Neighbourhood Environmental Correlates of Perceived Park Proximity in Montreal

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ABSTRACT

Objectives: Perceived proximity to recreational settings has been shown to be associated with increased physical activity levels. We examined individual socio-demographic and environmental correlates of perceived park proximity in Montreal to assess targets for ecological interventions to improve physical activity.

Methods: A stratified clustered sampling design was used to collect data on perceived park proximity from 864 adults residing in 300 Montreal census tracts. Perceived park proximity was measured by asking participants if they perceived a park as within walking distance of their home. Objective measures of park proximity and park density were constructed using geographic information systems (GIS). Canada Census data provided information on census tract population density and median income levels. Multilevel logistic regression was used to examine the likelihood of not perceiving a park as proximate.

Results: Older adults were more likely to perceive a park as not proximate to their home (OR: 1.04; 95% CI: 1.02-1.07). Perceived park proximity varied across Montreal neighbourhoods with an interclass correlation coefficient of 16.10%. Objective distance to the closest park (OR: 1.45; 95% CI: 1.10-1.92) was associated with adults' subjective perceptions of park proximity. Residents of neighbourhoods with higher population density (OR: 0.92; 95% CI: 0.87-0.97) and higher average income (OR: 0.45; 95% CI: 0.24-0.87) were less likely to view a park as outside walking distance to their residence.

Conclusion: Regardless of the actual distance to the park, neighbourhood environmental factors are associated with people's perceptions of having a park within walking distance of their homes.

Key words: Spatial behavior; urban health; residence characteristics; socioeconomic factors; environment

La traduction du résumé se trouve à la fin de l'article.

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Recent commentaries on neighbourhood environments and health have highlighted the importance of the built environment as a policy target for public health interventions seeking to improve population health.¹⁻³ Among built environmental resources, park and recreation settings have been recognized as key neighbourhood features that provide residents with opportunities for physical health,⁴ psychological health⁵ and social benefits.^{6,7} Perceived proximity to parks and recreational settings has been found to be associated with greater recreational and walking activity in urban adults.^{8,9} All things being equal, adults who view parks and recreation settings as more accessible and proximate may be more likely to walk or use those settings for physical activity or recreational purposes.

People's perceptions of the neighbourhood environment, however, can differ significantly.¹⁰ Older adults, those with lower levels of education, or those who have lived in an area longer may perceive their neighbourhood boundaries as smaller in scale.^{11,12} Spatial characteristics of the environment may also play a role in people's perceived accessibility to local neighbourhood features. For example, as might be expected, actual distance to a park has been shown to be associated with people's perceptions of park proximity.¹⁰ Less is known about the role of socio-environmental factors in shaping perceived park proximity. Yet, if public health interventions targeting urban design and the built environment are to succeed in promoting population health, greater knowledge is needed with regard to how socio-demographic and socio-economic factors are associated with people's perceptions of park

proximity and other neighbourhood resources. This study seeks to contribute to the development of an empirical evidence base around possible socio-environmental and socio-demographic targets for ecological interventions to improve physical activity levels. Three main questions guide the study: 1) What is the association between socio-demographic characteristics and perceived park proximity? 2) After adjusting for socio-demographic characteristics, is actual distance and/or park density associated with perceived proximity? and 3) Is neighbourhood-level income associated with the likelihood of residents perceiving a park as within walking distance, after adjustment for individual socio-demographic factors?

DATA AND METHODS

Sample

Data were drawn from the 2008 Montreal Neighbourhood Social and Organizational Environments study (MoNSOE). MoNSOE used a 2-stage stratified cluster sampling design. In stage 1, Montreal

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Metropolitan Area (MMA) census tracts (N=862) were stratified using 2001 Canada Census data into tertiles of high, medium, and low household income. One hundred census tracts (CTs) were randomly selected from each tertile ($n_i=300$). In stage 2, we randomly selected 3 individuals per tract who fulfilled the following target population criteria: non-institutionalized persons 25 years or older who had resided at their current address for at least one year ($n_i=902$). Random digit dialing of listed telephone numbers was used to select households and a computer-assisted telephone interviewing system guided questionnaire administration. Participants were able to complete the telephone interview in either French or English. Ethics approval was received from the General Research Ethics Board at Queen's University.

Measures

Outcome: Perceived Park Proximity

The MoNSOE questionnaire asked respondents if they had a park within walking distance of their place of residence or not. Analyses modeled the likelihood of individuals not perceiving a park as within walking distance of their residence.

Main Exposure Variables

Individual: Age was measured in years and was not found to have a curvilinear association with perceived park proximity. Socio-economic status (SES) was a score from an iterated principal factors procedure using income, educational attainment, and employment status. The factor score weighted household income at 0.53, educational attainment at 0.30, and employment status at 0.24. Marital status was grouped into four categories: a) married or common-law relationship, b) single, c) divorced or separated, and d) widowed. Residential duration was based on years and months at the current place of residence, and was log transformed due to its skewed distribution.

Environmental: To measure park proximity, respondents' six-digit postal codes were integrated into the MEGAPHONE© geographical information system containing land use data from the DMTI Spatial Inc. topographic file.¹³ Geospatial measures of park density and proximity were constructed. The density of parks was computed using kernel density estimations.^{14,15} Rather than counting the number of parks within an administratively-defined census tract, kernel density estimations transform a point distribution into a continuous density surface.^{16,17} The obtained density measures were then averaged within a 100 m road-network buffer area around each home. Such a buffer represents the area a person can cover when walking along the road network for 100 m from their home. For statistical analyses, the park density measure was transformed by taking its square root to provide a better model fit. Second, using the network analyst feature in ArcGIS, the road-network distance between each respondent's residence and their closest park was measured in metres. The park proximity measure based on actual distance had a skewed distribution and was log transformed to provide a better fit. Neighbourhood income was found to have a curvilinear association with perceived park proximity, and was thus grouped into tertiles with the middle tertile used as the referent. To control for differences in the degree of urbanicity, analyses also adjusted for neighbourhood population density.

Table 1. Characteristics of Montreal Neighbourhood Social and Organizational Environments Study (MoNSOE), Perceived Park Proximity Sample (n=864), 2008

Variables	Mean (standard deviation)
Neighbourhood variables	
CT population density	16.4 (5.8)
Individual variables	
Age	50.6 (14.4)
Self-reported health (1=poor to 5=excellent)	3.8 (1.1)
Distance to park	577.3 metres (915.1)
Park density	23.4 sq.km (19.2)
Residential duration	12.0 years (10.3)
	Percentage
Gender	
Female	64.5%
Male	35.5%
Income	
<\$28,000	22.9%
\$28,000-\$49,999	24.9%
\$50,000-\$74,999	24.3%
\$75,000-\$100,000	9.8%
>\$100,000	18.1%
Education	
Less than a high school degree	7.9%
High school degree or trade certificate	26.0%
College certificate	23.5%
Bachelors degree and higher	42.6%
Employed	62.4%
Marital status	
Married/Common-law relationship	56.3%
Single	22.6%
Divorced/Separated	13.5%
Widowed	7.6%
Perceived park proximity	
No park in walking distance	8.9%
Yes park in walking distance	91.1%

Statistical analysis procedures

Before analyzing data, MoNSOE response and cooperation rates were calculated according to accepted, standard definitions.¹⁸ To assess the representativeness of the MoNSOE sample, the overall sample was compared with the 2006 Canada census data. Using the sampling design, CTs were combined into low-, medium-, and high-income areas with 100 CTs within each category. Observed respondent data in each tertile were compared to those expected given the 2006 Canada census. The results from these analyses were summarized across the 300 census tracts and compared to the null hypothesis of no difference between the sample and the 2006 census.

Multilevel logistic regression was used for statistical analyses to account for the clustered nature of the sampling design and data. Census tracts were specified as a random effect. Analyses proceeded in several stages. First, the variance between neighbourhoods in the lack of perceived park proximity was estimated and reported as the intraclass correlation coefficient (ICC) using the formula for dichotomous outcomes proposed by Snijders and Bosker.¹⁹

A 95% plausible value interval for the ICC was also calculated to describe the range of variability in the lack of perceived park proximity across Montreal neighbourhoods. Three models were constructed. Model 1 examined the association of perceived park proximity with individual socio-demographic characteristics. Model 2 examined the association of perceived park proximity with actual park distance and park density, while controlling for individual factors. Finally, Model 3 added neighbourhood income and neighbourhood population density to examine their association with perceived park proximity. Odds ratios (ORs) and 95% confidence intervals (95% CIs) are reported for individual- and

Table 2. Adjusted Odds Ratios of Perceived Park Non-proximity, Montreal Neighbourhood Social and Organizational Environments Study (n=864), 2008

Variable	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Individual Variables			
Age	1.05 (1.02-1.07)***	1.04 (1.02-1.07)***	1.04 (1.02-1.07)***
Socio-economic status (SES)	0.86 (0.59-1.25)	0.85 (0.60-1.23)	0.87 (0.59-1.27)
Gender			
Female	1.03 (0.59-1.79)	0.97 (0.57-1.67)	0.89 (0.52-1.54)
Male (referent)	1.00	1.00	1.00
Marital status			
Widowed	0.52 (0.19-1.40)	0.60 (0.23-1.56)	0.62 (0.24-1.63)
Divorced/Separated	0.76 (0.34-1.70)	0.86 (0.40-1.88)	0.88 (0.40-1.92)
Single	1.11 (0.57-2.18)	1.28 (0.66-2.47)	1.41 (0.73-2.75)
Married/Common-law relationship (referent)	1.00	1.00	1.00
Residential tenure (log ₁₀)	0.56 (0.29-1.10)	0.55 (0.29-1.05)	0.56 (0.29-1.06)
Self-reported health	0.82 (0.65-1.05)	0.82 (0.65-1.03)	0.81 (0.64-1.02)
Environmental Variables			
Park distance (log ₁₀)	—	1.70 (1.26-2.29) ***	1.45 (1.10-1.92)**
Park kernel density (square root)	—	1.00 (0.86-1.15)	1.05 (0.90-1.21)
CT Population Density	—	—	0.92 (0.87-0.97)**
CT Household Median Income			
Low	—	—	0.63 (0.32-1.28)
Middle (referent)	—	—	1.00
High	—	—	0.45 (0.24-0.87)*
Δ Likelihood Ratio Chi Square	26.46***	14.62***	15.27**

*** p<0.001, ** p<0.01, *p<0.05

neighbourhood-level variables. Changes in the likelihood ratios were used to evaluate and compare models.

RESULTS

MoNSOE had a response rate of 33.8% and a cooperation rate of 73.6%. Chi-square analyses comparing the MoNSOE sample to 2006 Canada census data showed that the sample over-represented i) females, ii) individuals with an income less than \$50,000 per year, iii) individuals with more than a high school degree, or iv) individuals in a married or common-law relationship. Table 1 provides information on characteristics of the study. Of the MoNSOE sample of 902 respondents, 899 individuals reported perceived park proximity information. From the remaining sample, 11 observations were dropped because of missing SES data; 11, missing age information; 8, missing marital status information; 4, missing data on residential duration; and 1, missing self-reported health information. The final sample size was 864 individuals residing in 300 different census tracts. The average road-network distance to the closest park was 577 metres. In the sample, 8.9% reported not having a park within walking distance of their residence. The GIS measured average distance for this 8.9% was 1219 metres. Among those who reported perceiving a park as being within walking distance (91.1% of the sample), the average actual distance was 515 metres.

Table 2 provides the results of the multilevel logistic analyses. There was an estimated ICC of 16.10% (95% plausible value range: 3.96-47.35) in perceived park proximity across Montreal neighbourhoods. The final model (Model 3) indicated: 1) the older the respondent, the more likely a park was perceived as not being within walking distance (OR: 1.04; 95% CI: 1.02-1.07); 2) the farther the actual distance to a park, the more likely the park was perceived as not being within walking distance (OR: 1.45; 95% CI: 1.10-1.92); 3) the greater the neighbourhood population density, the less likely a participant would perceive a park as being outside walking distance (OR: 0.92; 95% CI: 0.87-0.97); and 4) participants residing in the highest income-tertile neighbourhoods compared to the middle-income tertile (OR: 0.45; 95% CI: 0.24-0.87) were less likely to view a park as being outside walking distance.

DISCUSSION

This cross-sectional study showed that both individual socio-demographic and environmental factors are associated with perceived park proximity in Montreal. Older Montreal adults were less likely to perceive parks as within walking distance after adjustment for self-rated health status and actual park distance. As expected, objective park distance measures were shown to be associated with adult perceptions of park proximity. Although actual park distance was significant, park density was not associated with perceived park proximity.

Neighbourhood environmental factors were also shown to be associated with perceived park proximity. The study showed a curvilinear association between perceived park proximity and neighbourhood median income levels net of census-tract population density. Compared to middle-income areas, residents of low-income areas were neither more nor less likely to perceive a park as being within walking distance to their home. Yet, residents of high-income areas were more likely to perceive a park as being within walking distance to their homes compared to residents of middle-income neighbourhoods. Compared to high-income areas, middle-income neighbourhoods are characterized in our sample by greater residential turnover. Under such conditions, residents may feel less knowledgeable about local amenities and less comfortable about accessing them. Future research might examine more closely the role or importance of gentrification or related factors on people's perceptions and use of local neighbourhood amenities. Regardless of the particular causal mechanism, this finding suggests that overall neighbourhood environmental characteristics are associated with people's perceptions of the spatial proximity of local amenities and features.

Limitations

This study has several limitations. First, the MoNSOE cooperation rate of 73.6% and response rate of 33.8% may suggest potential response bias. Direct comparability between survey response rates is difficult, however, given differences in the way in which researchers may define eligibility.²⁰ Nevertheless, in spite of decreas-

es in survey response rates reported over the past decade,²¹ surveys with low rates may still have excellent demographic representativeness, and no consistent empirical relationship has been found between response rates and non-response bias in random digit dialing surveys.²² Second, subjective assessments of park proximity may also be associated with general mobility status. Although the findings related to age may reflect certain mobility-related issues, mobility among other population groups may also play a role in people's perceptions of park proximity. Adjustment for self-rated health status may only partially adjust for this possibility.

One of the promises that knowledge about neighbourhood correlates of perceived park proximity holds is the capacity to design health promotion campaigns that might influence the physical activity behaviour of groups of people. As such, this study suggests that when it comes to people's perceptions of park proximity in Montreal, residents of middle-income areas tend to perceive parks as less proximate. While future research might identify the particular causal mechanism at work within middle-income areas, health promotion campaigns that seek to encourage physical activity and park use in Montreal might consider targeting such areas in an effort to familiarize people with local parks and reduce perceived barriers in people's access to such resources.

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RÉSUMÉ

Objectifs : Il est démontré que la proximité subjective de lieux récréatifs est associée à des niveaux d'activité physique accrus. Nous avons examiné les corrélats sociodémographiques et environnementaux individuels de la proximité subjective d'un parc, à Montréal, pour évaluer les cibles d'interventions écologiques visant à rehausser l'activité physique.

Méthode : À l'aide d'un protocole d'échantillonnage en grappes stratifié, nous avons recueilli des données sur la proximité subjective d'un parc auprès de 864 adultes résidant dans 300 secteurs de recensement de Montréal. Pour mesurer la proximité subjective, nous avons demandé aux participants s'il y avait un parc à distance de marche de leur domicile. Des mesures objectives de la proximité et de la densité des parcs ont été construites à l'aide de systèmes d'information géographique (SIG). Les données du Recensement du Canada ont fourni des renseignements sur la densité de population et le revenu médian dans les secteurs de recensement. Au moyen d'une analyse de régression logistique multiniveau, nous avons examiné la probabilité de ne pas percevoir un parc comme étant proche.

Résultats : Les personnes âgées étaient plus susceptibles de percevoir un parc comme n'étant pas proche de leur domicile (RC=1,04; IC de 95 %=1,02-1,07). La proximité subjective d'un parc variait d'un quartier à l'autre de Montréal, avec un coefficient de corrélation interclasse de 16,1 %. La distance objective jusqu'au parc le plus proche (RC=1,45; IC de 95 %=1,10-1,92) était associée aux perceptions subjectives de la proximité du parc chez les adultes. Les résidents des quartiers à densité de population élevée (RC=0,92; IC de 95 %=0,87-0,97) et à revenu moyen élevé (RC=0,45; IC de 95 %=0,24-0,87) étaient moins susceptibles de considérer qu'un parc n'était pas à distance de marche de leur domicile.

Conclusion : Peu importe la distance réelle du parc, les facteurs environnementaux du quartier sont associés à la perception des gens d'avoir un parc à distance de marche de leur domicile.

Mots clés : comportement spatial; santé en zone urbaine; caractéristiques de l'habitat; facteurs socioéconomiques; environnement