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The Impact of Neighborhood Park Access and Quality on Body Mass Index Among Adults in New York City

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Abstract

Objective—To evaluate the association between adult individuals' body mass index (BMI) and characteristics of parks (size and cleanliness) in an urban environment taking into account the physical and social environment of the neighborhood.

Methods—Cross-sectional, hierarchical linear models were used to determine whether park effects were associated with BMI using self-reported height and weight data obtained from the Community Health Survey in New York City (2002-2006).

Results—Both the proportion of the residential zip code that was large park space and the proportion that was small park space had significant inverse associations with BMI after controlling for individual socio-demographic and zip code built environment characteristics (-0.20 BMI units across the inter-quartile range (IQR) for large parks, 95% CI -0.32, -0.08; -0.21 BMI units across the IQR for small parks, 95% CI -0.31, -0.10, respectively). Poorer scores on the park cleanliness index were associated with higher BMI, 0.18 BMI units across the IQR of the park cleanliness index (95% CI 0.05, 0.30).

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Conclusions—This study demonstrated that proportion of neighborhoods that was large or small park space and park cleanliness were associated with lower BMI among NYC adults after adjusting for other neighborhood features such as homicides and walkability, characteristics that could influence park usage.

INTRODUCTION

As the prevalence of obesity has continued to rise nationally and in New York City (NYC), public health officials have engaged in multi-faceted prevention efforts aimed at reducing adult and childhood body mass index (BMI). In addition to developing programs designed to improve access to healthy foods, officials in NYC have promoted design and zoning initiatives intended to improve the use of space to encourage physical activity.(White House Task Force on Childhood Obesity Report to the President, 2010, New York City Government, 2010, New York City Department of Health and Mental Hygiene, 2010),(New York City Department of Design and Construction, 2010)

Existing research examining the association of built environment characteristics such as park access, size, and quality with obesity has produced mixed results. Some studies found an inverse association between park size, access, and density and weight outcomes(Jaime et al., 2011, Wolch et al., 2011, Saelens et al., 2012, Rundle et al., 2012) while other studies reported no association.(Potestio et al., 2009, Potwarka et al., 2008, Burdette and Whitaker, 2004, Prince et al., Norman et al., 2006) The lack of consistency in these findings may be attributed to cross-study heterogeneity in park size and characteristics and possibly differences in the neighborhood context surrounding parks. Park size may be an indicator for active versus passive engagement in physical activity, which in turn may affect obesity; whereas the condition and aesthetics of the park could impact visitation.(Bedimo-Rung et al., 2005) As opposed to active engagement which places an emphasis on moderate to vigorous physical activity, passive usage leads to more sedentary behaviors such as contemplation, picnicking or sunbathing.(Bedimo-Rung et al., 2005) Characteristics of the surrounding neighborhood are also likely important. For example, while distance to parks may be an important indicator of availability, whether an individual actually travels that distance and visits the park may depend on neighborhood safety measures, land use mix, and walkability.(Bedimo-Rung et al., 2005, Weiss et al., 2011) Previous research has shown that safety can be a factor in how residents perceive a local park, and whether proximity translates into use of the park and corresponding health benefits such as reduced obesity.(Mobley et al., 2006, Weiss et al., 2011, Cutts et al., 2009, Leslie et al., Scott D and EL, 1996) Furthermore, multiple studies have demonstrated associations between neighborhood walkability and physical activity and reduced risk of obesity.(Sallis and Glanz, 2009, Rundle et al., 2007, Rundle et al., 2009, Frank et al., 2004) Neighborhood context may be particularly relevant in a dense urban environment such as NYC where many residents access parks by walking or public transportation.

The purpose of this study was to evaluate the association between individuals' body mass index (BMI) and characteristics of parks (size and cleanliness) in an urban environment taking into account the physical and social environment of the neighborhood such as walkability, poverty, and homicides. We hypothesized that both characteristics of the park and the neighborhood surrounding the park affect BMI.

METHODS

The Community Health Survey (CHS) is a random-digit dial telephone survey of non-institutionalized adults aged 18 years and older conducted annually by the NYC Department of Health and Mental Hygiene (DOHMH) to monitor a range of health topics. Five consecutive years of survey data (2002-2006) were linked using Zip codes to geo-spatial data describing characteristics of the built environment. Sampling design and the weighting mechanism have been described elsewhere.(New York City Department of Health and Mental Hygiene, 2009)

BMI, the outcome of interest in this study, was calculated using self-reported weight in pounds divided by self-reported height in inches squared, multiplied by a factor of 703 (to convert pound/in^2 to kg/m^2). To reduce measurement error in BMI due to self-reported height and weights, a two-step procedure to eliminate biologically implausible BMI values was employed. First, subjects with height and weight values outside of established ranges (male height: 51.3-80.5 inches, male weight: 85.6-480.9 pounds; female height: 51.8-73.5 inches, female weight: 74.1-570.9 pounds) were eliminated. Second, subjects with BMI values outside of a valid range (male: 14.9-65.0; female: 13.4-76.1) were removed. (de Onis and Habicht, 1996, Physical status: the use and interpretation of anthropometry, 1995) From 2002 to 2006 a total of 48,482 subjects completed the CHS survey. After removing implausible BMI values and missing height and weight data, there were 44,282 subjects available for analysis.

The New York City Department of Parks and Recreation (NYCDP&R) provided data on park boundaries and park cleanliness. To account for park access of residents living in Zip code neighboring parks, all Zip code boundaries were buffered by 400 meters. The proportion of buffered Zip code area defined as park space was used as a measure of Zip code level park access. This variable was further delineated into the proportion of buffered Zip code that was large park space (> 6 acres) and the proportion that was small park space (≤ 6 acres); a definition determined by the NYCDP&R for administrative purposes.

The Park Inspection Program (PIP), conducted twice annually by NYCDP&R, provided park cleanliness measures. Specific details of this program have been reported elsewhere. (Rundle et al., 2012) Briefly, for each park, zones were created and evaluated on four cleanliness measures (the presence of litter, glass, weeds, and graffiti) on an annual basis and then averaged across the years 2000-2006. The four neighborhood-level cleanliness metrics have a range of 0 for no inspection failures in any park zone within the Zip code to 1 indicating failure on all park zone inspections within the Zip code. A total park cleanliness score assessed the overall condition of park cleanliness and was calculated by averaging the combined four individual measures.

Further Zip code-level measures of the built environment were derived to assess the association between neighborhood safety and walkability and BMI. To calculate the average number of homicides per 10,000 persons for each Zip code, the total number of homicides from 2003-2006 were averaged and divided by the Census 2000 population estimate.(New York Times, 2006) A neighborhood walkability index was calculated for each Zip code, incorporating several built environment measures including residential unit density, street intersection density, land use mix, retail floor space, and density of subway stations. The details of the construction of this variable have been described elsewhere.(Neckerman et al., 2009)

Descriptive statistics were used to describe the demographic characteristics of the study population with stratification by the proportion of Zip-code land area that was large parks and the proportion that was small parks. The Chi-square test was used to evaluate categorical variables by park space above and below the median for each pair, large and small. The T-test was used to compare mean BMI for large and small park space above and below the median. Associations between Zip code-level park space, park quality, walkability and homicides were determined using Pearson correlation coefficients. A linear mixed effects model which included a random effect for Zip code to account for clustering of BMI within each Zip code was used to predict individual BMI, adjusting for individual-level variables including: sex, age, race/ethnicity, education, household income relative to the United States federal poverty line, nativity, marital status, self-reported health, employment, and the number of children under the age of 18 in the household. All individual-level data was obtained by interview from the CHS. The proportion of residents below the federal poverty line was also included as a neighborhood variable and identified from the United States Census 2000. Each neighborhood-level variable was re-scaled by subtracting the median and dividing by the interquartile range (IQR). This approach improved comparability across the measures so the beta coefficients reflect associations with a difference in the interquartile range of that variable. The model accounted for Zip code-level sampling weights. Analyses were performed using HLM version 6.08 (Scientific Software International, Skokie, IL) and Stata version 12 (Stata Corporation, College Station, TX).

RESULTS

Demographic characteristics of the study population are presented in Table 1. Large park space as a percentage of Zip code land area ranged from 0% to 79% (median=6.4%). Small park space as a percentage of Zip code land area ranged from 0% to 8% (median=1.25%). After stratifying Zip codes by the median percentage of parks within a Zip code, there were no significant differences existed among demographic characteristics ($P>0.05$) (Table 1). The spatial distribution of the percentage of large and small parks can be observed in Figure 1.

Table 2 illustrates the correlations among Zip-code level built environment characteristics. There was no correlation between the percentage of the Zip area that was small park area and the percentage that was large park. Walkability had a significant inverse correlation with large parks ($\rho=-0.40$) and a positive correlation with small parks ($\rho=0.28$). Homicides per 10,000 persons had a significant positive correlation with both the percentage of area that was small parks ($\rho=0.29$) and with park cleanliness score ($\rho=0.30$), indicating that poor cleanliness scores had a positive association with homicide.

The multi-level modeling results revealed that both the proportion of the residential zip code that was large park space and the proportion that was small park space had significant inverse associations with BMI after controlling for individual socio-demographic and zip code built environment characteristics (-0.20 BMI units across the inter-quartile range (IQR) for large parks (95% CI -0.32, -0.08); -0.21 BMI units across the IQR for small parks (95% CI -0.31, -0.10), respectively; Table 3). Poorer scores on the park cleanliness index were associated with higher BMI (β=0.18, 95% CI 0.05, 0.30). Homicides per 10,000 persons had a significant positive association with BMI (β=0.33, 95% CI 0.17, 0.49) and increasing walkability had a significant inverse association (β=-0.40, 95% CI -0.50, -0.30). When considering the count of large and small parks in each zip code instead of the proportion of land covered by large and small park space in each zip code, the direction, magnitude, and significance of the associations with BMI did not change (data not shown).

DISCUSSION

This study demonstrated that greater neighborhood park access and greater park cleanliness were associated with lower BMI among NYC adults after adjusting for other neighborhood features such as homicides and walkability, characteristics that could influence park usage. This research supports policy aimed to improve park utilization through increasing the density and quality of parks and through improvements of the neighborhoods in the vicinity of parks.

Few studies have evaluated the association between park size or access and BMI in adults; most of the studies examining this association have focused on adolescents and demonstrated mixed results.(Wolch et al., 2011, Potwarka et al., 2008, Potestio et al., 2009, Burdette and Whitaker, 2004, Gordon-Larsen et al., 2006, Saelens et al., 2012) Among adults, the findings from this study were consistent with previous studies demonstrating a negative association between weight outcomes and physical activity environments including parks and sports facilities.(Saelens et al., 2012, Jaime et al., 2011, Rundle et al., 2012) An analysis by Rundle et al. evaluated park size in NYC as a determinant of BMI and observed an inverse association between access to large parks and BMI, similar to the results presented here; however, this effect was not observed for small parks.(Rundle et al., 2012) In contrast to Rundle et al., this analysis observed that access to large park space and access to small park spaces were both inversely associated with BMI and with similar magnitudes of association. One possibility to explain the discrepant results between the studies focuses on how each study defined neighborhoods. First, the report by Rundle et al. defined a subject's neighborhood as a half-mile radial buffer around his or her geo-coded residential address and, in contrast, this analysis focused on Zip code-specific effects. Aggregating data by different spatial scales may alter the observed association, a geographic concern known as the Modifiable Areal Unit Problem (MAUP) which is a problem for comparing results across studies that used different spatial scales of analysis.(Waller and Gotway, 2004, Openshaw, 1984) In comparing these two studies, as the geographic unit under consideration increases in size, small park space may have a greater influence on BMI in an urban environment where traversing across narrower administrative boundaries may not reflect the actual neighborhood attributes. Furthermore, the CHS data used for this study relied on self-report of BMI and uses a complex survey sample design as opposed measured BMI and a volunteer-based sample used in Rundle et al.

The mechanism through which park access and size are related to lower BMI is unclear. The finding that large park space is a predictor of BMI is consistent with the interpretation that large parks provide a mechanism for increased physical activity. However, this study observed inverse associations of similar magnitude for both large and small park sizes and BMI. Because smaller parks are less likely to support physical activity (e.g., usually lack running/walking path), the observed association might result from walking to get to the park, rather than physical activity in the park. Alternatively, small parks may be associated with lower BMI, but through a non-physical activity mechanism on individuals and the community. The presence of neighborhood parks induces feelings of pleasure and has the potential to reduce stress, anxiety, and depression; and thus have psychological health implications. (Bedimo-Rung et al., 2005)

Small parks might represent areas to foster community cohesion and social capital through formal and informal gatherings.(Bedimo-Rung et al., 2005) Social capital reflects features of the social environment through the relationships of people that promote trust, shared values, and norms of reciprocity.(Kawachi et al., 1999, Broyles et al., 2011) Within neighborhoods, social capital has the opportunity to prevent crime, improve the physical activity environment, and enhance local government.(Kawachi et al., 1999) Small community parks may be a setting in which, health information can be shared, models of physical activity can be established, and most importantly be a place where healthy behavioral norms can be established.(Broyles et al., 2011) Though the current analysis does not directly measure social capital and park usage, the modest inverse effects of small park space and BMI might suggest the presence of small parks in a Zip code reflects an environment amenable to a lower BMI.

After adjustment for built environment characteristics, the walkability index had the largest inverse association with BMI (-0.41 BMI units across the inter-quartile range). Previous studies have consistently observed an inverse association between neighborhood walkability and weight outcomes similar to the results observed in this study.(Sallis and Glanz, 2009, Frank et al., 2004, Rundle et al., 2007, Rundle et al., 2009) A high walkability index score, indicating high street connectivity, access to public transportation, mixed land use, and high population density, is indicative of an environment that promotes pedestrian activity which may lead to increased physical activity or co-occur with a food environment that is more varied and thus potentially supportive of more nutritious food options.(Freeman et al., 2013)

This study has several limitations. The cross-sectional study design limits causal inference. The observed associations between park size and BMI may be reflective of self-selection bias as residents who engage in regular park use may choose to live in Zip codes with a higher percentage of park space. Residential self-selection could also have resulted in individuals with a healthy lifestyle choosing to live in neighborhoods with less crime and greater walkability. However, residential choice in NYC is often limited by financial pressures and influenced through residential clustering by income, race, and ethnicity. To limit the extent of this potential bias and the opportunity for reverse causality, individual-level education, race, ethnicity, and socioeconomic status and Zip code socioeconomic status were included in the model. Further research should consider the use of an instrument to explore individual healthy-lifestyle factors prior to and after moving to a new Zip code and reasons for relocation as a mechanism to clarify the direction of the association. Finally as discussed above, Zip codes were used as the spatial scale for this analysis; an administrative unit that creates artificial boundaries. For example, residents living adjacent to a park but in a different Zip code would not be conferred the advantages of this park in a traditional Zip-code based analysis particularly where Zip-codes cover large land areas. To remedy these boundary effects, Zip code was buffered by 400 meters and this buffered park space was attributed to the adjacent Zip code. However, it is unclear if a 400 meter buffer is the appropriate boundary dimension.

Despite these limitations, this study has several strengths. First, the analysis adjusted for measures of neighborhood context including walkability, safety, and poverty that could influence BMI directly or through their effects on park usage. In addition, the study included measures of park cleanliness, obtained from the NYCDP&R Park Inspection Program; such objective measures of park maintenance are rarely available for studies relating park features to health outcomes.

In conclusion, this study provides additional evidence in support of increasing park space and better maintained parks as a way to reduce BMI among adults. Furthermore, these findings point to the influence the social and physical context of the neighborhood has on BMI. As urban planners and public health officials consider ways to enhance and design neighborhoods, efforts should be given to creating safe and clean physical activity environments that encourage use among nearby residents.

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References

BEDIMO-RUNG AL, MOWEN AJ, COHEN DA. The significance of parks to physical activity and public health: A conceptual model. American Journal of Preventive Medicine. 2005; 28:159–168. [PubMed: 15694524]

BROYLES ST, MOWEN AJ, THEALL KP, GUSTAT J, RUNG AL. Integrating Social Capital Into a Park-Use and Active-Living Framework. American Journal of Preventive Medicine. 2011; 40:522–529. [PubMed: 21496751]

BURDETTE HL, WHITAKER RC. Neighborhood playgrounds, fast food restaurants, and crime: relationships to overweight in low-income preschool children. Preventive Medicine. 2004; 38:57–63. [PubMed: 14672642]

CUTTS BB, DARBY KJ, BOONE CG, BREWIS A. City structure, obesity, and environmental justice: An integrated analysis of physical and social barriers to walkable streets and park access. Social Science & Medicine. 2009; 69:1314–1322. [PubMed: 19751959]

DE ONIS M, HABICHT JP. Anthropometric reference data for international use: recommendations from a World Health Organization Expert Committee. Am J Clin Nutr. 1996; 64:650–8. [PubMed: 8839517]

FRANK LD, ANDRESEN MA, SCHMID TL. Obesity relationships with community design, physical activity, and time spent in cars. American Journal of Preventive Medicine. 2004; 27:87–96. [PubMed: 15261894]

FREEMAN L, NECKERMAN K, SCHWARTZ-SOICHER O, QUINN J, RICHARDS C, BADER MD, LOVASI G, JACK D, WEISS C, KONTY K, ARNO P, VIOLA D, KERKER B, RUNDLE AG. Neighborhood walkability and active travel (walking and cycling) in New York City. J Urban Health. 2013; 90:575–85. [PubMed: 22941058]

GORDON-LARSEN P, NELSON MC, PAGE P, POPKIN BM. Inequality in the Built Environment Underlies Key Health Disparities in Physical Activity and Obesity. Pediatrics. 2006; 117:417–424. [PubMed: 16452361]

JAIME PC, DURAN AC, SARTI FM, LOCK K. Investigating environmental determinants of diet, physical activity, and overweight among adults in Sao Paulo, Brazil. J Urban Health. 2011; 88:567–81. [PubMed: 21327549]

KAWACHI I, KENNEDY BP, GLASS R. Social capital and self-rated health: a contextual analysis. Am J Public Health. 1999; 89:1187–93. [PubMed: 10432904]

LESLIE E, CERIN E, KREMER P. Perceived neighborhood environment and park use as mediators of the effect of area socio-economic status on walking behaviors. J Phys Act Health. 7:802–10. [PubMed: 21088312]

MOBLEY LR, ROOT ED, FINKELSTEIN EA, KHAXJOU O, FARRIS RP, WILL JC. Environment, obesity, and cardiovascular disease risk in low-income women. American Journal of Preventive Medicine. 2006; 30:327–332. [PubMed: 16530620]

NECKERMAN KM, LOVASI GS, DAVIES S, PURCIEL M, QUINN J, FEDER E, RAGHUNATH N, WASSERMAN B, RUNDLE A. Disparities in urban neighborhood conditions: evidence from GIS measures and field observation in New York City. J Public Health Policy. 2009; 30(Suppl 1):S264–85. [PubMed: 19190579]

NEW YORK CITY DEPARTMENT OF DESIGN AND CONSTRUCTION. [December 13 2013] Active Design Guidelines Promoting Physical Activity and Health in Design. 2010. [Online]. Available: http://www.nyc.gov/html/ddc/html/design/active_design.shtml

NEW YORK CITY DEPARTMENT OF HEALTH AND MENTAL HYGIENE. [December 13 2013] Community Health Survey: Methodology. 2009. [Online]. Available: http://www.nyc.gov/html/doh/html/survey/chs-methods.shtml

NEW YORK CITY DEPARTMENT OF HEALTH AND MENTAL HYGIENE. [December 13 2013] Healthy Bodegas Initiative. 2010. [Online]. Available: http://www.nyc.gov/html/doh/html/cdp/cdp_pan_hbi.shtml

NEW YORK CITY GOVERNMENT. [December 13 2013] Food Retail Expansion to Support Healty (FRESH). 2010. [Online]. Available: http://www.nyc.gov/html/misc/html/2009/fresh.shtml

NEW YORK TIMES. [December 13 2013] Homicide Map. 2006. [Online]. Available: http://www.nytimes.com/packages/html/nyregion/20060428_HOMICIDE_MAP.html

NORMAN GJ, NUTTER SK, RYAN S. Community Design and Access to Recreational Facilities as Correlates of Adolescent Physical Activity and Body-Mass Index. Journal of Physical Activity and Health. 2006; 3:S118–S128.

OPENSHAW, S. The modifiable areal unit problem. Norwich, UK: Geo Books; 1984.

PHYSICAL STATUS: THE USE AND INTERPRETATION OF ANTHROPOMETRY. Report of a WHO Expert Committee. World Health Organization Techincal Report Series. 1995; 854:1–452.

POTESTIO M, PATEL A, POWELL C, MCNEIL D, JACOBSON RD, MCLAREN L. Is there an association between spatial access to parks/green space and childhood overweight/obesity in Calgary, Canada? International Journal of Behavioral Nutrition and Physical Activity. 2009; 6:77. [PubMed: 19930567]

POTWARKA L, KACZYNSKI A, FLACK A. Places to Play: Association of Park Space and Facilities with Healthy Weight Status among Children. Journal of Community Health. 2008

PRINCE SA, KRISTJANSSON EA, RUSSELL K, BILLETTE JM, SAWADA MC, ALI A, TREMBLAY MS, PRUD'HOMME D. Relationships between neighborhoods, physical activity, and obesity: a multilevel analysis of a large Canadian city. Obesity (Silver Spring). 20:2093–100. [PubMed: 22262164]

RUNDLE A, DIEZ ROUX AV, FREEMAN LM, MILLER D, NECKERMAN KM, WEISS CC. The urban built environment and obesity in New York City: a multilevel analysis. Am J Health Promot. 2007; 21:326–34. [PubMed: 17465178]

RUNDLE A, NECKERMAN KM, FREEMAN L, LOVASI GS, PURCIEL M, QUINN J, RICHARDS C, SIRCAR N, WEISS C. Neighborhood food environment and walkability predict obesity in New York City. Environ Health Perspect. 2009; 117:442–7. [PubMed: 19337520]

RUNDLE A, QUINN J, LOVASI G, BADER M, YOUSEFZADEH P, WEISS C, NECKERMAN K. Body Mass Index and Park Access, Park Cleanliness, and Recreational Facilities in New York City. American Journal of Health Promotion. 2012; 27:262–269. [PubMed: 23448416]

SAELENS BE, SALLIS JF, FRANK LD, COUCH SC, ZHOU C, COLBURN T, CAIN KL, CHAPMAN J, GLANZ K. Obesogenic Neighborhood Environments, Child and Parent Obesity: The Neighborhood Impact on Kids Study. American journal of preventive medicine. 2012; 42:e57–e64. [PubMed: 22516504]

SALLIS J, GLANZ K. Physical Activity and Food Environments: Solutions to the Obesity Epidemic. Millbank Quarterly. 2009; 87:123–154.

SCOTT D, EL J. Factors that limit and strategies that might encourage people's use of public parks. Journal of Park Recreation Administration. 1996; 14:1–17.

WALLER, LA.; GOTWAY, CA. Applied Spatial Statistics for Public Health Data. Hoboken, NJ: John Wiley & Sons, Inc; 2004.

WEISS C, PURCIEL M, BADER M, QUINN J, LOVASI G, NECKERMAN K, RUNDLE A. Reconsidering Access: Park Facilities and Neighborhood Disamenities in New York City. Journal of Urban Health: Bulletin of the New York Academy of Medicine. 2011; 88:297–310. [PubMed: 21360245]

WHITE HOUSE TASK FORCE ON CHILDHOOD OBESITY REPORT TO THE PRESIDENT. [December 13 2013] Solving the problem of childhood obesity within a generation. 2010. [Online]. Available: http://www.letsmove.gov/

WOLCH J, JERRETT M, REYNOLDS K, MCCONNELL R, CHANG R, DAHMANN N, BRADY K, GILLILAND F, SU JG, BERHANE K. Childhood obesity and proximity to urban parks and recreational resources: A longitudinal cohort study. Health & Place. 2011; 17:207–214. [PubMed: 21075670]

Highlights

- We model an individual's body mass index (BMI) and characteristics of parks
- We explore the proportion of a Zip code that is park space and cleanliness of parks
- Increasing large and small park spaces results in a lower BMI
- Lower park cleanliness scores were associated with higher BMI
- Neighborhoods that feature multiple, clean parks can impact a person's BMI

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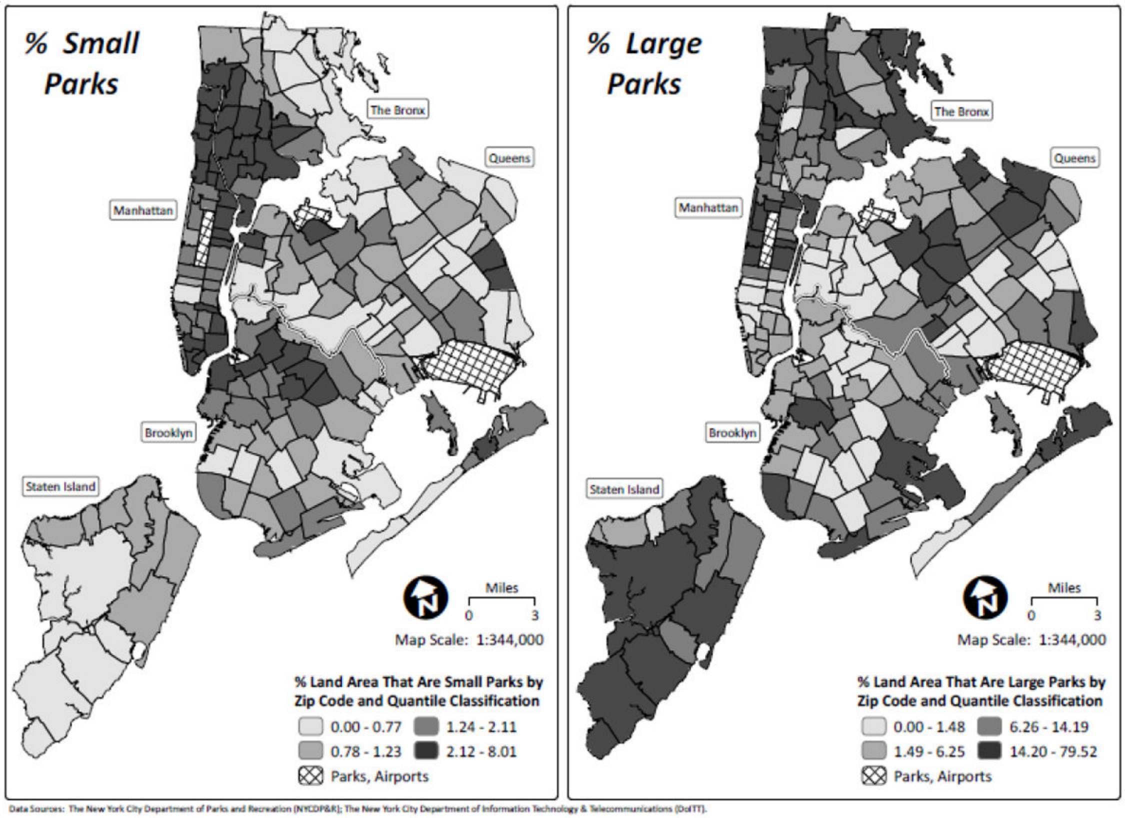

Figure 1.
Distribution of the percentage of large and small parks across New York City zip codes (through 2006). Increasing color intensity illustrates zip codes with a higher proportion of park space.

Table 1

Demographic characteristics of the study population for the full sample and stratified by park size (percentage of Zip code with park space above and below the median) for NYC adults (2002-2006)[a,b]

Variable	Study Sample (N=44,282)	% Large Parks > Median (N=23,714)	% Large Parks <= Median (N=20,568)	% Small Parks > Median (N=24,190)	% Small Parks <= Median (N=20,092)
BMI[c]	**Mean = 26.6, SD = 5.54**	**Mean = 26.6, SD = 5.47**	**Mean = 26.6, SD = 5.63**	**Mean = 26.6, SD = 5.70**	**Mean = 26.6, SD = 5.35**
Gender					
Male	41.6%	41.5%	41.6%	39.9%	43.5%
Female	58.5%	58.5%	58.4%	60.1%	56.5%
Age[d]					
18-24 Years	8.5%	8.0%	9.2%	8.7%	8.4%
25-44 Years	40.2%	38.2%	42.4%	41.4%	38.7%
45-64 Years	32.5%	33.4%	31.4%	31.8%	33.3%
65+ Years	18.8%	20.4%	17.0%	18.1%	19.6%
Race / Ethnicity[d]					
Non-Hispanic white	40.8%	44.7%	36.3%	34.1%	48.8%
Non-Hispanic black	24.9%	22.6%	27.5%	29.4%	19.5%
Non-Hispanic asian	6.9%	6.0%	7.9%	5.3%	8.8%
Hispanic	24.7%	24.2%	25.2%	28.5%	20.1%
Other	2.8%	2.6%	3.0%	2.8%	2.8%
Education[c]					
Less than High School	16.0%	14.9%	17.25%	18.2%	13.5%
High School Graduate	25.2%	24.7%	25.8%	23.1%	27.7%
Some College	22.3%	22.8%	21.7%	20.4%	24.5%
College Graduate	36.5%	37.6%	35.25%	38.3%	34.3%
Household Poverty[d,e]					
< 100%	18.0%	17.3%	18.9%	20.2%	15.3%
100-199%	19.8%	18.5%	21.3%	20.2%	19.3%
200-399%	23.8%	23.6%	24.0%	22.8%	25.1%
400-599%	17.0%	17.8%	16.1%	14.8%	19.7%

Variable	Study Sample (N=44,282)	% Large Parks > Median (N=23,714)	% Large Parks <= Median (N=20,568)	% Small Parks > Median (N=24,190)	% Small Parks <= Median (N=20,092)
BMI[c]	**Mean = 26.6, SD = 5.54**	**Mean = 26.6, SD = 5.47**	**Mean = 26.6, SD = 5.63**	**Mean = 26.6, SD = 5.70**	**Mean = 26.6, SD = 5.35**
> 600%	21.4%	22.9%	19.7%	22.0%	20.7%
Nativity					
U.S.-Born	64.3%	66.5%	61.8%	66.15%	62.05%
Foreign-Born	35.7%	33.5%	38.2%	33.85%	37.95%
Marital Status					
Married	37.2%	38.4%	35.8%	31.2%	44.4%
Not Married	62.8%	61.6%	64.2%	68.8%	55.6%
Self-Reported Health					
Excellent or Very Good	45.6%	46.2%	45.0%	45.3%	46%
Good, Fair, or Poor	54.4%	53.8%	55.0%	54.7%	54%
Employment					
Employed	59.4%	58.5%	60.3%	59.1%	59.6%
Not Employed	40.6%	41.5%	39.7%	40.9%	40.4%
Children less than 18					
Zero	61.8%	62.9%	61.3%	63.0%	61.1%
>= 1	39.2%	37.1%	38.7%	37.0%	38.9%

[a] Large and small parks are defined by acreage (large > 6 acres, small <= 6 acres) and are stratified by percentage of Zip codes above and below the median (large park median percent = 6.4%, small park median percent = 1.25%).

[b] There were no significant differences for variable groups by park space above and below the median (large and small), P>0.05.

[c] Data available for 44,282 subjects.

[d] Subject to rounding error.

[e] Household income relative to the federal poverty line.

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Table 2

Correlations of Zip code level park space, park quality, walkability, homicides, and the proportion of the Zip code that is poor for NYC (2002-2006).

	Median, IQR[a]	**% Large Parks (> 6 Acres)**	**% Small Parks (<= 6 Acres)**	**Park Cleanliness[b]**	**Walkability**	**Average Homicides**	**% Poverty[c]**
% Large Parks (> 6 Acres)	0.06, 0.13	1					
% Small Parks (<= 6 Acres)	0.012, 0.013	0.02	1				
Park Cleanliness	0.43, 0.31	0.09	0.06	1			
Walkability	-0.40, 3.59	-0.40^{***}	0.28^{***}	-0.23^{**}	1		
Average Homicides	0.42, 0.73	-0.08	0.29^{***}	0.30^{***}	0.16^{*}	1	
% Poverty	0.17, 0.18	-0.14	0.47^{***}	0.41^{***}	0.23^{**}	0.70^{***}	1

[a] IQR is the interquartile range

[b] A score of 0 indicates no inspection failures in any park zone within the Zip code. A score of 1 indicates failure on all park zone inspections within the Zip code.

[c] Proportion of subjects whose income is below 100% of the federal poverty line.

* $p<0.05$,

** $p<0.01$,

*** $P<0.001$

Table 3

Adjusted multivariable linear mixed effects model examining the association between Body Mass Index and Zip code level characteristics of the built environment[a] (Estimate (95% CI); NYC 2002-2006).

Neighborhood Characteristic[b]	Study Sample (N=37,543)[c]	*P*-value
Proportion Poverty	0.37 (0.15, 0.59)	0.001
Neighborhood Walkability Index	-0.40 (-0.50, -0.30)	<0.001
Average Homicides per 10,000 persons	0.33 (0.17, 0.49)	<0.001
Percentage Large Park	-0.20 (-0.32, -0.08)	0.001
Percentage Small Park	-0.21 (-0.31, -0.10)	<0.001
Area Weighted Park Cleanliness Score	0.18 (0.05, 0.30)	0.007
Proportion of Variance Explained	89%	

[a]Model adjusts for gender, age, race/ethnicity, income to poverty ratio, nativity, marital status, self-reported health, employment, and presence of children in the household and the beta coefficient presented in the table is mutually adjusted for the other variables listed in the table.

[b]Beta coefficient estimated for a difference equivalent to a 1 IQR change.

[c]6739 individuals excluded due to missing data.