What You See Is What You Get?

Questioning the Relationship Between Objective and Subjective Appraisals of Neighbourhood Resources in Relation to Health

Katherine L. Frohlich, PhD¹

Jennifer L. Bodnarchuk, PhD²

Dan Château, PhD²

Leslie Roos, PhD²

Shirley Forsyth²

ABSTRACT

Background: Some research concerned with place and health has used the study of opportunity structures in neighbourhoods to understand how place might get under the skin. It has become somewhat common to assume that objective indicators of opportunity structures are in some way equivalent to people's access to them. The general objective of this study, therefore, was to evaluate the level of convergence between objective and subjective evaluations of neighbourhood resources in Winnipeg, Canada.

Methods: Winnipeg residents (n=1,102) were sampled from 59 neighbourhood units to permit hierarchical linear modelling and to enable the testing of Winnipeg residents' individual-level subjective appraisals within neighbourhood-level objective characteristics. Several databases provided objective neighbourhood data on premature mortality rates, crime, housing, recreation programs, education, and household income. To evaluate subjective appraisals of these resources, data were gathered from the Winnipeg Quality of Life Survey (WQLS).

Results: We found that, when controlling for individual- and neighbourhood-level confounders, the objective data at hand match relatively well with participants' subjective perceptions of housing and crime, while neighbourhood-level premature mortality rates and the objective numbers of recreation programs across neighbourhood are not significant predictors of their subjective counterparts.

Conclusion: It may be that objective measures of some opportunity structures should be accompanied by subjective measures to ensure a more complete understanding of the impact of these resources on population health.

MeSH terms: Health resources; residence characteristics; population health; Manitoba

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

1. GRIS-Université de Montréal, Montréal, QC

2. MCHP – Manitoba Centre for Health Policy, University of Manitoba, Winnipeg, MB

Correspondence: Katherine L. Frohlich, Université de Montréal, Groupe de Recherche Interdisciplinaire en Santé (GRIS), C.P. 6128, succursale Centre-Ville, Montréal, QC H3C 3J7, Tel: 514-343-6430, Fax: 514-343-5645, E-mail: katherine.frohlich@umontreal.ca

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A growing number of neighbourhood studies in relation to health has greatly increased our understanding of how local environments influence health outcomes in populations.¹⁻⁵ Despite divergent results concerning the role of neighbourhood-level variables and their effects on individual health status,^{6,7} many researchers have shown evidence that community contexts independently affect the health status of all residents above and beyond individual/compositional effects.⁸⁻¹¹ One of the approaches to these neighbourhood studies has been to study "opportunity structures".¹²⁻¹⁵ These opportunity structures are socially constructed and patterned features of the physical and social environment that can either promote or damage health. These structures have been operationalized in multiple ways such as: access to healthy foods, leisure physical activities, cultural activities, safe recreation spaces, and/or smoking-free environments, to name a few.^{12,13,15-17}

Much of this literature makes a major assumption regarding the relationship between opportunity structures and health. Objective indicators of opportunity structures – that is, the number or quantity of these structures – are commonly assumed to be in some way equivalent to people's access to them. This assumption further presupposes that, when resources are accessible (in terms of distance, cost, etc.), people are able to use them in the intended ways.

A number of studies, however, have demonstrated that opportunity structures may be perceived differently by researchers than by local residents.^{10,18,19} Macintyre has found, for instance, marked differences between direct measurements of health-related phenomena such as overcrowding and public transport provision, and reported perceptions by local residents;⁷ local residents either under- or overestimate these resources in relation to researchers' data.

One way of testing the correspondence between objective measures and residents' perceptions is to include subjective and objective assessments of opportunity structures within the same study.²⁰⁻²⁴ This paper will explore the issue of whether objective and subjective appraisals of opportunity structures differ using data from Winnipeg, Canada. These data include material from two major sources: 1) the Winnipeg Quality of Life Survey (WQLS)

which contained 69 demographic and contextual questions, including those related to crime, housing, health and recreation programs; and 2) several databases providing objective neighbourhood characteristics and area-level demographic data. The general objective of this study was to evaluate how convergent the objective evaluations of neighbourhood resources were in relation to residents' appraisals of these same resources.

METHODS

Research design and sample

A sample of Winnipeg residents was randomly selected from a number of neighbourhood units to permit hierarchical linear modelling in which we could nest Winnipeg residents' individual-level subjective appraisals within neighbourhood-level objective characteristics.

Geographic units for neighbourhood-level data collection were based on 71 Community Centre Areas (CCAs) recognized by the General Council of Winnipeg Community Centres. The CCA boundaries were selected as the geographic units for several reasons based on mobility, history and population size. Three additional areas were defined and added to the 71 CCAs (despite not having a community centre), given their dense population.

To collect our study sample, individuals living in these 74 CCAs were contacted through random digit dialling using the Sudman method.²⁵ The initial phone call screen briefly explained the study to the respondent; respondents were asked for their age and gender, their postal code to determine the CCA of residence, and their length of residence within that CCA. Only those having lived in the CCA for at least one year and aged 18 or older were eligible to participate in the study. Eligible respondents were then stratified by age and gender for each CCA. Each participant had the option of being interviewed in person in a location of their choice by a trained interviewer, or completing the questionnaire on their own. T-tests for each of the questions tested for the equality of variances between these two large groups of respondents with no significant differences found.

Between June 2002 and March 2003, 1,102 adults were successfully interviewed

Figure 1. Community Centre Areas (CCAs) in Winnipeg, Canada
The 59 CCAs included in the present study are shown in grey and the omitted areas are shown in black (n=15).

(48% of informed residents). The WQLS questionnaire contained 64 contextual questions, including those related to respondents' perceptions of crime, housing, health and recreation programs. Responses to these questions were on a Likert scale. The questionnaire also contained a section for demographic information.

Due to issues of power, only the CCAs with at least 10 respondents successfully interviewed were used in the analyses (reducing the total sample of CCAs from 74 to 59). As seen in Figure 1, omitted CCAs were randomly distributed over a broad area of the city, therefore reducing concern with bias.

The individual-level data (Level 1) for this study yield from the WQLS. The CCA-level data (Level 2) were obtained from various data sources of the Manitoba Centre for Health Policy's (MCHP) research data repository. All predictors at the CCA level are aggregate and objective.

Measures

Individual-level Dependent Variables

Level 1 outcomes for health, crime, housing, and recreation programs were obtained from selected WQLS questions

for all respondents in a given CCA. For health, a self-reported health question was used. For crime, the responses to three questions were summed: a) safety from violent crime, b) safety from property crime, and c) feeling of comfort walking in your neighbourhood at night. The housing question asked about the condition of the majority of the housing in the neighbourhood, while for recreation programs, responses were summed for two questions regarding the availability of recreation programs: one for youth and one for adult programs.

Individual-level Predictors

Individual-level predictors were obtained from the demographic section of the WQLS questionnaire. Relevant questions were the respondent's age, sex, whether or not the respondent had graduated from high school, the highest level of education attained, and the respondent's estimate of the total household income.

CCA-level Predictors

The CCA-level measure for *health* was the premature mortality rate (PMR) for each CCA.

The CCA-level measure for *crime* was derived from 2000 calendar year data sup-

TABLE I
Socio-demographic Characteristics of WQLS Respondents

Characteristic		n	%
Sex	Male	432	39
	Female	669	61
	Missing	1	0
Age Group	18-29	169	15
	30-44	341	31
	45-64	407	37
	65+	185	17
Household Income (CAD\$)	<\$20,000	174	16
	\$20,000-\$39,999	267	24
	\$40,000-\$59,999	239	22
	\$60,000-\$79,999	149	14
	≥\$80,000	216	20
Education	Not reported	57	5
	Less than high school	94	9
	High school	108	10
	Some post-secondary	343	31
	Diploma or certificate	235	21
	University degree	313	28
	Missing	9	1

TABLE II
Results for the Random Effects Variance in the Models for Each of the Individual-level Outcomes

	Variance Estimate	df	χ^2	p-value	Variance Accounted for Between CCAs
Health					
Null model	0.03	58	100.63	0.00	
Level 1 model*	0.01	58	57.58	0.49	0.70
Level 2 model** (Premature Mortality Rate)	0.01	55	45.78	0.81	0.77
Crime					
Null model	1.74	58	379.59	0.00	
Level 1 model*	1.37	58	255.95	0.00	0.21
Level 2 model** (Crime Principal Component Score)	0.15	55	84.20	0.01	0.91
Housing					
Null model	0.33	58	631.12	0.00	
Level 1 model*	0.28	58	344.76	0.00	0.16
Level 2 model** (Housing Principal Component Score)	0.06	55	104.20	0.00	0.83
Recreation					
Null model	0.90	58	594.46	0.00	
Level 1 model*	0.83	58	378.97	0.00	0.07
Level 2 model** (Recreation Programs per 1000 Persons)	0.47	55	210.98	0.00	0.48

* Level 1 models are adjusted for individual age, sex, income, and education.

** Level 2 models are adjusted for neighbourhood income and education, as well as the corresponding neighbourhood variable indicated in parentheses.

plied by the Winnipeg Police Department, Crime Statistics Unit. The number of crimes against persons, crimes against property, and other crimes in each CCA were directly available from point data. A principal components analysis (PCA) performed on the crime variables indicated that a single score could describe the number of crimes in an area ($r^2 = .94$), with higher crime PCA scores representing higher levels of crime within the CCA.

The CCA-level *housing* variable was based on data supplied by the City of Winnipeg Community Services Department.²⁶ A principal components analysis reduced the number of housing variables needed to characterize a CCA to

three. The three variables used were: the median selling price of housing in each CCA, the percent of rental units in each CCA, and the mean age of houses in each CCA ($r^2 = .70$).

The CCA-level measure for *recreation programs* was based on the Social Programs Database (SPD) of MCHP. Recreational programs (e.g., sports, music, arts & crafts programs) were selected from the SPD, and the number of recreation programs per 1000 persons aged 0-65 in the population for each CCA was used in the present analysis.

Finally, the CCA-level demographic measures for percent of persons without a high school education and average house-

hold income were obtained from the 2001 Canadian Census data for Manitoba.

Statistical analyses

We performed hierarchical linear modelling (HLM)²⁷ to explore whether the individual-level outcome measures matched the CCA objective variables across neighbourhood types. HLM is an extension of linear regression allowing analysis of hierarchical, or nested, data. In our study, individuals are nested within CCAs and HLM allows modelling both within-CCA, or individual variation (i.e., level 1), and between-CCA variation (i.e., level 2).

The predictor of interest in each series of models was the level 2 objective measure corresponding to the level 1 outcome; we were interested in whether the objective "reality" could predict an individual's subjective rating for each of the outcomes (health, crime, housing, and recreation) while controlling for both individuals' personal characteristics as well as for CCA characteristics. All other predictors were included in the models, regardless of statistical significance, to control for potential confounding.

Three models were run for each of the four individual-level outcomes. First, a null model including no predictors was run to assess whether there was sufficient variation at level 2 to justify conducting a HLM analysis. Second, models were fit with all of the individual-level predictors (age, sex, income, and education). Results from this model indicate how much of the variance was accounted for by these individual variables. Third, a model was adjusted by adding to the individual-level model all of the CCA-level variables, that is, income and education, as well as the CCA-level variable corresponding to the individual-level outcome.

All preliminary analyses and data management were performed using SAS version 8.2 for Unix (SAS Institute, Inc., Cary, NC). The multi-level modelling was performed using HLM version 5.00 for Unix (Scientific Software International, Inc., Lincolnwood, IL).

RESULTS

Table I presents the socio-demographic characteristics of the WQLS respondents

demonstrating a wide range of ages, income brackets, and education levels.

Table II shows the random effects variance in the three models for each of the four individual-level outcomes. The intercept for each CCA was a random component in the models, and all predictors were centred, making the intercept equivalent to the CCA level value on the outcome. The first of the three models is the null model, containing no predictors and representing the variation in CCA intercepts to be modelled. The second model, the level 1 model, contains only individual-level predictors from the WQLS and represents the amount of variance accounted for by individuals' age, sex, income, and education. The third model, the level 2 model, adds all of the CCA-level variables. This model represents the additional variance explained by the variables at the CCA level, that is, premature mortality rate, crime, housing, recreation program density, respectively, as well as percent of persons without a high school education and average household income.

As seen in Table II, the variance estimates decrease across all individual-level outcomes (health, crime, housing and recreation) indicating that the predictors added to the model are able to explain some of the variance in CCA-level values (i.e., intercepts) on each of the outcomes. For the model predicting the individual-level subjective health outcome, for instance, the reduction in unexplained variance among neighbourhoods was reduced from 0.03 to 0.01 by adding individual- and CCA-level predictors, resulting in a statistically significant change and accounting for 77% of the variance between the CCAs. The model predicting the individual-level subjective crime outcome also saw a reduction in variance, with a significant amount of variation remaining even after CCA-level predictors were added to the model ($\chi^2 = 84.2$, $p=0.01$). However, 91% of the variance between CCAs for crime was accounted for by both the individual- and CCA-level predictors. For the housing models, even though the unexplained variance in the outcome was considerably reduced, significant variance still remained after individual- and CCA-level predictors were added ($\chi^2 = 104.2$, $p<0.00$). Finally, for the models predicting individual-level evaluations of recreation programs, the variance was significantly reduced, but our

TABLE III
Results for the Fixed Effects Models

Fixed Effect	Coefficient	SE	t-ratio	df	p-value
Health					
Level 2 Intercept	2.14	0.02	93.89	55	0.00
Premature Mortality Rate	0.01	0.04	0.38	55	0.71
Income	-0.0	0.00	-1.01	55	0.32
Education	0.61	0.30	2.07	55	0.04
Level 1 Sex	0.06	0.04	1.33	58	0.19
Income	-0.09	0.02	-4.61	58	0.00
Education	-0.07	0.02	-3.33	58	0.00
Age	0.00	0.00	0.73	58	0.47
Crime					
Level 2 Intercept	8.31	0.09	96.24	55	0.00
Crime Principal Component Score	0.65	0.07	8.88	55	0.00
Income	-0.00	0.00	-0.28	55	0.78
Education	3.00	1.21	2.48	55	0.02
Level 1 Sex	0.41	0.15	2.75	58	0.01
Income	-0.18	0.07	-2.60	58	0.01
Education	-0.21	0.06	-3.35	58	0.00
Age	0.00	0.01	0.07	58	0.94
Housing					
Level 2 Intercept	2.75	0.04	71.29	55	0.00
Housing Principal Component Score	0.17	0.03	5.10	55	0.00
Income	-0.00	0.00	-3.52	55	0.00
Education	1.12	0.54	2.08	55	0.04
Level 1 Sex	-0.03	0.05	-0.60	58	0.55
Income	-0.05	0.02	-2.61	58	0.01
Education	-0.04	0.02	-1.81	58	0.08
Age	-0.00	0.00	-2.81	58	0.01
Recreation					
Level 2 Intercept	6.23	0.10	64.85	55	0.00
Programs per 1000 Persons	-0.06	0.01	-1.23	55	0.23
Income	-0.00	0.00	-0.77	55	0.44
Education	5.51	1.39	3.97	55	0.00
Level 1 Sex	-0.15	0.10	-1.57	58	0.12
Income	-0.02	0.03	-0.46	58	0.65
Education	-0.03	0.03	-1.01	58	0.32
Age	-0.00	0.00	-1.80	58	0.08

model was able to account for only 48% of the variance; some other factors not identified by our study may be responsible for differences between the CCAs.

The fixed effects results for all of the CCA-level models from Table II are presented in Table III. For the Health model, the predictor of interest (i.e., PMR) was non-significant, but CCA-level education and individual-level income and education were significant predictors of subjective health. For the Crime model, CCA-level crime was one of several significant predictors of subjective appraisals of crime. CCA-level education and individual-level sex, income, and education also significantly predicted subjective crime. The Housing predictor of interest was also significantly related to its subjective counterpart, along with CCA-level income and education, as well as individual-level income and age. For Recreation, the only significant predictor of the subjective appraisals of recreational availability was CCA-level education.

DISCUSSION

The general goal of this paper was to evaluate whether objective measures are suffi-

cient for understanding how neighbourhood opportunity structures influence health in Winnipeg, Canada. The objective data at hand match relatively well with participants' subjective perceptions of housing and crime, while CCA-level premature mortality and the objective numbers of recreation programs across CCAs are not significant predictors of their subjective counterparts.

With regard to health, confounding is an issue given the well-known fact that income and education are related to both subjective appraisals of health, as well as the premature mortality rate.^{28,29} In Table II, the null model for health shows little variance (0.03) compared to the larger initial variances for crime (1.74) and housing (0.33). We further see, in Table III, that each of the three variables (i.e., PMR, income, education) does a good job of explaining what little variance is there. This then translates into a non-significant result for PMR in Table III ($p=0.71$). If we run the same model without income and education, however, PMR shows significance ($p=0.003$; model not shown).

Our findings with respect to recreational facilities concur with literature wherein

objective and subjective indicators of neighbourhood quality of life and resources do not always correlate significantly.^{22,24,30} The fact that our models predicting individual-level evaluations of recreation programs were only able to account for 48% of the variance may be due to the fact that knowledge about availability of programs may be explained by variables other than demographic characteristics and actual numbers of programs, and may be more associated with variables such as the social capital of neighbourhoods, that is, the involvement of community members in neighbourhood activities. These kinds of hypotheses remain to be explored.

In sum, it cannot be assumed that objective and subjective measures of neighbourhood opportunity structures are always one and the same. In practical terms, our findings inform us that the provision alone of neighbourhood resources may be insufficient in order to improve population health; resources must respond to residents' needs and residents must be made aware of how resources can be used to improve health and well-being. Future research, including that investigating inequities in resource use, should include both objective and subjective measures of some opportunity structures to ensure a more complete understanding of the impact of these resources on population health.

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RÉSUMÉ

Contexte : Quelques recherches qui s'intéressent aux rapports entre le lieu et la santé se sont inspirées de l'étude des « structures de possibilités » présentes dans les quartiers pour comprendre comment les milieux de vie affectent notre santé. On prend souvent pour acquis que les indicateurs objectifs des structures de possibilités équivalent *grosso modo* à l'utilisation de ces structures par la population. Nous avons voulu vérifier le degré de convergence entre les évaluations objectives et subjectives des ressources des quartiers à Winnipeg, au Canada.

Méthodes : Des résidents de Winnipeg (n=1 102) ont été échantillonnés dans 59 unités de voisinage afin de permettre une modélisation linéaire hiérarchique et pour mesurer les évaluations subjectives des résidents de Winnipeg par rapport aux caractéristiques objectives des quartiers. Plusieurs banques de données ont fourni des données objectives par quartier sur les taux de mortalité prématurée, la criminalité, le logement, les programmes récréatifs, l'instruction et le revenu des ménages. Pour mesurer les évaluations subjectives de ces ressources, nous avons regroupé des données tirées de l'enquête Winnipeg Quality of Life Survey (WQLS).

Résultats : Nous avons constaté, après rajustement des données pour tenir compte des facteurs de confusion individuels et collectifs, que les données objectives étaient à peu près équivalentes à la perception subjective des participants en ce qui a trait au logement et à la criminalité, mais que les taux de mortalité prématurée et le nombre réel de programmes récréatifs dans les quartiers n'étaient pas des prédicteurs significatifs de leurs équivalents subjectifs.

Conclusion : Pour mieux comprendre l'impact de certaines structures de possibilités sur la santé de la population, il faudrait peut-être ajouter des mesures subjectives de ces ressources aux mesures objectives déjà utilisées.