Park-Based Physical Activity in Diverse Communities of Two U.S. Cities

An Observational Study

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Background: Systematic study of human behavior in public parks and specific activity settings can inform policy to promote physical activity in diverse communities.

Methods: Direct observation was used to assess physical activity in public parks in Tampa FL (n=10) and Chicago IL (n=18). Parks were selected from census tracts with high concentrations of white, African-American, and Hispanic populations. Representation from low- and high-income census tracts was also achieved. Physical activity was measured by a modified version of the System for Observing Play and Leisure Activity in Youth (SOPLAY). Activity codes from SOPLAY were transformed to energy expenditure per person (kcal/kg/min).

Results: Seventy percent of Tampa and 51% of Chicago park users were observed engaged in sedentary behavior. In both cities, children were more likely than adults to be observed in walking or vigorous activity. In Tampa, parks located in neighborhoods with the highest concentration of Hispanic residents were associated with greatest levels of energy expenditure. In Chicago, parks in neighborhoods with the highest concentration of African Americans showed the highest energy expenditure per person. Gender was associated with physical activity only in Tampa parks. Energy expenditure also varied by activity areas.

Conclusions: More than one half of park users in both cities engaged in sedentary behavior. While differences in park-based physical activity by neighborhood income and racial/ethnic composition were observed, these differences can more likely be attributed to the types of designated activity areas that support physical activity. The study findings suggest that specific configurations of park environments can enhance physical activity in parks.
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Introduction

Lack of physical activity among U.S. residents is a major health concern, particularly among low-income and minority populations. National studies show that adults and children from racial and ethnic minority groups get less physical activity than their white counterparts.[1,2] Racial and ethnic minorities and low-income populations also bear a disproportionate risk of experiencing chronic diseases[3] among which obesity and overweight, stroke, diabetes, depression and anxiety, colon cancer, and cardiovascular diseases are linked to physical inactivity.[4] Efforts to increase physical activity in diverse communities could have positive health outcomes.

The ecologic model of health behavior examines how the modification of built environment features can positively affect behaviors such as physical activity.[5,6] Public parks can play a substantial role in increasing leisure-time physical activity because they offer a wide range of free or low-cost activities close to where people live and because their existence, design, and quality are influenced through public policy.[7,8] Access to parks and recreation areas has been identified as an important predictor of physical activity,[9–11] and a national study estimates that 70% of U.S. residents live within walking distance of a public park.[12] Moreover, 80% of U.S. residents report using public parks, and nearly one person in four uses them "frequently." If neighborhood parks are to help increase physical activity in diverse and disadvantaged communities, research is needed to describe how parks are used and identify which settings support physical activity. Studies of ethnically diverse

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and underserved populations are also needed to address disparities in physical activity through the provision of parks and recreation facilities.

Few studies have examined how the capacity of parks and the activity spaces within them contribute to physical activity. McKenzie et al.[13] observed users of eight large parks in Los Angeles and found that 62% of male park users and 71% of female park users were sedentary. Vigorous-intensity activity in specific activity areas ranged from 2% to 34% and was significantly lower in picnic (13%) and open-space areas (28%) than in all sport facilities (32%–34%) except for baseball/softball fields (23% vigorous activity). Another study found that girls living near parks with playgrounds, basketball courts, walking trails, swimming areas, and tracks accumulated more moderate-to-vigorous physical activity (MVPA) than girls living farther away.[11] However, residential areas with predominantly African-American and Hispanic populations appear to have lower access to park and recreation facilities.[14–16]

These study findings are helpful but provide an incomplete understanding of the association between public parks and physical activity in diverse communities. While parks have the potential to support physical activity, a substantial amount of use can be sedentary. Considerable variation exists in the conduciveness of specific activity settings within parks to support physical activity. Most studies of parks and physical activity have focused on proximity of parks and have not linked physical activity to specific modifiable park attributes. Because public parks can be influenced through public policy, identifying features most likely to support MVPA in diverse communities could suggest how park settings can be managed to increase physical activity among residents. The objectives of the present study were to (1) assess levels of physical activity in selected neighborhood parks, (2) compare levels of physical activity observed in parks located in neighborhoods of different racial/ethnic and income composition, and (3) examine whether levels of physical activity associated with specific activity areas vary by the racial/ethnic and income composition of neighborhoods.

Methods

Data and Setting

Study data came from direct-use observations of ten neighborhood parks in Tampa FL and 18 parks in Chicago IL. ArcGIS 9.0 and census files were used to identify parks in racially and ethnically diverse communities. Attempts were made to select parks in predominantly (>50%) white (non-Hispanic), African-American (black, non-Hispanic), and Hispanic census block groups and census tracts with low (below metro area median and 30% below poverty) and upper/middle (above metro area median and less than 10% poverty) income within a 0.5-mile buffer. Also, attempts were made to select three parks from each race/ethnicity-by-income category, with the final selection done in consultation with park administrators in each city. Block groups had high representations of each ethnic group in Tampa (African-American range=42%–70%; Hispanic range=49%–61%; white range=72%–88%) and Chicago (African-American range=60%–99%; Hispanic range=70%–93%; white range=53%–84%). Actual median incomes for the users of selected parks ranged from $27,321 to $50,368, and poverty percentages ranged from 14% to 28%. In Chicago neighborhoods, the median incomes of park users ranged from $27,776 to $46,055, and poverty percentages ranged from 10% to 34%. Parks were generally similar in facilities, activity areas, and accessibility to residents located within neighborhoods. The mean acreage for selected Tampa-area parks was 41 acres with a range of 11 to 145 acres. The mean acreage for Chicago-area parks was 46 acres with a range of 8 to 207 acres.

Measures

Physical activity. Physical activity was measured using a modified version of the System for Observing Play and Leisure Activity in Youth (SOPLAY)[17] similar to the method developed by McKenzie et al.[13] Observation codes accounted for age group (children/adult), gender, and activity levels (sedentary, walking/moderate, and vigorous). Construct validity of these physical activity codes has been established in previous studies.[18,19] Trained observers recorded observations of physical activity in the parks between 10 AM and 6 PM from Friday through Sunday during the spring (Tampa, March–April) and early summer (Chicago, May–June) of 2005. Following an established protocol, separate scans were made for girls, boys, women, and men. Park activity areas were scanned visually from left to right and the codes representing park users' activity levels were recorded on a standardized form. Four scanning periods were conducted for each activity zone (two for AM, two for PM hours). Cohen's kappa coefficients for inter-observer agreement between paired observers ranged from 0.79 to 0.97, which is well within the acceptable range.[20]

Physical activity codes were converted to energy expenditure (kcal/kg/min), providing a second measure of physical activity using previously validated codes.[13] Energy expenditure was estimated by summing the number of individuals in sedentary, walking, and vigorous categories and then multiplying by their respective constants, 0.051kcal/kg/min, 0.096kcal/kg/min, and 0.144kcal/kg/min.[17] Calculation of energy expenditure per person enables transformation of these data into a linear format to compare relative activity levels across parks, activity spaces, and neighborhoods. This also allows for a comparison of means through ANOVA, using energy expenditure per person as the dependent variable and activity areas and neighborhood composition as independent variables.

Age group and gender. Observers categorized individuals in parks into two age groups, children and adults. Children were coded as anyone who appeared to be 12 and under following previously validated protocols.[13] High inter-rater reliability indicated a sufficient agreement between observers on categorizations. Similarly, categorization as male or female was based on apparent gender.

Table 1. Primary activity zones in study parks used for physical activity observations by neighborhood type

	Neighborhood type					
	African-American, high-income	African-American, low-income	White, high-income	White, low-income	Hispanic, high-income	Hispanic, low-income
Courts[a]						
Tampa	0	79	0	28	15	100
Chicago	105	113	50	21	85	51
Sports fields[b]						
Tampa	0	72	0	487	0	0
Chicago	109	157	229	212	152	184
Shelters						
Tampa	0	785	480	0	1487	719
Chicago	9	0	0	0	0	0
Playgrounds						
Tampa	0	216	130	40	1001	164
Chicago	100	52	239	60	99	127
Open spaces						
Tampa	0	180	143	78	643	98
Chicago	0	0	55	62	0	385

[a]Courts include tennis, racquetball, volleyball, and basketball courts.
[b]Sports fields include soccer, football, and baseball/softball fields.

Park activity zones. Activity zones for all parks and their boundaries were mapped by two members of the research team prior to observations. In most cases, activity zones coincided with established recreation use areas such as playgrounds, courts (e.g., tennis, basketball), picnic areas, sports fields, and open spaces (see Table 1 for complete listing). Each member of the observation team was instructed on zone boundaries and carried a map of activity zones into the field.

Neighborhood composition. Neighborhood racial/ethnic composition was a categoric variable with three attributes (white, African American, and Hispanic) taken from topologically integrated geographic encoding and referencing (TIGER) census files. Neighborhood income was a dichotomous variable (low and middle/upper) from the same data source. A combined racial/ethnic and income variable (e.g., low-income white, high-income white) was created to examine physical activity by neighborhood composition.

Data Analysis

Differences in physical activity levels by age group and gender were tested using chi-square. Differences in mean energy expenditure by activity areas and racial/ethnic neighborhoods were assessed by one-way ANOVA. Scheffe's post-hoc test was used to specify sources of difference in multiple group comparisons. Differences in mean energy expenditure by neighborhood income were evaluated by t-tests. All analyses were conducted with SPSS version 14.0.

Results

Physical Activity

A total of 7043 park users were observed in the ten Tampa parks; a total of 2413 were observed in the 18 Chicago parks. Overall, 11% of park users were observed in vigorous activity, 23% were observed walking, and 65% were observed as sedentary. The breakdown for Tampa park users was 8% vigorous, 21% walking, and 70% sedentary; for Chicago it was 22% vigorous, 28% walking, and 51% sedentary. Significantly more adults than children were observed in the parks, especially in Tampa parks (56.4% vs 43.6%, Chicago; 66.3% vs 33.7%, Tampa). Men and boys were significantly more likely to be observed in the parks than women and girls, with the pattern more pronounced in Chicago parks (68.4% vs 31.6%, Chicago; 51.3% vs 48.7%, Tampa).

Statistically significant associations were observed between physical activity and age group and gender. In Tampa parks, more children (44.4%) than adults (23.2%) were observed in walking or vigorous activity ($\chi^2_{(2)}=529.7$, $p<0.001$). In Chicago parks, 52% of children were observed in walking or vigorous activity compared to 47.2% of adults ($\chi^2_{(2)}=9.6$, $p=0.008$). Gender differences were significant only for Tampa park users, where 33.6% of males and 26.8% of females were observed in walking or vigorous activity ($\chi^2_{(2)}=44.2$, $p<0.001$).

Variation in Physical Activity by Neighborhood Type

Mean energy-expenditure-per-person values for parks in different neighborhood types are shown in Table 2. Overall, significant differences in mean energy expenditure were observed in Tampa and Chicago parks. In Tampa, parks in neighborhoods (census tracts) with large concentrations of Hispanic Americans showed the highest mean energy expenditure per person (mean=0.069), followed by parks in predominantly white areas (mean=0.068) and parks in predominantly African-American areas (mean=0.067) ($F=3.06$, $p=0.047$). Post-hoc tests revealed significant differences

Table 2. Mean energy expenditure per person by racial and ethnic neighborhood composition

Racial/ethnic composition	*n*	Mean	SD	*F*	Eta^2
Tampa					
White	1389	0.068[a,c]	0.030	3.06*	0.001
African-American	1332	0.067[a]	0.028		
Hispanic	4322	0.069[c]	0.029		
Chicago					
White	980	0.082[a]	0.037	6.75**	0.006
African-American	664	0.087[b]	0.037		
Hispanic	767	0.082[a]	0.037		

[a–c]Means with different superscript are significantly different at $p<0.05$ (Scheffe's post-hoc test).
*$p<0.05$; **$p<0.01$.

in energy expenditure between parks in Hispanic and African-American neighborhoods. In Chicago, users of parks in neighborhoods identified as African American showed the highest energy expenditure (mean=0.087), followed by parks in Hispanic (mean=0.082) and white (mean=0.082) neighborhoods ($F=6.75$, $p=0.001$). Scheffe's post-hoc tests showed that mean energy expenditure of park users in African-American neighborhoods was significantly greater than mean energy expenditure of park users in Hispanic and white neighborhoods. Significant differences in energy expenditure were also observed according to neighborhood income (Table 3). In both cities, greater mean energy expenditure was observed in parks in higher-income neighborhoods, with the association stronger in Chicago ($F=10.17$, $p=0.001$) than Tampa ($F=6.44$, $p=0.011$).

Analysis of variance was also used to examine variation in energy expenditure in neighborhood parks defined jointly by racial/ethnic and income composition (Table 4). In Tampa parks, differences in energy expenditure in parks of different racial/ethnic and income composition were statistically significant ($F=8.96$, $p<0.001$). Scheffe's post-hoc tests indicate that energy expenditure was greatest in parks in neighborhoods identified as high-income Hispanic and low-income white, and lowest in high-income white and low-income Hispanic neighborhoods. Different results were obtained from Chicago parks. Although energy expenditure in parks of different racial/ethnic and income composition was statistically significant ($F=10.16$, $p<0.001$), parks in neighborhoods identified as high-income African-American had higher energy expenditure than all of the remaining racial/ethnic–income neighborhood types.

Table 3. Mean differences in energy expenditure per person by neighborhood income composition

Income composition	*n*	Mean	SD	*t*
Tampa				
Low-income	3046	0.068	0.029	−2.54*
High-income	3985	0.069	0.030	
Chicago				
Low-income	1146	0.081	0.036	−3.19**
High-income	1265	0.086	0.038	

*$p<0.05$; **$p<0.01$.

Table 4. Mean energy expenditure per person in parks from neighborhoods categorized by income and racial/ethnic composition

Income and racial/ethnic composition	*n*	Mean	SD	*F*	Eta^2
Tampa					
Low-income white	633	0.072[a]	0.031	8.96*	0.005
High-income white	756	0.066[b]	0.028		
Low-income African American	1332	0.067[b]	0.028		
High-income African American[c]	—	—	—		
Low-income Hispanic	1085	0.066[b]	0.028		
High-income Hispanic	3237	0.070[a]	0.030		
Chicago					
Low-income white	385	0.083[a]	0.036	10.16*	0.021
High-income white	595	0.080[a]	0.037		
Low-income African American	330	0.080[a]	0.035		
High-income African American	334	0.096[a]	0.037		
Low-income Hispanic	431	0.079[b]	0.037		
High-income Hispanic	336	0.086[a]	0.037		

[a–b]Means with different superscripts are significantly different at $p<0.05$ (Scheffe's post-hoc test).
[c]A park for this designation (higher-income and predominantly African-American) could not be found using our criteria for neighborhood selection.
*$p<0.001$.

It is important to note that these patterns are influenced by the activity zones where observations of physical activity occurred. For example, in Tampa parks in low-income white neighborhoods, 76.8% and 12.4% of observations were in baseball/softball and open-space activity areas, respectively. In high-income and Hispanic neighborhoods, 47.5% and 32% of observations occurred near picnic shelters and playgrounds, respectively. For the remaining subgroups, the percentage of observations conducted near picnic shelters ranged between 59% and 69.5%. As detailed below, picnic shelters were associated with low energy expenditure relative to other activity zones. In Chicago parks, baseball/softball fields and open-space areas generated the lowest energy expenditure values. In low-income white neighborhoods, 64% of observations were in baseball/softball fields (26%) and open-space areas (38%). In high-income white neighborhoods, 51% of observations occurred in baseball/softball fields (40.8%) and open-space areas (10.1%).

Table 5. Mean energy expenditure per person in parks by activity zones

Activity zones	*n*	Mean	SD	*F*	Eta^2
Tampa					
Picnic shelters	3471	0.059[a,b]	0.020	144.13*	0.127
Dog play areas	36	0.057[a,b]	0.016		
Fishing piers	83	0.060[a,b]	0.020		
Baseball/softball fields	549	0.071[b]	0.031		
Open spaces	1010	0.078[c]	0.033		
Playgrounds	1551	0.080[c]	0.035		
Basketball courts	90	0.098[d]	0.033		
Tennis/racquetball courts	132	0.098[d]	0.034		
Chicago					
Dog play areas[e]	8	0.057[a]	0.016	12.83*	0.039
Baseball/softball fields	781	0.074[a]	0.033		
Open spaces	173	0.083[a,b]	0.036		
Volleyball	52	0.084[a,b]	0.034		
Tennis/racquetball	198	0.086[a,b]	0.037		
Playgrounds	574	0.088[b,c]	0.039		
Basketball court	175	0.088[b,c]	0.036		
Soccer fields	249	0.094[b,c]	0.039		

[a–d]Means with different superscript are significantly different at $p<0.05$ (Scheffe's post-hoc test).
[e]This result should be interpreted with caution given the small N.
*$p<0.0001$.

Physical Activity by Activity Zones

How activity zones contributed to physical activity can be reported in greater detail. The percentages of people observed walking or engaged in vigorous physical activity in primary activity spaces in Tampa parks were as follows: tennis/racquetball courts (75%); basketball courts (74.4%); open-space areas (45.5%); playgrounds (44.6%); baseball/softball fields (32.5%); fishing areas (19.3%); and picnic shelters (16.9%). In Chicago, the percentages of people observed in walking or vigorous physical activity in primary activity zones were as follows: tennis/racquetball courts (54.5%); basketball courts (58.3%); open-space areas (46.8%); playgrounds (50.9%); and baseball/softball fields (37%).

The ANOVA results of energy expenditure by activity areas are reported in Table 5. For Tampa parks, the greatest energy expenditure (0.098) was associated with racquet sports (tennis and outdoor racquetball) and basketball courts. Dog play areas (0.057), picnic shelters (0.059), and fishing piers (0.060) were associated with the lowest energy expenditure. Scheffe's post-hoc tests revealed significant separation among the activity areas. Tennis/racquetball and basketball courts (0.096) had greater energy expenditure than all other areas. Interestingly, energy expenditure for baseball/softball fields was not significantly different from energy expenditure documented in picnic, fishing, and dog play areas. In Chicago parks, less separation in terms of mean differences was observed among activity zones. Mean energy expenditure per person on basketball courts (0.088), playgrounds (0.088), and soccer fields (0.094) was significantly higher than that observed on baseball/softball fields (0.074).

Discussion

Seventy percent of Tampa park users and 51% of Chicago park users were observed in sedentary activities. Among Tampa park users, 21% and 8% were observed in walking and vigorous activity, respectively. Among Chicago park users, 28% and 22% were observed in walking and vigorous activity, respectively. These findings are similar to reports from past studies using observational methods.[18,21] While many types of park use, both active and passive, combine to provide an array of social, economic, and psychological benefits sought through leisure experience,[22] the prevalence of sedentary activity in park settings suggests that there may be further opportunities to encourage physically active park use. Public parks are widely available, subject to public policy influence,[8] and can promote population level changes in physical activity,[1] so studies like the present one can provide information that leads to more health-promoting park management policies.

The association between age group and physical activity was statistically significant in both cities. In Tampa parks, 44% of children were observed walking or engaged in vigorous activity compared to 23.2% of adults. In Chicago parks, 52% of children were observed walking or engaged in vigorous activity versus 47% for adults. This evidence that many children are getting physical activity by using parks is encouraging. These results can inform policymakers on the importance of neighborhood parks as critical community spaces where children can be physically active. Additionally, the study provides evidence for improving facilities conducive to physical activity in existing parks and creating new parks as places where children can engage in MVPA.

The ANOVA procedures showed that physical activity, energy expenditure in particular, varied by neighborhood racial/ethnic and income composition. For example, in Tampa the highest levels of energy expenditure were generated in parks from high-income Hispanic neighborhoods and low-income white neighborhoods. The lowest energy expenditure was associated with high-income white neighborhoods and low-income Hispanic neighborhoods. These findings reflect the similar composition of Hispanic and white neighborhoods. In Tampa, block groups with a population greater than 50% Hispanic were also nearly 50% white. In Chicago, the greatest energy expenditure was recorded from parks in high-income African-American neighborhoods. In both cities, the association between activity zones and physical activity appears to underlie differences by racial/ethnic and income composition. These physical activity patterns suggest that ethnic and

racial groups vary in their use of parks. It was not possible to establish those differences in the present study. Further investigation is needed to identify resources and configurations of parks that would most effectively encourage people to be active in each kind of neighborhood.

To put energy expenditure into perspective, a hypothetical 150-pound man who lived in the least-active neighborhood (African-American neighborhoods in Tampa), who visited the parks three times a week at 30 minutes per time, and who had the average energy expenditure would burn 21,379 kcal over the course of a year. A person living in the most-active neighborhood type (African-American neighborhoods in Chicago) and visiting the parks for the same amount of time would expend 27,760 kcal in a hypothetical year. This is a difference of 6381 kcal a year, or almost 2 pounds.

Sedentary behavior and lower levels of energy expenditure were associated with dog play areas, picnic shelters, baseball/softball fields, and open-space areas. MVPA and higher energy expenditure were generated by the use of soccer fields and playgrounds and by basketball, tennis/racquetball, and volleyball courts. Relative differences in physical activity by activity zones were consistent across cities. While these patterns would be expected, the present study provides quantitative evidence of how various activity areas within parks facilitate and constrain physical activity. It also highlights the need to consider how activities and facilities now available in parks located in communities at greater risk of inactivity and its health consequences might be redesigned or better programmed to stimulate physical activity and reduce racial/ethnic and income inequalities in physical activity. Future research using more rigorous designs, such as quasi-experimental evaluations of park renovations, can build on these results to better understand how specific configurations of facilities enhance moderate and vigorous physical activity in parks. Future studies should also identify the activity and program preferences of neighborhood residents. Perhaps moderate and vigorous physical activity in public parks can be increased in ethnically diverse communities if programs and facilities and other interventions are "culturally salient and appropriate."[23]

The study has several limitations. First, the SOPLAY observations consist of momentary time sampling, meaning that each park user's activity level was assessed only at one moment and each physical activity category encompassed a range of intensities.[13,24] The energy expenditure measures were based on the SOPLAY physical activity categories, so they are not precise. Second, the observations did not represent early morning, weekday, and seasonal park use. Different patterns of physical activity could result if broader coverage was achieved. Third, the neighborhood types in Tampa can be better described as "mixed" areas where there were high concentrations of both Hispanic and white residents. In contrast, Chicago neighborhoods exhibited greater residential segregation. The study did, however, present data on how parks located in ethnically diverse residential areas contribute to physical activity. An additional strength is that the data were obtained by established protocols from 28 parks in two large cities.[13,17]

The present results underscore the need to better understand how public parks contribute to physical activity in diverse communities. Evidence of the extent of sedentary behavior in parks demonstrates the need to consider how parks can be designed and managed to encourage physically active park visits. Although parks are frequently touted as critical resources for physical activity, clearly more research is needed to guide managerial decisions and policy. Future studies should investigate how park infrastructure, amenities, and programs in activity areas affect physical activity in diverse communities. Another research priority would be to evaluate interventions specifically designed to increase physical activity in activity areas dominated by sedentary behavior.

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