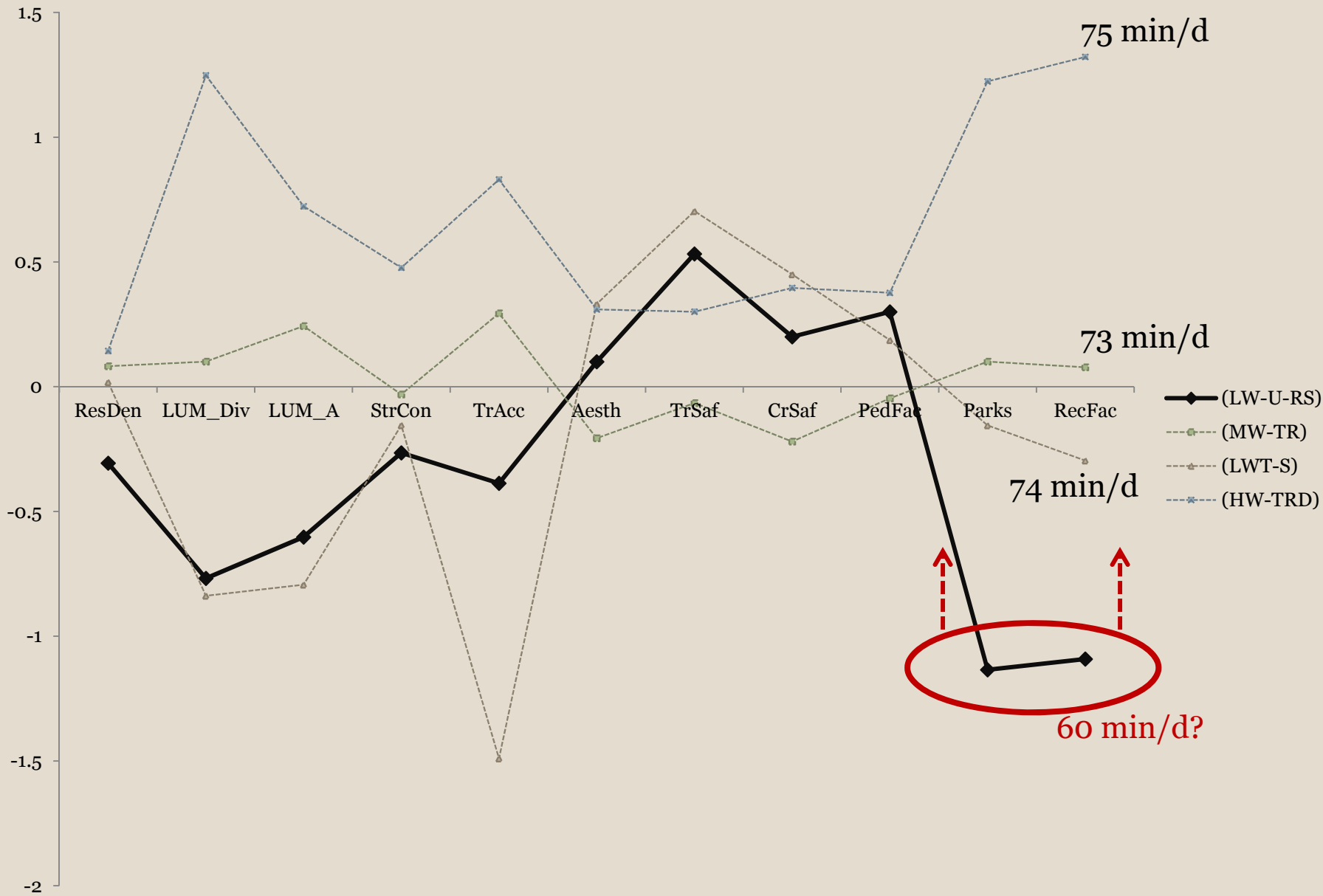


- How can we use these profiles?
 - Improve/alter particularly 'low' features to more resemble profiles with higher MVPA
 - ✦ Modify the modifiable...
 - Consider these combinations when building new neighborhoods
 - Is the ideal neighborhood low walkable with \geq average safety features

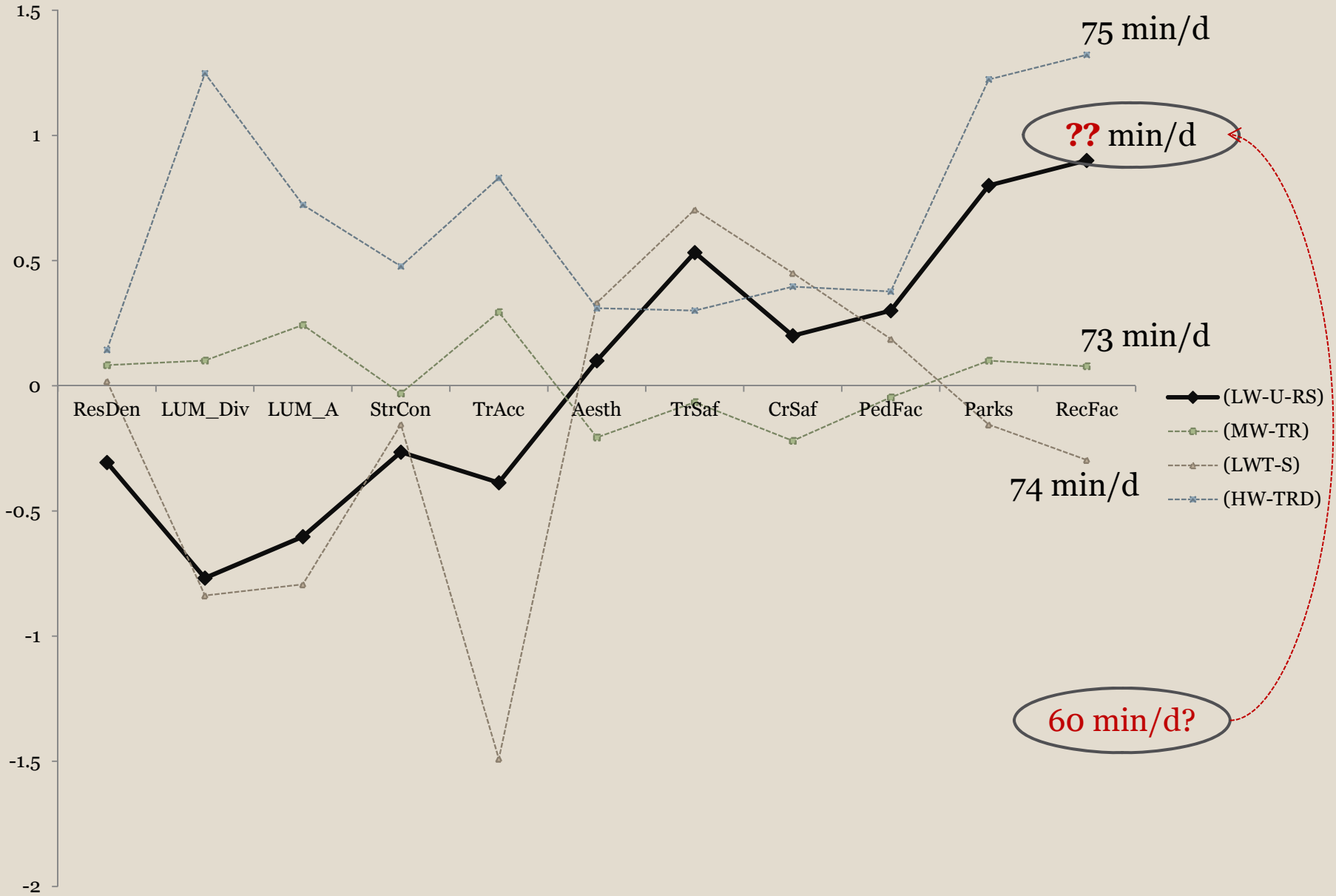
San Diego Profiles with Adjusted Out-of-School MVPA



San Diego Profiles with Adjusted Out-of-School MVPA



San Diego Profiles with Adjusted Out-of-School MVPA



Discussion Points



- How can we use these profiles?
 - Improve/alter particularly 'low' features to more resemble profiles with higher MVPA
 - ✦ Modify the modifiable...
 - Consider these combinations when building/modifying neighborhoods
 - Is the ideal neighborhood low walkable with \geq average safety features?

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- **Questions?**

References



- 2008 Physical Activity Guidelines for Americans, 2008.
- Carlson, J.A., Sallis, J.F., Conway, T.L., Saelens, B.E., Frank, L.D., Kerr, J., Cain, K.L., King, A.C., 2012. Interactions between psychosocial and built environment factors in explaining older adults' physical activity. *Prev Med* 54, 68–73.
- Cerin, E., Conway, T.L., Saelens, B.E., Frank, L.D., Sallis, J.F., 2009. Cross-validation of the factorial structure of the Neighborhood Environment Walkability Scale (NEWS) and its abbreviated form (NEWS-A). *Int J Behav Nutr Phys Act* 6, 32.
- Ding, D., Sallis, J.F., Kerr, J., Lee, S., Rosenberg, D.E., 2011. Neighborhood environment and physical activity among youth a review. *Am J Prev Med* 41, 442–455.
- Frank, L.D., Sallis, J.F., Saelens, B.E., Leary, L., Cain, K., Conway, T.L., Hess, P.M., 2010. The development of a walkability index: application to the Neighborhood Quality of Life Study. *Br J Sports Med* 44, 924–933.
- Long, M.W., Sobol, A.M., Cradock, A.L., Subramanian, S.V., Blendon, R.J., Gortmaker, S.L., 2013. School-day and overall physical activity among youth. *Am J Prev Med* 45, 150–157.
- Norman, G.J., Adams, M.A., Kerr, J., Ryan, S., Frank, L.D., Roesch, S.C., 2010. A latent profile analysis of neighborhood recreation environments in relation to adolescent physical activity, sedentary time, and obesity. *J Public Health Manag Pract* 16, 411–419.
- Saelens, B.E., Sallis, J.F., Black, J.B., Chen, D., 2003. Neighborhood-based differences in physical activity: an environment scale evaluation. *Am J Public Health* 93, 1552–1558.
- Sallis, J.F., Saelens, B.E., Frank, L.D., Conway, T.L., Slymen, D.J., Cain, K.L., Chapman, J.E., Kerr, J., 2009. Neighborhood built environment and income: examining multiple health outcomes. *Soc Sci Med* 68, 1285–1293.
- Troiano, R.P., Berrigan, D., Dodd, K.W., Mâsse, L.C., Tilert, T., McDowell, M., 2008. Physical activity in the United States measured by accelerometer. *Med Sci Sports Exerc* 40, 181–188.

Table. Participant Profile Demographics and Characteristics in San Diego Region

	Low Walkable, Unsafe, Parks and Recreation Sparse (LW-U-RS)		Moderate Walkable, Transit Access, and Recreation (MW-TR)		Low Walkable and Transit Access, Safe with Average Recreation Facilities (LWT-S)		High Walkable, Transit and Recreation Dense (HW-TRD)	
	n		n		n		n	
Parent								
Sex (% women)	70	81.4	135	88.9	42	78.6	61	91.8
Age (years)	69	41.0 (5.2)	134	41.6 (6.8)	42	42.5 (5.4)	60	40.9 (6.2)
Household Income (\$/year - median)	69	\$90,000-99,000	128	\$70,000-79,000	42	\$90,000-99,000	59	\$70,000-79,000
Education (% at least college degree)	69	52.2	133	57.1	42	69.1	59	66.1
Number of Vehicles	69	2.8 (1.2)	134	2.4 (1.1)	42	2.4 (0.8)	60	2.2 (0.9)
Number of Drivers	69	2.2 (0.5)	134	2.1 (0.6)	42	2.0 (0.4)	59	2.0 (0.5)
Marital Status (% married or living w/partner)	68	97.1	134	92.5	42	90.5	60	86.7
Number of People in Household	69	4.6 (1.0)	134	4.6 (1.1)	42	4.2 (0.9)	60	4.3 (1.1)
Years at current address	69	8.2 (4.3)	134	8.5 (5.6)	42	7.9 (4.6)	60	7.8 (4.7)
BMI (kg/m ²)	70	28.0 (6.4)	134	26.7 (5.0)	42	26.6 (4.7)	61	26.8 (6.4)
Children								
Sex (% women)	70	45.7	135	47.4	42	61.9	61	49.2
Age (years)	70	9.3 (1.6)	135	9.3 (1.7)	42	9.3 (1.6)	61	9.3 (1.5)
Race/Ethnicity (% nonwhite)	70	14.3	135	20.7	42	19.1	61	11.5
BMI (kg/m ²) (85th, 95th % tile)	70		135		42		61	
Overweight (%)	26	37.1	37	27.4	6	14.3	18	29.5
Obese (%)	11	15.7	19	14.1	1	2.4	9	14.8
Time 1 MVPA (min/d)	70	132.8 (51.6)	135	139.8 (53.4)	42	132.9 (45.9)	61	140.2 (51.3)
Time 1 Out of School MVPA (min/d)	70	90.3 (48.5)	135	103.9 (48.4)	42	101.5 (39.5)	61	104.5 (50.5)

Values shown are unadjusted means (standard deviations) unless noted otherwise
MVPA on valid days with 10hrs wear time

Table. Participant Profile Demographics and Characteristics in Seattle Region

	Low Walkable, Unsafe, Parks and Recreation Sparse (LW-U-RS)		Moderate Walkable, Transit Access, and Recreation (MW-TR)		High Walkable, Transit and Recreation Dense (HW-TRD)	
Parent	n		n		n	
Sex (% women)	87	89.7	130	85.4	149	83.9
Age (years)	86	41.3 (5.5)	130	41.2 (5.3)	148	42.4 (5.7)
Household Income (\$/year - median)	84	>\$100,000	129	>\$100,000	148	>\$100,000
Education (% at least college degree)	85	71.8	130	78.5	148	77.0
Number of Vehicles	84	2.7 (1.3)	130	2.3 (0.8)	147	2.2 (0.7)
Number of Drivers	86	2.2 (0.6)	129	2.1 (0.4)	147	2.1 (0.4)
Marital Status (% married or living w/partner)	86	95.4	130	96.2	148	96.6
Number of People in Household	86	4.6 (1.0)	130	4.5 (0.9)	148	4.4 (0.9)
How long at current address (years)	86	7.8 (4.3)	130	8.0 (4.4)	148	9.2 (6.0)
BMI (kg/m ²)	87	27.3 (6.3)	130	26.9 (6.1)	149	26.4 (5.5)
Children						
Sex (% women)	87	55.2	130	43.9	149	53.02
Age (years)	87	9.0 (1.4)	130	8.8 (1.4)	149	9.0 (1.60)
Race/Ethnicity (% nonwhite)	87	13.8	130	20.0	149	15.44
BMI (kg/m ²) (85th, 95th % tile)	87		130		149	
Overweight (%)	24	27.6	33	25.4	31	20.81
Obese (%)	13	14.9	11	8.5	9	6.04
Time 1 MVPA (min/d)	87	154.4 (51.4)	130	150.0 (48.0)	149	154.2 (56.7)
Time 1 Out of School MVPA (min/d)	87	120.9 (47.9)	130	116.3 (49.1)	149	118.6 (54.8)

Values shown are means (standard deviations) unless noted otherwise
 MVPA on valid days with 10hrs wear time

Table. Adjusted Mean Physical Activity of Children of each Neighborhood Profile in San Diego and Seattle Regions*

	Low Walkable, Unsafe, Parks and Recreation Sparse	Moderate Walkable, Transit Access, and Recreation	Low Walkable and Transit Access, Safe with Average Recreation Facilities	High Walkable, Transit and Recreation Dense
	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
<i>San Diego Region</i>				
MVPA (min/d)	114.2 ^{a,b,c,d} (96.8 , 134.7)	122.4 ^{a,b,c,d} (105.4 , 142.3)	121.5 ^{a,b,c,d} (103.1 , 143.3)	125.5 ^{a,b,c,d} (107.4 , 146.7)
Out of School MVPA (min/d)	59.8 ^a (47.0 , 76.0)	73.3 ^{b,c,d} (58.9 , 91.3)	73.8 ^{b,c,d} (58.0 , 93.9)	74.5 ^{b,c,d} (59.5 , 93.7)
<i>Seattle Region</i>				
MVPA (min/d)	142.3 ^{a,c,d} (115.0 , 174.7)	132.3 ^{a,c,d} (108.2 , 161.8)		139.1 ^{a,c,d} (112.8 , 171.6)
Out of School MVPA (min/d)	101.5 ^{a,c,d} (75.8 , 135.9)	93.1 ^{a,c,d} (70.2 , 123.3)		94.8 ^{a,c,d} (70.7 , 127.0)

MVPA on valid days with 10hrs wear time

All models adjusted for child gender, race and age, parental marital status, income, education, number in household, years at current address, number of cars per legal driver in household, and high/low walkability/nutrition

Mean values with similar superscript letters on the horizontal plane are not statistically different based on post hoc follow-up tests.