Assessment of an internet-administered neighbourhood-specific physical activity questionnaire

Levi Frehlich [a], Anita Blackstaffe [a], Gavin McCormack [ab]

University of Calgary: [a] Faculty of Medicine - Department of Community Health Sciences, [b] Faculty of Environmental Design

Background and Purpose: Tools for measuring neighbourhood-specific physical activity are scarce. Importantly, given that 83% of developed countries have access to the internet, there is a need for more reliable and valid internet-administered tools for capturing physical activity, and context or neighbourhood-specific physical activity.

Objectives: The aim of this study was to assess internet-administered test-retest reliability and construct validity, of a questionnaire developed to measure neighbourhood-specific physical activity undertaken in the last week (N-IPAQ).

Methods: n=281 adults completed the online N-IPAQ on two occasions, at least 7-days apart. The N-IPAQ captured self-reported frequency and minutes of neighbourhood based physical activity during the last 7-days of: walking and bicycling for transportation, walking for leisure, and moderate and vigorous-intensity physical activity. Participant's were tertiled (low-, medium-, high-walkable) by their Walk Score® based on postal code. Walk Score® is based on a scale from 0-100 in which postal codes with amenities located close to home are assigned higher scores and postal codes with amenities located further away are assigned a lower score using a distance decay function. Maximum points (100) are received for postal codes with amenities located within 400 meters (a 5-minute walk) and a zero score is assigned to postal codes with amenities located further than a 30-minute walk from home, with higher scores indicating a higher neighbourhood walkability. Reliability of physical activity participation (yes vs. no) was assessed using Cohen's Kappa coefficients (κ) and proportion of overall agreement, while reliability of physical activity duration was assessed using intraclass correlations (ICC). Binary logistic regression estimated associations (odds ratios: OR and 95% confidence intervals) between participation in neighbourhood-specific physical activity variables and tertiled neighbourhood walkability. Linear regression estimated differences for Walk Score® in relation neighbourhood-specific physical activity variables. All models were adjusted for covariates (sex, age, number of dependents, dog ownership, motor vehicle access, bicycle access, and education) and included data from Time 1 only.

Results: The sample included 69.4% women, and 68.6% with university education. Kappa statistics for participation in neighbourhood physical activities were all considered moderate (κ=0.41 to 0.58) (Table 1). The correlations in self-reported neighbourhood physical activities were moderate for days per week (ICC=0.50 to 0.66), poor to moderate for usual minutes per day (ICC=0.37 to 0.57) and moderate for minutes per week (ICC=0.49 to 0.69) (Table 2). Compared with participants residing in low walkable neighbourhoods, those in high walkable neighbourhoods were more likely (p<.05) to report participation in neighbourhood walking for transportation (OR=3.02) and to undertake more weekly minutes of neighbourhood walking for transportation (b=41.08). A 1-unit increase in Walk Score® was also associated with a 1.4-minute per week increase in neighbourhood walking for transportation (p<.05) (Table 3).

Conclusions: Our findings suggest that the N-IPAQ administered via the internet provides reliable estimates of neighbourhood-based physical activity behaviour. This finding supports our previous testing of the N-IPAQ when administered via a self-report "paper-and-pencil" format.

Implications for Practice and Policy: The goal of the N-IPAQ is to provide more accurate estimates of the physical activity undertaken inside residential neighbourhoods. Future studies investigating neighbourhood built characteristics or other neighbourhood-based interventions and physical activity, may consider using our online version of the N-IPAQ.

Table 1. Proportion (%) of Overall Agreement (p_o), and Kappa (κ) coefficients for self-reported physical activity between Time 1 and Time 2

Physical activity	Time 1 % (n)	Time 2 % (n)	p_o	κ (95%CI)
Bicycled for transportation in neighbourhood	4.2 (11)	6.5 (17)	94.6	0.47 (0.24 to 0.71)*
Walked for transportation in neighbourhood	73.2 (191)	67.8 (177)	82.4	0.58 (0.47 to 0.69)*
Walked for recreation in neighbourhood	57.9 (151)	54.0 (141)	73.2	0.46 (0.35 to 0.57)*
Vigorous physical activity in neighbourhood	44.1 (115)	41.4 (108)	76.6	0.52 (0.42 to 0.63)*
Moderate physical activity in neighbourhood	35.3 (92)	37.9 (99)	72.8	0.41 (0.30 to 0.53)*

*p <.05. n = 261 completed the Time 1 and Time 2 surveys. Seven-days elapsed between Time 1 and Time 2 surveys.

Table 2. Intraclass Correlations (ICC)# for self-reported neighbourhood physical activity between Time 1 and Time 2

Physical Activity Measure	For all participants n	For all participants ICC (95%CI)	Those reporting participation only n	Those reporting participation only ICC (95%CI)
Bicycling for transportation during the last 7 days [in days]	261	0.52 (0.43 to 0.60)*	7	0.70 (0.00 to 0.94)*
Usual time spent bicycling for transportation on one of those days [in minutes]	261	0.40 (0.29 to 0.49)*	7	0.81 (0.25 to 0.97)*
Computed: Total transportation minutes/week by bicycle	261	0.60 (0.52 to 0.68)*	7	0.85 (0.37 to 0.97)*
Walking for transportation during the last 7 days [in days]	261	0.66 (0.58 to 0.72)*	161	0.60 (0.49 to 0.69)*
Usual time spent walking for transportation on one of those days [in minutes]	261	0.57 (0.48 to 0.65)*	161	0.44 (0.31 to 0.56)*
Computed: Total transportation minutes/week by walking	261	0.64 (0.56 to 0.71)*	161	0.59 (0.48 to 0.68)*
Walking for leisure during the last 7 days [in days]	261	0.60 (0.52 to 0.67)*	111	0.75 (0.65 to 0.82)*
Usual time spent walking or leisure on one of those days [in minutes]	261	0.50 (0.40 to 0.58)*	111	0.55 (0.40 to 0.67)*
Computed: Total minutes/week spent walking for recreation, leisure, or exercise	261	0.69 (0.61 to 0.74)*	111	0.71 (0.61 to 0.79)*
Undertaking vigorous physical activity for leisure during the last 7 days [in days]	261	0.55 (0.46 to 0.63)*	81	0.49 (0.30 to 0.64)*
Usual time spent in vigorous physical activity for leisure on one of those days [in minutes]	261	0.55 (0.46 to 0.63)*	81	0.44 (0.24 to 0.60)*
Computed: Total minutes/week spent in vigorous physical activity	261	0.49 (0.39 to 0.57)*	81	0.37 (0.17 to 0.54)*
Undertaking moderate physical activity for leisure during the last 7 days [in days]	261	0.50 (0.41 to 0.59)*	60	0.45 (0.22 to 0.63)*
Usual time spent in moderate physical activity for leisure on one of those days [in minutes]	261	0.37 (0.26 to 0.47)*	60	0.34 (0.09 to 0.54)*
Computed: Total minutes/week spent in moderate physical activity	261	0.49 (0.39 to 0.57)*	60	0.46 (0.23 to 0.64)*
Computed: Total minutes/week active^	261	0.70 (0.63 to 0.76)*	217	0.68 (0.60 to 0.74)*

#Two-way mixed model. *p <.05. ^Sum of: Computed: Total transportation minutes/week by bicycle; Computed: Total transportation minutes/week by walking; Computed: Total minutes/week spent walking for recreation, leisure, or exercise; Computed: Total minutes/week spent in vigorous physical activity, and; Computed: Total minutes/week spent in moderate physical activity. Seven days elapsed between Time 1 and Time 2 surveys.

Table 3: Associations between self-reported participation in and duration of neighbourhood-based physical activity and objectively measured neighbourhood walkability at Time 1 only (n = 261)

Adjusted logistic regression odds ratios (OR) for the association between participation and neighbourhood walkability

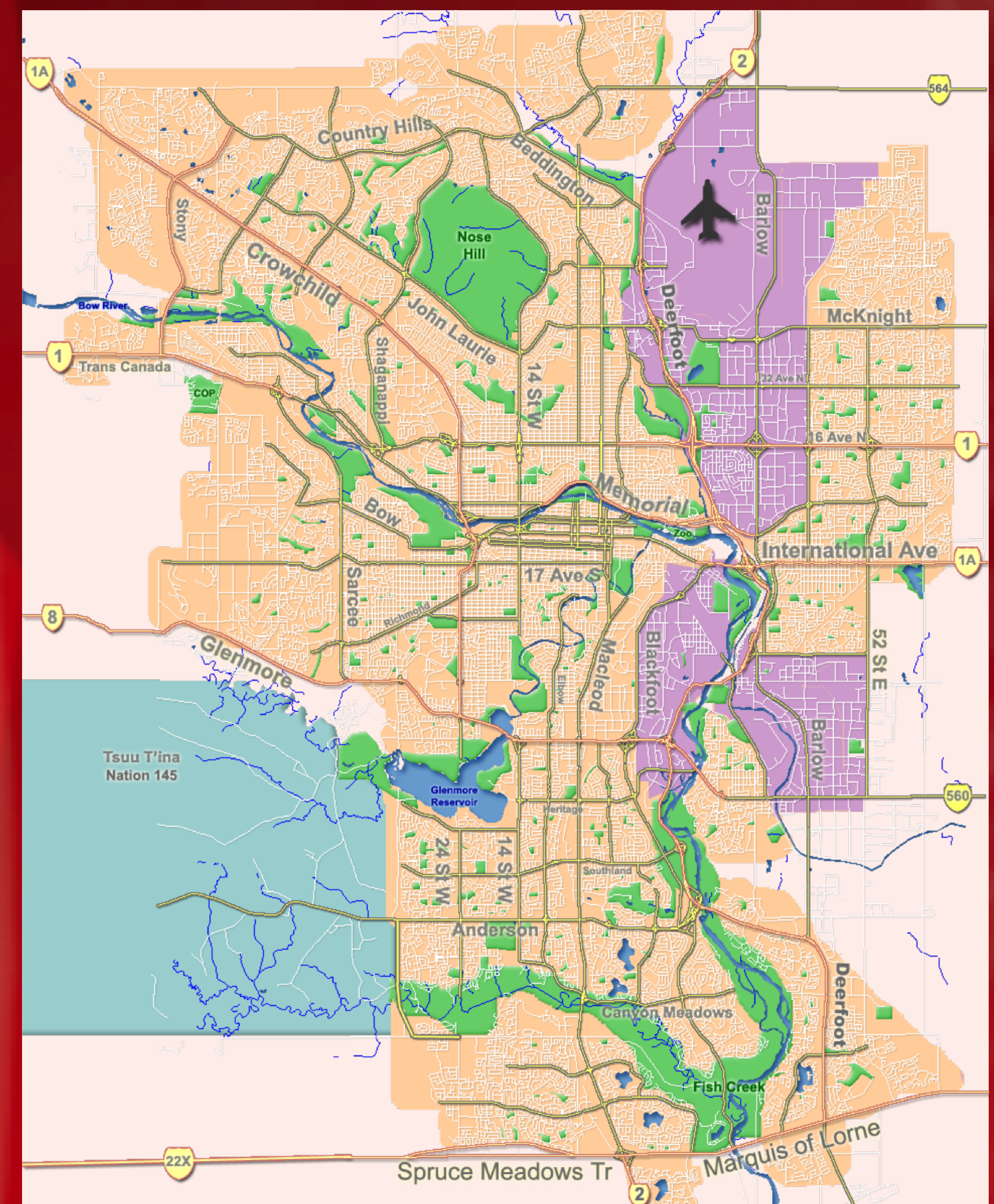| Walkability	Cycled for Transportation OR (95%CI)	Walked for Transportation OR (95%CI)	Walked for Recreation OR (95%CI)	Vigorous Physical Activity OR (95%CI)	Moderate Physical Activity OR (95%CI)
Low walkable	Ref	Ref	Ref	Ref	Ref
Medium walkable	0.69 (0.14 to 3.32)	1.20 (0.61 to 2.34)	1.17 (0.62 to 2.21)	1.42 (0.75 to 2.66)	2.02 (1.06 to 3.86)*
High walkable	0.87 (0.20 to 3.81)	3.02 (1.39 to 6.56)*	0.78 (0.42 to 1.47)	1.32 (0.70 to 2.49)	1.61 (0.83 to 3.12)

Adjusted linear regression unstandardized regression coefficients (b) for the association between duration and neighbourhood walkability

Walkability	Min/wk Cycling for Transportation b (95%CI)	Min/wk Walking for Transportation b (95%CI)	Min/wk Walking for Recreation b (95%CI)	Min/wk Vigorous Physical Activity b (95%CI)	Min/wk Moderate Physical Activity b (95%CI)	Min/wk Total Activity^ b (95%CI)
Low walkable	Ref	Ref	Ref	Ref	Ref	Ref
Medium walkable	-0.76 (-5.44 to 3.92)	7.75 (-30.38 to 45.89)	-6.80 (-52.08 to 38.48)	-8.17 (-37.34 to 20.99)	0.63 (-22.29 to 23.54)	-7.35 (-91.91 to 77.20)
High walkable	-1.20 (-5.89 to 3.50)	41.08 (2.87 to 79.30)*	-14.57 (-59.94 to 30.81)	17.64 (-11.59 to 46.87)	9.10 (-13.87 to 32.06)	52.05 (-32.69 to 136.79)

Adjusted linear regression unstandardized regression coefficients (b) for the association between duration and neighbourhood Walk Score®

Walkability	Min/wk Cycling for Transportation b (95%CI)	Min/wk Walking for Transportation b (95%CI)	Min/wk Walking for Recreation b (95%CI)	Min/wk Vigorous Physical Activity b (95%CI)	Min/wk Moderate Physical Activity b (95%CI)	Min/wk Total Activity^ b (95%CI)
Walk Score	-0.03 (-0.17 to 0.10)	1.40 (0.32 to 2.47)*	-0.32 (-1.59 to 0.96)	0.50 (-0.32 to 1.33)	0.12 (-0.53 to 0.76)	1.67 (-0.72 to 4.06)

*p <.05. ^Sum of: Total of weekly transportation bicycling, transportation walking, recreation walking, vigorous physical activity, and moderate physical activity minutes.
Logistic and linear regression models adjusted for age, sex, presence of dependent children under 6 and 6-18 years, dogs living in the household, access to a motor vehicle, access to a bicycle, and education. b: unstandardized regression coefficient. OR: odds ratio.

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