

Association of Park Size, Distance, and Features With Physical Activity in Neighborhood Parks

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Physical inactivity has consistently been linked to greater obesity prevalence and numerous related chronic diseases.^{1–5} Socioecologic models of physical activity promotion emphasize how the built environment facilitates or restricts opportunities for exercise.^{6,7} Within this paradigm, parks have been acknowledged as important behavior settings for physical activity.^{8–11} For example, older adults rate opportunities for physical activity as one of the most salient benefits of parks.¹² In another study, parks were identified as the most common place for physical activity by residents in several Los Angeles neighborhoods.¹³ However, most research on relationships between parks and physical activity has lacked specificity and detail and has evaluated broad factors such as total park area or proximity.¹⁴

A recent review of studies examining physical activity and park proximity found that 8 of 13 studies showed some significant positive associations.¹⁴ However, these studies generally used simple, single-item, categorical indicators of park proximity (e.g., is there a park near your home?), without examining the total number of parks or availability of parkland within a specified distance or a more precise measure of park proximity. The few studies that examined the aggregate number of parks or amount of proximal parkland generally reported strong associations with physical activity.^{15–18}

Researchers have suggested that park features and park size may also be correlates of park-related physical activity. Few studies have examined park size in relation to residents' physical activity. However, one study found that park attractiveness and proximity were only predictive of nearby residents' self-reported activity when park size was taken into account.¹⁹ With respect to features, Cohen et al.²⁰ reported that adolescent girls who lived near (<0.5 miles) parks with playgrounds, basketball courts, multipurpose rooms (usually gymnasiums), walking paths, swimming areas, and tracks had higher levels

Objectives. We studied whether park size, number of features in the park, and distance to a park from participants' homes were related to a park being used for physical activity.

Methods. We collected observational data on 28 specific features from 33 parks. Adult residents in surrounding areas (n=380) completed 7-day physical activity logs that included the location of their activities. We used logistic regression to examine the relative importance of park size, features, and distance to participants' homes in predicting whether a park was used for physical activity, with control for perceived neighborhood safety and aesthetics.

Results. Parks with more features were more likely to be used for physical activity; size and distance were not significant predictors. Park facilities were more important than were park amenities. Of the park facilities, trails had the strongest relationship with park use for physical activity.

Conclusions. Specific park features may have significant implications for park-based physical activity. Future research should explore these factors in diverse neighborhoods and diverse parks among both younger and older populations. (*Am J Public Health.* 2008;98:1451–1456. doi:10.2105/AJPH.2007.129064)

of nonschool physical activity than did girls not living near parks with such facilities. Having nearby parks with streetlights, floodlights, shaded areas, and drinking fountains was also related to greater physical activity. By contrast, living near parks with skateboard areas and areas for lawn games was negatively related to girls' physical activity.²⁰ Another study in 4 suburban parks reported increased activity intensity in parks with more overall site improvements and in those with organized activities, trails or paths, play structures, and sport fields or courts. However, having picnic shelters with grills in the park was related to lower activity intensity.²¹

Park proximity, size, and features have been minimally investigated in relation to physical activity, and little research has examined these factors concurrently. In our study, we addressed this prior limitation and also responded to calls for increased specificity in ecologic models²² by relating characteristics of individual parks to the physical activity that occurred in specific parks. Overall, we sought to determine the degree to which park size, number of features in the park, and proximity of the park from participants'

homes were related to the use of a park for physical activity.

METHODS

Data were collected in 4 neighborhoods, designated by municipal planning boundaries, in a medium-sized city in Ontario, Canada. Each neighborhood was approximately 1 square mile in size. Two were characterized by grid-like street patterns and a significant mix of commercial and residential land use; the other 2 were almost exclusively residential and had a larger proportion of curvilinear streets (although numerous paths connecting streets were also common in both neighborhoods).

Study Sample

From property lists provided by municipal officials, 250 residential households per neighborhood were randomly selected for participation in the study. We took significant steps to ensure that multihousehold properties (e.g., triplexes) were appropriately represented in the sampling frame. Introductory letters were mailed to selected households, and in

TABLE 1—Sample Sociodemographic Characteristics: Ontario, August 2006

Characteristics	No. (%)
Total	380 (100.0)
Gender	
Men	134 (36.2)
Women	236 (63.8)
Age, y	
18–34	104 (28.1)
35–54	163 (44.1)
≥55	103 (27.8)
Marital status	
Married or living with a partner	278 (75.2)
Single	92 (24.8)
Education level	
Graduated from college	241 (65.1)
Did not graduate college	129 (34.9)
Employment status	
Employed full time	195 (52.7)
Employed part time	48 (13.0)
Retired	62 (16.8)
Other	65 (17.5)

Note. A total of 380 participants provided valid physical activity data, which were used in this study. However, 10 participants did not provide data for all 5 variables listed in the table. These missing responses are not included in the table, such that the percentages in the last column sum to 100.

late summer 2006, trained research assistants distributed study packages door-to-door to adults and explained the purpose of the study and the materials to be completed. The staff then returned approximately 10 days later to pick up the packages and provide \$5 compensation. A total of 960 study packages were originally distributed, and completed study materials were retrieved from 585 residents for a return rate of 60.9%.

Data from 380 participants were included: 1 randomly selected respondent from each unique household that provided valid physical activity data. Participants ranged in age from 18 to 88 years; their mean age was 45.8 years (SD=15.6). Most participants were female, were married or living with a partner, had graduated college, and were employed full-time. These and other characteristics of the study sample are summarized in Table 1. Overall, the participants in the study were largely representative of the larger community, except that the current sample

contained a slightly higher proportion of female and married persons.

Analysis of Park Characteristics

Maps for each neighborhood produced using Geographic Information Systems technology and showing street and park layers were obtained from the local planning department. The 4 study neighborhoods contained a total of 33 parks (6–10 each). Information was also gathered on park sizes from the municipality’s database.

Data on park features were collected with the Environmental Assessment for Public Recreation Spaces (EAPRS) instrument.²³ This instrument has been shown to have good interrater reliability, particularly for facility and amenity presence.²³ Two trained researchers observed the 33 parks by using the EAPRS tool during August 2006, the same time period during which we collected physical activity data from participants. The interrater reliability for feature presence or absence for the 16 parks that were observed by both raters was .81. The facilities and amenities within the observed parks did not vary in cleanliness or condition (all were rated very highly); consequently, we focused on the presence or absence of 28 specific features that form the major elements of the EAPRS instrument.

These features were categorized in this study as either facilities (n=13) or amenities (n=15). Facilities were features of parks that were primary settings for physical activity (e.g., paved trail, unpaved trail, path, open space, wooded area, meadow, water area, playground, ball diamond, soccer pitch, tennis court, basketball court, and pool). Amenities were features of parks that might support opportunities for physical activity (e.g., drinking fountain, picnic area, restroom, table, bench, trash can, shelter or pavilion, historical or educational feature, landscaping, bike rack, parking lot, rules sign, sidewalk adjacent, roadway through, and having more than 1 entrance).

Finally, the average distance to the park from the participants’ homes within the neighborhood was calculated. Each participant’s home address was coded by using Cartesian coordinates (x, y) on a commercially produced map (intercoder reliability of 98% was established by 2 authors independently coding 50 homes), and the parks within the

neighborhoods were coded by using the centroid of each park as a reference point. The Euclidean distance between each home and each park was calculated, as was the average distance from each park to all the homes of participants’ in the same neighborhood.

Physical Activity Log

Participants completed a detailed 7-day physical activity log booklet in which they recorded the duration, intensity, and location of each physical activity episode. Correlations between the log booklet and the Godin–Shepard Leisure Time Exercise Questionnaire²⁴ were significant (all *P*<.01) with respect to the number of reported weekly episodes of mild (r=0.28), moderate (r=0.45), and strenuous (r=0.61) physical activity. The participants recorded location descriptions for each physical activity episode as open-ended text. The beginning of the log booklet included several sample pages that provided lengthy, descriptive location examples (e.g., walked down King Street, through Greenstone Park, up Queen Street to office), and the instructions provided with the log booklet included specific directions to note the use of parks or trails. We coded the location descriptions for each episode for whether they included the use of a park within the participant’s neighborhood. Distinct codes were inputted for individual parks such that it was possible to compute the number of episodes that included the use of each of the 33 parks in the 4 neighborhoods. However, more than half of the parks were not used at all for physical activity during the course of the study week; consequently, parks were dichotomized as “parks with some physical activity” or “parks with no physical activity” for the purposes of the following analyses.

Statistical Analysis

We used binary logistic regression to examine differences between parks with some physical activity and those with no physical activity with respect to their distance from participants’ homes, their size, and their aggregate and individual features (i.e., facilities and amenities). Two additional neighborhood variables, safety and aesthetics, were included in the analyses to account for how the area around the park may influence whether the

park was used for physical activity. Specifically, in addition to the physical activity log booklets, participants in the study completed the abbreviated version of the Neighborhood Environment Walkability Survey (NEWS), which assessed their perceptions of neighborhood attributes.²⁵ Safety (e.g., “there is a high crime rate in my neighborhood”) and aesthetics (e.g., “there are trees along the streets in my neighborhood”) were measured by 8 and 4 items, respectively, all of which were rated on a scale ranging from strongly disagree (1) to strongly agree (4). The ratings of participants living within 500 m of each park were used to calculate measures of safety and aesthetics for the area around each individual park. In the initial regression model described below, neighborhood safety and aesthetics were included as covariates in addition to the key variables of park size, features, and distance.

RESULTS

In total, 14 of the 33 parks were used for physical activity by participants within the same neighborhood, whereas 19 were not mentioned in any of the participants’ physical activity episodes. The 33 parks ranged in size from 0.10 to 232.82 hectares; their mean size was 9.96 hectares. The average distance to the 33 parks from participants’ homes within the same neighborhood was 970 m. The number of features (out of 28) within the parks ranged from 1 to 25, with a mean of 4.06 facilities (out of 13) and 5.09 amenities (out of 15) for an average of 9.15 total features.

Across the 33 parks, open space was the most common facility (in 13 parks in which physical activity was reported and in 16 parks in which no physical activity was reported), followed by path (in 9 and 8 parks, respectively), playground (in 8 and 7 parks, respectively), wooded area (in 9 and 4 parks, respectively), unpaved trail (in 8 and 3 parks, respectively), meadow (in 7 and 4 parks, respectively), paved trail (in 9 and 1 parks, respectively), water area (in 6 and 3 parks, respectively), ball diamond (in 4 and 1 parks, respectively), soccer pitch (in 5 and 0 parks, respectively), basketball court (in 1 and 3 parks, respectively), pool (in 2 and 1 parks, respectively), and tennis court (in 1 and 1 park, respectively)

TABLE 2—Odds Ratios (ORs) for Predicting Any Physical Activity Occurring in a Park, by Park Characteristic: Ontario, August 2006

Park Characteristic	Unadjusted OR (95% CI)	Adjusted ^a OR (95% CI)
Size	1.82 (0.90, 3.66)	
Number of features	1.43 (1.13, 1.76)	1.45 (1.09, 1.82)
Average distance to park	1.02 (0.83, 1.29)	

Note. CI = confidence interval.

^aAdjusted ORs are for all 3 variables included in the regression model together (only significant ORs are shown). The control variables of perceived neighborhood safety and perceived neighborhood aesthetics were included in both the unadjusted analyses and the adjusted model.

With respect to amenities, having an adjacent sidewalk was the most common feature (in 13 parks in which physical activity was reported and in 17 parks in which no physical activity was reported), followed by a trash can (in 14 and 14 parks, respectively), bench (in 11 and 12 parks, respectively), more than 1 entrance (in 12 and 8 parks, respectively), rules sign (in 8 and 7 parks, respectively), landscaping (in 7 and 7 parks, respectively), table (in 6 and 5 parks, respectively), bike rack (in 4 and 1 parks, respectively), parking lot (in 4 and 1 parks, respectively), historical or educational feature (in 4 and 1 parks, respectively), roadway through the park (in 3 and 0 parks, respectively), shelter or pavilion (in 2 and 1 parks, respectively), restroom (in 2 and 1 parks, respectively), drinking fountain (in 1 and 1 park, respectively), and picnic area (in 1 and 0 parks, respectively).

Shown in Table 2 are the results of the unadjusted and adjusted logistic regression analyses comparing parks with some physical activity with parks with no physical activity in terms of their size, total features (facilities plus amenities), and average distance to the park from participants’ homes within the neighborhood after we controlled for perceived neighborhood safety and aesthetics. Parks

that were used for physical activity had a mean area of 22.34 hectares, a mean of 12.43 features, and were, on average, 955 m from participants’ homes. Parks that were not used for physical activity had a mean area of 0.83 hectares, a mean of 6.74 features, and were 990 m from participants’ homes. Of the 3 park variables, in both the adjusted and unadjusted tests, only the number of features was a significant predictor of a park being used for some physical activity (odds ratio [OR]=1.45; 95% confidence interval [CI]=1.09, 1.82; *P*=.03 when all 3 variables were included in the model). Neither perceived neighborhood safety nor aesthetics were significantly related to the use of a park for physical activity.

Shown in Table 3 are the results of logistic regression models examining whether the number of facilities or the number of amenities was more important for explaining the significance of the number of features. Parks that were used for physical activity had an average of 5.86 facilities and 6.57 amenities, compared with only 2.74 facilities and 4.00 amenities in parks that were not used for physical activity. In the unadjusted analyses, a greater number of both facilities (OR=1.85; 95% CI=1.18, 2.90; *P*=.01) and amenities

TABLE 3—Odds Ratios (ORs) for Predicting Any Physical Activity Occurring in a Park, by Park Features Category: Ontario, August 2006

Park Features Category	Unadjusted OR (95% CI)	Adjusted ^a OR (95% CI)
Number of facilities	1.85 (1.18,2.90)	2.04 (1.05,3.96)
Number of amenities	1.49 (1.04,2.14)	0.89 (0.50,1.58)

Note. CI = confidence interval.

^aAdjusted ORs are for both variables included in the regression model together.

TABLE 4—Odds Ratios (ORs) for Predicting Any Physical Activity Occurring in a Park, by Park Facilities: Ontario, August 2006

Park Facilities ^a	No. of Parks With Feature (of 33)	Unadjusted OR (95% CI)	Adjusted ^b OR (95% CI)
Paved trail	10	32.41 (3.27,320.36)	25.93 (2.15,312.51)
Unpaved trail	11	7.11 (1.40,36.12)	
Wooded area	13	6.75 (1.43,31.90)	

Note. CI = confidence interval.

^aOnly significant predictors are shown in table. Nonsignificant facilities in unadjusted models were path, open space, meadow, water area, playground, ball diamond, soccer pitch, tennis court, basketball court, and pool.

^bAdjusted ORs are for all 3 variables included in the regression model together (only significant ORs are shown).

(OR = 1.49; 95% CI = 1.04, 2.14; *P* = .03) was significantly associated with increased odds of at least some physical activity occurring in the park. However, when both variables were included in the analysis together (adjusted model), only the number of facilities was significantly related to the same outcome variable (OR = 2.04; 95% CI = 1.05, 3.96; *P* = .03).

Finally, we sought to understand which of the 13 facilities was related to physical activity occurring in parks. Shown in Table 4 are the unadjusted and adjusted ORs for the 3 park facilities that were significantly related to parks experiencing at least some use for physical activity (the 10 other facilities were not significant predictors in the unadjusted analyses). The presence of paved trails (OR = 32.41; 95% CI = 3.27, 320.36; *P* = .01), unpaved trails (OR = 7.11; 95% CI = 1.40, 36.12; *P* = .02), and wooded areas (OR = 6.75; 95% CI = 1.40, 31.90; *P* = .02) were significantly related to park-based physical activity when examined independently. However, when we examined these 3 variables concurrently, only the presence of a paved trail was a significant predictor of some physical activity occurring in a park. Indeed, parks with a paved trail were almost 26 times as likely to be used for physical activity as were parks without a paved trail (OR = 25.93; 95% CI = 2.15, 312.51; *P* = .01).

DISCUSSION

We examined the relative importance of park size, distance, and features in predicting the use of a specific park for physical activity. Our study extended previous studies that

examined 1 or more of these characteristics, but often in relation to more generalized measures of activity not linked to context or location. Our data showed that only the number of features was a significant predictor, and a follow-up analysis showed that only the number of facilities was associated with increased odds of at least some physical activity occurring in the park when both facilities and amenities were considered simultaneously. Specifically, the presence of paved trails, unpaved trails, and wooded areas were significantly associated with park-based physical activity, and the relationship was strongest for paved trails.

Findings from other studies support the current results. For example, Giles-Corti et al.¹⁹ created an index of park attractiveness using 5 factors related to environmental quality (e.g., presence of a water feature), 3 amenity factors (e.g., presence of sports facilities), and 2 safety factors (e.g., lighting). Park attributes were assigned weights on the basis of their presence and estimated importance to physical activity using ratings by an expert panel. In one of their analyses using ratings of more than 500 public open spaces, the researchers showed park size to be somewhat more important than park attractiveness in explaining whether respondents had used any public open space for physical activity in the past 2 weeks. However, they noted that larger public open spaces generally have more attributes that make them more attractive to users. In testing this idea, actual observations of physical activity participation in 12 of these areas showed that in parks of equal

size, parks with more attributes attracted more users.

We also found that particular park features were related more strongly to park-based physical activity than were others. Parks with a paved trail, unpaved trail, or wooded area were more than 7 times as likely to be used for physical activity as were parks without these facilities. Several previous studies showed frequent and strong associations between trails and physical activity, although these are rarely examined in the context of parks.^{26,27} Paved trails are versatile facilities that support a wide variety of physical activities (e.g., brisk walking, running, and cycling) performed by people of different ages and skill levels for both transportation and recreation. Unpaved trails may also be favored by some runners and walkers who seek out softer surfaces. Minimal research has explored the nature of trail use, including the amount and intensity of activity that occurs there, motives for using the trail, or the specific features of trails that are conducive to physical activity.^{28,29} For this latter purpose, a tool was recently developed³⁰ to audit trails for their activity-promoting features. More-detailed research on the features of parks and trails (and other environments) will elucidate the factors that best promote physical activity.

Mounting evidence suggests that park planning may affect physical activity. Previous research has documented that both the amount of parkland and the number of parks create a setting conducive to both neighborhood and park-based physical activity. Parks developed with more facilities and supporting amenities, such as restrooms, bicycle racks, and attractive landscaping, also appear more likely to attract users for active purposes.¹⁹ In the current sample of adults, natural park facilities were more strongly associated with parks being used for physical activity. Future research should examine elements such as trails, water areas, wooded areas, and meadows as activity facilitators. Trails, in particular, were herein the most consistent and strongest correlate of park-based physical activity. Findings about park proximity and features suggest that a system of attractive, natural parks interconnected by trails may be effective for physical activity promotion among adults.

Limitations

In our study, the 33 specific parks were mentioned in between 0 and 118 episodes in the participants' physical activity logs. However, more than half of the parks were not used at all for physical activity during the study week. Consequently, treating the dependent variable as a continuous measure, even when transformed, would have violated statistical assumptions related to normality. Future studies that capture a greater and less skewed quantity of physical activity across parks may wish to reexamine the relative importance of features, size, and distance by using a more scaled version of the park use outcome used here. Collecting park use data across a greater time period may also provide additional insights into the use of specific venues, including parks, for physical activity. Similarly, examining these issues in a season other than summer may produce different results.

Issues related to the selected study neighborhoods and parks are also worth noting. First, given the cross-sectional study design, we cannot definitively state whether park features cause physical activity behavior in those settings or whether active people opt to live near parks with particular elements. Also, our analyses used park centroids for coding locations, which potentially overstates distance approximations for larger parks. However, only 2 parks in the present study were large enough for this to be an issue, and because each had residents within the neighborhood on only 1 or 2 sides of the park, we adjusted the centroids of these parks (i.e., moved them closer) accordingly. Furthermore, our use of straight-line rather than street-network distance from parks to homes may have affected the observed importance of distance. Although several parks traversed neighborhood boundaries, some were confined within areas characterized by either more grid-like or more curvilinear street patterns that may affect distance-related behaviors such as travel to parks (although many paths connecting streets in the curvilinear areas may have negated some of these differences). As such, the findings of this study may be limited to similar types of neighborhoods.

In addition, saturation of parks within many urban areas may make distance a less important factor influencing use. Per area,

urban neighborhoods in the United States and Canada have substantially more parks than do more suburban or rural areas, thus providing more park options in greater proximity. Distance may be a more important factor in park use in suburban and especially rural areas, where the choice to go to a park farther away, which may have more amenities, could require significantly more time or resources (e.g., transportation costs).

The 33 parks studied did not vary on most EAPRS indicators related to cleanliness and condition (most rated highly), including maintenance of facilities and absence of debris and graffiti. Thus, our analyses focused solely on the presence or absence of various facilities and amenities. In future studies, purposefully selecting parks with various degrees of cleanliness and disrepair will provide greater insight into the relative importance of these factors in influencing park-based physical activity. Furthermore, given the relative paucity of existing data examining how specific park features affect physical activity, it was premature to weight the 13 park facilities in our analyses, but this may be possible in future studies. As well, we studied only a few parks (33), those most proximal to the study neighborhoods. Finally, neither objective crime data for the neighborhoods around the parks nor data describing the safety of individual parks were collected.

Future Research

We examined park characteristics among adults, but future research should explore these issues among youth and other population subgroups. Past research has reported that the absence of nearby parks and sports venues was related to fewer walking and cycling trips among 10- to 12-year-olds,³¹ but youth-oriented park studies are relatively rare.¹⁴ The ubiquity and free cost of public parks may make them especially valuable for promoting physical activity among youth.

We inferred information about park-related physical activity (e.g., frequency, duration, intensity) from participants' descriptions of physical activity—episode locations. The log booklets, combined with questionnaires that assessed additional personal and neighborhood characteristics, provided a comprehensive and expedient means of collecting a

wide range of data from a large number of people (including, necessary for any distance calculations, participants' addresses). Nevertheless, direct observation within parks provides another systematic means of collecting setting-specific physical activity data.^{13,32} In future studies, observational methods should be combined with interviews of park participants to gather information about park use and other personal attributes. Similarly, behavioral observational data can be paired with setting observational data, like that collected by using the EAPRS instrument. In general, the use of complementary methods in future studies can provide a more comprehensive picture of park-based physical activity. ■

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A.T. Kaczynski conceptualized the study and supervised all aspects of its implementation. L.R. Potwarka assisted with data collection, analysis, and writing. B.E. Saelens contributed to analysis and writing.

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Human Participant Protection

This study was approved by the Office of Research Ethics at the University of Waterloo.

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