Patterns of obesogenic neighborhood features and residential property values

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Abstract

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Obesity is a growing problem in the United States, and past research has investigated ways in which neighborhood characteristics may influence obesity prevalence. However, studying features of the obesogenic neighborhood can be difficult because of the need for complex multilevel analyses. Using data from the Seattle Obesity Study, a cross-sectional study of socioeconomic disparities in diet and health based on a representative sample of 2,001 adult residents of King County, WA, we examined property value as a new metric for capturing aspects of the built environment. We used regression analyses to examine the associations between property value and 22 total self-reported access to neighborhood amenities and perception of neighborhood characteristic variables, and further investigated the association between these neighborhood features and BMI. Eight of the 11 access to amenities variables and ten of the 11 neighborhood perception variables were associated with property values ($p<0.001$). The largest difference in property values due to access to amenities was associated with access to a convenience store ($60,000 lower property value); the largest differences in property value due to neighborhood perceptions was believing the neighborhood to be attractive, ($100,000 higher property value) and trusting

the people in the neighborhood ($90,000 higher property value). We further found that the association between neighborhood features and BMI depended on gender. The data provide evidence that, because of its ability to capture complex information about the built environment, neighborhood perceptions, and socioeconomic status in a single metric, property values can be of great use in epidemiology studies.

INTRODUCTION

More than one-third of adults in the United States are obese, and the prevalence of obesity has increased substantially over the past two decades.[1,2] Previous studies have shown that obesity is inversely related with income and education in women, though there are conflicting results regarding this association in men.[2] Studies have also shown an association between neighborhood socioeconomic disadvantage and obesity for both men and women.[3,4] There has been a focus on the associations between obesity and access to food sources, opportunities for physical education such as distances to parks, and neighborhood safety; however, linking such features of the obesogenic neighborhood to obesity rates can be problematic due to the need for complex multilevel analyses.[5]

Property values, an objective measure of both individual and neighborhood wealth, capture information about economic security and lifetime accumulation of wealth, giving them an advantage over more traditional socioeconomic status (SES) variables such as annual income.[6] Measures of individual wealth derived from property values may also be closer to self-reported income than measures derived from the use of group income census data.[7] In addition to providing information about individual wealth, property values may also capture more complex information about neighborhood features. Despite the advantages of this new metric, property values are not often used in epidemiology studies.

When used in research, property values have been related to obesity and self-reported health. One study conducted in southeast Wales found that low property values were associated with having poor diet quality and being obese compared to higher value properties.[8] Another study done in Northern Ireland showed that residents of homes with higher property values were less likely to report being in poor health than residents of homes with lower property values.[9]

Although previous research has elucidated some of the pathways by which built environment and SES characteristics may influence health, the introduction of property

value as a new wealth metric establishes a need for studies investigating the association between this metric and neighborhood characteristics. A previous study using the same dataset as the analyses described in this paper found an association between property value and BMI among adult women, but not men, in King County, Washington.[10] This paper examines possible explanations for the observed association by seeking to understand which features of the neighborhood are most closely associated with property values and obesity.

METHODS

Sample and Study Design

Data were drawn from the National Institutes of Health funded Seattle Obesity Study (SOS). The SOS was a cross-sectional study of socioeconomic disparities in diet and health, based on a representative sample of 2,001 adult residents of King County, WA. The study used a stratified random sampling scheme to ensure adequate representation by income and race/ethnicity. King County zip codes with high percentages of annual household incomes less than $35,000, African-Americans, or Hispanics were oversampled. Following standard procedures, commercial databases were used to match randomly generated telephone numbers with residential addresses.

Data Collection

A pre-notification letter was mailed to potential respondents, followed by telephone calls. Once the household was contacted, one adult was randomly selected to participate in the study. After verbal consent was obtained, trained interviewers administered a 20 minute telephone survey that collected individual-level data on food shopping and eating habits, food-related attitudes, food insecurity, physical activity, self-report access to neighborhood amenities, perceived neighborhood characteristics, and socio-demographic and health

variables. Each respondent was also asked to complete a written food frequency questionnaire.

In addition, data on respondents' home location and 2008 King County tax assessor records were used to develop measures of neighborhood-level property values. A detailed description of the creation of this variable can be found elsewhere.[6] Briefly, respondent's addresses were geocoded, and each point was checked by a technician for accuracy and plausibility. The assessed value of each unit was calculated from the value of the land and any improvements, such as driveways and buildings, attached to the land. Neighborhood property value was then defined as the mean property value for residential units within a ten-minute walk of the respondent's geocoded home.

All the study protocols were approved by the Institutional Review Board of the University of Washington. The study was conducted from November 2008 to April 2009.

Statistical Analysis

While the focus of the SOS was to examine the role of dietary variables and access to food environment in explaining socioeconomic disparities in health, the purpose of the present study is to examine data on self-reported access to amenities and neighborhood perceptions in relation to objective data on neighborhood-level property value.

In total, access to 11 amenities and 11 neighborhood perception variables were examined. For the 11 self-report access to amenities variables, respondents were asked if they had the following within a ten minute walking distance of their home: (1) supermarket/grocery store; (2) convenience store; (3) restaurant, full service or family style; (4) fast food restaurant; (5) coffee shop, café; (6) bar, tavern, or pub; (7) liquor store; (8) sports facility, playing fields, courts, or golf courses; (9) park, recreational area, or trail; (10) neighborhood retail stores (drug store/pharmacy, hardware store, book store, video/music store, clothing store, or

bank); (11) mall, shopping center or plaza. Answers were recorded as binary (yes/no) variables.

The 11 neighborhood perception variables included the following statements: (1) I feel safe walking in my neighborhood; (2) My neighborhood is safe for pedestrians; (3) My neighborhood is well lit at night; (4) My neighborhood is safe from crime; (5) People in my neighborhood know each other; (6) I trust the people in my neighborhood; (7) My neighborhood is clean; (8) My neighborhood is attractive; (9) Fast traffic is a problem in my neighborhood; (10) Heavy traffic is a problem in my neighborhood; (11) My neighborhood is diverse. Agreement with the statements was measured on a 5-point Likert scale (strongly disagree, disagree, neutral, agree, strongly agree), but strongly disagree and disagree were combined to create a 4-point scale for the analysis.

Two different statistical techniques were used to investigate the association between the self-reported access and perception variables, neighborhood-level property value, and obesity. First, univariate linear regression was used to determine how each of the 11 self-reported access variables was associated with neighborhood-level property value. Separate models were used for each access variable. Property value was slightly skewed; thus it was log-transformed before inclusion as the dependent variable in the model. Coefficients were exponentiated to give the geometric mean property values for both levels (yes/no) of the access variable. R-squared values were calculated to determine how much of the variation in property value was due to variation in these variables.

Univariate linear regression was also used to determine the association between property value and each of the 11 neighborhood perception variables. The analysis approach was the same as for the previous aim: separate models were used for each perception variable with log-transformed property value as the dependent variable.

Generalized linear models (GLM) with Poisson distribution and log link were then used to determine the prevalence ratio (PR) of obesity, defined as BMI$\geq$30, associated with

each of the self-reported access to amenities and perception of neighborhood characteristic variables. A secondary analysis was done using linear regression with BMI as the outcome variable, stratified by gender. BMI was slightly skewed so it was log-transformed for inclusion in the model and coefficients were exponentiated to give ratios of geometric mean BMI for each level of the independent variables. For both analyses, confounders included in the models were age (continuous, years), race/ethnicity, annual household income, number of members of the household, education, and homeownership.

RESULTS

Population

The majority of respondents in the SOS were women (62%), and 80% self-reported as white. Mean age was 54.5 years (standard deviation: 15.1 years). Mean annual household income was $75,000, and 55% of respondents had at least a college degree. Median neighborhood-level property value was approximately $246,000, and most respondents owned their own home (80%).

Associations of Self-Report Neighborhood Variables and Property Values

Table 1 presents the results of the linear regression for selected characteristics of the proximal neighborhood. Eight of the 11 access to amenities variables were associated with property value ($p<0.001$). Of these eight variables, reporting access to grocery stores and supermarkets, convenience stores, fast food restaurants, bars, liquor stores, neighborhood retail stores, and malls, shopping centers, or plazas were associated with a lower geometric mean neighborhood-level property value. Only access to a park or recreational trail was statistically significantly associated with higher property values. Access to a full service restaurant, coffee shop or café, and sport facility, playing field, court, or golf course were not associated with property values.

The largest differences in geometric mean neighborhood-level property values were associated with access to convenience stores and fast food restaurants. Respondents who lived within a ten-minute walking distance of a convenience store had a $60,000 lower property value compared to those who did not, and ten-minute walking distance access to a fast food restaurant was associated with a $50,000 lower property value. By contrast, those who lived within a ten-minute walking distance of a supermarket or grocery store had a $23,000 lower property value compared to those who did not, and access to a park, recreational area, or trail was associated with a $30,000 higher property value.

Access to convenience stores and fast food restaurants gave the highest R-squared values, accounting for 6.1% and 5.5% of the variance in property value, respectively.

Trends in attitudes towards neighborhood characteristics are also associated with property value (Table 2). For ten of the perception variables, there was an indication of a significant trend ($p_{trend}<0.05$). Only the statement “My neighborhood is well lit at night” was not associated with property value. The first eight statements, which cover neighborhood safety, social cohesiveness, and attractiveness and cleanliness, all have positive associations; that is, higher levels of agreement are associated with higher property values. By contrast, the last three statements, which cover neighborhood traffic and diversity, have a negative association with property value.

The differences in geometric mean property value between those who strongly agreed and those who strongly disagreed /disagreed to the perception statements tended to be larger than the differences associated with access to amenities. The largest differences were for “My neighborhood is attractive,” which was associated with a $100,000 higher property value, and “I trust the people in my neighborhood,” which was associated with $90,000 higher property value. The smallest difference among the statistically significant results was for “Fast traffic is a problem in my neighborhood,” which was associated with $25,000 lower property value.

The statement “My neighborhood is attractive” gave the highest R-squared value, accounting for 13.0% of the variance in neighborhood-level property value.

Associations of Self-Report Neighborhood Variables and Obesity

Only one access variable was associated with obesity (Table 3). After adjusting for age, race, gender, education, household income, number of household members, and home ownership, residents who lived within a 10 minute walking distance of a coffee shop or café were 0.76 times as likely to be obese than those who did not (95% CI: 0.61, 0.95, p=0.015). Five perceived neighborhood characteristics were associated with obesity (Table 4). The statements “My neighborhood is safe for pedestrians,” “My neighborhood is well lit at night,” and “I trust the people in my neighborhood” were all inversely related to obesity (p_{trend}=0.004, 0.044, and 0.018, respectively). By contrast, the statements addressing heavy traffic and diversity were positively associated with obesity (p_{trend}=0.023 and 0.008, respectively).

When comparing obesity among those who strongly agreed versus those who strongly disagreed/disagreed, the greatest decrease in obesity prevalence was for the statements “My neighborhood is safe for pedestrians” (PR: 0.69, 95% CI: 0.51, 0.93, p=0.004) and “I trust the people in my neighborhood” (PR: 0.68, 95% CI: 0.49, 0.96, p=0.028). Strong agreement with the statement “My neighborhood is diverse” was associated with a 1.68 higher obesity prevalence compared to those who strongly disagreed/disagreed (95% CI: 1.11, 2.55, p=0.008).

Associations of Self-Report Neighborhood Variables and BMI by Gender

Table 5 presents results for the linear regression of log-transformed BMIs and self-reported access variables when stratifying by gender. There are no statistically significant results for men, but both access to a full service restaurant and access to a coffee shop or

café were associated with a slightly lower BMI in women (full service restaurant: ratio of geometric means = 0.97, 95% CI: 0.95, 0.99, p-0.039; coffee shop or café: ratio of geometric means = 0.97, 95% CI: 0.94-0.99, p=0.014).

Six of the neighborhood perception variables were associated with BMI in women (Table 6). When comparing BMI among those who strongly agreed versus those who strongly disagreed/disagreed, the greatest negative difference in BMI was for the statement ”I trust the people in my neighborhood” (ratio of geometric means: 0.91, 95% CI: 0.87, 0.96, p<0.001). The greatest positive difference in BMI was for the statement “My neighborhood is diverse” (ratio of geometric means: 1.07, 95% CI: 1.03, 1.12, p<0.001). The other statements negatively associated with BMI were “I feel safe walking in my neighborhood,” “My neighborhood is safe for pedestrians,” and “People in my neighborhood know each other” (p_{trend}=0.008, 0.004, and 0.027 respectively). “Heavy traffic is a problem in my neighborhood” (p_{trend}=0.032) was positively associated with BMI.

In contrast to this, only a single attitude variable was associated with BMI for men (Table 6). Agreement with the statement “My neighborhood is well lit at night” was associated with a lower in BMI (ratio of geometric means for strongly agree to strongly disagree/disagree: 0.95, 95% CI: 0.92, 0.99, p=0.009).

DISCUSSION

The results of this population-based study suggest that the neighborhood-level property value metric captures complex information about the built environment and trends in attitudes towards neighborhood characteristics. Respondents who lived in areas with increased access to retail and food sources, including grocery stories, and decreased access to parks and recreation areas had lower property values. Furthermore, perceptions of the neighborhood traditionally considered to be positive, such as safety and

attractiveness, were associated with higher property value, whereas traffic and diversity were consistently associated with lower property value.

Although there were strong associations between these self-reported factors and property values, the associations between the self-reported factors and obesity and BMI were less straightforward, even after adjusting for demographic and independent SES characteristics. Access to a coffee shop or café, which was one of the three access variables not associated with property value, was also the only access variable associated with obesity, and one of only two access variables associated with BMI in women. Furthermore, the other variable associated with BMI in women, access to a full service restaurant, was not associated with property value.

This discrepancy was less apparent in the neighborhood perception variables. Four of the perception variables ("My neighborhood is safe for pedestrians," "I trust the people in my neighborhood," "Heavy traffic is a problem in my neighborhood," and "My neighborhood is diverse") were associated with property values, obesity, and BMI in women. The remaining six neighborhood perceptions that were associated with property values were not associated with obesity or BMI. Interestingly, the only perception variable associated with BMI in men, "My neighborhood is well lit at night" is also the only perception variable not associated with property values.

These findings are in agreement with other studies, which have concluded that associations between attributes of the built environment and BMI are complex and not readily understood.[11] Several potential pathways have been suggested to explain this association. Perceptions of socioeconomic disadvantage may reflect objective disadvantage, and residents of such neighborhoods may have less access to resources necessary for obtaining healthy food and exercise.[12] However, our study found that access to grocery stores and supermarkets was associated with a lower property value, suggesting that distance to healthy food is not the only factor needed to explain the disparities in obesity

based on neighborhood disadvantage. It is possible that fast food restaurants and convenience stores may be more common around grocery stores and supermarkets, in which case increased access to healthy foods would also mean increased access to unhealthy foods. Future studies should investigate the spatial association between different types of food sources.

Another possible pathway to explain the association between neighborhood characteristics and obesity is that those who perceive their neighborhood as unsafe may be more likely to experience psychological distress, which can in turn lead to increased physiological distress, poor diet, and irregular exercise.[12] In contrast, the perception of neighborhood collective efficacy can mediate the negative association between objective measures of crime and poverty and outdoor play and exercise.[13] Our study found that perceptions of social cohesiveness such as agreement with the statement “People in my neighborhood know each other” were not associated with obesity or BMI among men, but were associated with lower BMI among women.

Previous research has also found a differential association between property values and BMI by gender.[10] One possible explanation for this is that property values serve as a proxy for SES, and income and education are known to be inversely related to obesity among women.[2] However, the findings of this study support the hypothesis that this association is more complex and that property values encompass more than just accumulation of wealth. The differential association between men and women also suggests that, for BMI and obesity, aspects of the neighborhood beyond social cohesiveness – including perceptions of neighborhood safety, traffic, and diversity – are of greater importance for women than for men.

The complexity of these pathways highlights the potential benefit of using property value as a single measure to encompass multiple neighborhood attributes. Previous studies have shown that property value is related to obesity and health behaviors that may affect

obesity such as diet quality.[8,9] Furthermore, a study using SOS data observed an association between obesity and property values among women.[10] Given these findings, and the results from our study, one possible conclusion that can be drawn is that property values mediate the relationship between the built environment and health outcomes. While property values are reflective of features of the neighborhood, they can also serve as a measure of accumulation of wealth, and can therefore capture aspects of SES that can impact health and obesity independently from built environment characteristics.

The present study has numerous limitations. Data on BMI and obesity are based on self-reported height and weight. Respondents tend to overestimate their height and underestimate their weight, and thus the prevalence of obesity may be slightly underestimated in this dataset.[14] However, this would only affect the results of the GLM and linear regression with BMI as the outcome, and, because the bias is likely to be nondifferential, the observed association is probably closer to the null than the true association. It is also possible that self-reported access did not accurately reflect actual access if respondents were unaware of what amenities were in their neighborhood. This inaccuracy would only affect the results if it was differential based on property value or BMI.

The study also utilized multiple tests, so the reported p-values are likely inflated. Because there are a total of twenty-two independent variables, using an α-level of 0.05, we would expect that each analysis would find at least two statistically significant results due to chance alone. However, given the number of statistically significant results, we can conclude that many of the findings were probably not due to chance.

The comparisons between built environment features and obesity and BMI also do not account for self-selection; people who value being able to access healthy foods and opportunities for physical activity, and may therefore be healthier overall, are more likely to move into neighborhoods with these features. Furthermore, the cross-sectional study design limits our ability to draw causal inferences between neighborhood perceptions, the property

value metric, and obesity. To address this limitation, future studies should utilize a cohort design when studying the association between these variables. Finally, because characteristics of neighborhoods differ between cities, the results of this study may not be generalizable to settings outside of King County.

Despite these limitations, this study provides strong evidence that property value can serve as both a measure of wealth and of neighborhood characteristics. Because of its ability to capture complex information about built environment, neighborhood perceptions, and individual SES in a single metric, property values can be of great use in epidemiologic studies.

Table 1. Geometric means of neighborhood property values by selected characteristics of the proximal neighborhood. Analyses based on unadjusted univariate linear regression analysis, King County 2008-2009.

	N	Property Value ($)	95% CI	P-value	R-squared
Supermarket/Grocery Store		**Geometric Mean**			0.0116
No	1095	268665	261565, 275960	ref	
Yes	894	245996	240174, 251959	<0.001	
Convenience store					0.0613
No	1253	292360	284037, 300923	ref	
Yes	729	236987	231846, 242244	<0.001	
Full service restaurant					0.0003
No	1149	258125	251038, 265415	ref	
Yes	836	254361	248423, 260441	0.43	
Fast food restaurant					0.0546
No	906	279258	272671, 286001	ref	
Yes	1070	230648	224758, 236696	<0.001	
Coffee shop/café					0.0002
No	1165	258342	251156, 265736	ref	
Yes	812	255041	249137, 261087	0.492	
Bar					0.0383
No	978	278466	271351, 285766	ref	
Yes	940	237098	231186, 243161	<0.001	
Liquor store					0.0252
No	427	266759	261301, 272333	ref	
Yes	1482	228228	219628, 237162	<0.001	
Park, recreational area, or trail					0.0155
No	1549	232608	223937, 241612	ref	
Yes	441	262877	257617, 268243	<0.001	
Sports facility, playing field, court, or golf course					0.0002
No	1154	254460	247476, 261641	ref	
Yes	834	257110	251118, 263248	0.578	
Neighborhood retail stores					0.0184
No	959	269777	263179, 276540	ref	
Yes	1035	241463	235350, 247731	<0.001	
Mall, shopping center, or plaza					0.0205
No	410	263611	258399, 268928	ref	
Yes	1584	228146	219386, 237255	<0.001	

Table 2. Comparisons of geometric means of neighborhood property value by attitudes toward neighborhood characteristics using unadjusted univariate linear regression, King County 2008-2009.

	N	Geometric Mean Property Value ($)	95% CI
I feel safe walking in my neighborhood			
Strongly Disagree / Disagree	243	210401	201459, 219740
Neutral	68	221944	204808, 240516
Agree	660	241980†	234983, 249182
Strongly Agree	1011	281048†	273898, 288382
P-value for trend		<0.001	
R-Squared		0.066	
My neighborhood is safe for pedestrians			
Strongly Disagree / Disagree	305	228294	218725, 238284
Neutral	74	241994	219290, 267050
Agree	748	243738‡	237141, 250522
Strongly Agree	860	280899†	273181, 288838
P-value for trend		<0.001	
R-squared		0.041	
My neighborhood is well lit at night			
Strongly Disagree / Disagree	568	261443	252650, 270541
Neutral	113	262254	243924, 281966
Agree	710	256202	248443, 264202
Strongly Agree	596	250201‡	242360, 258293
P-value for trend		0.064	
R-Squared		0.002	
My neighborhood is safe from crime			
Strongly Disagree / Disagree	651	229335	223092, 235755
Neutral	152	246143‡	231534, 261678
Agree	728	257664†	250129, 265426
Strongly Agree	443	303361†	291376, 315837
P-value for trend		<0.001	
R-squared		0.063	
People in my neighborhood know each other			
Strongly Disagree / Disagree	543	228795	221771, 236041
Neutral	101	242067	224553, 260946
Agree	826	260751†	253584, 268123
Strongly Agree	496	284805†	274298, 295715
P-value for trend		<0.001	
R-squared		0.040	
I trust the people in my neighborhood			
Strongly Disagree / Disagree	235	206398	198233, 214898
Neutral	155	221478‡	209804, 233800
Agree	757	244361†	237818, 251083
Strongly Agree	829	293185†	284879, 301733
P-value for trend		<0.001	
R-squared		0.095	

Table 2 continued.

My neighborhood is clean			
Strongly Disagree / Disagree	204	212571	203636, 221897
Neutral	80	215488	203642, 228023
Agree	719	236258†	229962, 242726
Strongly Agree	994	285661†	278084, 293440
P-value for trend		<0.001	
R-squared		0.078	
My neighborhood is attractive			
Strongly Disagree / Disagree	229	202665	194984, 210649
Neutral	120	215535	204420, 227256
Agree	770	235836†	230038, 241777
Strongly Agree	871	299989†	291481, 308745
P-value for trend		<0.001	
R-squared		0.130	
Fast traffic is a problem in my neighborhood			
Strongly Disagree / Disagree	823	261163	253873, 268665
Neutral	155	273509	254975, 293391
Agree	606	258417	250439, 266649
Strongly Agree	403	236786†	227706, 246227
P-value for trend		0.001	
R-squared		0.011	
Heavy traffic is a problem in my neighborhood			
Strongly Disagree / Disagree	1361	265370	259655, 271210
Neutral	119	252812	234427, 272641
Agree	289	239648†	228950, 250850
Strongly Agree	218	225418†	214370, 237032
P-value for trend		<0.001	
R-squared		0.020	
My neighborhood is diverse			
Strongly Disagree / Disagree	234	323508	305758, 342289
Neutral	61	285036‡	255225, 318332
Agree	513	266066†	256281, 276225
Strongly Agree	1145	239251†	234235, 244375
P-value for trend		<0.001	
R-squared		0.060	

† With “strongly disagree/disagree” as the reference group, p-value <0.001

‡ With “strongly disagree/disagree” as the reference group, 0.001 $\leq$ p-value < 0.005

Table 3. Prevalence ratio of obesity associated with selected characteristics of the proximal neighborhood Analyses conducted using a separate generalized linear model for each characteristic, King County 2008-2009.

	PR	95% CI	P-value
Supermarket/Grocery Store	0.86	0.69, 1.07	0.163
Convenience store	1.02	0.81, 1.30	0.844
Full service restaurant	0.87	0.70, 1.10	0.231
Fast food restaurant	0.90	0.72, 1.12	0.351
Coffee shop/café	0.76	0.61, 0.95	0.015
Bar	0.83	0.66, 1.04	0.106
Liquor store	0.88	0.67, 1.15	0.351
Park, recreational area, or trail	0.93	0.72, 1.21	0.593
Sports facility, playing field, court, or golf course	0.94	0.75, 1.18	0.599
Neighborhood retail stores	0.87	0.70, 1.08	0.200
Mall, shopping center, or plaza	1.01	0.78, 1.31	0.930

Estimates adjusted for age, race, gender, education, income, household size , and home ownership.

Table 4. Prevalence ratio of obesity by attitudes toward neighborhood characteristics using unadjusted univariate linear regression using a separate generalized linear model for each characteristic, King County 2008-2009.

	PR	95% CI	P-value
I feel safe walking in my neighborhood			
Strongly Disagree / Disagree	ref	ref	ref
Neutral	0.74	0.39, 1.42	0.371
Agree	0.80	0.57, 1.11	0.174
Strongly Agree	0.74	0.54, 1.02	0.067
P-value for trend			0.088
My neighborhood is safe for pedestrians			
Strongly Disagree / Disagree	ref	ref	ref
Neutral	1.51	0.94, 2.4	0.083
Agree	0.83	0.62, 1.12	0.227
Strongly Agree	0.69	0.51, 0.93	0.017
P-value for trend			0.004
My neighborhood is well lit at night			
Strongly Disagree / Disagree	ref	ref	ref
Neutral	0.91	0.56, 1.49	0.721
Agree	0.84	0.65, 1.09	0.196
Strongly Agree	0.76	0.57, 1.00	0.049
P-value for trend			0.044
My neighborhood is safe from crime			
Strongly Disagree / Disagree	ref	ref	ref
Neutral	0.81	0.51, 1.29	0.379
Agree	1.05	0.82, 1.34	0.719
Strongly Agree	0.80	0.59, 1.09	0.163
P-value for trend			0.399
People in my neighborhood know each other			
Strongly Disagree / Disagree	ref	ref	ref
Neutral	0.61	0.33, 1.14	0.121
Agree	0.86	0.67, 1.12	0.264
Strongly Agree	0.85	0.63, 1.14	0.278
P-value for trend			0.282
I trust the people in my neighborhood			
Strongly Disagree / Disagree	ref	ref	ref
Neutral	0.95	0.60, 1.51	0.829
Agree	0.87	0.63, 1.20	0.408
Strongly Agree	0.68	0.49, 0.96	0.028
P-value for trend			0.018
My neighborhood is clean			
Strongly Disagree / Disagree	ref	ref	ref
Neutral	1.02	0.56, 1.86	0.955
Agree	0.98	0.68, 1.42	0.929
Strongly Agree	0.89	0.62, 1.28	0.544
P-value for trend			0.431

Table 4 continued.

My neighborhood is attractive			
Strongly Disagree / Disagree	ref	ref	ref
Neutral	0.99	0.61, 1.59	0.954
Agree	0.78	0.56, 1.08	0.139
Strongly Agree	0.76	0.55, 1.05	0.094
P-value for trend			0.069
Fast traffic is a problem in my neighborhood			
Strongly Disagree / Disagree	ref	ref	ref
Neutral	0.76	0.48, 1.22	0.254
Agree	0.93	0.72, 1.20	0.576
Strongly Agree	1.16	0.88, 1.53	0.284
P-value for trend			0.474
Heavy traffic is a problem in my neighborhood			
Strongly Disagree / Disagree	ref	ref	ref
Neutral	0.94	0.58, 1.53	0.802
Agree	1.11	0.82, 1.50	0.508
Strongly Agree	1.50	1.10, 2.03	0.010
P-value for trend			0.023
My neighborhood is diverse			
Strongly Disagree / Disagree	ref	ref	ref
Neutral	1.17	0.51, 2.71	0.713
Agree	1.48	0.94, 2.31	0.089
Strongly Agree	1.68	1.11, 2.55	0.014
P-value for trend			0.008

Estimates adjusted for age, race, gender, education, income, household size , and home ownership.

Table 5. Ratios of geometric mean BMI associated with 10 minute walking access to neighborhood amenities using a separate linear regression models for each variable, stratified by gender, King County 2008-2009.

	Women			Men			
	Ratio of Means	95% CI	P-value	Ratio of Means	95% CI	P-value	P-value for Gender*Access Interaction
Supermarket/Grocery Store	0.98	0.96, 1.01	0.17	0.99	0.96, 1.01	0.274	0.981
Convenience store	1.01	0.98, 1.04	0.549	0.99	0.97, 1.02	0.646	0.305
Full service restaurant	0.97	0.95, 0.99	0.039	0.98	0.96, 1.01	0.234	0.608
Fast food restaurant	1.00	0.97, 1.02	0.887	0.99	0.96, 1.01	0.337	0.375
Coffee shop/café	0.97	0.94, 0.99	0.014	0.98	0.95, 1.00	0.086	0.722
Bar	0.99	0.97, 1.02	0.66	0.98	0.96, 1.01	0.158	0.322
Liquor store	0.99	0.96, 1.02	0.447	0.99	0.96, 1.03	0.731	0.899
Park, recreational area, or trail	0.98	0.95, 1.01	0.22	0.99	0.95, 1.02	0.426	0.613
Sports facility, playing field, court, or golf course	0.99	0.96, 1.01	0.303	1.00	0.97, 1.03	0.948	0.447
Neighborhood retail stores	0.99	0.97, 1.02	0.664	0.99	0.97, 1.02	0.552	0.747
Mall, shopping center, or plaza	1.01	0.98, 1.04	0.587	1.00	0.96, 1.03	0.773	0.459

Estimates adjusted for age, race, education, income, number of household members , and home ownership

Table 6. Ratios of geometric mean BMI by attitudes toward neighborhood characteristics using unadjusted univariate linear regression using separate linear regression models for each characteristic, stratified by gender, King County 2008-2009.

	Women			Men			
	Ratio of Means	**95% CI**	**P-value**	**Ratio of Means**	**95% CI**	**P-value**	**P-value for Gender*Neighborhood Characteristic Interaction**
I feel safe walking in my neighborhood							
Strongly Disagree / Disagree	ref	ref	ref	ref	ref	ref	
Neutral	0.92	0.85, 1.00	0.056	0.98	0.9, 1.06	0.562	
Agree	0.95	0.91, 0.99	0.024	1.01	0.96, 1.07	0.633	
Strongly Agree	0.94	0.89, 0.98	0.004	0.99	0.94, 1.05	0.843	
P-value for trend			0.008			0.741	0.233
My neighborhood is safe for pedestrians							
Strongly Disagree / Disagree	ref	ref	ref	ref	ref	ref	
Neutral	1.01	0.93, 1.09	0.882	1.08	1.01, 1.17	0.036	
Agree	0.98	0.94, 1.02	0.407	1.02	0.98, 1.06	0.416	
Strongly Agree	0.95	0.91, 0.99	0.011	1.01	0.97, 1.05	0.537	
P-value for trend			0.004			0.919	0.048
My neighborhood is well lit at night							
Strongly Disagree / Disagree	ref	ref	ref	ref	ref	ref	
Neutral	1.00	0.94, 1.06	0.885	0.96	0.91, 1.02	0.166	
Agree	0.99	0.96, 1.02	0.528	0.97	0.94, 1.01	0.119	
Strongly Agree	0.97	0.94, 1.00	0.066	0.95	0.92, 0.99	0.009	
P-value for trend			0.079			0.014	0.792
My neighborhood is safe from crime							
Strongly Disagree / Disagree	ref	ref	ref	ref	ref	ref	
Neutral	0.97	0.93, 1.01	0.129	0.96	0.92, 1.01	0.097	
Agree	0.99	0.96, 1.02	0.543	1.01	0.98, 1.04	0.519	
Strongly Agree	0.96	0.93, 1.00	0.038	1.00	0.97, 1.04	0.789	
P-value for trend			0.085			0.525	0.2511

Table 6 continued

People in my neighborhood know each other							
Strongly Disagree / Disagree	ref		ref	ref		ref	
Neutral	0.94	0.89, 1.00	0.038	1.01	0.96, 1.06	0.830	
Agree	0.97	0.93, 1.00	0.051	1.00	0.97, 1.04	0.839	
Strongly Agree	0.96	0.92, 0.99	0.020	1.00	0.96, 1.04	0.962	
P-value for trend			0.027			0.918	0.15
I trust the people in my neighborhood							
Strongly Disagree / Disagree	ref		ref	ref		ref	
Neutral	0.98	0.92, 1.05	0.597	1.04	0.98, 1.12	0.205	
Agree	0.94	0.9, 0.99	0.01	1.03	0.98, 1.08	0.215	
Strongly Agree	0.91	0.87, 0.96	<0.001	1.01	0.96, 1.05	0.826	
P-value for trend			<0.001			0.752	0.015
My neighborhood is clean							
Strongly Disagree / Disagree	ref		ref	ref		ref	
Neutral	1.01	0.94, 1.07	0.846	1.03	0.96, 1.11	0.444	
Agree	1.00	0.96, 1.04	0.958	1.01	0.96, 1.06	0.696	
Strongly Agree	0.99	0.95, 1.03	0.529	1.02	0.97, 1.07	0.361	
P-value for trend			0.357			0.369	0.404
My neighborhood is attractive							
Strongly Disagree / Disagree	ref		ref	ref		ref	
Neutral	1.02	0.96, 1.09	0.546	0.97	0.9, 1.04	0.346	
Agree	0.98	0.94, 1.02	0.334	0.98	0.94, 1.03	0.497	
Strongly Agree	0.98	0.93, 1.02	0.246	0.97	0.93, 1.02	0.267	
P-value for trend			0.134			0.317	0.508
Fast traffic is a problem in my neighborhood							
Strongly Disagree / Disagree	ref		ref	ref		ref	
Neutral	0.96	0.92, 1.00	0.078	0.98	0.94, 1.02	0.285	
Agree	1.01	0.98, 1.04	0.549	0.97	0.95, 1.00	0.083	
Strongly Agree	1.03	0.99, 1.06	0.097	1.02	0.97, 1.06	0.455	
P-value for trend			0.094			0.882	0.23

Table 6 continued

Heavy traffic is a problem in my neighborhood							
Strongly Disagree / Disagree	ref	ref	ref	ref	ref	ref	
Neutral	0.98	0.93, 1.04	0.551	0.99	0.95, 1.03	0.545	
Agree	1.01	0.98, 1.05	0.503	1.01	0.97, 1.05	0.661	
Strongly Agree	1.06	1.01, 1.11	0.015	1.01	0.96, 1.06	0.664	
P-value for trend			0.032			0.607	0.4397
My neighborhood is diverse							
Strongly Disagree / Disagree	ref	ref	ref	ref	ref	ref	
Neutral	0.99	0.92, 1.07	0.830	1.03	0.95, 1.11	0.485	
Agree	1.03	0.99, 1.08	0.105	1.03	0.98, 1.08	0.220	
Strongly Agree	1.07	1.03, 1.12	<0.001	1.01	0.97, 1.05	0.688	
P-value for trend			<0.001			0.982	0.003

Estimates adjusted for age, race, education, income, number of household members, and home ownership.

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