Who benefits from walkability? Relationships between the built environment and neighborhood-based physical activity among subpopulations

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BACKGROUND

- Regular physical activity can reduce the risk of cardiovascular disease, hypertension, type II diabetes, hyperlipidemia, osteoporosis, depression, some cancers, and overweight and obesity.[1]
- Higher levels of neighborhood walkability is associated with higher levels of physical activity.[2]
- There is limited evidence regarding the social distribution of physical activity resulting from population health interventions, including those that focus on creating physical activity supportive built environments.[3]
- Few studies have investigated whether physical activity supportive built environments benefit most or all subpopulations defined by different socio-demographic characteristics (e.g., sex, age, socioeconomic status).[4, 5]

AIM

- To investigate the extent to which neighborhood walkability was associated with physical activity of adults with different socio-demographic and health-related characteristics.

METHOD

SAMPLE DESIGN

- **Target population:** urban-dwelling adults residing in Calgary, Alberta, Canada.[6]
- A random cross-sectional sample completed telephone-interviews between July-October, 2007 (n=2199; RR=33.6%) and January-April 2008 (n=2223; RR=36.7%), with n=2006 also completing a postal questionnaire.
- The telephone and postal surveys captured physical activity behaviour and attitudes, and socio-demographic and health-related characteristics.

SURVEY VARIABLES

- **Neighborhood-based physical activity:** usual weekly minutes of neighborhood-based walking, moderate-intensity, and vigorous-intensity physical activity weighted by their metabolic equivalents and totaled (MET.mins/wk).[7]
- **Socio-demographic characteristics**: sex, age, education (≤high school vs. college/university), number of children <18 years of age (none vs. ≥1 child), motor vehicle access (always vs. sometimes/never), annual household income (<$80,000 vs. ≥$80,000/year), and dog ownership (non-owner vs. owner).
- **Health-related characteristics:** self-rated health (poor/fair/good vs. very good/excellent), and body mass index (healthy weight [<25 km/m^2] vs. overweight [≥25 kg/m^2]).

OBJECTIVELY-DETERMINED WALKBILITY

- Geographical Information Systems derived built environment attributes underwent a two-staged cluster analysis which identified three neighborhood types: **high walkable (HW); medium walkable (MW); low walkable (LW)** (see Table 1).[6]

STATISTICAL ANALYSIS

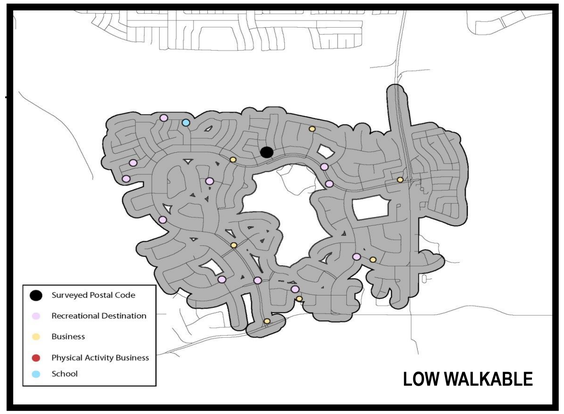
- Generalized Linear Models were used to estimate the differences in total neighborhood-based physical activity (MET.mins/wk) between the three neighborhood types within each socio-demographic and health-related strata.

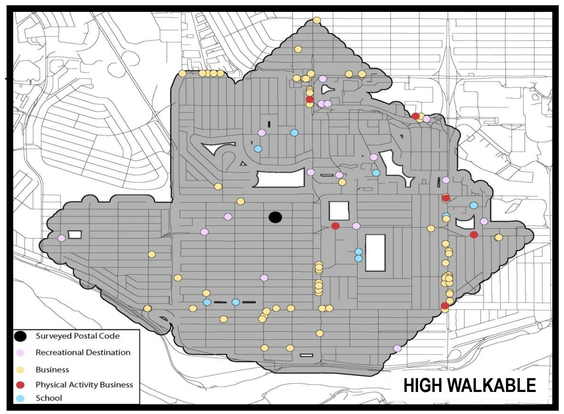
TABLE 1. ENVIRONMENTAL ATTRIBUTES BY NEIGHBORHOOD TYPE

	Neighborhood built environment profile					
	Low walkable N(neighborhoods) = 2064		Moderate walkable N(neighborhoods) = 1330		High walkable N(neighborhoods) = 263	
Environmental attribute	**Mean ± SD**	**CV**	**Mean ± SD**	**CV**	**Mean ± SD**	**CV**
Environmental attribute based on area within 1.6 km of respondents home						
Wallshed area (km^2)	2.15 ± 0.69	0.32	3.36 ± 0.85	0.25	3.70 ± 1.07	0.29
# of businesses/km^2	11.95 ± 11.49	0.96	32.65 ± 22.16	0.68	142.87 ± 119.12	0.83
# of bus stops/km^2	11.06 ± 4.38	0.40	14.30 ± 4.10	0.29	29.87 ± 33.42	1.12
Mix of park types/ km^2	0.57 ± 0.56	0.99	0.29 ± 0.31	1.09	0.34 ± 0.46	1.33
Mix of recreational destinations/km^2	0.24 ± 0.27	1.14	0.64 ± 0.41	0.64	0.48 ± 0.32	0.67
Sidewalk m/km^2	13958.02 ± 24440.46	0.17	19565.06 ± 2513.46	0.13	17255.24 ± 3691.15	0.21
Environmental attribute based on administrative boundary in which respondents home was located						
Total population/km^2	2826.07 ± 920.33	0.33	2680.18 ± 925.01	0.35	7451.57 ± 2364.48	0.32
% of green space area	19.00 ± 9.00	0.46	17.00 ± 11.00	0.66	15.00 ± 14.00	0.90
Paths/cycleway m/km^2	2742.63 ± 1167.85	0.43	1845.47 ± 10005.27	0.54	3507.57 ± 3185.74	0.91

SD: Standard deviation. CV: Coefficient of variation. Differences among neighborhood profiles all statistically significant ($p < 0.05$).

EXAMPLES OF LW AND HW NEIGHBORHOODS





RESULTS

- With the exception of those who were ≥61 years of age, overweight, and owned dogs, other subpopulations residing in high walkable neighborhoods participated in higher amounts of physical activity compared with those residing in low or medium walkable neighborhoods after adjusting for covariates (p<.05; Figures 1 and 2).

PHYSICAL ACTIVITY LEVELS IN HW VS. LW NEIGHBORHOODS AMONG SUBPOPULATIONS

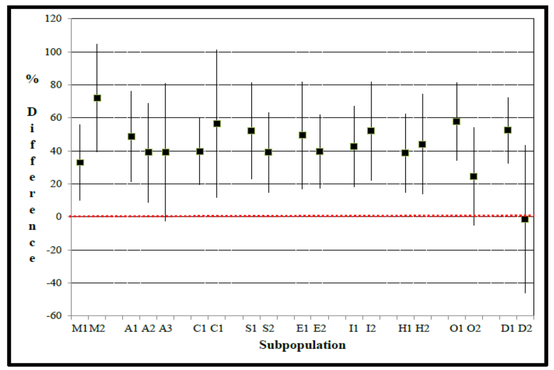


Figure 1. Percent difference in mean total physical activity (MET-mins/wk) between LW (reference line) vs. HW neighborhoods for each subpopulation (***M1:*** *motor vehicle access always;* ***M2:*** *motor vehicle access never/sometimes;* ***A1:*** *18-40 yrs;* ***A2:*** *41-60 yrs;* ***A3:*** *≥61 yrs of age;* ***C1:*** *No children at home;* ***C2:*** *≥1children at home;* ***S1:****male;* ***S2:*** *female;* ***E1:*** *high school or less;* ***E2:*** *college/university;* ***I1:*** *<80000/yr;* ***I2:*** *≥80000/yr;* ***H1:*** *Poor to good health;* ***H2:*** *very good to excellent health;* ***O1:*** *not overweight;* ***O2:*** *overweight;* ***D1:*** *not dog owner;* ***D2:*** *dog owner*). Whiskers represent 95% confidence intervals.

PHYSICAL ACTIVITY LEVELS IN HW VS. MW NEIGHBORHOODS AMONG SUBPOPULATIONS

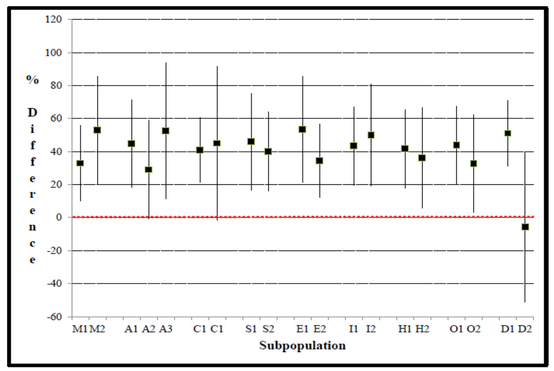


Figure 2. Percent difference in mean total physical activity (MET-mins/wk) between MW (reference line) vs. HW neighborhoods for each subpopulation (***M1:*** *motor vehicle access always;* ***M2:*** *motor vehicle access never/sometimes;* ***A1:*** *18-40 yrs;* ***A2:*** *41-60 yrs;* ***A3:*** *≥61 yrs of age;* ***C1:*** *No children at home;* ***C2:*** *≥1children at home;* ***S1:****male;* ***S2:*** *female;* ***E1:*** *high school or less;* ***E2:*** *college/university;* ***I1:*** *<80000/yr;* ***I2:*** *≥80000/yr;* ***H1:*** *Poor to good health;* ***H2:*** *very good to excellent health;* ***O1:*** *not overweight;* ***O2:*** *overweight;* ***D1:*** *not dog owner;* ***D2:*** *dog owner*). Whiskers represent 95% confidence intervals.

CONCLUSIONS

- Creating neighborhoods with highly connected pedestrian networks, a large mix of businesses, high population densities, high access to sidewalks/pathways, and many bus stops within walking distance of home may support and encourage higher levels of physical activity among adults.
- Most subpopulations appear to have higher physical activity levels if they reside in highly walkable versus less walkable neighborhoods.
- Therefore, creating highly walkable neighborhoods is a potentially beneficial population health intervention as it does not appear to contribute to physical activity inequalities among subpopulations.
- Further research is needed to investigate the influence of neighborhood walkability on other subpopulations (based on disability status, ethnicity etc.).

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