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Does Climate Modify the Relationship Between Neighbourhood Walkability and Physical Activity?

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Occupational and Environmental Health Seminar

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Conflict of Interest Statement

- I don’t have any conflicts of interest
- I have no financial, professional, or personal interests that may influence the statements in this presentation

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Outline

1. Built environment and walkability
2. Climate
3. Climate's effect on walkability and physical activity
4. Public health implications and next steps

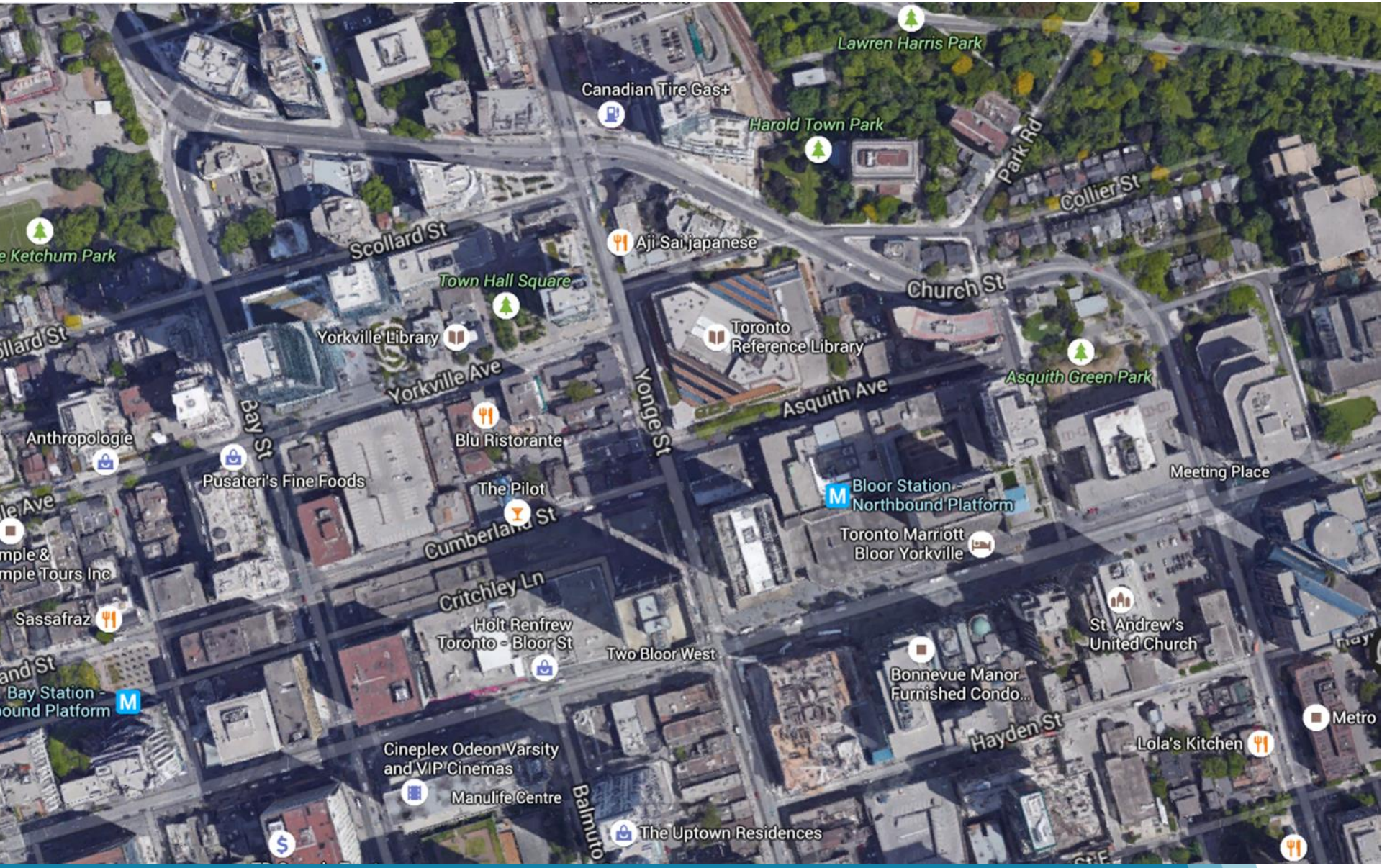
Why Physical Activity?

- The World Health Organization states that insufficient physical activity is the primary cause for approximately:
  - 30% of ischemic heart disease
  - 27% of diabetes
  - 21-25% of breast and colon cancers
- Physical activity guidelines recommend adults do at least 150 minutes of moderate-intensity physical activity per week
  - Most people do not meet these guidelines, increasing their risk of chronic disease

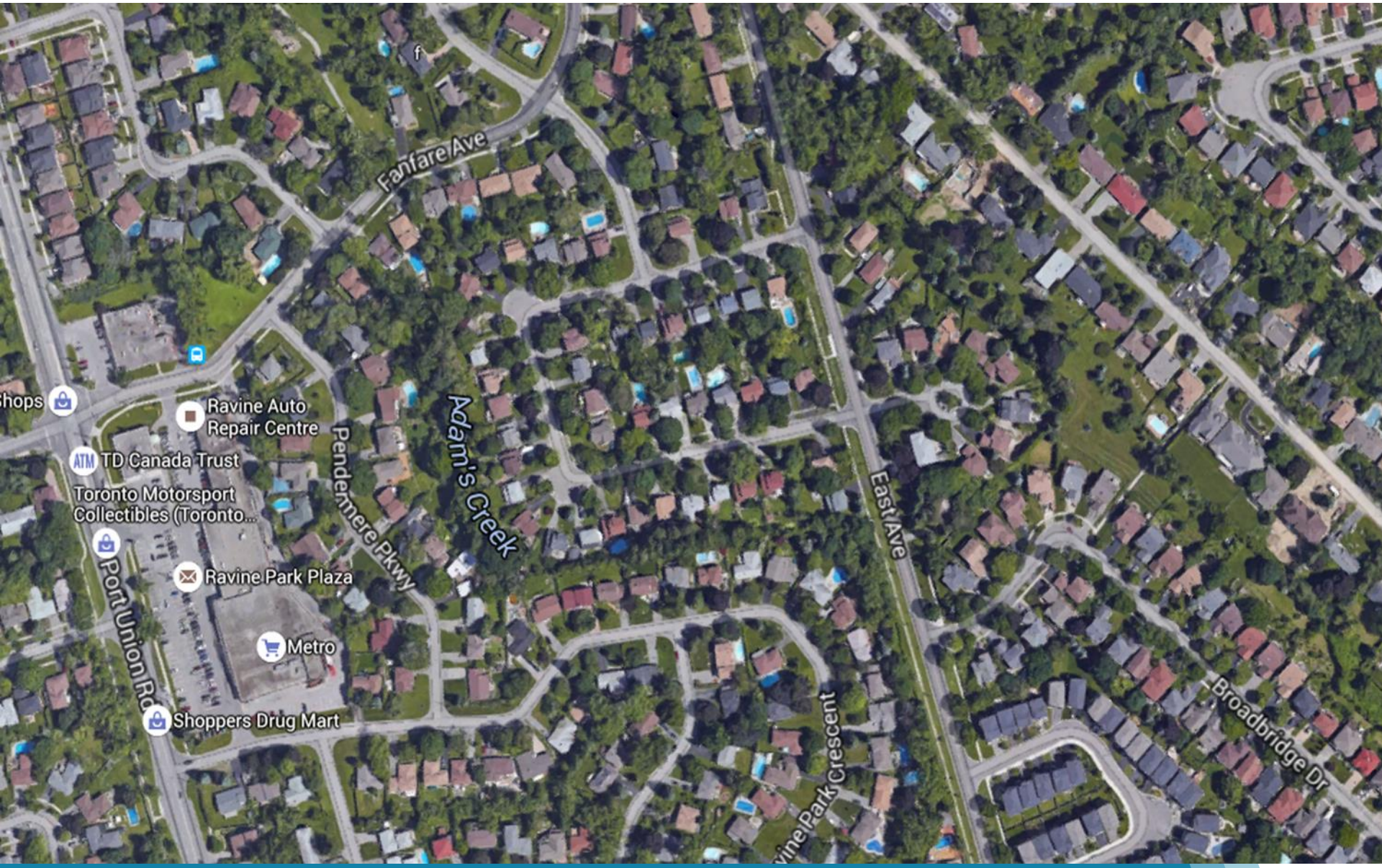
Built environment and walkability

- **Built environment**: physical components of the environment that have been created or modified by humans
  - E.g., buildings, streets, parks
- **Walkability**: the degree to which a neighbourhood encourages walking
  - High walkability: variety of shops, services, employment, education, parks/rec. nearby, well-connected streets

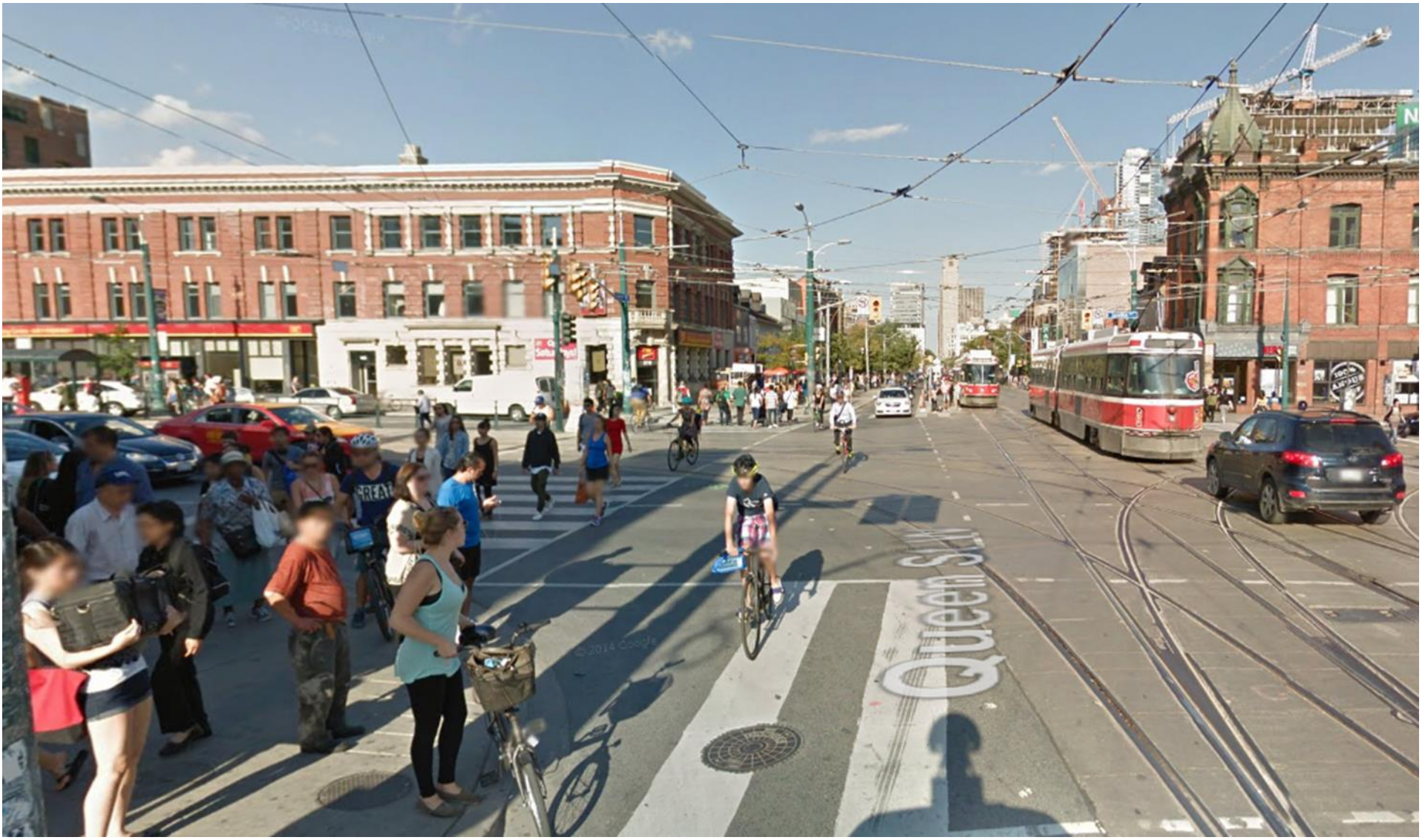
Built Environment and Walkability



Built Environment and Walkability



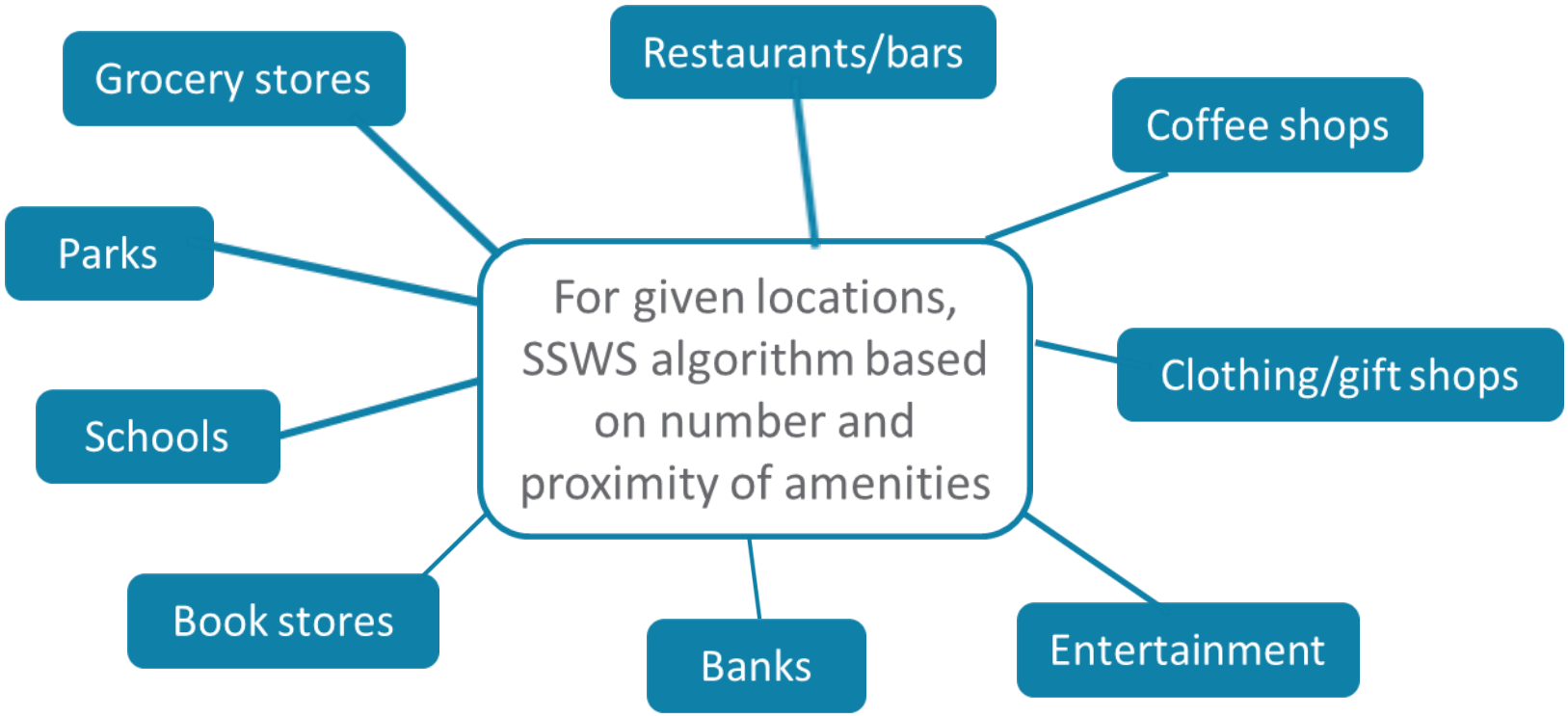
Built Environment and Walkability



Built Environment and Walkability

- Public health focus on built environment
  - Chief Public Health Officer's Report on the State of Public Health in Canada 2017 – Designing Healthy Living
  - Improving Health by Design in the Greater Toronto-Hamilton Area by the GTHA Medical Officers of Health
  - CDC's Healthy Community Design Initiative
- Communities are increasingly considering walkability when planning urban development, citing potential health benefits

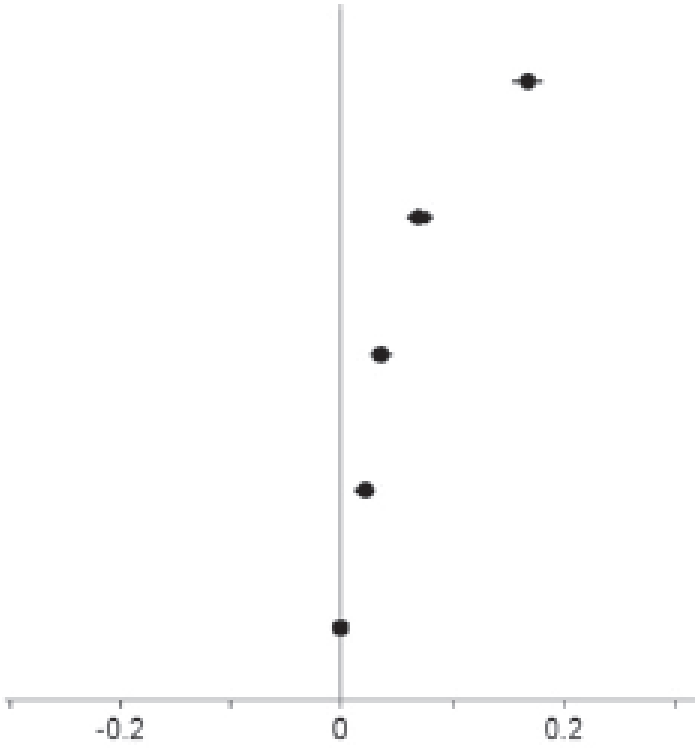
Walkability Data: Street Smart Walk Score® (www.walkscore.com)



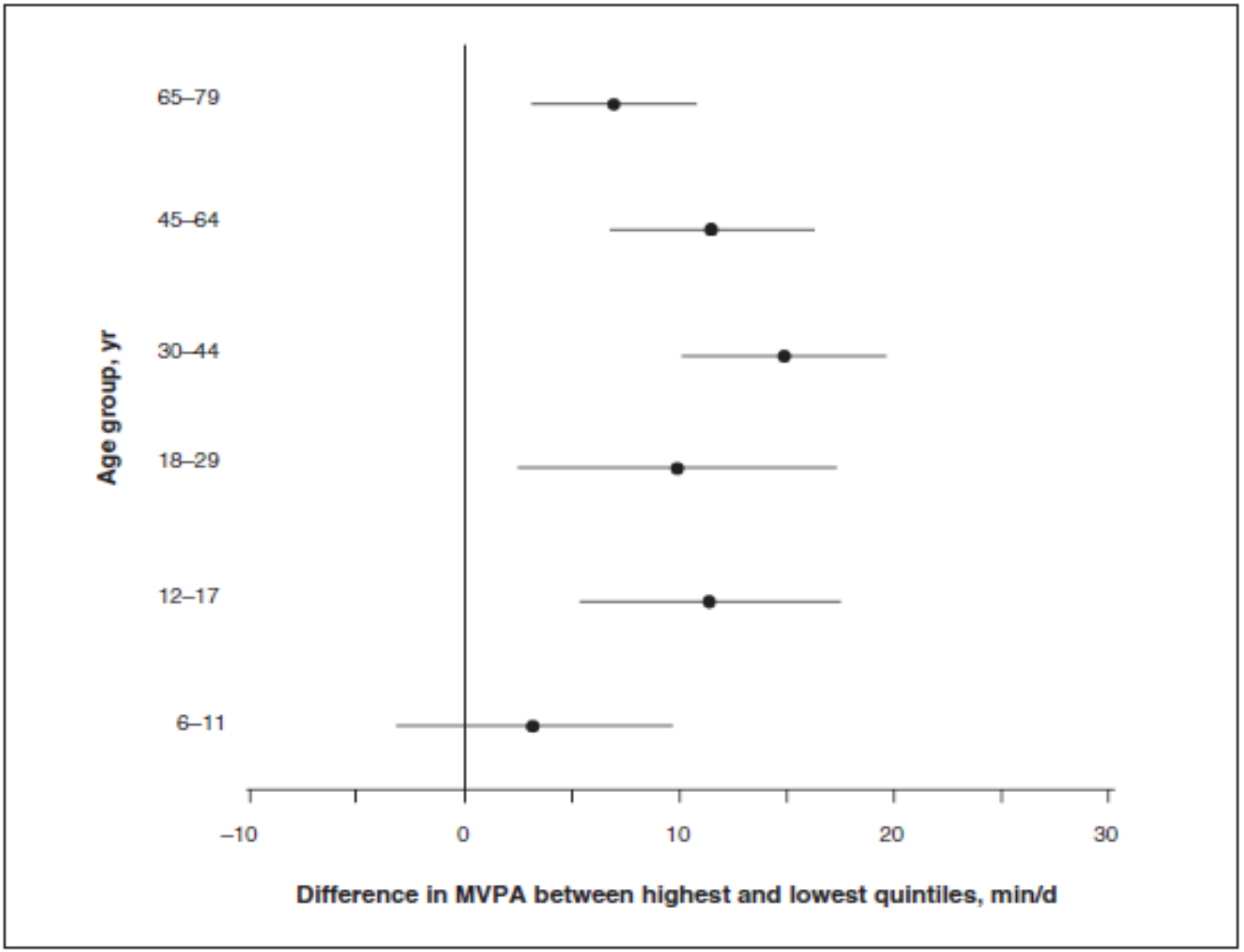
Penalties for lower intersection densities and longer block lengths

Built Environment and Walkability

Quin-tile	People in each quintile	Mean (SD) energy expend.	Unadjusted difference from Q1 [95% CI]	Adjusted[a] difference from Q1 [95% CI]	Adjusted[a] difference from Q1 in average energy expenditure, with 95% CIs (kcal/kg/day)
a) Transport Walking					
Q5	26,009	0.26 (0.56)	**0.18 [0.17, 0.19]**	**0.17 [0.15, 0.18]**	
Q4	29,157	0.16 (0.41)	**0.08 [0.07, 0.09]**	**0.07 [0.06, 0.08]**	
Q3	30,141	0.13 (0.35)	**0.04 [0.03, 0.05]**	**0.04 [0.03, 0.05]**	
Q2	31,370	0.11 (0.32)	**0.03 [0.02, 0.04]**	**0.02 [0.01, 0.03]**	
Q1	34,641	0.08 (0.27)	REF	REF	



From: Thielman J, Rosella L, Copes R, Lebenbaum M, Manson H. Neighborhood walkability: differential associations with self-reported transport walking and leisure-time physical activity in Canadian towns and cities of all sizes. *Prev Med* 2015;77:174–80.

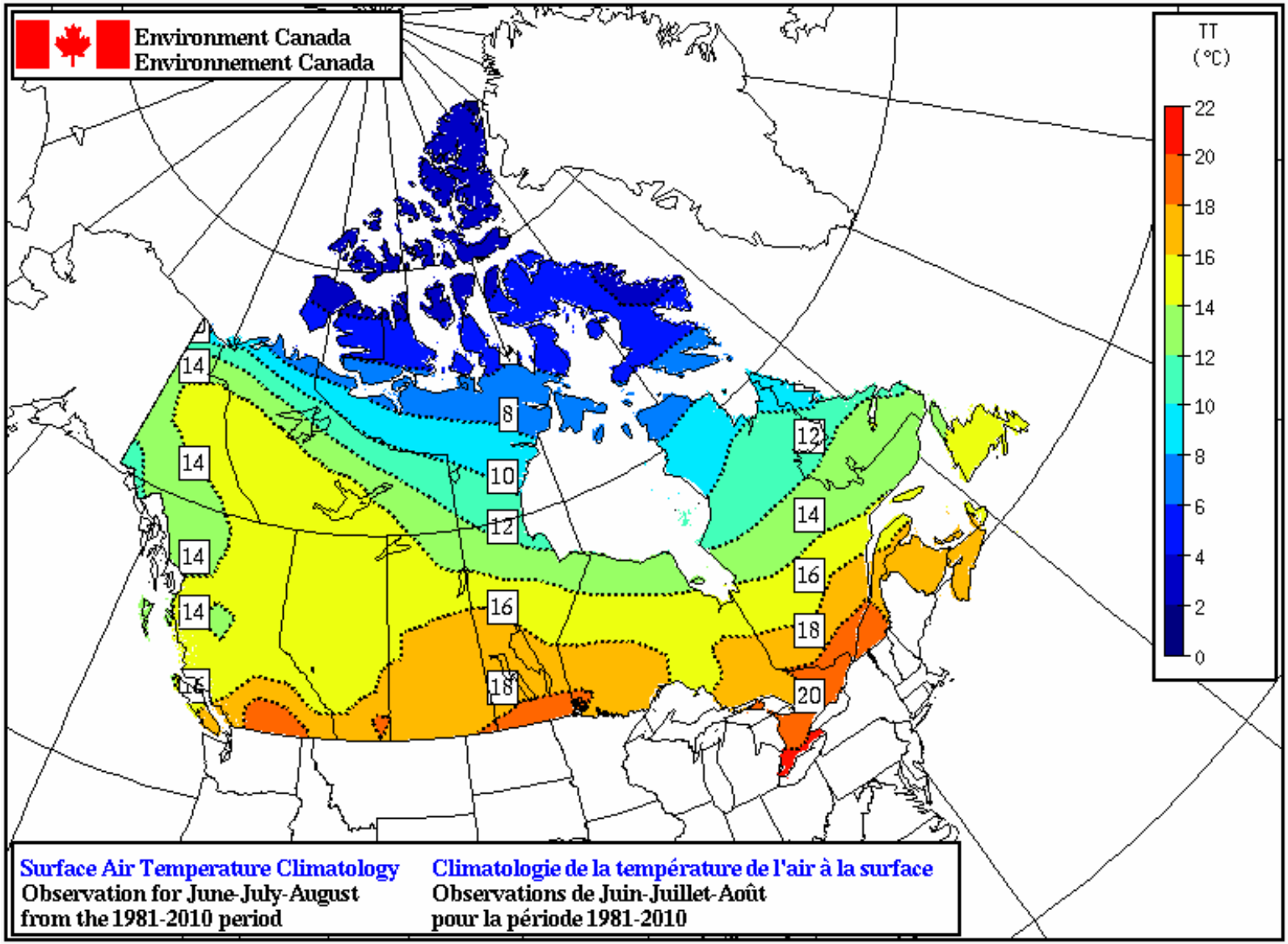


From: Thielman J, Manson H, Chiu M, Copes R, Rosella L. Residents of highly walkable neighbourhoods in Canadian urban areas do substantially more physical activity: a cross-sectional analysis. *CMAJ Open* 2016;4:E720–E728

Climate

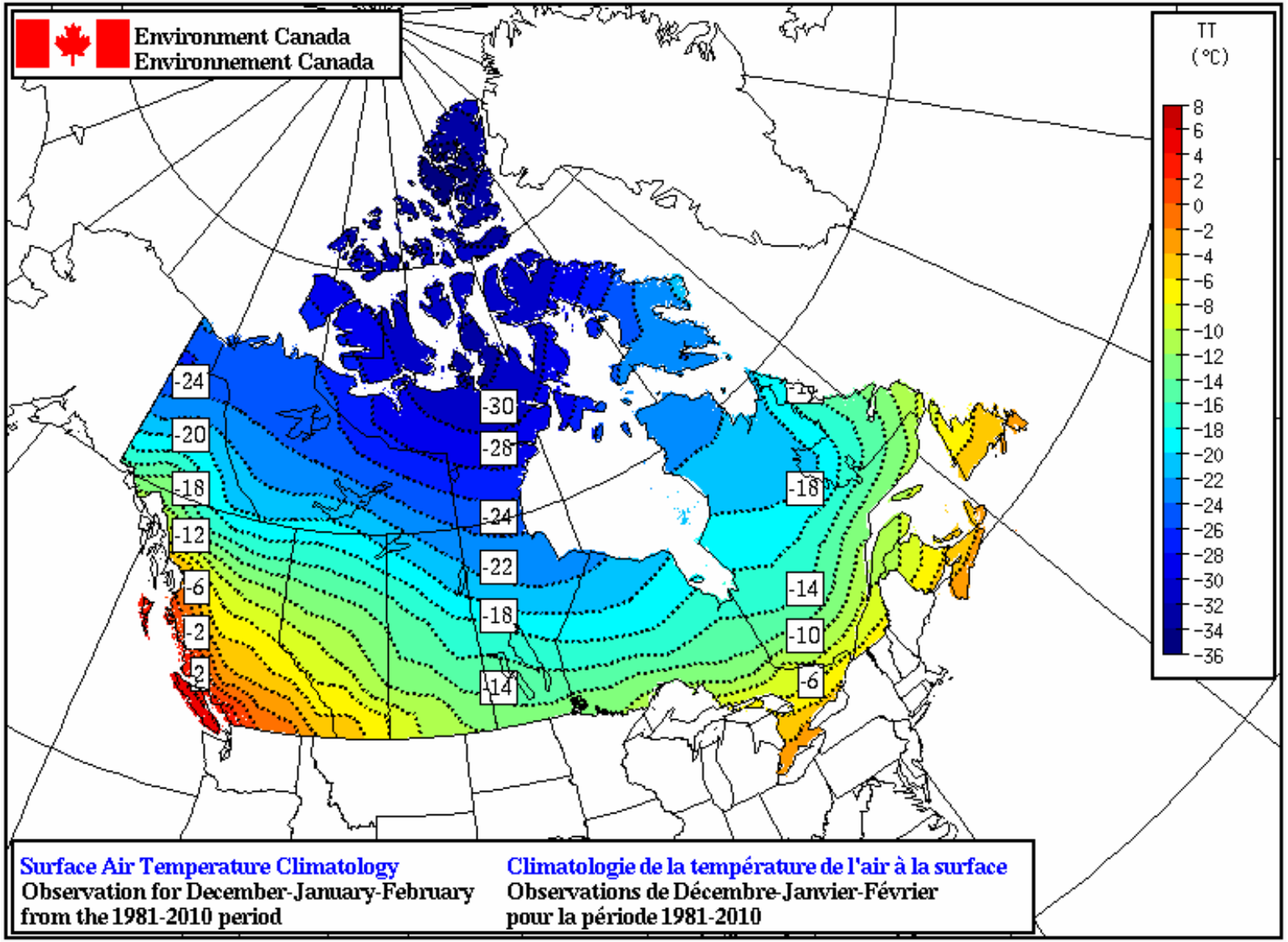
- Weather: day-to-day fluctuations in temperature, precipitation, etc.
- Climate: long-term averages of temperature, precipitation, etc.
- Does climate modify the relationship between neighbourhood walkability and physical activity?
- Compare regions with different climates

Temperature Climatology - Map - Average - Jun-Jul-Aug (Summer)



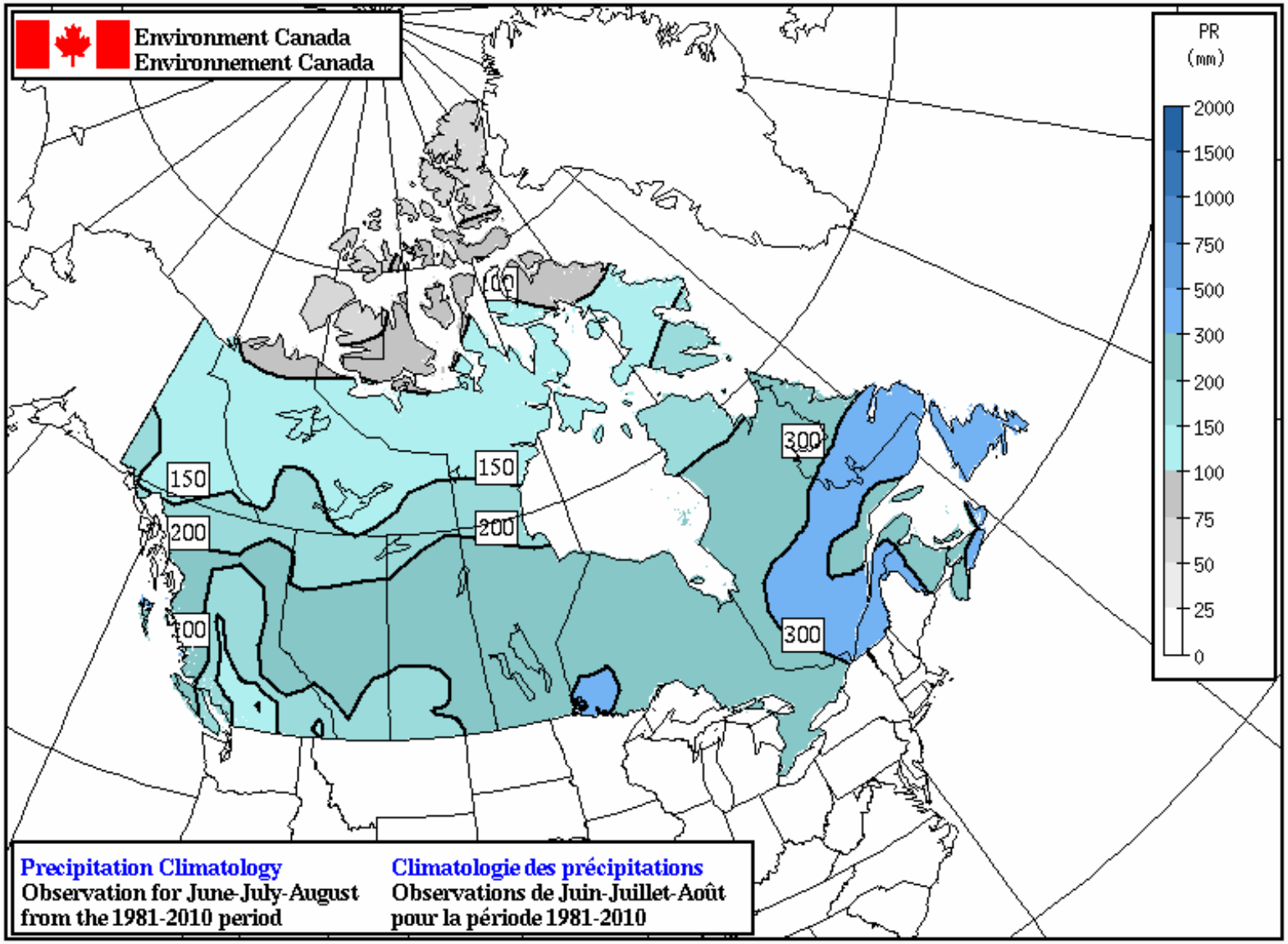
From: https://weather.gc.ca/saisons/clim_e.html

Temperature Climatology - Map - Average - Dec-Jan-Feb (Winter)



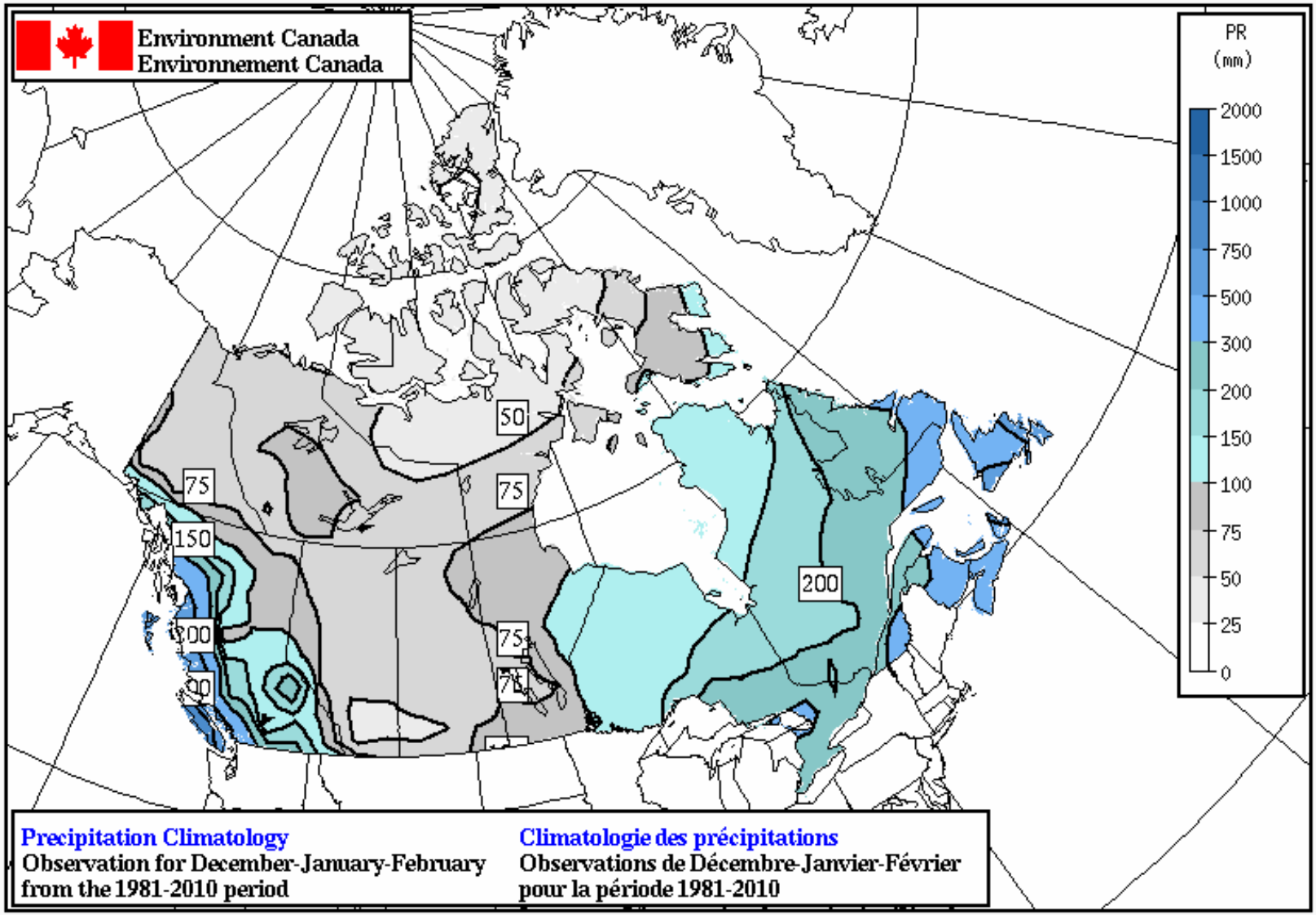
From: https://weather.gc.ca/saisons/clim_e.html

Precipitation Climatology - Map - Average - Jun-Jul-Aug (Summer)



From: https://weather.gc.ca/saisons/clim_e.html

Precipitation Climatology - Map - Average - Dec-Jan-Feb (Winter)



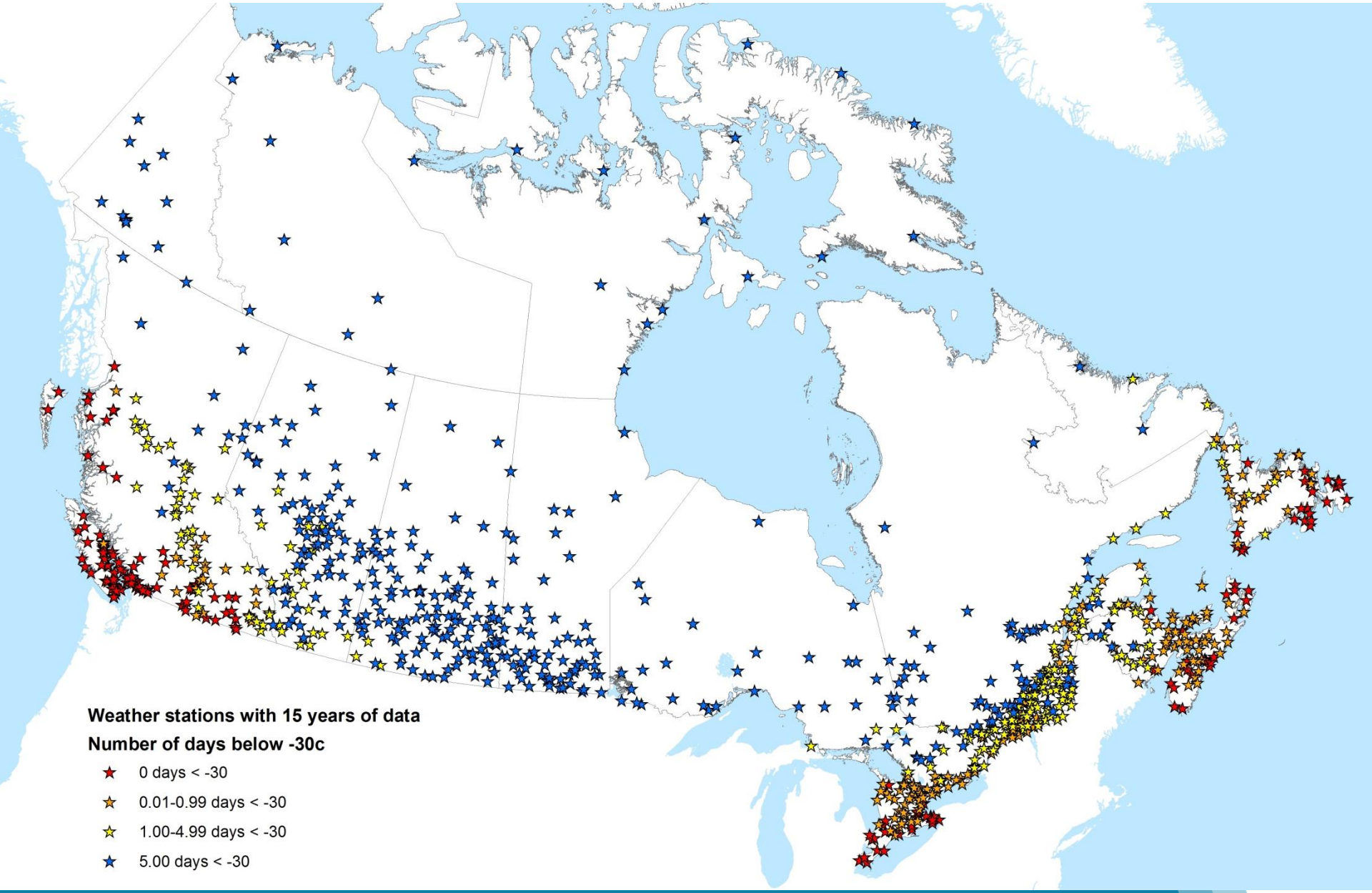
From: https://weather.gc.ca/saisons/clim_e.html

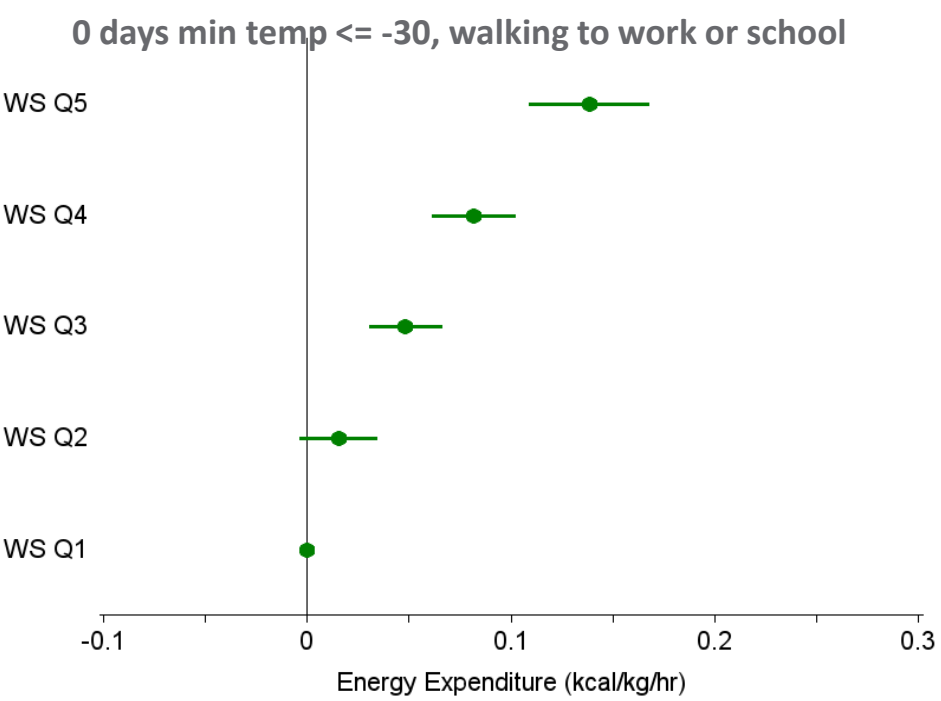
Climate's Effect on Walkability and Physical Activity

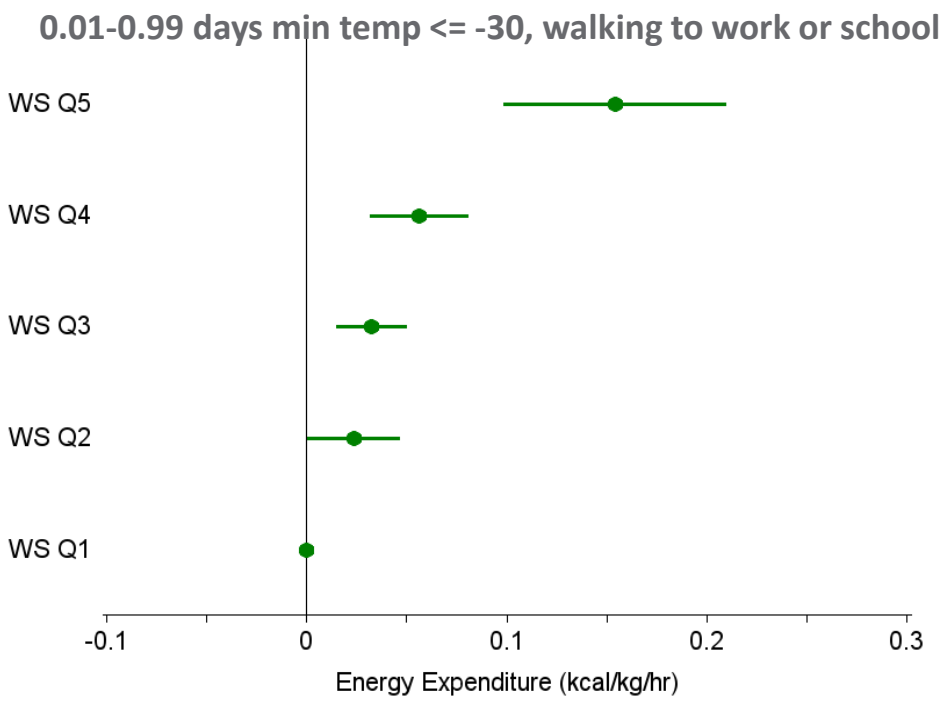
- Research objectives:
  - Examine relationships between various climate variables, such as temperature and precipitation averages, and physical activity
  - Examine whether the relationship between walkability and physical activity differs according to climate
    - Do climate and walkability interact?
  - Results will inform efforts to increase walkability with the goal of improving physical activity levels

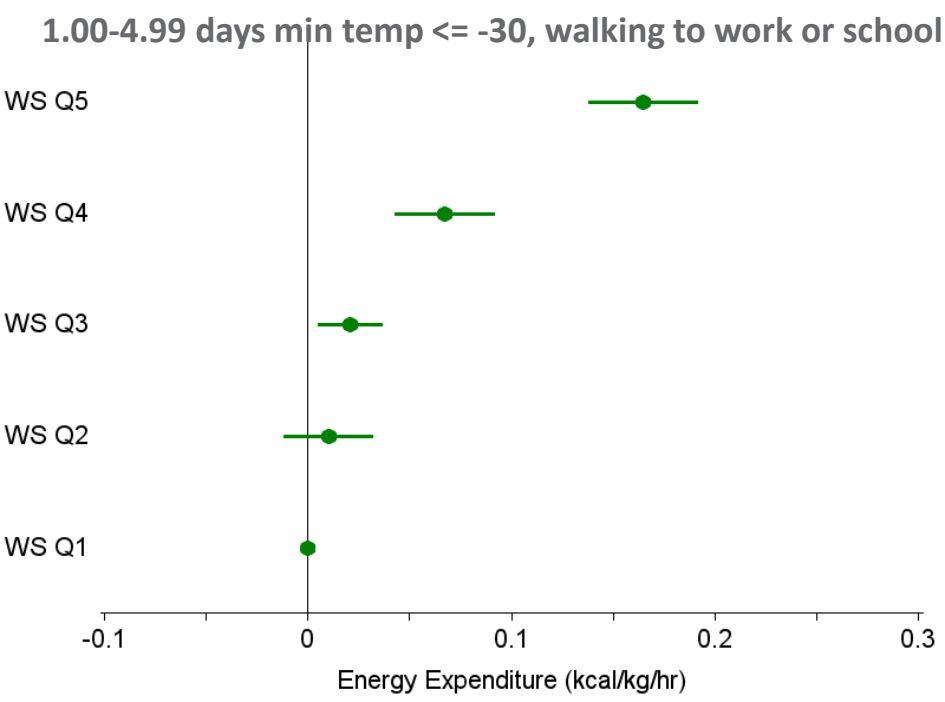
Climate's Effect on Walkability and Physical Activity

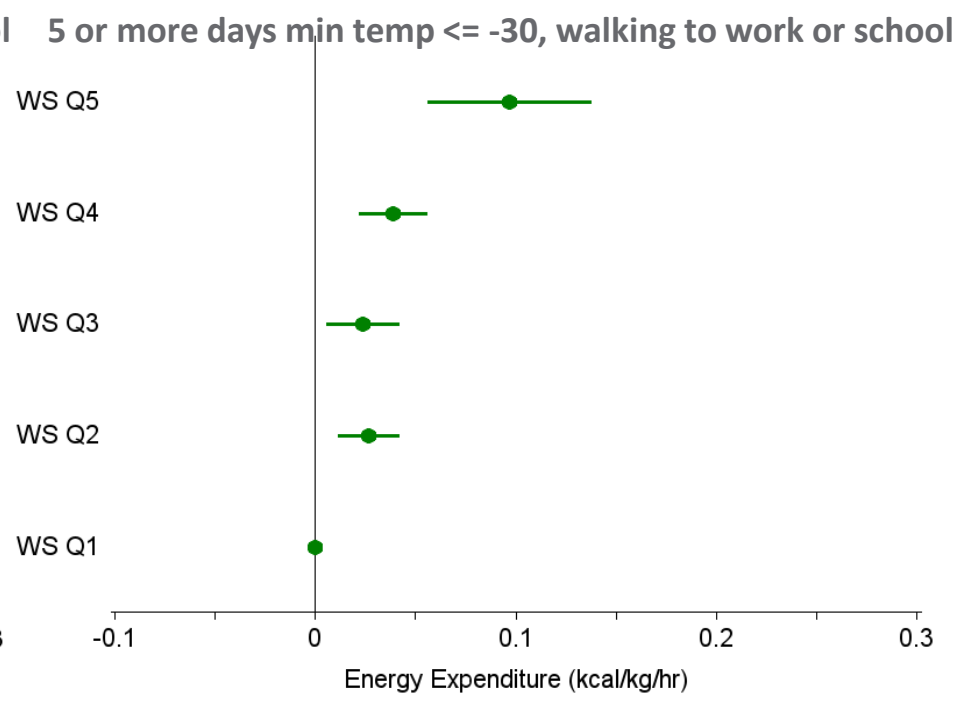
Average Maximum Temperature in Hottest Month
Average Minimum Temperature in Coldest Month
Hottest & Coldest Month Average Temp. Difference
Average Total Precipitation in Driest Month
Average Total Precipitation in Wettest Month
Average # of Days per Year Precipitation >= 0.2mm
Average # of Days per Year Precipitation >= 5mm
Average # of Days per Year Precipitation >= 10mm
Average # of Days per Year Precipitation >= 25mm
Average Number of Days per Year Rainfall >= 0.2mm
Average Number of Days per Year Rainfall >= 5mm
Average Number of Days per Year Rainfall >= 10mm
Average Number of Days per Year Rainfall >= 25mm
Average Number of Days per Year Snowfall >= 0.2cm
Average Number of Days per Year Snowfall >= 5cm
Average Number of Days per Year Snowfall >= 10cm
Average Number of Days per Year Snowfall >= 25cm
Average # of Days per Year Snow Depth >= 1cm
Average # of Days per Year Snow Depth >= 5cm
Average # of Days per Year Snow Depth >= 10cm
Average # of Days per Year Snow Depth >= 20cm
Average Number of Days per Year Max Temp <= 0
Average Number of Days per Year Max Temp > 0
Average Number of Days per Year Max Temp > 10
Average Number of Days per Year Max Temp > 20
Average Number of Days per Year Max Temp > 30
Average Number of Days per Year Max Temp > 35
Average Number of Days per Year Min Temp > 0
Average Number of Days per Year Min Temp <= 2
Average Number of Days per Year Min Temp <= 0
Average Number of Days per Year Min Temp < -2
Average Number of Days per Year Min Temp < -10
Average Number of Days per Year Min Temp < -20
Average Number of Days per Year Min Temp < -30
Average Number of Days per Year Humidex > 30
Average Number of Days per Year Humidex > 35
Average Number of Days per Year Humidex > 40
Average Number of Days per Year Wind Chill < -20
Average Number of Days per Year Wind Chill < -30
Average Number of Days per Year Wind Chill < -40
Average Number of Degree Days per Year > 24
Average Number of Degree Days per Year > 18
Average Number of Degree Days per Year > 15
Average Number of Degree Days per Year > 10
Average Number of Degree Days per Year > 5
Average Number of Degree Days per Year > 0
Average Number of Degree Days per Year < 0
Average Number of Degree Days per Year < 5
Average Number of Degree Days per Year < 10
Average Number of Degree Days per Year < 15
Average Number of Degree Days per Year < 18


Weather stations with 15 years of data
Number of days below -30c
0 days < -30
0.01-0.99 days < -30
1.00-4.99 days < -30
5.00 days < -30

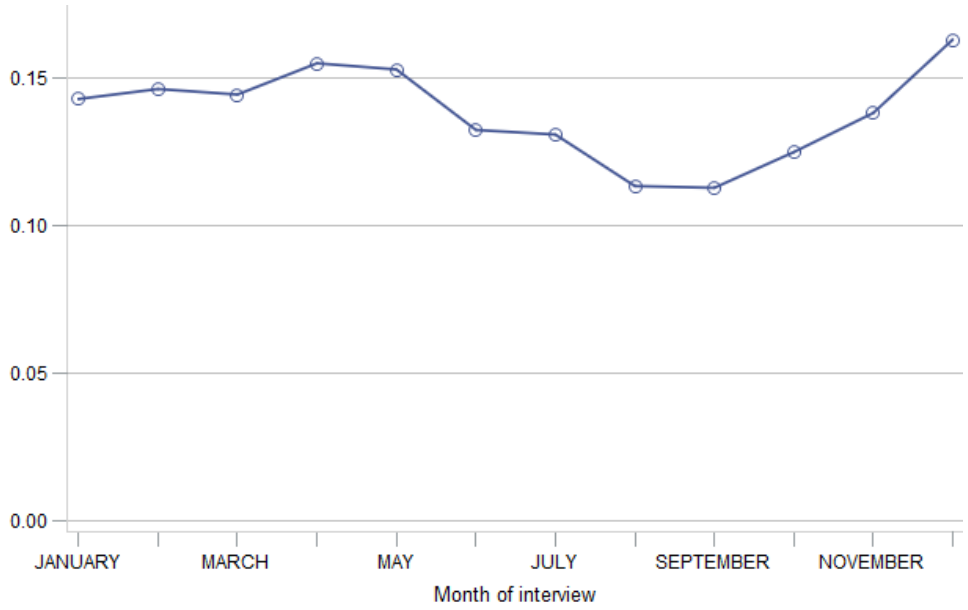

0 days min temp <= -30, walking to work or school
WS Q5
WS Q4
WS Q3
WS Q2
WS Q1
-0.1
0
0.1
0.2
0.3
Energy Expenditure (kcal/kg/hr)


0.01-0.99 days min temp <= -30, walking to work or school
WS Q5
WS Q4
WS Q3
WS Q2
WS Q1
-0.1
0
0.1
0.2
0.3
Energy Expenditure (kcal/kg/hr)

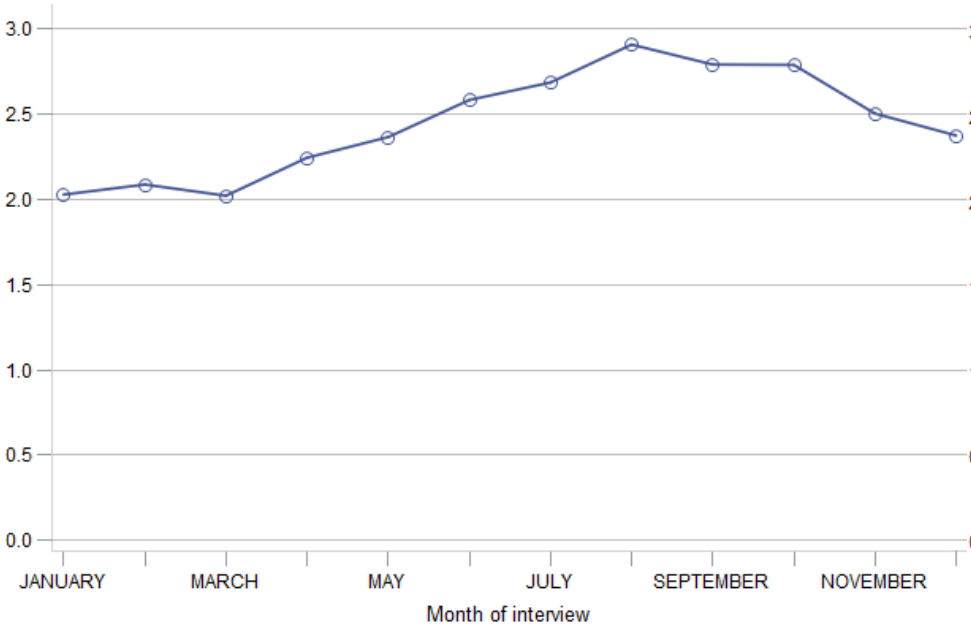

1.00-4.99 days min temp <= -30, walking to work or school
WS Q5
WS Q4
WS Q3
WS Q2
WS Q1
-0.1
0
0.1
0.2
0.3
Energy Expenditure (kcal/kg/hr)


5 or more days min temp <= -30, walking to work or school
WS Q5
WS Q4
WS Q3
WS Q2
WS Q1
-0.1
0
0.1
0.2
0.3
Energy Expenditure (kcal/kg/hr)

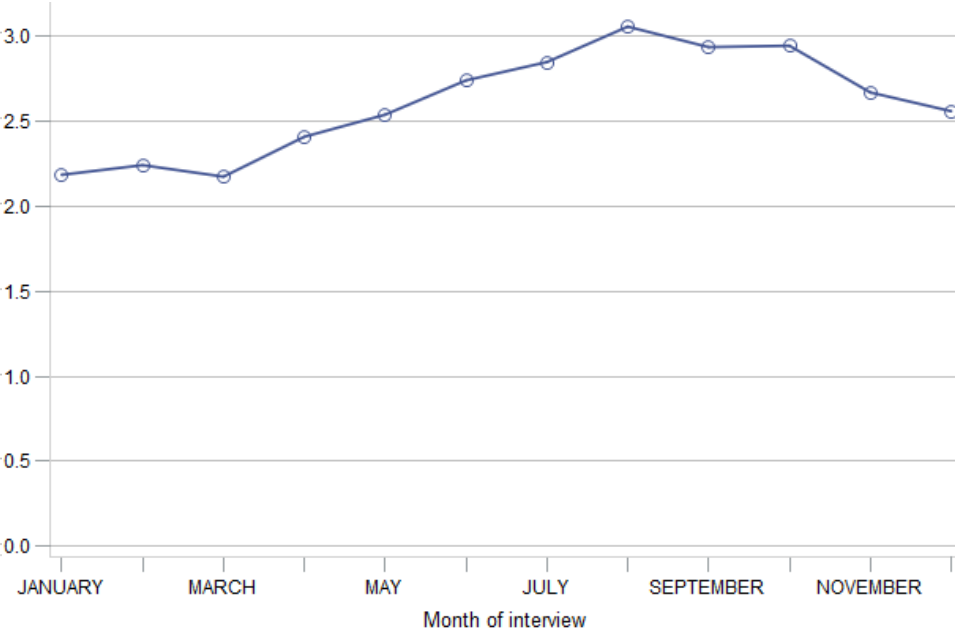
Average energy expenditure on walking to work or school



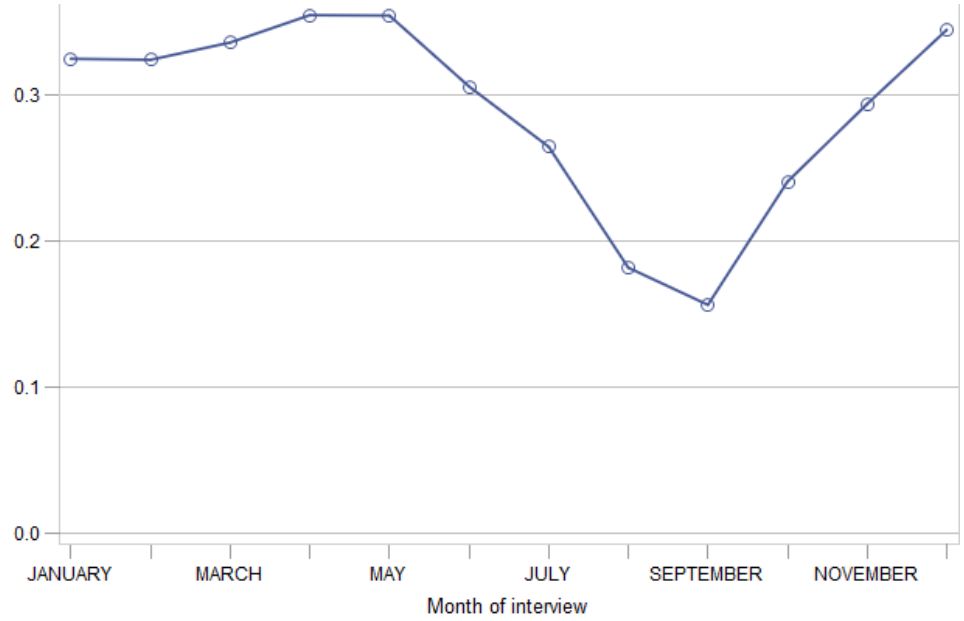
Average energy expenditure on leisure physical activity



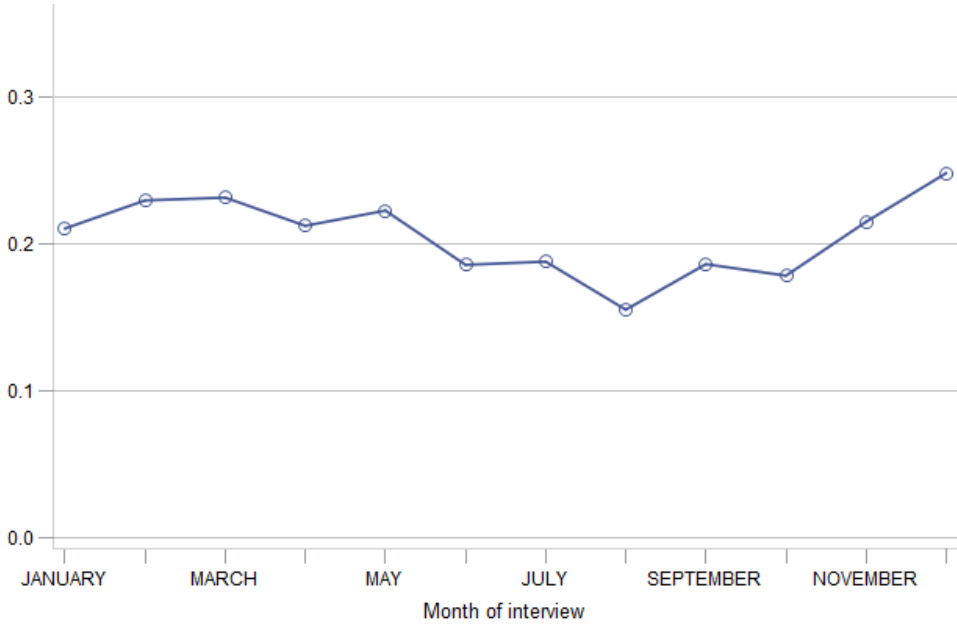
Average energy expenditure on total physical activity



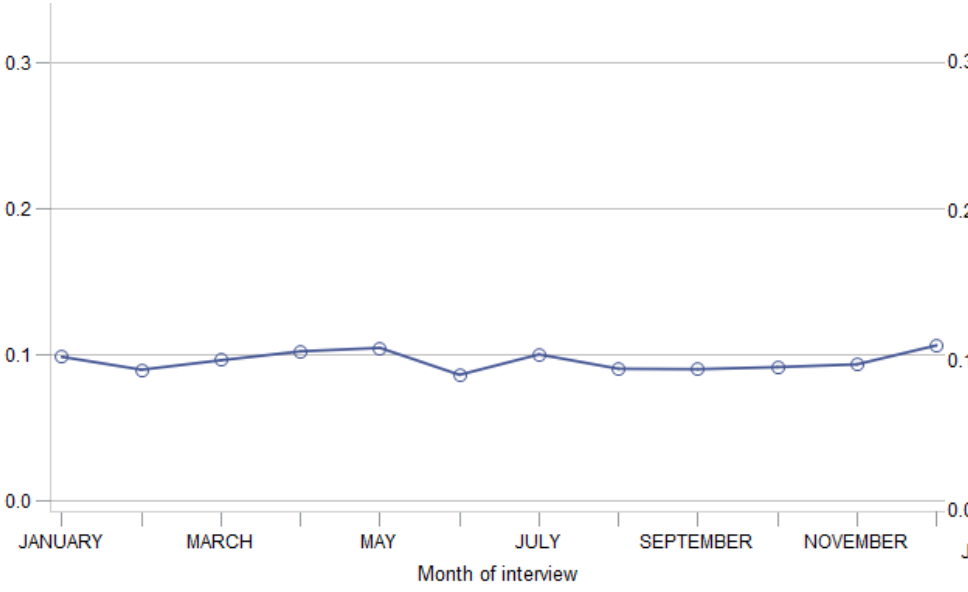
Age 12-17, walking to work or school



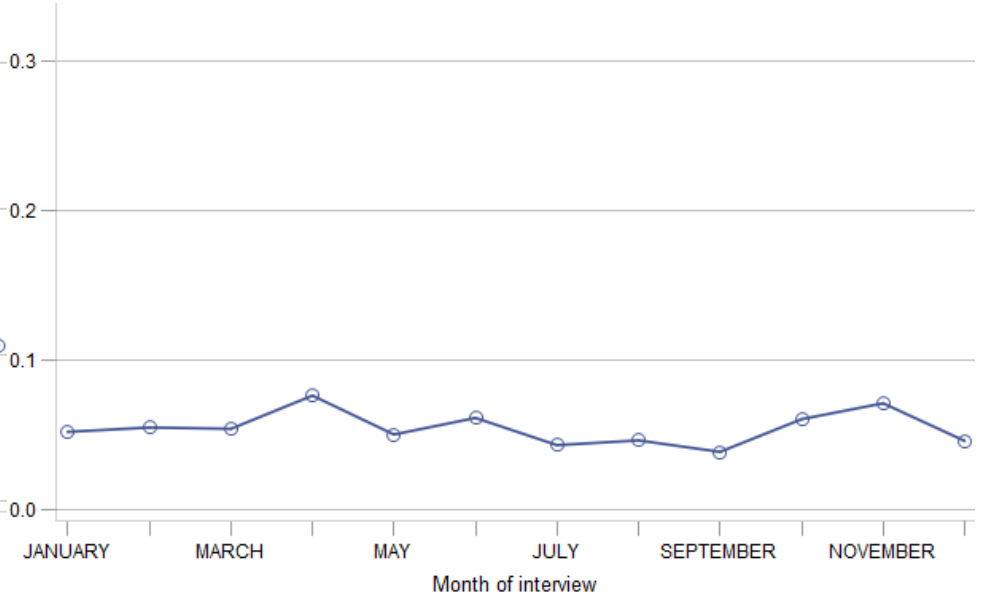
Age 18-29, walking to work or school



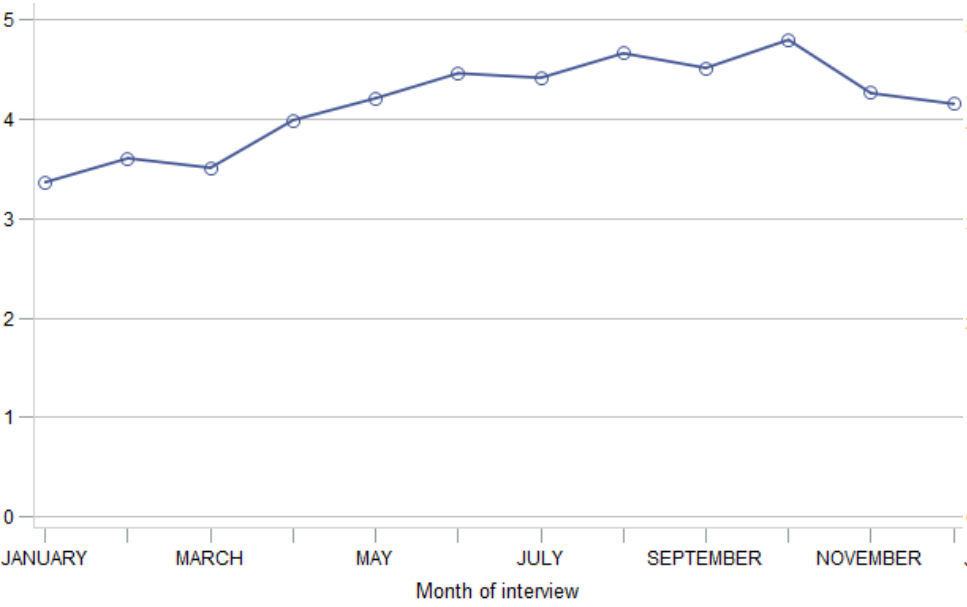
Age 30-64, walking to work or school



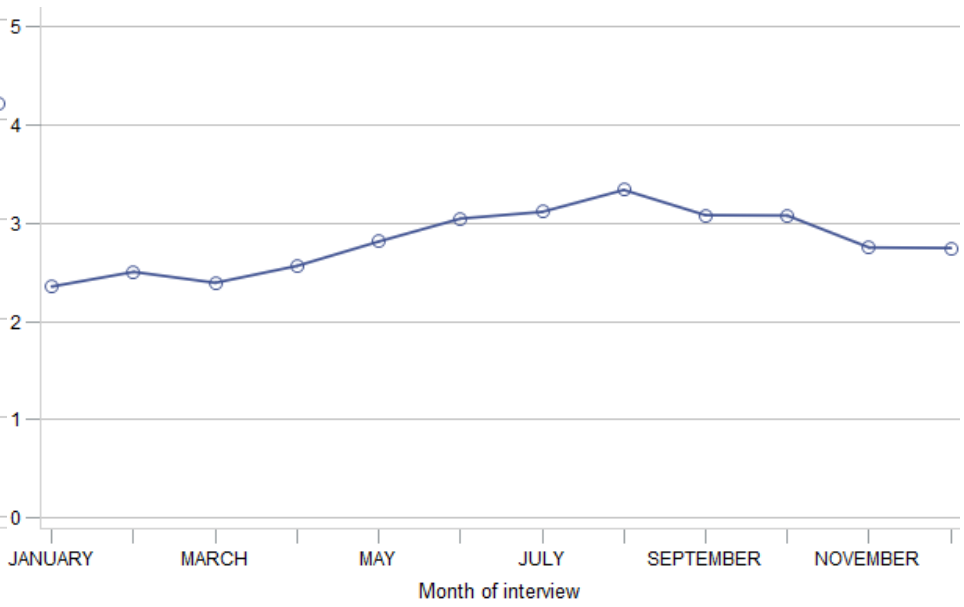
Age 65 and up, walking to work or school



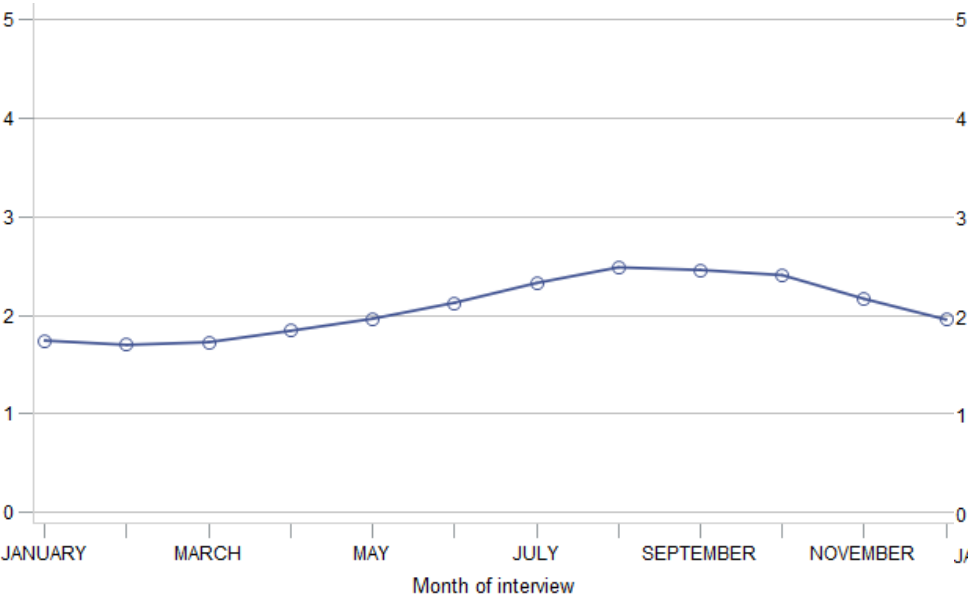
Age 12-17, leisure physical activity



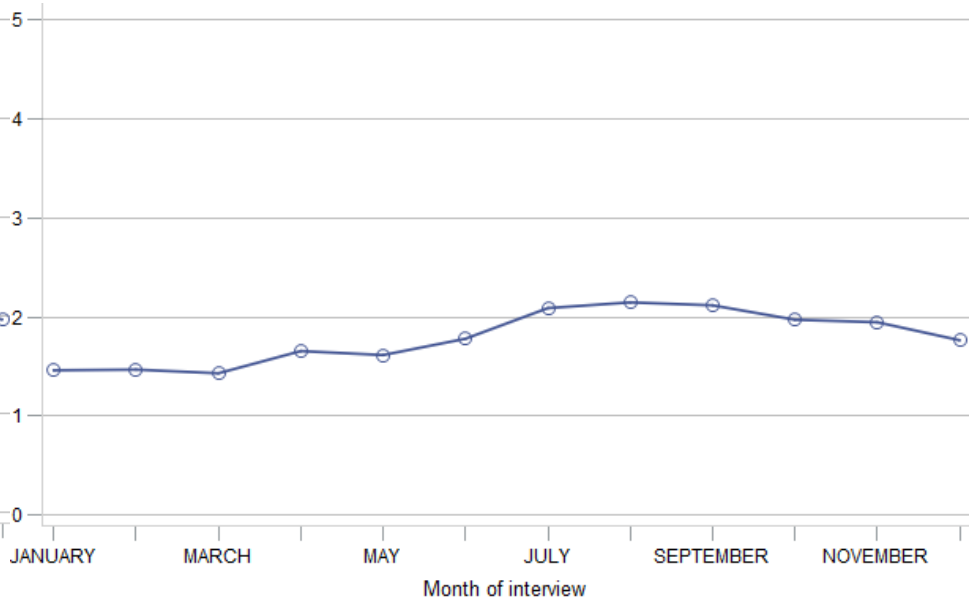
Age 18-29, leisure physical activity



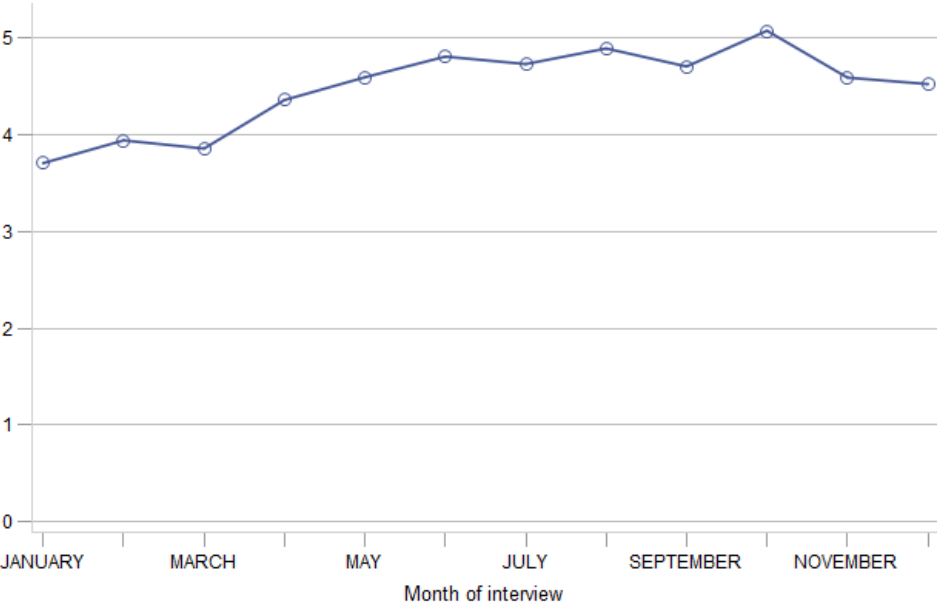
Age 30-64, leisure physical activity



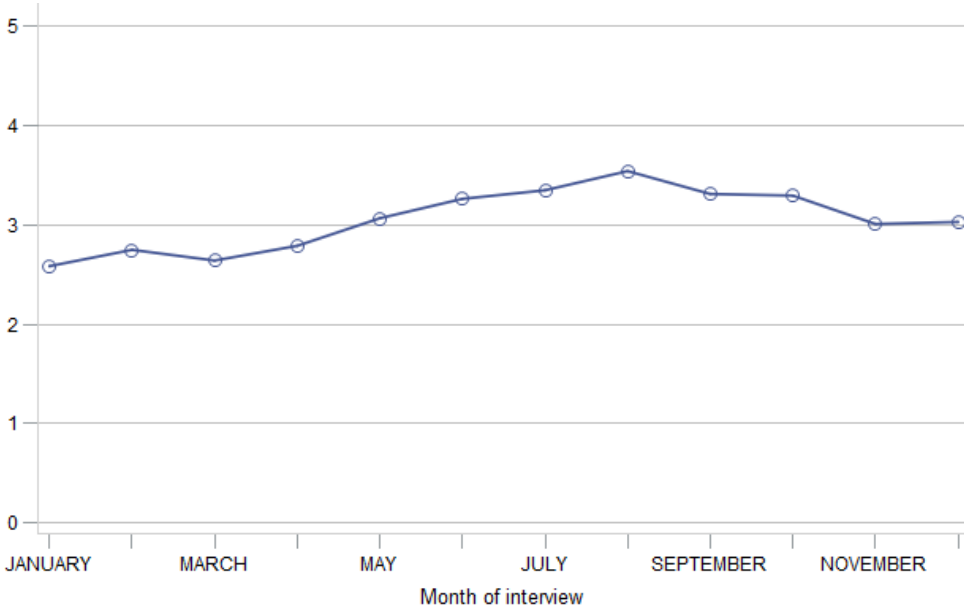
Age 65 and up, leisure physical activity



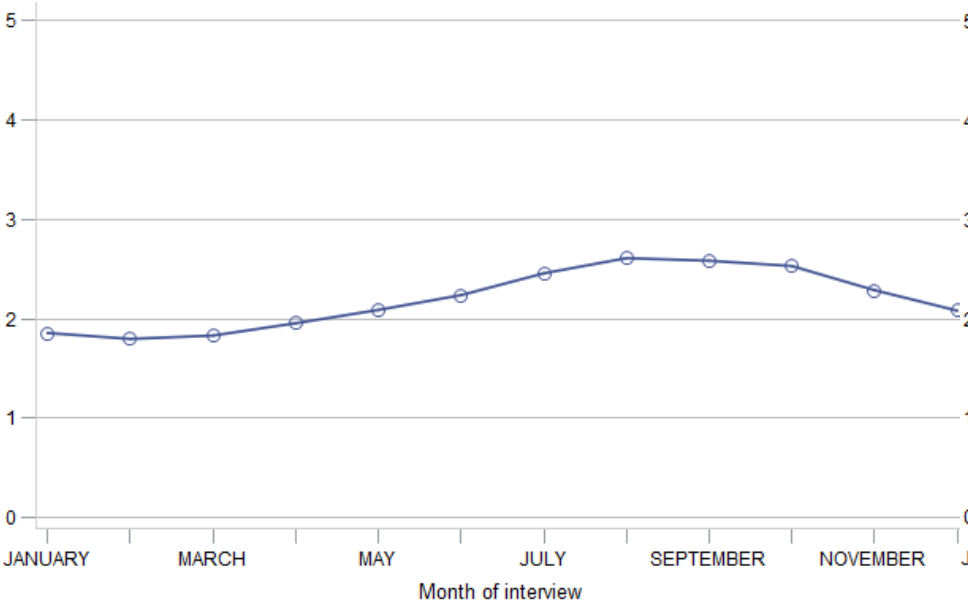
Age 12-17, total physical activity



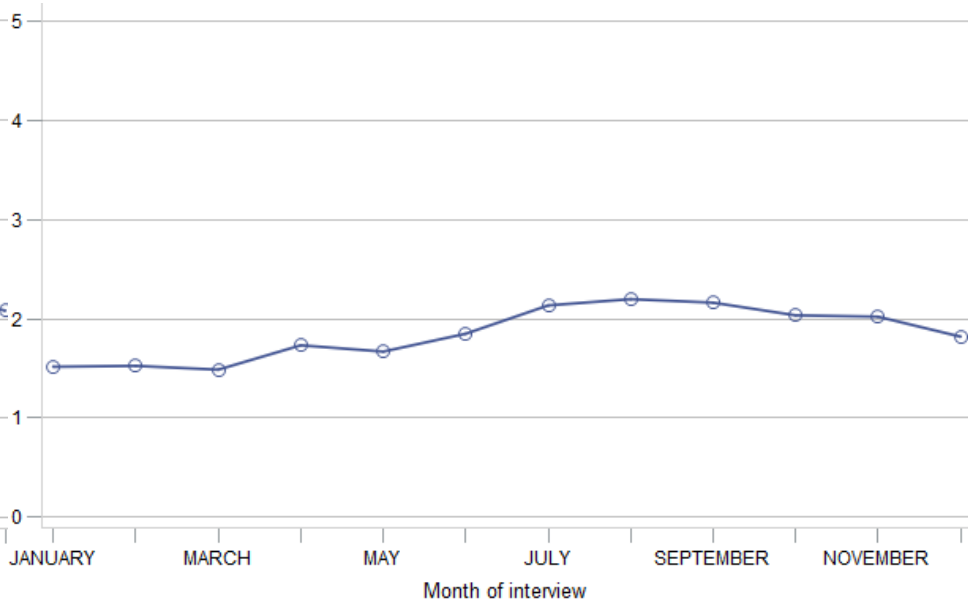
Age 18-29, total physical activity



Age 30-64, total physical activity



Age 65 and up, total physical activity



Public Health Implications and Next Steps

- Policy and program implications:
  - Findings should spur additional research to test hypotheses
  - Efforts to improve physical activity may need to be adapted according to a region's climate
  - One-size-fits-all approach to the built environment/walkability does not work in all locations

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