Associations between the Built Environment and Location-Based Physical Activity

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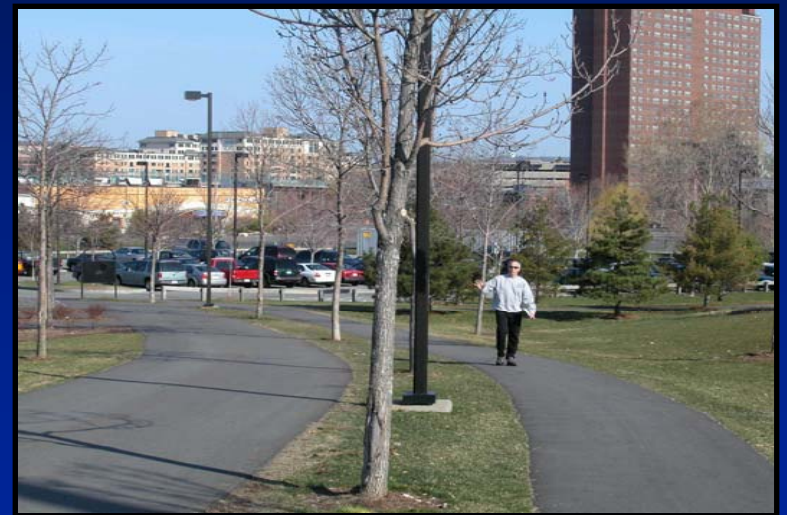
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Study rationale

- Growing evidence that certain attributes of built environment (BE) are positively associated with physical activity (PA)

- Small number of studies have used both objective measures of BE and PA

  – *Mixed evidence of associations in these studies*

- Implicit assumption that PA is occurring within area (e.g., buffer) around home – *yet location of activity is unknown*

Objectives

1. Quantify PA of various intensities in specific areas around residential and work locations

2. Examine associations between objective built environment variables and location-based PA

Data collection

- Conducted brief intercept surveys with 1194 adults (≥ 18 y) walking, running, cycling, and in-line skating at 5 trails in Massachusetts
  - Time-frame: fall, 2004; spring/summer, 2005
- Recruited sub-sample of 178 "regular" users to wear accelerometer and GPS unit for 4 days (2 weekend days, 2 weekdays)

Equipment

GPS Unit

- GeoStats GPS data logger with Garmin GPS receiver/antenna
- Passive logger has no user interface and requires no user input
- Weight ~ 1 lb.
- Battery life ~5 days

Actigraph accelerometer (model 7164)

Data processing: overview

- Merge accelerometer and GPS data
  - Minute-by-minute database
  - Create location-based PA variables within 1 km buffers using two data sources and GIS methods
- Create 5 built environment variables using GIS data layers
  - 1 km home and work buffers
  - Intersection density, land use mix, population and housing unit density, vegetation index

Sample of merged accelerometer-GPS data

ID	Local Time	Counts	Steps	Moderate (yes/no)	Starting Longitude	Starting Latitude	Ending Longitude	Ending Latitude
4029	09:00	1867	62	1	-71.1448	42.36622	-71.145	42.36618
4029	09:01	3591	110	1	-71.1452	42.36615	-71.146	42.3659
4029	09:02	3853	110	1	-71.146	42.36588	-71.1469	42.36567
4029	09:03	4221	114	1	-71.147	42.36565	-71.1467	42.36525
4029	09:04	3829	113	1	-71.1467	42.36525	-71.1459	42.36548
4029	09:05	4165	102	1	-71.1458	42.3655	-71.1452	42.36513
4029	09:06	1317	50	1	-71.1452	42.36513	-71.1453	42.36493
4029	09:07	3745	109	1	-71.1454	42.36483	-71.146	42.3645
4029	09:08	3718	110	1	-71.146	42.36448	-71.1467	42.36385
4029	09:09	3940	112	1	-71.1467	42.36383	-71.1473	42.36325
4029	09:10	4102	110	1	-71.1473	42.36323	-71.1479	42.36267

GPS points for one participant
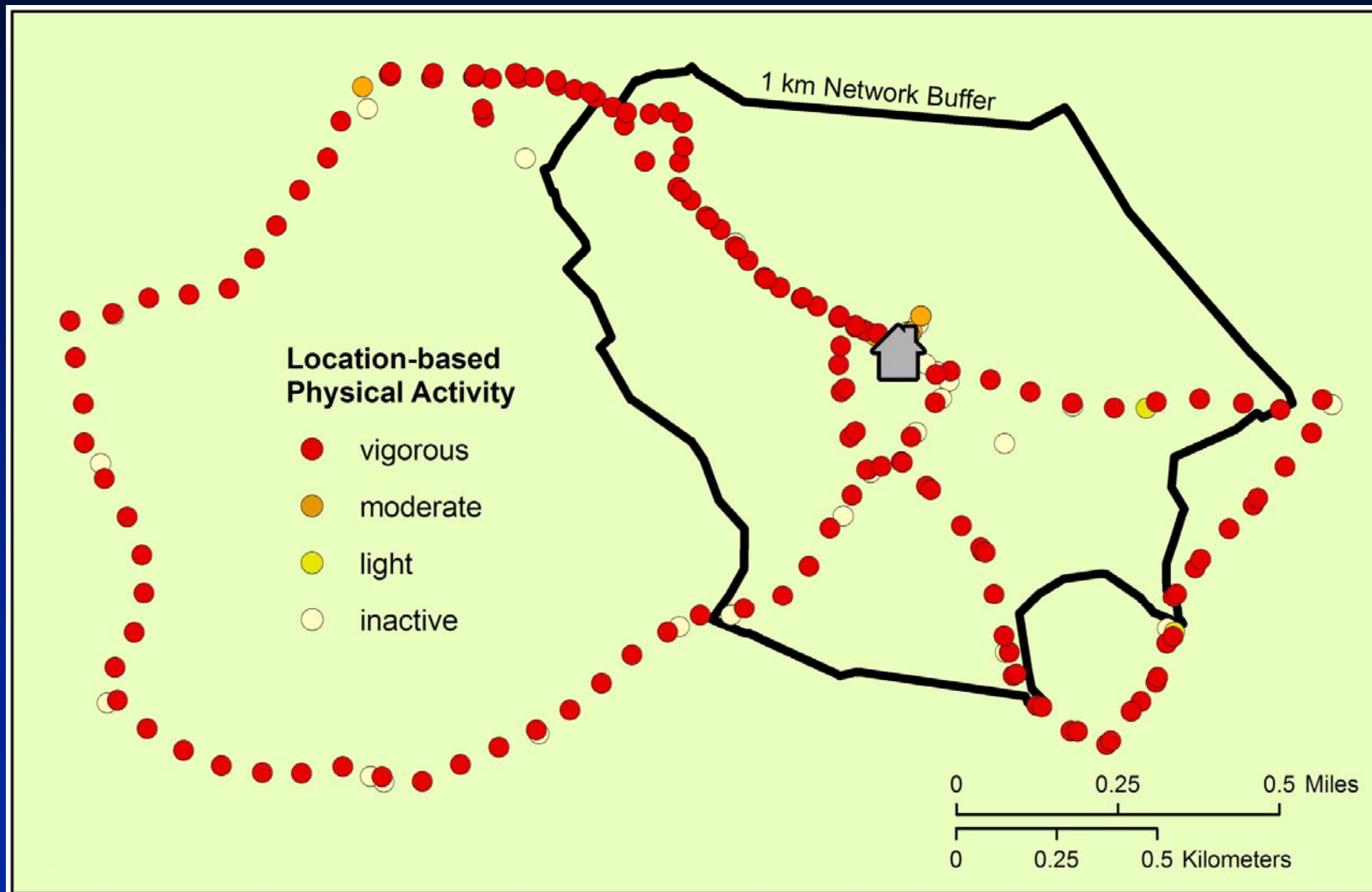
Statistical analysis

- Multiple linear regression to assess associations between BE variables around home address and PA outcomes
  - Square root transformations of PA
- Generalized linear models (Poisson regression) for BE around work and PA

Analytic sample characteristics (n = 149)

- Age
  - Mean (SD) = 43.9 (12.9) yrs
- Gender
  - 52.7% female
  - 47.3% male
- Race
  - 73.0% - white
  - 27.0% - non-white
- Education
  - 81.1% ≥ college education
  - 20.3% ≤ "some" college

Daily minutes of accumulated moderate and vigorous PA by location

Location	Moderate Mean (SD)	Vigorous Mean (SD)
All	53.8 (30.1)	7.0 (13.3)
Home 1km buffer	14.4 (16.7)	1.4 (3.7)
Work 1km buffer	9.1 (14.8)	1.0 (2.9)

Moderate PA = 1952-5724 ct/min; vigorous ≥ 5725 ct/min.

Associations between BE around home and moderate-vigorous PA*

	Overall PA		PA in 1 km buffer	
	Adjusted r^2	P-value	Adjusted r^2	P-value
Intersection density	0.0131	0.47	0.1257	0.0015
Land use mix	0.0006	0.71	0.1318	0.0012
Residential population density	0.0000	0.79	0.1310	0.0013
Housing unit density	0.0019	0.57	0.1459	0.0004
Vegetation index	0.0128	0.49	0.1451	0.0003

Adjusting for age, gender, and race

Associations between BE around work and location-based moderate-vigorous PA*

	PA in 1 km work buffer	
	Estimate (SE)	P-value
Intersection density	-19.43 (19.48)	0.32
Land use mix	0.72 (0.23)	0.0020
Residential population density	0.00 (0.00)	0.29
Housing unit density	0.00 (0.00)	0.68
Vegetation index	0.01 (0.23)	0.95

*Adjusting for age, gender, and race

Strengths and limitations

- Strengths
  - Examines BE associations with PA linked to specific physical contexts
- Limitations
  - Lack of standards for GPS processing (e.g., defining valid day)
  - Unable to clearly determine time indoors
  - Did not assess BE characteristics beyond buffers (*next step*)

Conclusions

- BE around homes showed associations with location-based PA, *but not with overall moderate-vigorous PA*

- Except for land use mix, BE characteristics within work buffers did not show associations with PA within those contexts

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