Using Life Patterns Data to Explore How Built Environments Shape Human Behaviours and Health

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Overview

1. Let's talk about place
2. Space, time and place
3. Place and health - mechanisms
4. Integrated perspectives: from individuals to places
5. Linking people to places: physical activity & nutrition

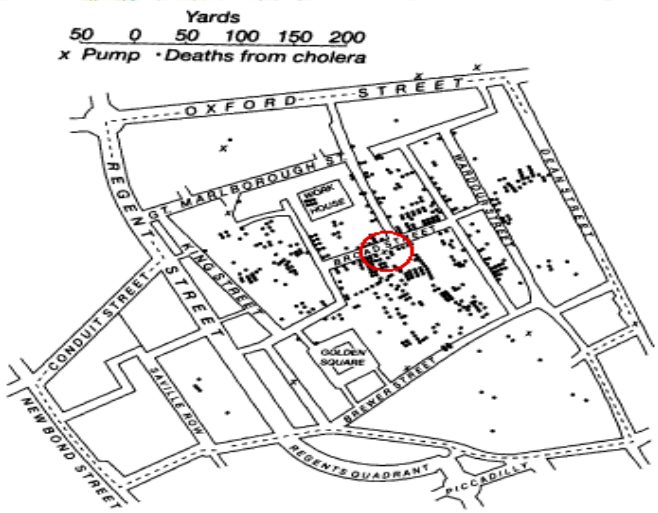
"You will find, as a general rule, that the constitutions and habits of people follows the nature of the land where they live."

- Airs, Waters, Places - Hippocrates (~400BC)

"Health research requires an understanding of the human world by studying people's relations with nature, their geographical behaviour as well as their feelings and ideas in regard to space and place."

-the humanistic perspective in health geography (Tuan, 1976)

On the mode of communication of cholera
John Snow, London, 1855.



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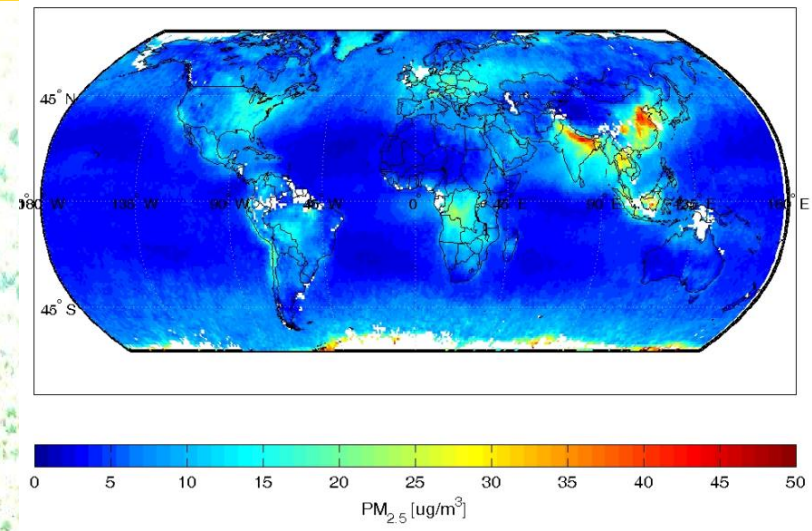
Spatial Variation in Fine Respirable Particulate Matter



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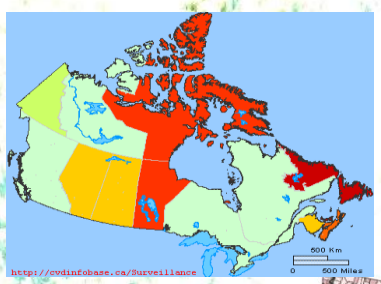
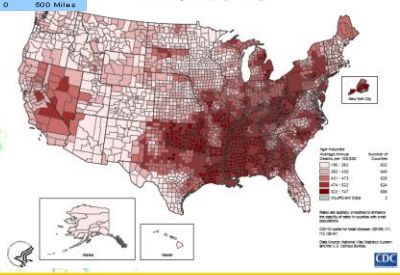
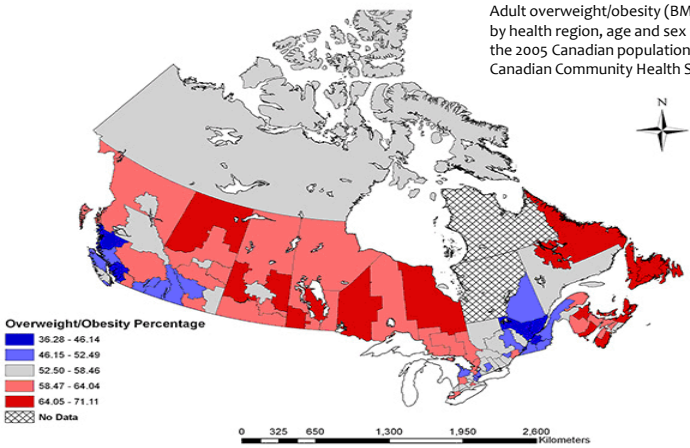
Spatial Variation in CVD





Spatial Variation in Obesity

Adult overweight/obesity (BMI ≥ 25) prevalence by health region, age and sex standardized to the 2005 Canadian population (25-64 years), Canadian Community Health Survey, 2005



Describing Context

- **Space**
  - Dimension in which phenomena are distributed geometrically
  - Describes 'where' a location is, e.g. latitude and longitude
- **Time**
  - Describes when activities occur and their duration
  - The only resource we all have equal amounts of
- **Place**
  - Describes 'what' a location is, or the meaning attached to space

"Place is to *space* as history is to *time* and home is to *house*."
Tunstall et al. (2004)

Conceptualizing Place(s)

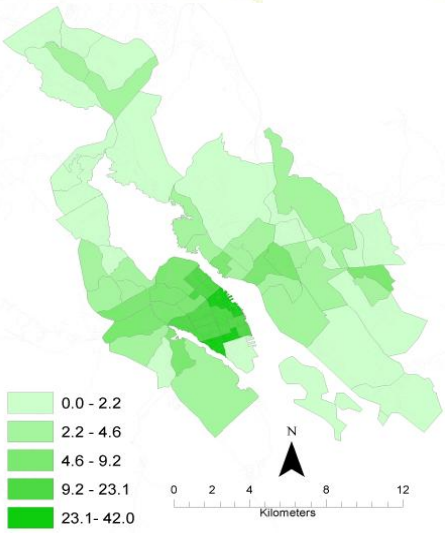
Q: Why do health outcomes and human behaviours vary from place to place?

Possible Explanations:

1. Compositional: places are aggregates of the individuals
2. Contextual: places reflect our decisions and behaviours or of natural phenomena
   - Spatial patterning and diffusion of risk factors
   - Role of space and place in social relations: interaction
   - Landscapes and sense of place: 'topophilia', therapeutic
3. Relational:
   - Social networks
   - Mobility and the lifecourse
   - Territories (social power relations, cultural meanings)

Compositional

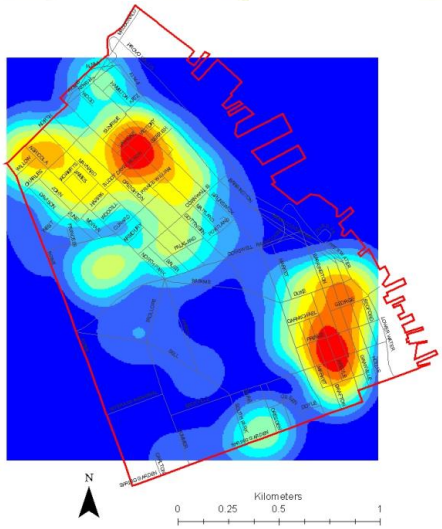
Example:
% of people who walk to work



May also be interested in:
- household income
- employment rates
- religious affiliation
- political support
- gender makeup
- other individual factors?

Contextual

Example:
Serious crime offences in Zone 4



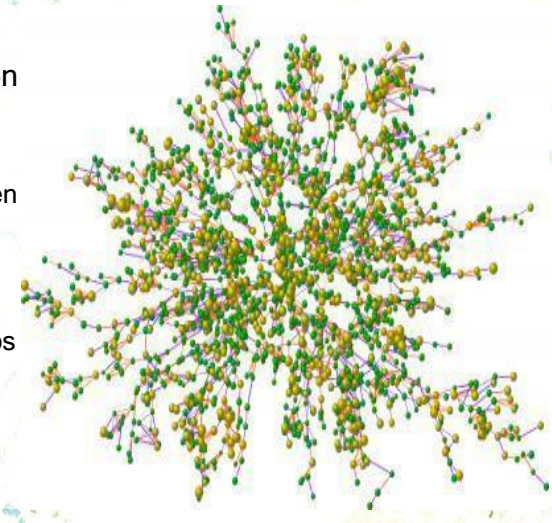
Other examples include:
- air quality
- traffic counts
- green space
- walkability
- risk of pedestrian injury
- other upstream health determinants?

Relational

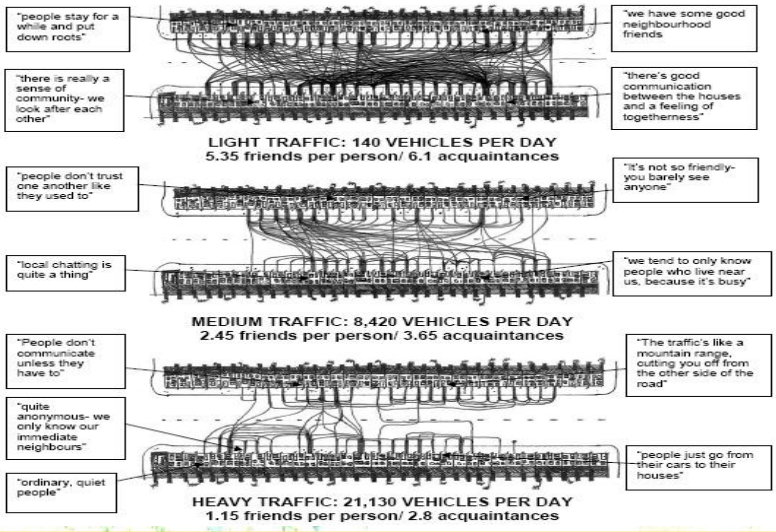
Example:
Obesity as social contagion

•mapping and measuring the 'invisible' relationships between people, places or institutions

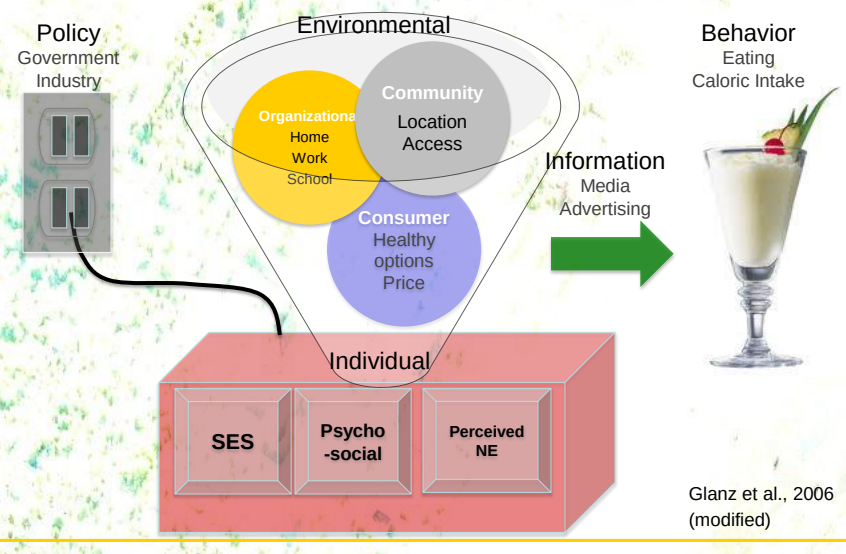
- distance between actors
- activities of individuals/groups
- connectors
- gatekeepers



Influence of Context on Social Interaction



Model of Community Nutrition Environments

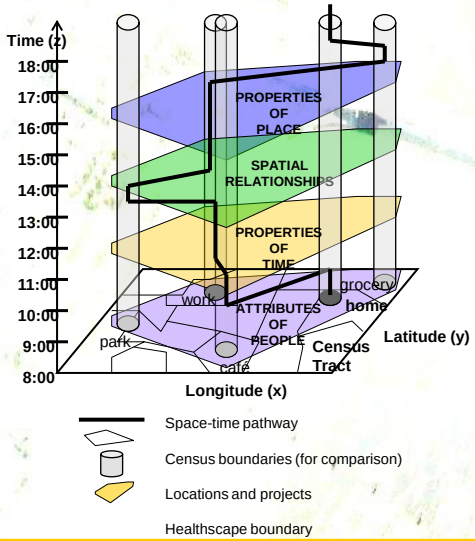


Glanz et al., 2006 (modified)

Modeling Context for Health Research

- A modification of Hägerstrand's (1970) 'time-geography' which breaks down life into a series of paths (or trajectories) and projects (activities)

- How do we begin to measure all of these things?



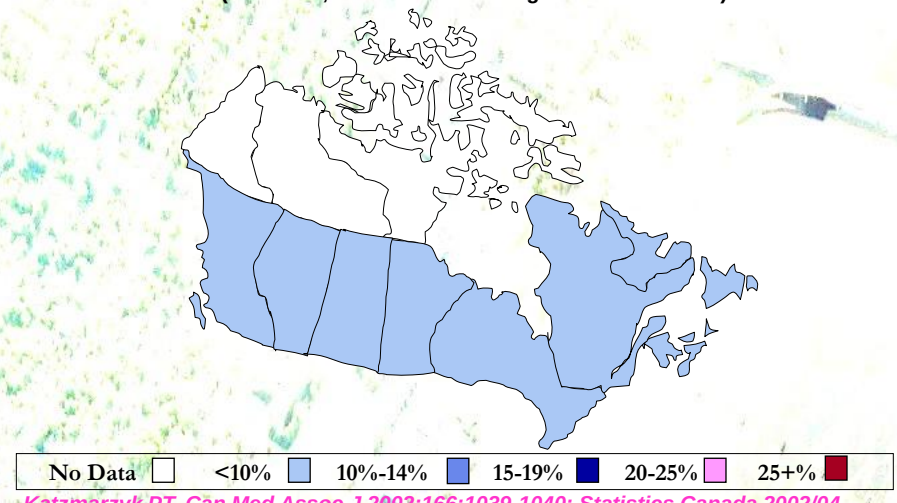
Investigating Places of Physical Activity and Nutrition

- **Importance of cultivating PA behaviours among youth**
  - Decline in PA from childhood to adolescence and beyond
  - Carry important consequences for future (adult) health
  - Sedentary activities dominating youth time

- **Environment, Nutrition and Physical Activity Project**
  - Objective measurement of PA and location (actimetry and GPS)
  - Develop GIS-based approach to PA-location processing
  - Examine how MVPA varies by school SES and urbanicity

Obesity Trends* Among Canadian Adults HPS, 1985

(*BMI ≥ 30, or ~ 30 lbs overweight for 5'4" woman)



Katzmarzyk PT. Can Med Assoc J 2002;166:1039-1040; Statistics Canada 2002/04

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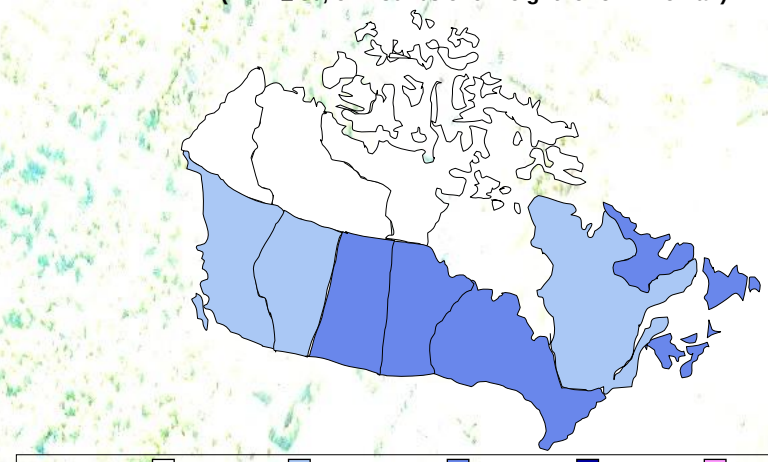

No Data | <10% | 10%-14% | 15-19% | 20-25% | 25+%

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Obesity Trends* Among Canadian Adults
NPHS, 1994

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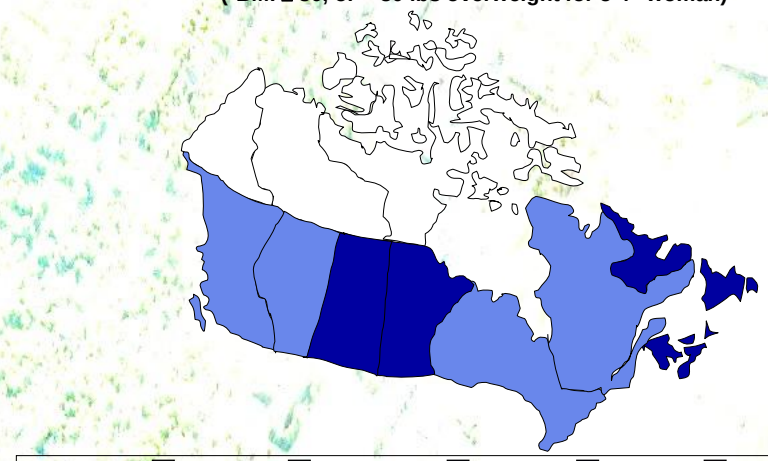

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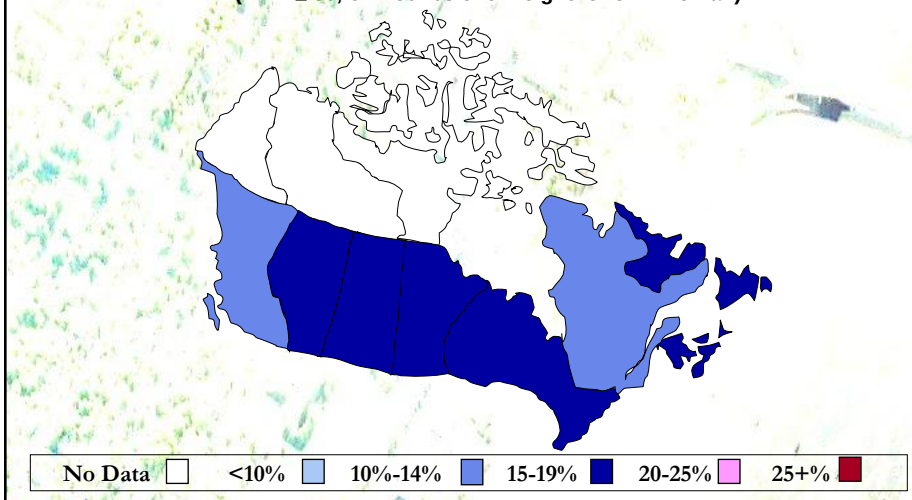

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Obesity Trends* Among Canadian Adults
CCHS, 2000

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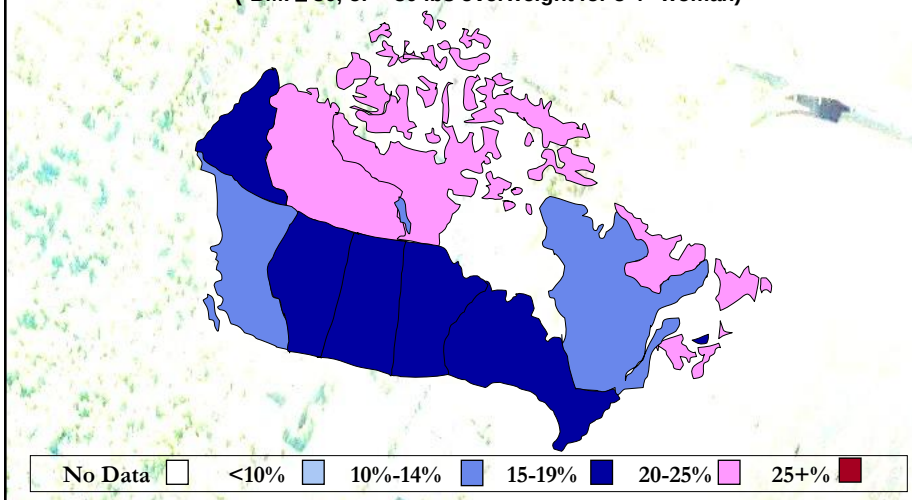

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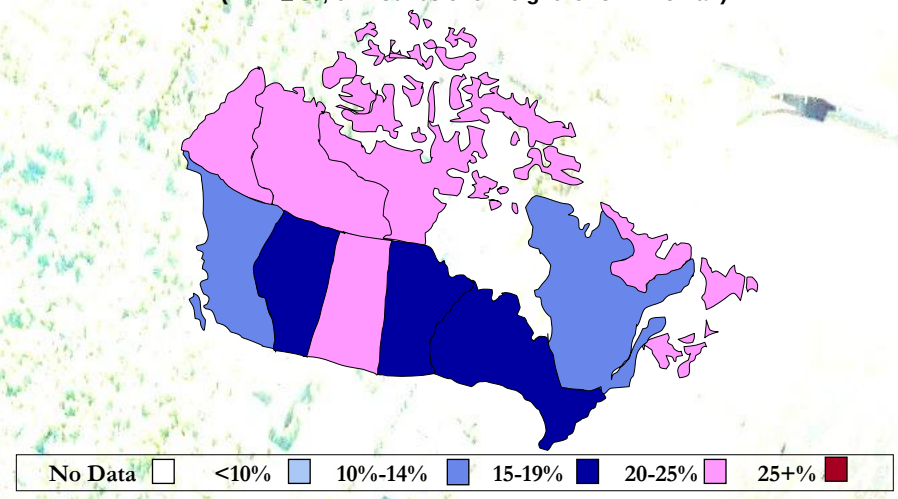

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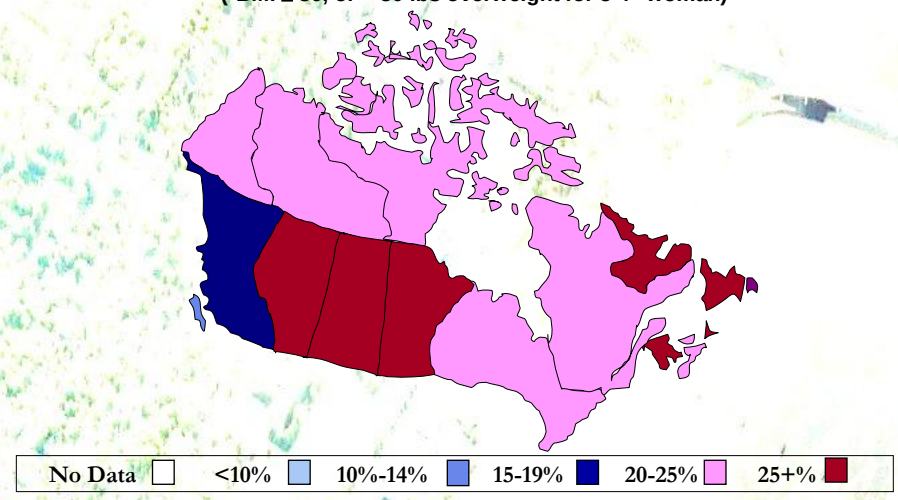

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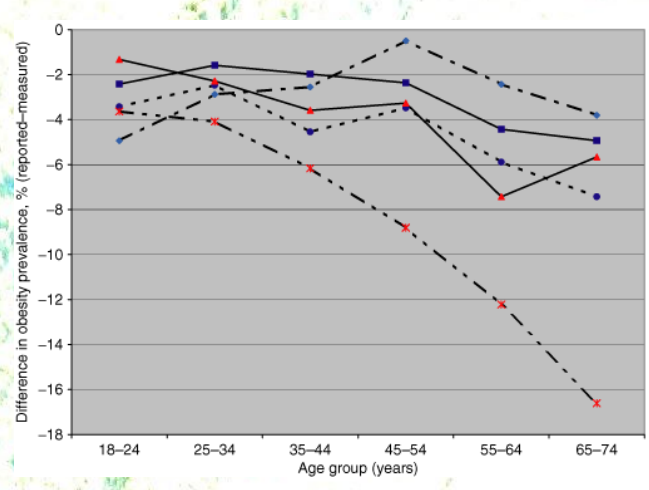
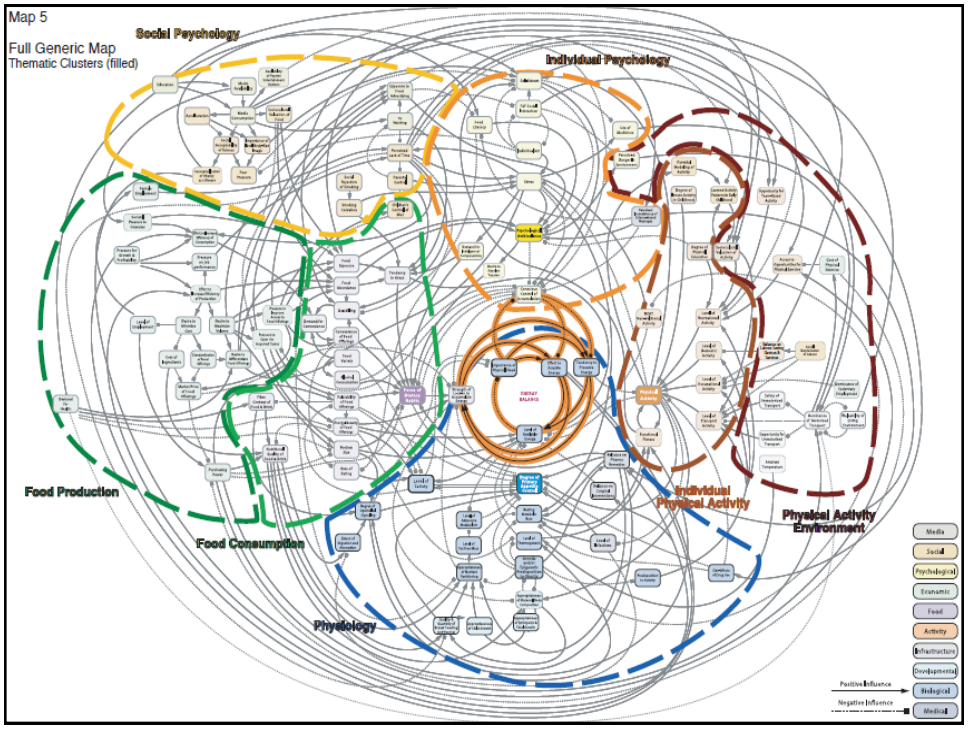
Prevalence values are conservative estimates



Gorber & Tremblay, 2010

Quiz: Guess the gender that: a) under-reports weight; b) over-reports height



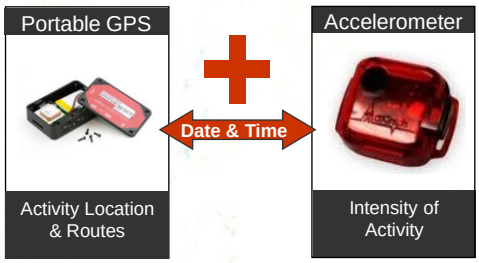
Investigating Places of Physical Activity and Nutrition

- Do the contexts of life (e.g. built environments) influence levels of physical activity?
  - Mixed evidence and inconsistencies
- Inconsistencies due to: measurement challenges, unknown exogenous variables, bias (e.g. misclassification)
  - > 90% of studies limit scope of built environment to residential neighbourhood (Leal & Chaix, 2011)
  - > 60% of MVPA occurs in locations > 1km from home or other anchor locations (Troped et al., 2010)
- Linking accurate understandings of individual activities in space and time to features of built and social environments is key to advancing interventions to promote PA

MVPA = Moderate-to-vigorous physical activity

The ENACT Project

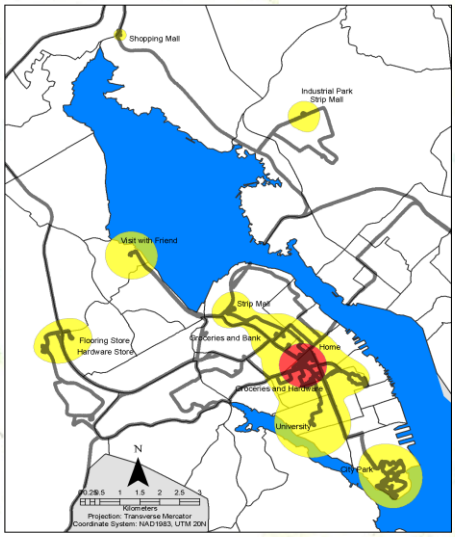
- Six schools stratified by SES and urbanicity (n = 1400)
- 380 students, 12-16 years
- Demographics, dietary quality, health behaviours, physical measurements, scheduled activity diary, time-activity monitoring
- Actimetry and GPS: 8 d period, 30 s epoch, 1 s location



The Activity Space

Questions we can begin to answer:

- Where do people go?
- When do they go there?
- How often do they go there?
- How do they get there?
- What type of activity might they be doing there?
- Who else goes there and are they likely to meet?



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Analysis

- Matched data examined in GIS and locations of MVPA identified using combination of street network, cadastral data, satellite imagery and an enhanced POI (TeleAtlas)
- Percentage of total MVPA time calculated for each location category by sex and urbanicity
- Computed median MPVA by school SES and urbanicity for home, school, commuting and other locations combined
- Differences in median MVPA evaluated using Kruskall-Wallis test for group comparisons

MVPA= Moderate-to-vigorous physical activity

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Percentage Time in MVPA by Location

	Urban		Suburban		Rural	
Location of MVPA	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Home	7.81	6.69	15.93	10.20	13.42	11.13
School	16.52	15.05	11.96	11.01	17.62	18.04
Commuting	41.73	35.12	14.52	21.59	14.36	9.29
Athletic facility	0.20	1.43	0.96	0.32	2.11	1.09
Entertainment	0.01	0.01	0.00	0.01	0.00	0.06
Greenspace	0.45	0.79	2.06	1.27	3.01	2.13
Military	0.00	0.15	0.00	0.00	0.00	0.01
Parking lot	0.35	0.11	0.04	0.02	0.04	0.02
Religious	0.96	0.28	0.16	0.15	0.00	0.08
Residential	2.35	2.39	5.22	3.81	2.34	1.03
Restaurant	0.34	0.12	0.34	0.11	0.12	0.05
Retail	1.39	0.64	1.61	1.83	0.19	1.79
School	0.40	0.30	0.16	0.13	0.09	0.15
Services	0.12	0.02	0.10	0.01	0.03	0.04
Transportation	0.24	0.47	0.06	0.45	0.00	0.08
No GPS coordinates	27.12	36.45	46.87	49.09	46.67	55.02

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Urbanicity, SES and Time in MVPA

	Minutes of MVPA (Mean ± SD) by Location				
	Home	**School**	**Commuting**	**Activity Locations**	**Total**
Urban (*n*=91)	20.8±25.1	**45.7±45.2**	**110.3±107.1**	**19.7±27.1**	**196.6±163.8**
Low SES (*n*=54)	17.7±19.9	39.2±42.9	93.7±107.7	20.0±26.3	170.4±165.1
High SES (*n*=37)	25.8±30.8	55.3±47.4	134.4±102.8	19.4±28.5	234.8±156.3
Suburban (*n*=102)	20.0±29.5	**18.6±28.0**	**31.5±55.2**	**14.8±26.8**	**84.9±103.2**
Low SES (*n*=79)	16.7±25.2	16.0±19.9	37.5±60.3	13.9±24.4	84.2±101.5
High SES (*n*=23)	31.0±39.5	27.6±45.8	10.9±20.0	17.7±34.3	87.2±110.9
Rural (*n*=123)	20.4±29.2	**29.8±39.7**	**19.5±39.7**	**12.0±22.1**	**81.7±98.2**
Low SES (*n*=73)	22.0±30.2	38.9±46.8	26.2±52.6	14.4±25.6	101.6±116.3
High SES (*n*=50)	18.0±27.9	16.5±20.1	9.8±18.2	8.4±15.2	52.7±51.9

Note: Boldface indicates significant difference in MVPA by urbanicity. Activity locations category includes >5 minutes spent at other locations than home or school and not commuting. Commuting=active transportation; low SES is defined as <$50,000 in household income. MVPA, moderate-to-vigorous physical activity

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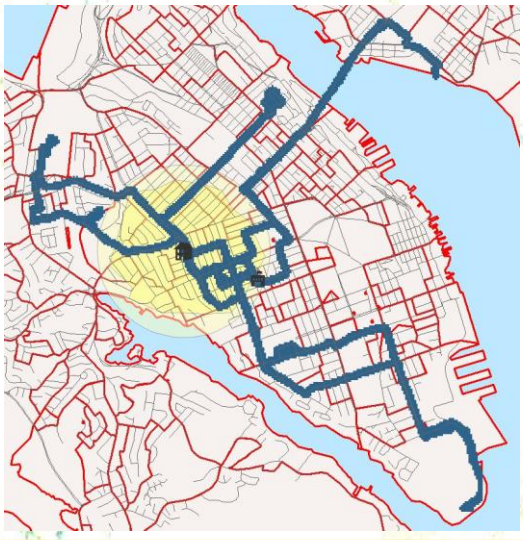
Be aware of limitations in linking places to people

Light yellow round circle = 1 km euclidean distance

Solid yellow shape = 1 km network distance

Blue lines = Actual range of child using GPS



Be aware of limitations in linking places to people

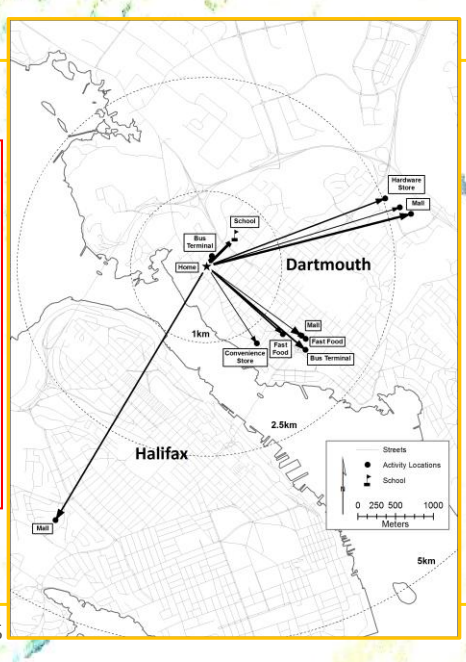
Approach	Food Type	Counts
1 Km Network Buffer	All food Fast food Grocery Convenience Restaurant	44 11 3 13 17
1Km Circular Buffer	All food Fast food Grocery Convenience Restaurant	75 15 6 23 31
GPS Buffer	All food Fast food Grocery Convenience Restaurant	128 33 18 49 28

Key Messages

Range of locations where MVPA occurs varies considerably with distance

Underestimate of actual (network) distances

Frequency of location visits represented by line thickness



Key Messages from ENACT

- Importance of understanding physical activity (PA) contexts cannot be understated
- Locations such as malls and retail land uses, green spaces, and residential land uses support PA among youth
- MVPA will occur at distances well beyond those typically considered
- Results consistent with research reporting higher levels of adult PA in urban areas
- Urbanicity and design are factors in duration of MVPA at different locations

MVPA = Moderate-to-vigorous physical activity

For more information:

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