Published in final edited form as:
Public Health. 2013 April ; 127(4): 325–332. doi:10.1016/j.puhe.2013.01.003.

USE OF NEIGHBORHOOD PARKS: DOES SOCIOECONOMICSTATUS MATTER? A FOUR CITY STUDY

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Abstract

Objectives—To determine if neighborhood socio-economic status (SES) influences park use and park-based physical activity.

Study design—Cross sectional study

Methods—We systematically observed the use and characteristics of 24 neighborhood parks in Albuquerque NM, Chapel Hill/Durham NC, Columbus OH, and Philadelphia, PA in three seasons, (spring, summer and fall), observing nearly 36,000 park users; twelve were in high-poverty neighborhoods and 12 in low-poverty. We surveyed 3,559 park users and 3,815 local residents, assessed park incivilities, and interviewed park administrators about management practices.

Results—The size and number of facilities in high poverty neighborhood parks were similar to those in low poverty neighborhood parks, but the former had more hours of programming. Neighborhood poverty level, perception of safety, and the presence of incivilities were not associated with the number of observed park users. However, programmed activities and the number of activity facilities were strongly correlated with park use and energy expended in the park.

Conclusions—The finding that park programming is the most important correlate of park use and park-based physical activity suggests that there are considerable opportunities for facilitating increased PA among both high and low poverty area populations.

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Keywords

Physical activity; socio-economic status; green space; direct observation; parks; safety

Introduction

Higher socio-economic status (SES) has been found to be an important correlate of greater leisure time physical activity (PA) (1–3), yet whether differences in leisure time PA between high and low-income populations are due to individual preferences or other factors is unknown. Veblen theorized that people, rich or poor, try to impress others by engaging in conspicuous consumption and conspicuous leisure, and that those with more resources are more apt to engage in both (4). Yet, some goods and leisure activities are more important to the wealthy than to the poor--and as income increases, the wealthy spend more on these commodities, which have been called “superior goods” (5). Public parks are spaces suited for leisure time recreation and PA for all, yet they have been considered a “superior good” in that the demand for them increases in higher income areas.

Accordingly, in some localities residents in higher income areas have access to more parks and green space than residents in lower incomes areas (6, 7). However, some studies indicate the opposite--that lower SES groups sometimes have more or at least similar access to parks as higher SES groups (8, 9). There are also mixed findings with respect to whether PA is associated with proximity to parks and recreational facilities, with many studies reporting a positive relationship (10–12) and others reporting none (13–15).

Several studies have suggested that access to recreational facilities like parks is less of a barrier to PA than individual factors, such as self-efficacy and individual cognitions (2, 16, 17). Evidence for the role of individual factors includes documented relationships between leisure time PA and social support, and time spent watching television, which may displace time that could be devoted to moderate or vigorous PA (1, 2, 16, 18).

Where physical access to parks is relatively similar between low and high income groups, less leisure time PA among low-income groups has been attributed to differences in neighborhood aesthetics, park quality (19), maintenance, and dis-amenities—i.e. signs of vandalism and neglect (20). Factors like perception of safety and crime are considered barriers to PA (21). However, a recent study showed that perceiving a lack of safety was a barrier to PA regardless of SES, but the relationship of safety to PA was not significant after accounting for individuals’ perceptions of their own health (22). Another study also found that perception of safety was not associated with objectively measured use of public parks (23).

In summary, the literature on leisure time PA and park use is not conclusive as to the relative contribution of SES, environmental factors, and individual preferences. Prior studies have been limited geographically, did not account for differences in individual access to parks and other recreational facilities, and did not used objectively measured data. To overcome these limitations, our study surveyed populations with similar access to parks in disparate geographic locations using both direct observation and self-report. Our study’s goal was to examine whether neighborhood SES was an independent correlate of park-based PA, given equal access. Because PA is a critical contributor to health and a determinant of well-being and longevity (24, 25), understanding the social and contextual factors that promote or hinder activity engagement is critical to developing interventions or remedies.

Methods

Six neighborhood parks that served as the recreational and social focus of the neighborhood were chosen in each of four sites (Philadelphia, PA, Columbus, OH, Chapel Hill/Durham, NC, and Albuquerque, NM)] (26). Twelve parks were in neighborhoods where the percentage of households in poverty within 0.5 miles of the park was higher than the local city or county poverty rate and the other 12 were in neighborhoods where the percentage of households in poverty was lower.

Compared to all potential parks available for selection in the cities, those chosen had an average of 25% more physical activity facilities such as basketball courts, picnic areas, fields, playgrounds, and tennis courts, but they had fewer gymnasiums.

We used the System for Observation of Play and Recreation in Communities (SOPARC) to measure neighborhood park use (27). SOPARC provides data on each individual (i.e., gender, age-grouping, race/ethnicity grouping, and PA intensity) observed in a park target area. During an area scan (i.e., an observation sweep moving from left to right), the PA of each individual present was coded using momentary time sampling as sedentary (i.e., lying down, sitting, or standing), walking, or vigorous (e.g., running) (28, 29). We counted females and males during separate scans and recorded the predominant activity for each gender.

In addition, during each visit to an activity area observers made entries to describe whether the space was accessible, usable, equipped, supervised, and provided organized activities. The area was coded as accessible if it was not locked, usable if facilities were not broken or the area flooded, and equipped if play materials like balls or nets were supplied by the park. The area was coded as supervised when park or adjunct personnel (e.g., park rangers, playground supervisors, volunteers, sport officials, teachers) were present and available to direct park users or respond to emergencies. It was coded as providing organized PA when a scheduled exercise class or sport practice or competition was being led by park staff or adjunct personnel.

Field staff received extensive training on SOPARC and met specified certification criteria to ensure accuracy in data collection. We conducted observations during four different time periods on 2 weekdays and both weekend days in one week during each of three seasons, (spring, summer, and fall) during 2010 and 2011 (30). If the weather was inclement, we rescheduled park visits to occur during the same time period(s) on the next matching clement day ensuring observations were conducted on the same day of the week.

Surveys of Park users and Residents

Between observations at each park, field staff conducted intercept interviews with park users and household surveys with local residents about behaviors and perceptions related to their park use and physical activity. For each park we interviewed approximately 150 adults in the park and 150 residents from randomly selected households, approximately half of whom were within 0.25 mile of the park, and half between 0.25 and 0.50 mile of the park. Previous studies have shown that proximity to parks is a strong predictor of use (31–33). Because the average walking trip for an individual is about 0.4 miles (34), we assumed that those living within a 0.5 mile buffer around a park would have relatively easy access, regardless of neighborhood SES.

In some locations where a sufficient number of households were not accessible or occupants were not reachable, household surveys were conducted at proximal locations, such as

storefronts or bus stops. Only residents living within the 0.5 mile radius of the park were eligible for participation.

Given that aesthetics have been cited as relevant to physical activity (16, 21, 35, 36), field staff used an abbreviated tool (35) to conduct audits of road segments bordering the parks to document a variety of conditions, including incivilities (e.g., graffiti, trash, litter, poor maintenance).

We interviewed park staff at each of the parks to document the scope of programs and services available to the public and the estimated number of participants in park-sponsored programs and events. When a park was not staffed, we interviewed the area director.

Analysis of the survey data

To reduce potential biases due to differences in park users' and residents' characteristics, we used propensity score weighting (37). Propensity score weighting is an effective way of eliminating the differences in the observed characteristics (such as age, gender, and race/ethnicity) between the high and low poverty groups. We applied two separate propensity score models, one for park users and one for residents. The characteristics used in the propensity score models for both the park users and residents were: age, gender, race/ethnicity, length of residence at their current address, whether the park user or resident exercised at work, and site.

The propensity score was used to build weights (38, 39) for park users belonging to the low poverty group. Park users in the low poverty group who had similar characteristics to park users in the high poverty group were 'up-weighted' when computing the effect of poverty. Park users in the low poverty group with characteristics dissimilar to the high poverty group were 'down-weighted' when computing the effect of ethnicity. The ultimate result of this propensity weighting was to eliminate differences between the two poverty groups for both the park users and residents. We applied the propensity score weights using the TWANG R package (40), which uses a non-parametric regression technique.

Analysis of the observation data

Using the data generated from the SOPARC observations, we created two outcomes of interest: number of park users and total metabolic equivalents (METs) per park per day. One MET equals the energy expended by a person at rest for one hour. We assigned the following METs based on the activity observed: sedentary 1.5 METs, walking 3 METs, and vigorous activity 6 METs. The unit of analysis was park-day. This means that the four observations made during one day and across target zones within a park were aggregated at the park level for each day of observation, 12 days per park (4 days of observation for each of 3 seasons). We used generalized mixed effect models and treated parks as a random effect to allow for potential correlation of the 12 observation days nested within each park. The coefficients of both day level and park level covariates were treated as fixed effects. The poverty variable was rescaled so that every unit increase represented a 5% increase in households in poverty. The models controlled for season, whether it was a weekday or week-end day, the number of acres per park, number of people residing within a ½ mile radius from the park, state, whether the park had any full-time or part-time staff, the number of either organized or supervised activities, the number of sports facilities (e.g., fields, courts), and the percentage of interviewed residents and park users that perceived the park as safe. We modeled the number of park users with a Poisson regression and implemented robust standard errors to account for the over dispersion. However, we modeled total METs per park per day using a linear mixed effect model.

Results

Philadelphia had the highest rates of poverty and Chapel Hill/Durham the least (Table 1). The parks varied in size, from 3.6 to 24 acres, and we excluded acres that were forested and not suitable for recreational use. In Albuquerque and Chapel Hill/Durham, most of the parks had no full-time programming staff dedicated to a specific park. In contrast, all six parks in Philadelphia and three in Columbus had full-time employees. All 24 parks had play areas and 17 had fields for organized sports, but only three had walking paths.

We interviewed 3,559 park users and 3,815 local residents, and found significant differences among cities with respect to park visitation, use, and perception of park safety. Meanwhile, residents and park users within the same city reported very similar behaviors and experiences (Table 1).

Albuquerque and Philadelphia residents reported visiting their local neighborhood park an average of once per week, with visits less frequent by Chapel Hill/Durham and Columbus residents. In Albuquerque 17.3% of residents reported usually exercising in the park, almost double those living around Chapel Hill/Durham (8.8%) and Columbus parks (9.8%). Compared to those in the three other cities (41.3–50.3%), Philadelphia residents were much more likely to meet people they know in the park (75.5%). Meanwhile, Philadelphia residents were the most likely to report watching electronic media (screen time) and report not exercising at all (35.8%). Columbus residents were less likely to report that their neighborhood park was safe or very safe. (71.2% vs. 89.4–95.8%) and also reported visiting their local parks the least often.

Park users in Philadelphia reported visiting their park more frequently in the past seven days than those in the other three cities (Table I). They also reported being more likely to meet people they know and to exercise in the park more frequently than park users in the other three cities. Chapel Hill/Durham park users reported engaging in more weekly exercise sessions overall and were the least likely to report not exercising. Compared to the sample of residents, the majority of park users considered their neighborhood very safe or safe. Fewer than 10% in Ohio and 2% in Chapel Hill/Durham reported their parks unsafe. The average time reported watching electronic media was lower among parks users than the resident sample.

High poverty area parks were similar in size to low poverty area parks (mean 8.1 vs. 9.2 acres) (Table II). All parks had playgrounds and 75% had multiple-use sports fields. High poverty areas parks were more likely to have gymnasiums and outdoor basketball courts, but less likely to have tennis courts. Full-time staffing in the parks was similar across SES. Although not statistically significant, low poverty area parks had more hours budgeted for part-time staff (mean 106 vs. 60 hours). Parks in high poverty areas offered a greater number of programs and were also more likely to offer a snack service for youth and before or after school programming. In addition, more organized activities were observed in the high poverty area parks. Outreach strategies were similar among park types, but more low poverty area parks used email for outreach. A greater percentage of high poverty area parks reported receiving a budget cut in the last year.

Parks in high poverty areas tended to have more graffiti ($p < .06$) and litter along the streets surrounding the park ($p < .08$), and to be surrounded by buildings in poorer condition than those in lower poverty neighborhoods ($p = .10$) (data not shown).

Respondent Characteristics and Park Use

After controlling for age, gender, race/ethnicity, length of residency, exercise at work, and site, the likelihood of participation in park programs and the frequency of seeing people they knew was higher among both park users and residents in the high poverty area parks, but their perception of park safety was lower. Differences between high and low poverty parks users were seen in the percent who don't exercise (higher for high poverty, the percent who exercise in the park (lower for high poverty) and duration of park stay (higher for high poverty) (Table III). Those in high poverty areas reported staying at the park 11 minutes longer per visit.

In our sample of 24 parks we did not find an independent effect of percent of households in poverty on observed park use (Table IV). More park users visited parks on weekend days and when there were supervised or organized activities. Fall was the busiest season and accounted for an average of 4% more users per day compared to spring and summer. Summer had 11% fewer users than in spring. Each park having at least one supervised or organized activity accounted for 79% more park users per day and 192 more METs per day expended, equivalent to counting 192 people walking briskly for 20 minutes (Table 4).

Discussion

Our primary finding that the strongest factor associated with the number of park users METs expended in the park per day was the number of areas with observed organized and supervised activities. Supervised and organized activities constitute the "demand goods" that attract people to a park (41); these include competitive sports where moderate and vigorous physical activity is integral to the events. Competitions, events, and classes draw not only participants themselves, but also attract friends, family members, and spectators, potentially multiplying the number of park users. One study assessing the impact of free exercise classes in Brazil found they increased the level of PA in the park as well as attracting more females and seniors (44). We also found that objectively measured park use does not appear to be associated with socio-economic status. Although we dichotomized poverty as either higher or lower than the average city poverty level in this study, our model used a continuous measure of percentage of households in poverty and yielded the same null finding.

Other studies have found associations between perception of aesthetics and self-reported physical activity (21, 42, 43), but the condition of the parks was not associated with our objective measures of park use. We did find that the condition of the parks was somewhat inferior in high poverty parks, but it did not appear to matter to park use. Surprisingly, concerns about safety were also not correlated with objectively measured park use. Park users tended to regard their neighborhood parks as safe, or perhaps they would not be in the park. Although neighborhood residents' perceptions of safety were less positive than the park user sample, only a minority of residents was concerned about safety in the park, and these individuals may not have visited the parks anyway, regardless of this perception.

Limitations

There are several reasons why we may not have found differences in observed park use by neighborhood poverty level. First, our sample size of six parks per city was very low, and with 4 cities we may not have enough power to detect a difference. Second, our definition of a "neighborhood park" may have resulted in selecting parks that were very similar to one another and thus may not have been a full representation of the range of park options available in local communities. Third, the strongest predictors of park use and park-based energy expenditure (METs) were organized and supervised activities, and we observed more

of these in high poverty area parks than in low poverty area parks. This could have confounded the relationships between poverty and park use. Fourth, additional park management practices could be compensating for the impact of poverty on park use. Although high poverty area parks had fewer part time staff hours, they offered more unique activities and were more likely to offer snacks that might attract more park users. Another possibility is that disparities in poverty may vary by city, with some cities deliberately offering more programs and services in high poverty area parks. We did not have enough parks and cities to analyze the SES differences at the city level.

Conclusion

Our main finding that park programming is the most important correlate of park use suggests that there are considerable opportunities for facilitating increased PA among both high and low poverty area populations. The finding is particularly important in that many assume that low levels of physical activity is due to lack of access to parks and other green space, when in fact, existing spaces are underutilized. Therefore, increasing the demand for and use of existing space should be high in the agenda for promoting PA. Future research should test in a longitudinal fashion the impact of different strategies to increase park use, comparing free classes, holding events, or offering other incentives, as well as whether the context of a high or low poverty area park moderates the response to the intervention.

Acknowledgments

This study was supported by NHLBI grant # R01HL092569. Approval of the study was obtained from the respective IRBs at RAND, Ohio State University, PIRE, University of Pennsylvania, and UNC-Chapel Hill.

References

1. McNeill LH, Kreuter MW, Subramanian SV. Social environment and physical activity: a review of concepts and evidence. Social Science & Medicine (1982). 2006; 63(4):1011–1022.
2. Cerin E, Leslie E. How socio-economic status contributes to participation in leisure-time physical activity. Social Science & Medicine (1982). 2008; 66(12):2596–2609.
3. Proper KI, Cerin E, Brown WJ, Owen N. Sitting time and socio-economic differences in overweight and obesity. International Journal Of Obesity (2005). 2007; 31(1):169–176. [PubMed: 16652126]
4. Veblen, T. The Theory of the Leisure Class: An economic study in the evolution of institutions. New York: MacMillan Company; 1899.
5. Joassart-Marcelli P. Leveling the Playing Field? Urban Disparities in Funding for Local Parks and Recreation in the Los Angeles. Region Environment and Planning A. 2010; 42(5):1174–1192.
6. Moore LV, Diez Roux AV, Evenson KR, McGinn AP, Brines SJ. Availability of recreational resources in minority and low socioeconomic status areas. American Journal Of Preventive Medicine. 2008; 34(1):16–22. [PubMed: 18083446]
7. Dahmann N, Wolch J, Joassart-Marcelli P, Reynolds K, Jerrett M. The active city? Disparities in provision of urban public recreation resources. Health & Place. 2010; 16(3):431–445. [PubMed: 20056472]
8. Ellaway A, Kirk A, Macintyre S, Mutrie N. Nowhere to play? The relationship between the location of outdoor play areas and deprivation in Glasgow. Health & Place. 2007; 13(2):557–561. [PubMed: 16777464]
9. Macintyre S, Macdonald L, Ellaway A. Do poorer people have poorer access to local resources and facilities? The distribution of local resources by area deprivation in Glasgow, Scotland. Social Science & Medicine (1982). 2008; 67(6):900–914.
10. 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(2):417–24. [PubMed: 16452361]

11. Cohen, D.; Sehgal, A.; Williamson, S.; Sturm, R.; McKenzie, TL.; Lara, R., et al. Park Use and Physical Activity in a Sample of Public Parks in the City of Los Angeles. Santa Monica: RAND; 2006.
12. Cohen DA, Ashwood JS, Scott MM, Overton A, Evenson KR, Staten LK, et al. Public parks and physical activity among adolescent girls. Pediatrics. 2006; 118(5):e1381–9. [PubMed: 17079539]
13. Abercrombie LC, Sallis JF, Conway TL, Frank LD, Saelens BE, Chapman JE. Income and racial disparities in access to public parks and private recreation facilities. Am J Prev Med. 2008; 34(1): 9–15. [PubMed: 18083445]
14. Timperio A, Ball K, Salmon J, Roberts R, Crawford D. Is availability of public open space equitable across areas? Health & Place. 2007; 13(2):335–340. [PubMed: 16581285]
15. Witten K, Hiscock R, Pearce J, Blakely T. Neighbourhood access to open spaces and the physical activity of residents: a national study. Prev Med. 2008; 47(3):299–303. [PubMed: 18533242]
16. Kamphuis CB, van Lenthe FJ, Giskes K, Huisman M, Brug J, Mackenbach JP. Socioeconomic differences in lack of recreational walking among older adults: the role of neighbourhood and individual factors. The International Journal Of Behavioral Nutrition And Physical Activity. 2009; 6:1–1. [PubMed: 19123927]
17. McNeill LH, Wyrwich KW, Brownson RC, Clark EM, Kreuter MW. Individual, social environmental, and physical environmental influences on physical activity among black and white adults: a structural equation analysis. Annals Of Behavioral Medicine: A Publication Of The Society Of Behavioral Medicine. 2006; 31(1):36–44. [PubMed: 16472037]
18. Drenowatz C, Eisenmann JC, Pfeiffer KA, Welk G, Heelan K, Gentile D, et al. Influence of socio-economic status on habitual physical activity and sedentary behavior in 8- to 11-year old children. BMC Public Health. 2010; 10:214–214. [PubMed: 20423487]
19. Crawford D, Timperio A, Giles-Corti B, Ball K, Hume C, Roberts R, et al. Do features of public open spaces vary according to neighbourhood socio-economic status? Health Place. 2008; 14(4): 889–93. [PubMed: 18086547]
20. Weiss CC, Purciel M, Bader M, Quinn JW, Lovasi G, Neckerman KM, et al. Reconsidering access: park facilities and neighborhood disamenities in New York City. J Urban Health. 2011; 88(2): 297–310. [PubMed: 21360245]
21. 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. Journal of Physical Activity & Health. 2010; 7(6):802–810. [PubMed: 21088312]
22. Tucker-Seeley RD, Subramanian SV, Li Y, Sorensen G. Neighborhood safety, socioeconomic status, and physical activity in older adults. American Journal Of Preventive Medicine. 2009; 37(3):207–213. [PubMed: 19595554]
23. Cohen D, Golinelli D, Williamson S, Sehgal A, Marsh T, McKenzie TL. Effects of Park Improvements on Park Use and Physical Activity: Policy and Programming Implications. American Journal of Preventive Medicine. 2009; 37(6):475–480. [PubMed: 19944911]
24. Weiler R, Stamatakis E, Blair SN. Physical inactivity is associated with earlier mortality--the evidence is incontrovertible. Br J Gen Pract. 2011; 61(593):719–20. [PubMed: 22137395]
25. Lee IM, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet. 2012; 380(9838):219–29. [PubMed: 22818936]
26. Mertes, J.; Hall, J. Park, Recreation, Open Space and Greenway Guidelines. Ashburn, VA: National Recreation and Park Association; 1996.
27. McKenzie TL, Cohen DA, Sehgal A, Williamson S, Golinelli D. System for Observing Parks and Recreation in Communities (SOPARC): Reliability and feasibility measures. Jl of Physical Activity and Health. 2006; 3 (Suppl 1):S208–S222.
28. McKenzie TL, Sallis JF, Nader PR, Patterson TL, Elder JP, Berry CC, et al. BEACHES: an observational system for assessing children's eating and physical activity behaviors and associated events. J Appl Behav Anal. 1991; 24(1):141–51. [PubMed: 2055797]
29. Sallis JF, McKenzie TL, Conway TL, Elder JP, Prochaska JJ, Brown M, et al. Environmental interventions for eating and physical activity: a randomized controlled trial in middle schools. American journal of preventive medicine. 2003; 24(3):209–17. [PubMed: 12657338]

30. Cohen DA, Setodji C, Marsh T, Williamson S, Evenson K, Ward P, et al. How Much Observation is Enough? Refining the Administration of SOPARC. Jl of Physical Activity and Health. 2011 in press.

31. Mowen A, Orsega-Smith E, Payne L, Ainsworth B, Godbey G. The role of park proximity and social support in shaping park visitation, physical activity, and perceived health among older adults. J Phys Act Health. 2007; 4(2):167–79. [PubMed: 17570886]

32. Roemmich JN, Epstein LH, Raja S, Yin L, Robinson J, Winiewicz D. Association of access to parks and recreational facilities with the physical activity of young children. Preventive Medicine: An International Journal Devoted to Practice and Theory. 2006; 43(6):437–441.

33. Grow HM, Saelens BE, Kerr J, Durant NH, Norman GJ, Sallis JF. Where are youth active? Roles of proximity, active transport, and built environment. Med Sci Sports Exerc. 2008; 40(12):2071–9. [PubMed: 18981942]

34. NHTS. National Household Travel Survey. US DOT. 1995

35. Grant TL, Edwards N, Sveistrup H, Andrew C, Egan M. Inequitable walking conditions among older people: examining the interrelationship of neighbourhood socio-economic status and urban form using a comparative case study. BMC Public Health. 2010; 10:677–677. [PubMed: 21054879]

36. Saelens BE, Sallis JF, Black JB, Chen D. Neighborhood-based differences in physical activity: an environment scale evaluation. American journal of public health. 2003; 93(9):1552–8. [PubMed: 12948979]

37. Rosenbaum PR, Rubin D. The central role of the propensity score in observational studies for causal effects. Biometrika. 1983; 70:41–55.

38. Hirano K, Imbens GW, Ridder G. Efficient Estimation of Average Treatment Effects Using the Estimated Propensity Score. Econometrica. 2003; 71(4):1161–1189.

39. McCaffrey D, Ridgeway G, Morral A. Propensity Score Estimation with Boosted Regression for Evaluating Adolescent Substance Abuse Treatment. Psychological Methods. 2004; 9:403–425. [PubMed: 15598095]

40. Ridgeway, G.; McCaffrey, DF.; Morral, AR. A tutorial for the twang package R vignette. Santa Monica, CA: RAND; 2006. Toolkit for Weighting and Analysis of Nonequivalent Groups.

41. Jacobs, J. The Death and Life of Great American Cities. New York: Modern Library; 1961. Ch. 5: The Uses of Neighborhood Parks; p. 116-145.1993 Modern Library Edition ed

42. Ball K, Bauman A, Leslie E, Owen N. Perceived environmental aesthetics and convenience and company are associated with walking for exercise among Australian adults. Preventive medicine. 2001; 33(5):434–40. [PubMed: 11676585]

43. Humpel N, Owen N, Iverson D, Leslie E, Bauman A. Perceived environment attributes, residential location, and walking for particular purposes. American journal of preventive medicine. 2004; 26(2):119–25. [PubMed: 14751322]

44. Parra DC, McKenzie TL, Ribeiro IC, Ferreira Hino AA, Dreisinger M, Coniglio K, et al. Assessing physical activity in public parks in Brazil using systematic observation. Am J Public Health. 2010; 100(8):1420–6. [PubMed: 20558792]

Table I

Comparison of Parks and Survey Respondents (nearby residents and park users) in Four U.S. Cities

	Chapel Hill/Durham, NC (n=6 parks)	Albuquerque, NM (n=6 parks)	Columbus, OH (n=6 parks)	Philadelphia, PA (n=6 parks)	P value*
Average size (acres)	13.5	7.3	6.9	6.75	0.03
# parks with full time program staff	2/6	1/6	3/6	6/6	0.04
Avg. Pop. Density (.5 mile radius)	5,944	4,473	7,532	18,323	<.0001
% households in poverty (.5 mile radius)	10.3	15.8	20.6	28.5	0.06
% households in poverty citywide	8.8	11.2	14.8	24.3	0.01
Total park users observed over 12 days in 3 seasons	13,357	6,862	6,502	9,269	0.33
Residents (N)	909	960	900	1046	
Frequency of park use last 7 days (days)	0.7	1.0	0.5	1.0	<.0001
% Usually exercise in the park	8.8	17.3	9.8	11.3	<.0001
% Meet people they know in the park	50.3	39.5	41.3	75.5	<.0001
% Never exercise at all	5.3	14.5	21.5	35.8	<.0001
Frequency of exercise in past 7 days (days)	4.0	3.1	2.8	2.0	<.0001
Mean screen time (hours)	2.36	2.48	2.74	3.48	<.0001
% Perceived park as safe or very safe	93.3	95.8	71.2	89.4	<.0001
Park Users (N)	897	993	680	989	
Frequency of park use last 7 days (days)	1.8	2.1	1.8	2.7	<.0001
% Usually exercise in the park	22.0	21.2	14.8	23.3	<.0001
% Meet people they know in the park	59.6	38.5	41.5	79.2	<.0001
% Never exercise at all	5.6	10.6	25.1	30.9	<.0001
Frequency of exercise in past 7 days (days)	4.0	3.7	2.6	2.5	<.0001
Mean screen time – (hours)	2.13	2.33	2.49	3.02	<.0001
% Perceive park as safe or very safe	98.3	97.2%	91.6	95.3	<.0001

*p-value based upon chi-sq for categorical variables and t-test for continuous variables

Table II

Park management practices and park use by neighborhood poverty level (N=24 parks)

	High poverty (n=12)	Low poverty (n=12)	P value
Park characteristics			
Average park acres	8.1	9.2	0.57
% with playground	100	100	1.0
% with multi-purpose field	75	75	1.0
% with gymnasium	50	17	0.09
% with outdoor basketball	92	58	0.06
% with tennis court	8	75	0.0003
% with picnic area	92	92	1.0
% with walking path	8	17	0.56
Number of activity facilities	5.1	4.6	0.57
Park management practices			
Mean # full time staff[1]	2.3	1.5	0.38
Mean # part-time staff	6.3	7.2	0.86
Mean part-time staff hours[2]	60.4	106.3	0.28
Mean # unique programs offered	6.4	3.2	0.12
% offering snack service for youth	66.7	18.2	0.02
% offering snack service for seniors	0.0	8.3	0.31
% offering before OR after school program	50.0	8.3	0.02
% using following communications strategies			
Mailers	16.7	0.0	0.14
Banners	33.3	33.3	1.00
Website	66.7	58.3	0.67
Email	8.3	33.3	0.13
% with park Advisory Board	66.7	58.3	0.67
% with decreased budgets in past year	25.0	8.3	0.27
Park Use			
Average number of users observed by park	1493	1506	0.98
Average number of users per usable? acre	223	170	0.41

	High poverty (n=12)	Low poverty (n=12)	P value
Average number of users per pop. In .5 mile	0.23	0.23	0.97
Average number of users per 10,000 population/acres	285	248	0.67
Average number of organized activities/park observed over 12 days	15.6	10.4	0.38
Average number of supervised activities/park observed over 12 days	17.9	17.8	0.99

[1]Only 16 of 24 parks were staffed.

[2]Staff hours are only available for 10 parks (7 high, and 3 low).

Table III

Propensity score weighted analysis (controlling for age, gender, race/ethnicity, length of residency, exercise at work, and site)

	Park Users (N=3,559)			Local Residents (N=3,815)		
Variable	**High poverty (n=1770)**	**PS weighted Low poverty**	**p-value**	**High poverty (n=1936)**	**PS weighted Low poverty**	**p-value**
% visiting the park once a week or more	60	64.7	.073	30.0	28.1	.35
% often or sometimes seeing people they know	59.4	52.1	.005	37.8	31.5	.003
% perceive park safe/very safe	93.4	98.8	<.001	83.	92.4	<.001
% participating in park sponsored program	14.7	9.4	.002	11.5	8.4	.02
% who usually exercise at park	20.4	25.3	.038	12.1	11.8	.82
% exercise at home	21.2	17.8	.080	22.9	24.0	.55
% exercise at health club	20.2	22.3	.329	22.1	25.5	.05
% don't exercise	22.0	17.3	.036	23.4	20.6	.13
Average number of visits in past 7 days	2.12	2.05	.534	1.50	1.25	.01
Average length of stay (minutes)	88.0	77.3	<.001	44.2	43.4	.74
Mean # days engaged in exercise in past 7	2.95	2.94	.893	2.87	2.78	.32

Table IV

Predictors of park users and park-based energy expenditure (METs)

	Incidence Rate ratio # of park users	P-value	Beta –coefficient for METs/day (s.e.)	P-value
Intercept	--	.06	459 (511)	.37
% households in poverty	0.92	.39	−17 (29)	.55
Weekend	1.50	.003	117 (29)	.0001
Spring	1.00	ref	---	---
Summer	0.90	.44	−54 (36)	.13
Fall	1.04	.74	0.6 (36)	.98
Park size in acres	1.01	.46	−13 (6.6)	.06
Population in .5 mile radius	1.00	.22	.0007 (.01)	.96
Park has full or part-time staff	1.81	.20	109 (161)	.51
Percent of residents who perceive park as safe	1.00	.96	.36 (6.4)	.96
Any observed organized or supervised activity in a target area	1.79	<.001	192 (37)	.0000
Number of activity facilities	1.13	.01	28 (27)	.30
Albuquerque, NM site	1.90	.12	−315 (281)	.28
Columbus, Oh site	0.82	.53	−406 (200)	.06
Philadelphia, PA site	0.4	.06	−544 (256)	.05