

# Perception of Neighborhood Disorder and Health Service Usage in a Canadian Sample

Alexa Martin-Storey, Ph.D. · Caroline E. Temcheff, Ph.D. · Paula L. Ruttle, Ph.D. · Lisa A. Serbin, Ph.D. · Dale M. Stack, Ph.D. · Alex E. Schwartzman, Ph.D. · Jane E. Ledingham, Ph.D.

Published online: 21 October 2011  
© The Society of Behavioral Medicine 2011

## Abstract

**Background** Neighborhood environment, both actual and perceived, is associated with health outcomes; however, much of this research has relied on self-reports of these outcomes.

**Purpose** The association between both perception of neighborhood disorder and neighborhood poverty (as measured by postal code socioeconomic status) was examined in the prediction of health service usage.

**Method** Participants in a longitudinal project were contacted in mid-adulthood regarding their perception of neighborhood disorder. Their census tract data and medical records were drawn from government databases.

**Results** Higher perceived neighborhood disorder was significantly associated with higher levels of total health services usage, lifestyle illnesses, specialist visits, and emergency room visits, even when neighborhood poverty and individual-level variables were controlled for. Neighbor-

hood poverty was only significantly associated with fewer total hospitalizations.

**Conclusions** Higher perceived neighborhood disorder was associated with higher rates of health service usage, suggesting further investigation into the mechanisms by which perceptions of the environment influences health outcomes.

**Keywords** Health service usage · Perceived neighborhood disorder · Census tract data · Childhood aggression

## Introduction

An expanding body of literature has suggested that the association between objective measures of neighborhood quality and residents' health outcomes may be mediated by individuals' subjective perceptions of the neighborhoods in which they live [1–4]. One important aspect of subjective assessment of neighborhood is perception of neighborhood disorder, which refers to the lack of social and physical control individuals feel they have over events in their neighborhoods [5] and is reflected by physical manifestations such as litter, noise pollution, graffiti, gang activity, and public substance abuse [6]. Results from past studies link perception of neighborhood disorder to a number of problematic self-reported health and behavioral outcomes, even after controlling for census-derived measures of postal code socioeconomic status [4, 7–10]. However, one of the limitations of the research examining the impact of neighborhood characteristics on health outcomes has been the traditional reliance on self-reported health outcomes [11]. The current study examined the association between perceived neighborhood disorder and health service usage in the context of neighborhood poverty (as measured by

---

A. Martin-Storey (✉)  
Population Research Centre, University of Texas at Austin,  
1 University Station G1800,  
Austin, TX 78712, USA  
e-mail: alexa.martin@gmail.com

C. E. Temcheff  
Department of Educational and Counselling Psychology,  
McGill University,  
Montreal, QC H3A 1Y2, Canada

P. L. Ruttle · L. A. Serbin · D. M. Stack · A. E. Schwartzman  
Centre for Research in Human Development,  
Psychology Department, Concordia University,  
Montreal, QC, Canada

J. E. Ledingham  
School of Psychology, University of Ottawa,  
Ottawa, ON, Canada

postal code socioeconomic status), individual-level adult socioeconomic status, gender, and childhood aggression.

Perception of neighborhood disorder has been used in the prediction of health and mental health outcomes for several reasons. First, perception of neighborhood disorder is associated with other objective assessments of the neighborhood environment [12, 13]. Self-reports of the neighborhood environment, including assessments of disorder, offer a reliable and convenient way to assess the neighborhood [14, 15], suggesting that self-reported neighborhood disorder may add valuable information to health service providers' understanding of the context in which the individual lives. However, perceived neighborhood disorder and observer rated disorder are significantly associated at moderate levels [16–18] so that while people's perception of their neighborhood partially reflects the physical environment, it may also provide additional information regarding the individual's experienced neighborhood that is not easily accessible to external observers. Understanding the role of perceived neighborhood disorder in determining health outcomes allows for a better understanding of the complex ways in which the neighborhood environment influences health and can inform both health care research and health care provision.

#### Neighborhood Disorder and Health

An association between perception of neighborhood disorder and health outcomes is probable for several reasons. First, perceptions of neighborhood disorder and neighborhood socioeconomic status are correlated [1, 7, 19], and individuals who live in lower socioeconomic status neighborhoods experience poorer health outcomes [20–22]. This association reflects the well-established link between individual-level poverty and health [23–25] and structural differences between low and high socioeconomic status neighborhoods regarding access to both health and health enhancing services [26, 27].

While the impact of low socioeconomic status on health may in part explain the association between perception of neighborhood disorder and health outcomes, a growing body of literature suggests that perceived neighborhood disorder continues to be associated with health and mental health outcomes despite controlling for neighborhood- and individual-level socioeconomic status [4, 28]. This subjective assessment of the environment and the impact of this subjective assessment may indeed be one of the factors by which neighborhood disorder influences health [7, 29].

Several mechanisms potentially link perception of neighborhood disorder to health outcomes beyond disadvantage. First, negative appraisals of neighborhood

disorder are associated with higher levels of stress [30, 31], and elevated stress is associated with negative health outcomes [32, 33]. For instance, perception of neighborhood disorder is associated with greater fear of neighborhood crime [34–36], even when general neighborhood disadvantage has been controlled [37]. As fear of crime is a significant source of stress [38], the impact of this fear on subsequent health outcomes may be a possible mechanism by which perceptions of neighborhood disorder influence health outcomes. Second, higher levels of perceived neighborhood disorder have been linked with lower levels of social support [38–40], and lowered levels of social support are associated with negative health outcomes [41]. Third, high perceived neighborhood disorder and violence are associated with reduced self-esteem [28], which is also associated with deleterious health and mental health outcomes [42, 43]. Finally, perceived neighborhood disorder may influence engagement in health enhancing activities, such as walking, outdoor exercise, and participation in organized physical activities of neighborhood recreation services that may have positive health benefits [44]. Neighborhood in general plays a distal role in determining individual health, and focusing on perceived neighborhood disorder suggests multiple pathways by which the broader neighborhood context influences individual well-being.

#### Factors Associated with Neighborhood Disorder

Individual-level factors influence perception of neighborhood disorder and thus may be anticipated to influence the impact of perception of neighborhood disorder on health outcomes. Women and younger people are more likely to be distressed by their neighborhood environments [45–47], and higher levels of educational attainment and income are associated with both lower levels of perceived neighborhood disorder [45, 47] and lowered impact of perceived neighborhood disorder on health outcomes [48]. Age, gender, educational attainment, and income would all be factors that shape the way people interact with their neighborhood environment. This differential exposure may reveal different levels of disorder to the individual (e.g., younger people may spend more time interacting with the neighborhood and may have more opportunities to witness disorder, or women's experiences of street harassment may make neighborhoods seem more dangerous and hostile). In this way, individual characteristics alter the individual's experienced neighborhood and the subsequent impact of this perceived neighborhood disorder on health outcomes.

While these demographic factors may shape the way individuals interact with their environment, the current

study sought to go a step further by examining the impact of childhood aggression on the association between perceived neighborhood disorder and health care service usage. Indeed, childhood aggression represents a persistent and maladaptive pattern of behavior that, after being learnt in childhood, influences the individuals' problem solving style across a wide variety of contexts [49–51] and is associated with negative health outcomes [24, 52, 53]. Childhood aggression is associated with negative outcomes such as dropping out of school [54–56] and living in poverty [56–58], which may subsequently increase the likelihood of both negative health outcomes and living in disadvantaged neighborhoods. Aggression in general increases the likelihood of an individual evaluating ambiguous situations as being hostile or threatening [59]. Childhood aggression, then, as reflecting a persistent pattern of behavior, may be associated with adult aggression, such that aggressive children become aggressive adults who perceive elevated levels of disorder in their neighborhoods. Further, childhood and adolescent aggression increases the likelihood of engaging in delinquent and criminal activity [60, 61], which may familiarize individuals with disordered aspects of their environment. Using childhood, rather than adult aggression, provides a clearer picture of the association between aggression and neighborhood disorder, as assessments of adult aggression may be influenced by frustration with current neighborhood conditions.

### The Current Study

The impact of perceived neighborhood disorder, neighborhood poverty, childhood aggression, and adult socioeconomic status on physical health and medical service usage was examined in adults living in and around Montreal, Canada. This study contributes to the existing literature in three ways. First, Canada has a universal, single-payer health care system that provides access at no cost for most medical services. Previous research with Canadian samples using both self-reported health and linked medical records indicates that low-income individuals use a disproportionate number of health services, which is only partially accounted for by their greater number of health problems [62–64]. In addition to using more health services, low-income individuals have different patterns of health service usage, such as they are less likely to visit a physician and more likely to visit a hospital [63] and may be less likely to use some kinds of preventative care services [65]. While income continues to play a role in Canadian's health disparities, these disparities are less pronounced than those in the USA [66], such that this health care system controls for some, but not all, inequities in health service usage [67,

68] and would be anticipated to reduce the effect of both individual and subsequent neighborhood poverty on service usage.

Second, the current study relied on medical records collected from the province of Québec. Relying on medical service usage data corrects for the problems of same-rater bias that may occur when both self-reports of neighborhood disorder and health are used together. Using medical data may also reduce recall bias, particularly regarding benign medical acts such as well checkups. Assessing medical service usage as an outcome can provide valuable information for healthcare providers in terms of how individual- and neighborhood-level factors influence interactions with the healthcare system.

Third, the moderating role of individual demographic and behavioral factors that interact with perceived neighborhood disorder in the prediction of health outcomes was examined. Testing the role of childhood aggression and other individual-level factors as they influence the association between perceived neighborhood disorder and health service usage provides a unique opportunity to integrate multiple contextual levels into the prediction of health outcomes.

It was anticipated that individuals who perceived high levels of neighborhood disorder would have higher rates of medical service usage. Furthermore, when examined in the context of the control variables, higher rates of health service usage were anticipated to be associated with both lower neighborhood poverty and higher perceptions of neighborhood disorder, although perceived neighborhood disorder was anticipated to have a greater impact on this outcome. The association between perceived neighborhood disorder and health service usage was also anticipated to be significant even after controlling for demographic variables and childhood aggression. Finally, the moderating roles of the control variables, gender, age, income, educational attainment, and childhood aggression were examined regarding the impact of perceived neighborhood disorder. Perceived neighborhood disorder was anticipated to have a greater impact on health outcomes in women, younger individuals, individuals with lower levels of educational attainment and income, and individuals with higher levels of childhood aggression.

## Method

### Participants

The Concordia Longitudinal Risk Project began with the in-school screening of French-speaking school children in grades 1, 4, and 7 classes in 1976–1977 and 1977–1978. Participation in the screening was voluntary, with

over 95% of the students consenting to participate. The study was approved by the school board, as well as by parent and teacher committees at each of the schools. As was standard procedure during this time period, both parents and children had the option to withdraw from the study at any time. From the original 1,770 participants selected, a representative subsample was recruited for the current study. During the second period of data collection in 1999–2003, the participants were between ages 28 and 40, with a mean age of 33.99 (SD = 2.75). Five hundred ninety-six individuals (354 women) had retrievable health and neighborhood data. Those individuals who agreed to participate and had medical records did not significantly differ from those individuals who did not have available medical records based on years of education, level of adult income, or childhood aggression. The participants were white, native French speakers living in 157 different postal code areas, with approximately 60% living in the greater Montréal area.

#### Dependent Variable

##### *Health Service Usage*

Provincial medical records between the years of 1992 and 2003 regarding all medical services utilized were obtained from the Régie de l'Assurance-Maladie du Québec, for all participants who had medical records with the province of Québec. All permanent residents of the province are covered by this “single-payer” system, which provides payment for all costs incurred by medical services. The medical records used in the present study covered all contacts with the health care system occurring between the years of 1992 and 2003, as these were the years that medical records could be retrieved. The total number of medical acts the individual received during this period was used as the outcome variable to achieve a more cohesive view of the individual's health functioning. These records contained numeric codes specifying medical acts, assessments, and diagnostic information which were used to construct five outcome variables: (1) total number of medical acts performed within the province (minus all obstetric and gynecological visits in order to allow for fair comparison between men and women), (2) total number of medical acts performed due to lifestyle-related illness (i.e., obesity, type II diabetes, ulcers, alcoholism, drug-abuse), (3) total visits to medical specialists, (4) total emergency room visits, and (5) total hospitalizations, descriptives for which can be seen in Table 1. As would be expected, there was considerable variability in healthcare usage, as some of these outcomes such as emergency room visits and hospitalizations would

be naturally infrequent in a population of this age. Outliers were present in the current data. Standardized procedures were followed to manage these outliers, such that all outliers that were three or more standard deviations away from the mean were brought to just above three standard deviations from the mean [69]. Even after making these alterations, variables remained skewed.

#### Independent Variables

##### *Childhood Aggression*

The Pupil Evaluation Inventory [70] was used to assess childhood aggression in the initial period of testing in 1976–1978. Students were asked to nominate up to four classmates of each gender who fit the description stated in the 20 items, which included questions such as “Those who start a fight over nothing.” The students had the option of nominating up to four students on each of the 20 aggression items. Number of nominations were subsequently summed and divided by class size for each student, such that children who were nominated for few or no items would receive low scores, while children who were nominated for many items would receive higher scores. These total scores were subsequently standardized for gender and classroom, and this standardized value was employed in the current analyses. Research has demonstrated that the Pupil Evaluation Inventory peer nominations show very high inter-rater reliability and internal consistency and represent a valid and reliable method of rating children's aggression [71].

##### *Perceived Neighborhood Disorder*

The subscale of “neighborhood disorder” from the Neighborhood for Children Rating Scales developed by Coulton, Korbin and Su [72] was used to assess participants' perception of their current neighborhood disorder in 1999–2003. This subscale contained questions regarding common indices of neighborhood disorder such as litter, poorly maintained property, public substance use, and vandalism. These items were summed, such that a higher score was associated with a higher rate of perceived neighborhood disorder. The scale has a high level of internal reliability ( $\alpha=0.93$ ), is concordant with other assessments of neighborhood disorder [72], and has been previously used to examine health outcomes [45]. For the purpose of the current analyses and in order to interpret the interaction effects, neighborhood disorder was dichotomized as to whether the participant had neighborhood scores below 3 (indicative of lower levels of neighborhood disorder) or of 3 and above (indicative of high levels of neighborhood disorder).

**Table 1** Descriptive statistics table (prior to removal of outliers)

	Mean	SD	Minimum	Maximum
Perception of neighborhood disorder	2.14	1.63	1.00	12.93
Census variables				
Unemployed individuals (%)	5.10	1.50	2.00	9.00
Families earning 10,000 or less (%)	4.60	2.40	0.00	11.00
Medical service usage <sup>a</sup>				
Total medical acts	91.27	99.05	3.00	1,738.00
Lifestyle illnesses	2.11	7.51	0.00	82.00
Specialist visits	46.73	63.12	0.00	1,030.00
Emergency room visits	40.39	80.82	0.00	1,668.00
Hospitalizations	1.97	3.77	0.00	75.00
Individual variables				
Childhood aggression (standardized)	0.20	0.97	-1.59	3.14
Education (total years)	12.47	2.56	5.00	21.00
Adult family income (CAD)	43,518.45	2,905.19	5,884.53	145,600.00

SD standard deviation

<sup>a</sup>Means, standard deviations, minimum and maximums for medical service usage prior to standardization of the data

### Neighborhood Poverty

The current study used data collected from the 2001 Canadian Census Micro Data Set, a longer census form sent to 20% of the general population in each Canadian postal code. All indicators of neighborhood poverty were significantly correlated (0.12 to 0.91); thus, two measures of neighborhood poverty used in previous studies were selected to represent neighborhood poverty [21, 73, 74]. These measures were percentage of unemployed individuals and percentage of households reporting incomes under CAN \$10,000 per year. A factor of these two variables was created using principal component analyses and was used in the current analyses.

### Sociodemographic Factors

During the 1999–2003 wave of data collection, participants were asked over the telephone about their total years of education, as well as their current family income. Descriptive statistics for these variables can be seen in Table 1.

### Procedure

Participants were assessed in school-based sociometric testing in 1976–1977 and 1977–1978. Over 20 years later and after a certification of the ethical acceptability of the current study was issued in 1999, a representative subsample of participants from the original study were contacted by telephone between 1999 and 2003 to request their participation in the current wave of data collection. Those interested in participating affirmed consent at this time. Individuals who agreed to participate were given a package of questionnaires including the Neighborhood Environment

for Children Rating Scales [72]. Participants were financially compensated with \$50 once the surveys were returned. Included in the information gathered via the questionnaire package was the participants' postal code. Using the first three letters and digits of the postal code, census track data on the participants' census tracks from the year 2001 were retrieved and used in subsequent analyses. Finally, medical data were collected from the Régie de l'Assurance-Maladie du Québec for the participants from the years 1992–2003 in 2006.

### Results

A MANOVA was used to assess the association between perceived neighborhood disorder and lifestyle illness, total hospitalizations, total emergency room usage, and total visits to a specialist. Total medical acts was not included in this initial MANOVA as this variable was a composite variable composed from these and other medical acts. Preliminary correlations between perceived neighborhood disorder, neighborhood poverty, and health outcomes are presented in Table 2. To further investigate these associations between perception of neighborhood disorder, neighborhood poverty, and control variables, linear regressions were employed. Gender, age, years of education, and income were controlled in the first step, childhood aggression was added in the second step, neighborhood poverty was included in the third step, and perception of neighborhood disorder was included in the fourth step. Interaction terms were included independently in the fifth step.

The MANOVA had a Wilks' lambda of 0.98 ( $F(4, 591) = 3.83, p < 0.001$ ), and the value of Pillai's trace was 0.03, suggesting that there were significantly higher levels of

**Table 2** Association between control, predictor, and outcome variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Neighborhood disorder	1.00	0.36**	0.16**	0.05	-0.27**	-0.25**	0.15**	0.16**	0.11**	0.05	0.12**	0.13**	-0.08*	0.08*
2. Neighborhood poverty		1.00	0.03	0.00	-0.12**	-0.22**	0.03	0.04	0.03	-0.03	0.01	0.02	-0.02	-0.06
3. Childhood aggression			1.00	-0.02	-0.20**	0.07	0.18**	0.10*	0.11*	0.06	0.15**	0.12**	0.03	0.11*
4. Age				1.00	-0.12**	-0.03	-0.04	-0.01	0.03	-0.06	-0.03	-0.07	0.01	-0.09*
5. Education					1.00	0.31**	-0.16**	-0.10*	-0.19**	-0.01	-0.10*	-0.09*	0.16**	0.01
6. Income						1.00	-0.16**	-0.09*	-0.12**	-0.07	-0.11**	-0.12**	0.00	0.09*
7. Total medical acts							1.00	0.16**	0.34**	-0.72**	0.86**	0.88**	0.15**	0.74**
8. Lifestyle illness								1.00	0.04	0.12**	0.09*	0.09*	-0.04	0.06
9. Injuries									1.00	0.12**	0.17**	0.15**	0.08*	0.00
10. Infections										1.00	0.62**	0.60**	0.18**	0.52**
11. Specialist visits											1.00	0.91**	0.08	0.80**
12. Emergency room visits												1.00	0.06	0.88**
13. Well checkups													1.00	0.06
14. Hospitalizations														1.00

\* $p < 0.05$ ; \*\* $p < 0.01$

medical service usage amongst individuals who perceived their neighborhoods as having higher levels of disorder. Further, tests of between-subject effects suggested that this association remained true for all health service usage outcomes except hospitalization. As seen in Table 3, perception of neighborhood disorder was positively related to overall health service usage (total medical acts), medical visits due to lifestyle-related illnesses, medical visits to specialists, emergency room visits, and total number of hospitalizations. These results suggest that increased levels of perceived neighborhood disorder were related to increased medical service usage. Conversely, perception of neighborhood disorder was not related to medical visits due to injuries, infections, obstetric and gynecological visits, or well checkups (not presented). Lower neighborhood poverty was not associated with any of the health outcomes examined, with the exception of increased number of hospitalizations.

The predictive effects of perception of neighborhood disorder were observed while controlling for the predictive effects of childhood aggression, level of education, adult income, and actual neighborhood poverty based on census data. Consistent with previous studies with this sample [51], increased levels of childhood aggression were found to predict greater overall service usage, more visits to specialists, and more emergency room visits. Further, significant interactions were observed between childhood aggression and perceived neighborhood disorder in predicting lifestyle illness ( $\beta = 0.09, t = 2.01, p < 0.05$ ), visits to specialists ( $\beta = 0.09, t = 2.19, p < 0.05$ ), total emergency room visits ( $\beta = 0.10, t = 2.47, p < 0.05$ ), and total hospitalizations ( $\beta = 0.08, t = 2.01, p < 0.05$ ). In all four of these cases, there was no significant difference in health service usage across level of disorder for individuals with low levels of childhood aggression, or for individuals with high levels of childhood aggression who perceived low levels of neighborhood disorder. However, individuals with high levels of childhood aggression, who perceived high levels of neighborhood disorder, had the higher rates of medical service usage.

A main effect of gender was found for total medical service usage, medical visits to specialists, emergency room visits, and total hospitalizations, suggesting that women seek medical attention more frequently than men. Significant interactions between gender and perception of neighborhood disorder were found for emergency room visits ( $\beta = 0.09, t = 2.05, p < 0.05$ ) as well as for visits to specialists ( $\beta = 0.11, t = 2.83, p < 0.01$ ). In both cases, perception of neighborhood disorder was associated with increased service usage for women, but not for men. A main effect of education was found for total medical acts. The interaction between education and neighborhood disorder was significant ( $\beta = 0.08, t = 1.95, p <$

**Table 3** Standardized regression coefficients reflecting the relation between childhood behavioral characteristics and adult health outcomes

	All medical acts			Medical visits for lifestyle illnesses			Medical visits to specialists			Emergency room visits			Total hospitalizations		
	$\beta$	$\Delta R^2$	F step	$\beta$	$\Delta R^2$	F step	$\beta$	$R^2$	F step	$\beta$	$R^2$	F step	$\beta$	$R^2$	F step
<b>Step 1</b>															
Gender	0.19**			0.12**			0.30**			0.23**			0.41**		
Age	0.03			0.01			0.03			-0.02			-0.02		
Education	-0.18**			-0.09*			-0.12**			-0.16**			-0.10*		
Income	-0.16**			-0.11**			-0.09*			-0.12**			-0.06		
		0.11	18.02**		0.04	5.69**		0.12	19.16**		0.10	16.27**		0.19	34.27**
<b>Step 2</b>															
Gender	0.18**			0.11**			0.29**			0.22**			0.41**		
Age	0.04			0.02			0.04			-0.02			-0.01		
Education	-0.15**			-0.07			-0.09*			-0.13**			-0.08*		
Income	-0.15**			-0.11*			-0.08*			-0.11**			-0.06		
Childhood aggression	0.16**			0.07			0.11**			0.12**			0.09*		
		0.02	15.64**		0.00	2.58		0.01	7.77**		0.01	8.47**		0.01	5.57**
<b>Step 3</b>															
Gender	0.19**			0.11**			0.29**			0.22**			0.41**		
Age	0.04			0.01			0.04			-0.02			-0.02		
Education	-0.14**			-0.07			-0.09*			-0.13**			-0.07		
Income	-0.13**			-0.09*			-0.07*			-0.09			-0.05		
Childhood aggression	0.15**			0.06			0.10*			0.11**			0.09*		
Neighborhood disorder	0.08*			0.08*			0.08*			0.09*			0.05		
		0.01	4.36*		0.01	3.72**		0.01	4.23*		0.01	4.74**		0.00	2.01
<b>Step 4</b>															
Gender	0.19**			0.11**			0.29**			0.22**			0.40**		
Age	0.04			0.01			0.04			-0.02			-0.02		
Education	-0.14**			-0.07			-0.09*			-0.13**			-0.08*		
Income	-0.13**			-0.09*			-0.07			-0.09*			-0.07		
Childhood aggression	0.15**			0.06			0.10**			0.11**			0.08*		
Neighborhood disorder	0.08*			0.09*			0.08*			0.08*			0.09*		
Neighborhood poverty	0.01			-0.01			0.00			0.03			-0.12**		
		0.00	0.05		0.00	0.10		0.00	0.00		0.00	0.38		0.01	9.62**
Overall F	13.47**				4.18**		12.85**			11.46**			22.59**		
Adjusted R <sup>2</sup>	0.13				0.05		0.12			0.11			0.20		

1 = male, 2 = female

\* $p < 0.05$ ; \*\* $p < 0.01$

0.05) such that when disorder was high, level of education was not associated with total medical acts, but when disorder was low, higher levels of education predicted fewer medical acts. As can be seen in Table 3, a main effect of income was found for total medical acts and total emergency room visits, but in both of these cases, the interaction term was not significant.

Finally, age was also interacted with neighborhood disorder. No significant interactions were found regarding total medical service usage, medical visits to specialists, and medical acts due to lifestyle illness. A significant interaction was found for emergency room usage ( $\beta=0.08$ ,  $t=2.09$ ,  $p<0.05$ ), such that no significant difference in emergency room usage across level of disorder was found for younger individuals, but for older individuals, higher levels of disorder were associated with higher rates of emergency room usage.

## Discussion

The findings illustrate that higher perceived neighborhood disorder was associated with higher levels of medical service usage and continued to be associated with total medical service usage, medical visits due to lifestyle-related illnesses, emergency room visits, and total hospitalizations even after controlling for the other known health risks. These findings support previous research linking perception of neighborhood disorder to health outcomes [1–4], suggesting that perception of neighborhood disorder may be an important determinant in the association between neighborhood and health outcomes. Further, childhood aggression, gender, and educational attainment moderated the association between perceived neighborhood disorder and health service usage. Perceived neighborhood disorder may influence these health outcomes via several pathways including impact on individual stress levels, social support, access to neighborhood services, self-concept, and depression [28, 30, 31, 38–40, 44], all of which are associated with negative health outcomes [32, 33, 41–43].

Unlike perception of neighborhood disorder, neighborhood poverty was not associated with the majority of the health service usage outcomes examined in the current study, with the exception of hospitalizations. Previous research linking neighborhood socioeconomic status and health has frequently used self-reported health outcomes [21, 22, 42], in older participants [20, 73, 75] and in more economically heterogeneous, American samples [75]. In many of these studies, neighborhood poverty is used as a stand-in variable for individual socioeconomic status. The lack of association between neighborhood poverty and negative health outcomes may

have occurred due to the use of Canadian data. The Canadian health care system, providing “universal coverage,” may mitigate some of the association between neighborhood poverty and deleterious health outcomes.

The one case in which neighborhood poverty was significant may also be indicative of the unique role of the Canadian health care system in determining the association between socioeconomic status and health care access. Within a Canadian context, low socioeconomic status individuals are more likely to be hospitalized than higher socioeconomic status individuals [63], and while Quebec has a fairly comprehensive community clinic program designed to address the health needs of individuals in both low and high socioeconomic status areas [76], these clinics may act to reduce problems associated with short-term medical service use, but not the kinds of long-term, chronic problems that require hospitalization within their catchment neighborhoods. Finally, persistent hospitalizations may reflect the presence of serious, debilitating illnesses that may deleteriously impact the individual’s socioeconomic status, subsequently forcing them to live in less expensive neighborhoods.

The current findings also go beyond previous research by determining how perceived neighborhood disorder interacted with childhood aggression. Childhood aggression also related to health service usage and was found to moderate the impact of perceived neighborhood disorder, such that high levels of childhood aggression, coupled with high levels of perceived neighborhood disorder, were associated with the highest levels of health service usage. Individuals high in childhood aggression may be more sensitive to the stressors in their environment, such that perceived disorder has a greater impact on their health. Conversely, individuals with higher levels of childhood aggression may also interact with their environment in such a way that they are more aware of the level of neighborhood disorder (e.g., delinquency and criminality). Indeed, aggressive youth are more likely to be involved in disorderly behavior, a trend that continues throughout adulthood [77]. Adult aggression was not assessed in the current study, and future research may be able to clarify the role played by aggression by examining both childhood and adult aggression in the prediction of health outcomes.

Women’s perceptions of neighborhood disorder were associated with health outcomes more frequently than men’s perceptions. This may reflect gender differences in stress caused by perceived neighborhood disorder. Women in the current study did not report higher levels of neighborhood disorder, but they may be more sensitive to the negative ramifications of disorder in their neighborhoods. Increased stress, as a result of neighborhood disorder, has been suggested as a mechanism by which neighborhood factors influence health outcomes [18].



Educational attainment and income were anticipated to moderate the relation between disorder and health service usage. Higher levels of education were protective regarding total health care service usage for individuals who perceived their neighborhoods as being low in disorder, but not for individuals who perceived their neighborhoods as being high in disorder. While the research supporting the moderating effects of educational attainment and income on the relation between neighborhood disorder and health outcomes is limited [48], the difference between the present findings and previous research may have occurred because the participants in the present study had a lower level of extreme economic distress.

The current findings did not suggest a significant effect for age regarding the health service usage. A significant interaction, however, was found regarding emergency room usage, whereby disorder was associated with service usage but only for older individuals. This interaction, along with the other non-significant findings, may suggest that lack of age effects occurred due to the limited age of the participants. Future research may better understand the relation between neighborhood and health service usage by examining this association in a sample with a wider age range.

Findings from the present study provide a unique opportunity to explore the ways in which both individual and neighborhood factors influence medical service usage in adulthood. Specifically, they support the role of perceived neighborhood disorder in the relation between neighborhood and health outcomes. However, there are several limitations that can be addressed by future research. Although census assessments of neighborhood poverty and perceptions of neighborhood disorder are related [13, 18], differences between these assessments may reflect different geographic definitions of neighborhood [78]. Thus, the fact that perception of neighborhood disorder was more strongly associated with health outcomes when compared with neighborhood poverty may indicate that the individual's experienced neighborhood is different from their census-defined neighborhood but reflect the individual's experienced environment. Future research may wish to include other objective assessments of neighborhood disorder, or examine the overlap between census and individual described neighborhood boundaries to establish the relation between neighborhood disorder and individual-level health.

The current study provided an opportunity to examine factors influencing health service usage. However, including variables such as family of origin socioeconomic status that were not available in the current study may have acted to further clarify the role of these variables on individual-level health outcomes. Results

are correlational, as the assessments of perceived neighborhood disorder, census disadvantage, education, and income were assessed during a time period that overlapped with the assessment of health outcomes. Future research, in which both perception of neighborhood disorder and health service usage are assessed at multiple time points, may help clarify the directionality of the current findings. As well, the current findings suggest that experienced stress may be an important factor in determining the association between perceived neighborhood disorder and health outcomes. Future research may wish to include assessments of this variable. Finally, the current study drew from a Canadian sample, reducing the generalizability of these findings to other countries without universal health care.

The current findings reflect the importance of perception of neighborhood disorder in determining health outcomes in a Canadian sample. By including childhood aggression, as well as more traditional demographic variables, it was possible to tease out the association between perceptions of neighborhood disorder and health. It was also possible to better understand how factors such as childhood aggression, gender, educational attainment, and income acted to modify the association between perceived neighborhood disorder and health outcomes. The association between perceptions of neighborhood disorder and health service usage suggests designing interventions that address both individual perceptions of the environment as well as community-level poverty and disorder and indicates that the separate needs of different demographic groups should be taken into consideration in attempts to reduce the impact of neighborhood factors on health care inequities.

**Acknowledgments** The Concordia Longitudinal Research Project has received funding from the Social Sciences and Humanities Research Council of Canada, the Canadian Institutes for Health Research, and the Fonds de recherche sur la société et la culture. Additionally, the first author was funded by a CGS Doctoral Grant from the Social Sciences and Humanities Research Council of Canada. The authors wish to thank Claude Senneville and the other individuals involved in the data collection and management. Finally, the authors wish to thank the participants who donated their time to this project.

**Conflict of Interest Statement** The authors of the current study have no conflicts of interest to disclose regarding the data collection, analyses, or interpretation.

## References

1. Deng S, Lopez V, Roosa MW, Ryu E, Burrell GL, Tein J, et al. (2006) Family processes mediating the relationship of neighborhood disadvantage to early adolescent internalizing problems. *The Journal of Early Adolescence*. 26(2):206–31.

2. McNeill LH, Wyrwich K, Brownson R, Clark E, Kreuter, M. Individual, social environmental, and physical environmental influences on physical activity among black and white adults: A structural equation analysis. *Annals of Behavioral Medicine*. 2006. 31: 36–44.
3. Weden MM, Carpiano RM, Robert SA. Subjective and objective neighborhood characteristics and adult health. *Soc Sci Med*. 2008 03;66(6):1256–70.
4. Wen M, Hawkey LC, Cacioppo JT. Objective and perceived neighborhood environment, individual SES and psychosocial factors, and self-rated health: An analysis of older adults in Cook county, Illinois. *Soc Sci Med*. 2006;63:2575–90.
5. Skogan W. *Disorder and decline: Crime and the spiral of decay in American neighborhoods*. New York: Free; 2000.
6. Perkins DD, Taylor RB. Ecological assessments of community disorder: Their relationship to fear of crime and theoretical implications. *Am J Community Psychol*. 1996 02;24(1):63–107.
7. Feldman PJ, Steptoe A. How neighborhoods and physical functioning are related: The roles of neighborhood socioeconomic status, perceived neighborhood strain, and individual health risk factors. *Annals of Behavioral Medicine*. 2004;27(2):91–9.
8. Monden CWS, Lenthe FJ van, Mackenbach JP. A simultaneous analysis of neighbourhood and childhood socio-economic environment with self-assessed health and health-related behaviours. *Health & Place* 2006;12:394–40.
9. Steptoe A, Feldman PJ. Neighborhood problems as sources of chronic stress: Development of a measure of neighborhood problems, and associations with socioeconomic status and health. *Annals of Behavioral Medicine*. 2001;23(3):177–85.
10. Stiffman AR, Hadley-Ives E, Elze D, Johnson S, Doré P. Impact of environment on adolescent mental health and behavior: Structural equation modeling. *Am J Orthopsychiatry*. 1999 01;69(1):73–86.
11. Diez-Roux AV. Neighborhood stress and health. In (Ed). G. Fink, *Encyclopedia of Stress*. 2007:825–827.
12. Kawachi I, Kennedy BP, Wilkinson RG. Crime: Social disorganization and relative deprivation. *Soc Sci and Med*. 1999;48: 719–731.
13. Sampson RJ, Raudenbush SW. Systematic social observation of public spaces: A new look at disorder in urban neighborhoods. *Am J of Sociol*. 1999 11;105(3):603–51.
14. Gidlow C, Cochrane T, Davey RC, Smith G, Fairburn J. Relative importance of physical and social aspects of perceived neighbourhood environment for self-reported health. *Preventive Medicine: An International Journal Devoted to Practice and Theory*. 2010 08;51(2):157–63.
15. O'Brien DT, Wilson DS. Community perception: The ability to assess the safety of unfamiliar neighborhoods and respond adaptively. *J Pers Soc Psychol*. 2011 04;100(4):606–20.
16. Austin DM, Furr LA, Spine M. The effects of neighbourhood conditions on perceptions of safety. *J Crim Just*. 2002 30: 417–427.
17. O'Neil R, Parke RD, McDowell DJ. Objective and subjective features of children's neighborhoods: Relations to parental regulatory strategies and children's social competence. *Applied Dev Psych*. 2001 22:135–155.
18. Perkins DD, Meeks JW, Taylor RB. The physical environment of street blocks and resident perceptions of crime and disorder: Implications for theory and measurement. *J Environ Psychol*. 1992 03;12(1):21–34.
19. Mares AS, Desai RA, Rosenheck RA. Association between community and client characteristics and subjective measures of the quality of housing. *Psychiatric Services*. 2005 03;56(3):315–9.
20. Menece VH, Shoostari S, Nowicki S, Fournier S. Does the relationship between neighborhood socioeconomic status and health outcomes persist into very old age? A population-based study. *J Aging Health*. 2010 02;22(1):27–47.
21. Ross NA, Tremblay S, Graham K. Neighbourhood influences on health in Montreal, Canada. *Soc Sci Med*. 2004 10;59(7):1485–94.
22. Matthews SA, Yang T. Exploring the role of the built and social neighborhood environment in moderating stress and health. *Annals of Behavioral Medicine*. 2010 05;39(2):170–83.
23. Ball K, Mishra GD, Crawford D. Social factors and obesity: An investigation of the role of health behaviours. *Int J Obes*. 2003 03;27(3):394–403.
24. Poulton R, Caspi A, Milne BJ, Thomson WM, Taylor A, Sears MR, et al. Association between children's experience of socio-economic disadvantage and adult health: A life-course study. *The Lancet*. 2002 11;360(9346):1640–5.
25. Robbins JM, Vaccarino V, Zhang H, Kasl SV. Socioeconomic status and type 2 diabetes in African American and non-Hispanic white women and men: Evidence from the Third National Health and Nutrition Examination Survey. *Am J Public Health*. 2001 Jan; 91(1):76–83.
26. Estabrooks PA, Lee RE, Gyuresik NC. Resources for physical activity participation: Does availability and accessibility differ by neighborhood socioeconomic status? *Annals of Behavioral Medicine*. 2003;25(2):100–4.
27. Gardner M, Barajas RG, Brooks-Gunn J. Neighborhood influences on substance use etiology: Is where you live important? In: Scheier P, Lawrence, editor. *Handbook of drug use etiology: Theory, methods, and empirical findings*. Washington, DC: American Psychological Association; 2010. p. 423–41.
28. Haney TJ. 'Broken windows' and self-esteem: Subjective understandings of neighborhood poverty and disorder. *Soc Sci Res*. 2007 09;36(3):968–94.
29. Taylor SE, Repetti RL, Seeman T. Health psychology: What is an unhealthy environment and how does it get under the skin? *Annu Rev Psychol*. 1997;48:411–47.
30. Franco LM, Pottick KJ, Huang C. Early parenthood in a community context: Neighborhood conditions, race-ethnicity, and parenting stress. *J Community Psychol*. 2010 07;38(5):574–90.
31. Hill TD, Ross CE, Angel RJ. Neighborhood disorder, psychophysiological distress, and health. *J Health Soc Behav*. 2005 06;46(2):170–86.
32. Hasson D, Von Thiele S, Lindfors P. Self-rated health and allostatic load in women working in two occupational sectors. *Journal of Health Psychology*. 2009 05;14(4):568–77.
33. Juster R, McEwen BS, Lupien SJ. Allostatic load biomarkers of chronic stress and impact on health and cognition. *Neurosci Biobehav Rev*. 2009 12;35(1):2–16.
34. Ross CE, Jang SJ. Neighborhood disorder, fear, and mistrust: The buffering role of social ties with neighbors. *Am J Community Psychol*. 2000 08;28(4):401–20.
35. Sampson RJ, Raudenbush SW. Seeing disorder: Neighborhood stigma and the social construction of 'broken windows'. *Soc Psychol Q*. 2004 12;67(4):319–42.
36. Wyant BR. Multilevel impacts of perceived incivilities and perceptions of crime risk on fear of crime: Isolating endogenous impacts. *J Res Crime Delinquency*. 2008 02;45(1):39–64.
37. Scarborough BK, Like-Haislip T, Novak KJ, Lucas WL, Alarid LF. Assessing the relationship between individual characteristics, neighborhood context, and fear of crime. *J Crim Justice*. 2010 07;38(4):819–26.
38. Kruger DJ, Reischl TM, Gee GC. Neighborhood social conditions mediate the association between physical deterioration and mental health. *Am J Community Psychol*. 2007 12;40(3–4):261–71.
39. Kim J. Neighborhood disadvantage and mental health: The role of neighborhood disorder and social relationships. *Soc Sci Res*. 2010 03;39(2):260–71.

40. Kim J, Ross CE. Neighborhood-specific and general social support: Which buffers the effect of neighborhood disorder on depression? *J Community Psychol*. 2009 08;37(6):725–36.
41. Uchino BN. Social support and health: A review of physiological processes potentially underlying links to disease outcomes. *J Behav Med*. 2006 08;29(4):377–87.
42. Dickerson SS, Gruenewald TL, Kemeny ME. Psychobiological responses to social self threat: Functional or detrimental? *Self and Identity*. 2009 04;8(2–3):270–85.
43. Ford M, Collins NL. Self-esteem moderates neuroendocrine and psychological responses to interpersonal rejection. *J Pers Soc Psychol*. 2010 03;98(3):405–19.
44. Wilbur J, Zenk S, Wang E, Oh A, McDevitt J, Block D, et al. Neighborhood characteristics, adherence to walking, and depressive symptoms in midlife African American women. *J Women's Health*. 2009 08;18(8):1201–10.
45. Elo IT, Mykkyta L, Margolis R, Culhane JF. Perceptions of neighborhood disorder: The role of individual and neighborhood characteristics. *Soc Sci Quart*. 2009 12;90(5):1298–320.
46. Pampalon R, Hamel D, De Koninck M, Disant M. Perception of place and health: Differences between neighbourhoods in the Québec city region. *Soc Sci Med*. 2007 07;65(1):95–111.
47. Roosa MW, White RMB, Zeiders KH, Tein J. An examination of the role of perceptions in neighborhood research. *J Community Psychol*. 2009 04;37(3):327–41.
48. Christie-Mizell C, Steelman LC, Stewart J. Seeing their surroundings: The effects of neighborhood setting and race on maternal distress. *Soc Sci Res*. 2003 09;32(3):402–28.
49. Asendorpf JB, Denissen JJA, van Aken, Marcel A. G. Inhibited and aggressive preschool children at 23 years of age: Personality and social transitions into adulthood. *Dev Psychol*. 2008 07;44(4):997–1011.
50. Cairns RB, Cairns BD, Xie H, Leung M, Hearne S. Paths across generations: Academic competence and aggressive behaviors in young mothers and their children. *Dev Psychol*. 1998 11;34(6):1162–74.
51. Huesmann LR, Eron LD, Lefkowitz MM, Walder LO. Stability of aggression over time and generations. *Dev Psychol*. 1984 11;20(6):1120–34.
52. Caspi A, Begg D, Dickson N, Harrington H, Lagnley J, Moffitt TE, Silva PA. Personality differences predict health-risk behaviours in young adulthood: Evidence from a longitudinal study. *J Personality and Social Psychology*. 1997 73:1052–63.
53. Temcheff CE, Serbin LA, Martin-Storey A, Stack DM, Ledingham JE, Schwartzman, AE. Predicting adult physical health outcomes from childhood aggression, social withdrawal and likeability: a 30-year prospective, longitudinal study. *Int J Behav Med*. 2011 18:5–12.
54. Brook JS, Newcomb MD. Childhood aggression and unconventionality: Impact on later academic achievement, drug use, and workforce involvement. *J Gen Psychol*. 1995 12;156(4):393–410.
55. Huesmann LR, Dubow EF, Boxer P. Continuity of aggression from childhood to early adulthood as a predictor of life outcomes: Implications for the adolescent-limited and life-course-persistent models. *Aggressive Behav*. 2009 03;35(2):136–49.
56. Kokko K, Bergman LR, Pulkkinen L. Child personality characteristics and selection into long-term unemployment in Finnish and Swedish longitudinal samples. *Int J Behav Dev*. 2003 03;27(2):134–44.
57. Kokko K, Pulkkinen L. Aggression in childhood and long-term unemployment in adulthood: A cycle of maladaptation and some protective factors. *Dev Psychol*. 2000;36(4):463–72.
58. Odgers CL, Moffitt TE, Broadbent JM, Dickson N, Hancox RJ, Harrington H, et al. Female and male antisocial trajectories: From childhood origins to adult outcomes. *Dev Psychopathol*. 2008;20(2):673–716.
59. Dodge KA. Translational science in action: Hostile attributional style and the development of aggressive behavior problems. *Development and Psychopathology*. 2006 18: 791–814.
60. Fite PJ, Colder CR, Lochman JE, Wells KC. Developmental trajectories of proactive and reactive aggression from fifth to ninth grade. *J Clin Child Adolescent Psychol*. 2008 04;37(2):412–21.
61. Loeber R, Lacourse E, Homish DL. Homicide, violence, and developmental trajectories. In: Archer J, editor. *Developmental origins of aggression*. New York: Guilford; 2005. p. 202–19.
62. Alter DA, Stukel T, Chong A, Henry D. Lesson from Canada's Universal Care: Socially disadvantaged patients use more health services, still have poorer health. *Health Aff* 2011;30(2):274–83.
63. Lemstra M, Mackenbach J, Neudorf C, et al. High healthcare utilization and costs associated with lower socioeconomic status: Results from a linked dataset. *Can J of Pub Health* 2009;100(3):180–183.
64. Health Disparities Task Group of the Federal/Provincial/Territorial Advisory Committee on Population Health and Health Security. (Dec. 2004). *Reducing health disparities—roles of the health sector: Discussion paper*. Ottawa: Minister of Health. Available at [http://www.phac-aspc.gc.ca/ph-sp/disparities/pdf06/disparities\\_recommended\\_policy.pdf](http://www.phac-aspc.gc.ca/ph-sp/disparities/pdf06/disparities_recommended_policy.pdf), Accessibility verified June 6<sup>th</sup> 2011.
65. Katz S, Zemencuk J, Hofer T. Breast cancer screening in the United States and Canada, 1994: Socioeconomic gradients persist. *Am J Public Health*, 2000, 90(5), 799–803.
66. Lasser KE, Himmelstein DU, Woolhandler S. Access to care, health status, and health disparities in the United States and Canada: Results of a cross-national population-based survey. *Am J Public Health*. 2006 07;96(7):1300–7.
67. Hankivsky O, Christoffersen A. Intersectionality and the determinants of health: A Canadian perspective. *Critical Public Health*. 2008 09;18(3):271–83.
68. Johnson S, Abonyi S, Jeffrey B, Hackett P, Hampton M, McIntosh T, et al. Recommendations for action on the social determinants of health: A Canadian perspective. *The Lancet*. 2008 11;372(9650):1690–3.
69. Tabachnick BG, Fidell LS. *Using Multivariate Analysis*, 4th Edition. Boston: Allyn & Bacon; 2001.
70. Pekarik EG, Prinz RJ, Liebert DE, Weintraub S, Neale JM. The pupil evaluation inventory: A sociometric technique for assessing children's social behavior. *J Abnorm Child Psychol*. 1976;4:83–97.
71. Lyons J, Serbin LA, Marchessault K. The social behavior of peer-identified aggressive, withdrawn, and aggressive/withdrawn children. *J Abnorm Child Psychol*. 1988 10;16(5):539–52.
72. Coulton CJ, Korbin JE, Su M. Measuring neighborhood context for young children in an urban area. *Am J Community Psychol*. 1996 02;24(1):5–32.
73. Hou F, Myles J. Neighbourhood inequality, neighbourhood affluence and population health. *Soc Sci Med*. 2005 04;60(7):1557–69.
74. Roos LL, Magoon J, Gupta S, Chateau D, Veugelers PJ. Socioeconomic determinants of mortality in two Canadian provinces: Multilevel modelling and neighborhood context. *Soc Sci Med*. 2004 10;59(7):1435–47.
75. Clarke CA, Miller T, Chang ET, Yin D, Cockburn M, Gomez SL. Racial and social class gradients in life expectancy in contemporary California. *Soc Sci Med*. 2010 05;70(9):1373–80.
76. Bozzini L. Local Community Services Centres (CLSCs) in Quebec: Description, evaluation, perspectives. *J Pub Health Pol*. 1988;9(3):346–75.
77. Brook JS, Brook DW, Zhang C, Cohen P. Pathways from adolescent parent-child conflict to substance use disorders in the fourth decade of life. *Am J Addictions*. 2009 18:235–242.
78. Coulton CJ, Korbin J, Chan T, Su M. Mapping residents' perceptions of neighborhood boundaries: A methodological note. *Am J Community Psychol*. 2001 04;29(2):371–83.