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Assessing the Contribution of Parks to Physical Activity using GPS and Accelerometry

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Abstract

Purpose—Parks offer a free option for physical activity in many communities. How much time people spend using parks and the contribution that parks makes to their physical activity is not known. This study describes patterns of park use and physical activity among a diverse adult sample.

Methods—From five US states, 238 adults enrolled in or near 31 study parks. Participants wore a global positioning system (GPS) monitor (Qstarz BT-Q1000X) and an ActiGraph accelerometer (GT1M) concurrently for three weeks. Parks were mapped from local and national park shape files. Park visits and travel to and from the parks were derived from the objective data.

Results—Participants visited parks a median of 2.3 times/week and park visits lasted a median of 42.0 minutes. Overall, participants engaged in a median of 21.7 minutes/day of moderate activity and 0.1 minutes/day of vigorous activity, with an average of 8.2% of all moderate and 9.4% of all vigorous activity occurring within the parks. Among those with at least one park visit (n=218), counts per minute, moderate, moderate to vigorous physical activity (MVPA), number and time in MVPA bouts/day, and sedentary behavior were all higher on days when a park was visited compared to days when a park was not visited. Considering several definitions of active travel, walking or bicycling to and from the park added an additional 3.7 to 6.6 mean minutes of MVPA per park visit.

Conclusion—Parks contributed as a place and destination for physical activity, but were underutilized. One of the next steps in this line of inquiry is to understand characteristics of parks used more often as a place and destination for physical activity.

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Keywords

accelerometer; active travel; geographic information systems (GIS); global positioning systems (GPS)

Introduction

Given the high levels of physical inactivity in the United States (US) and its contribution to chronic diseases, morbidity and mortality, efforts to reduce it are warranted (20, 32). Countries like Finland and Brazil have been demonstrating success in increasing levels of physical activity at the population level by investing in parks and recreational facilities and programming (23, 36). Whether this paradigm could be useful in the US depends on the current degree with which parks are already used for moderate to vigorous physical activity (MVPA), the intensity of activity recommended in the 2008 National Physical Activity Guidelines (33).

In the US, it is estimated that residents travel an average of seven miles to access their closest park, with shorter distances in more urban areas (40). Quantitative and qualitative reviews indicate that access to parks is an important correlate of physical activity (15, 16, 26). In support of this, increasing access to places for physical activity was incorporated as part of the US National Physical Activity Plan, developed to help implement the 2008 guidelines (34). Public parks offer a free option for physical activity in most communities. For many, access is not a barrier to park use; nevertheless, it is unclear how much time people spend using parks and the contribution that park use makes to their overall physical activity.

A challenge to answering how important parks are for physical activity relates to how park use is measured, since several methods exist. First, through surveys or interviews, participants report their own park use (for example: (37)). However, this self-report is susceptible both to recall bias and social desirability bias, and if the study focuses on younger children it must rely on parental recall. Second, participation in scheduled programs or classes, provided by parks and recreation departments or outside organizations, has been used in parks to indicate use of services, although uncommonly used for research (5). However, this method misses people who may use the park, but have not signed up for any park services. Instead of focusing on use by individuals, a third method relies on observations by park users to indicate use, such as with the System for Observing Play and Recreation in Communities (SOPARC) method (27). Limitations of the observational methods are the time and expense, as this method requires multiple observations over different days and seasons of the year to be reliable (7).

More recently, researchers are using global positioning systems (GPS) to assess where physical activity occurs (18, 22). This method requires participants to wear a GPS monitor that locates where they are and requires researchers to access electronic maps of parks (in a format called shape files) to overlay with the participant locations from the GPS data in order to determine if parks were visited. Researchers focusing on children have added accelerometry, in addition to GPS, to explore how much physical activity happens at parks (for example (14, 19, 29)). Expanding on these studies of youth, we used accelerometry with GPS to objectively measure park visits among a diverse sample of adults, a population for whom this work has not been explored. Using GPS and accelerometry, we build on currently available methods to describe patterns of park use and the contribution of parks to physical activity. Secondarily, we document the contribution to overall physical activity of the trip to and from the park. This research contributes to our understanding of how people are actually

interacting with their environments. GPS data combined with accelerometry provides empirical evidence of location and level of physical activity, including visits to parks, and thus helps to fill this conceptual and empirical void.

Methods

Study Sample and Recruitment

Participant enrollment occurred during the spring, summer, and fall between May 2009 and April 2011 (n=92 in 2009, n=148 in 2010, and n=4 in 2011). Participants came from study centers in five states: Los Angeles, California (CA); Albuquerque, New Mexico (NM); Chapel Hill and Durham, North Carolina (NC); Columbus, Ohio (OH); and Philadelphia, Pennsylvania (PA). At each of the five locations, participants were recruited at or near six (for NM, NC, OH, and PA) or seven (for CA) study parks (3). Compared to all available parks for each city, the study parks had more physical activity facilities, such as basketball courts, picnic areas, and fields. In the parks, participants were recruited in person, following completion of a brief park survey, and through posted flyers. In neighborhoods surrounding the park, participants were recruited following household interviews. More detail on recruitment is described elsewhere (3, 12). Inclusion criteria for enrollment were age ≥ 18 years, English speaking, ambulatory, and either living within one mile from the study park or recruited during a visit at the study park.

This study was approved by the Institutional Review Board at each university or organization affiliated with the five study centers, and participants provided written informed consent. Visits were conducted in a research office or at the park. All participants were asked to wear an accelerometer and GPS unit for three weeks, with weekly exchanges of units with local study staff. At enrollment, participants were weighed with a Tanita Bc551 scale and measured for height using a Seca Portable Stadiometer. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared and participants were grouped into four categories: underweight ($<18.5 \text{ kg/m}^2$), normal weight ($18.5\text{--}25.0 \text{ kg/m}^2$), overweight ($25.0\text{--}30.0 \text{ kg/m}^2$), and obese ($\geq 30.0 \text{ kg/m}^2$). Participants received a monetary incentive at the conclusion of the data collection period (\$200–225 US dollars).

Physical Activity Measurement

For three one-week periods, participants wore an ActiGraph (model #GT1M; Pensacola, Florida) accelerometer on their right hip secured by a belt to measure accelerations in the vertical plane. Each participant received written instructions and a telephone number to call with questions. Data were collected and stored in 60-second epochs. Non-wear time was defined as at least 90 consecutive minutes of zero counts, with allowance of 1 or 2 minutes of nonzero counts if no counts were detected in a 30 minute window upstream and downstream of the 90 minute period (4). Counts for non-wear minutes were set to missing.

Physical activity was calculated as average counts/minute and then converted to minutes/day based upon time spent in different physical activity intensities. A number of ActiGraph studies of adults provide count thresholds or cutpoints to distinguish MVPA from other forms of less intense activity. We used the cutpoints originally applied to the National Health and Nutrition Examination Survey (32), calculated by taking the weighted average of cutpoints from Freedson et al (13), Yngve et al (39), Leenders et al (21), and Brage et al (2). Vigorous intensity was defined as ≥ 5999 counts/minute and moderate intensity as 2020–5998 counts/minute. Bouts of MVPA were defined as consecutive sets of time ≥ 10 minutes when accelerometer counts were ≥ 2020 counts/minute, with allowance for interruptions of one or two minutes in the moving 10-minute window below the threshold. A “lower moderate” intensity threshold was calculated based on studies that incorporated more

lifestyle activities that may be more appropriate for older adults (24), defined as 760–2019 counts/minute. Light intensity physical activity was defined between 101–759 counts/minute and sedentary behavior was defined as ≤ 100 counts/minute (25).

GPS Measures

For three one-week periods, participants also wore the Qstarz BT-Q1000X portable GPS units (weight 65 grams, dimensions 72×46×20 mm) on their waist during all waking hours. The units were set to record latitude, longitude, and speed every minute, with the Wide Area Augmentation System (WAAS) enabled (a system of satellites and ground stations that provides correction data to increase the accuracy of GPS readings). The map datum used was World Geodetic Survey 1984 and the position format was latitude and longitude in degrees and minutes (HD° MM'). Participants were asked to keep the unit dry and to charge it overnight, every night. Each participant received written instructions and a telephone number to call with questions.

GIS Data

Shape files for the parks in the study were obtained from the appropriate parks and recreation and planning departments. This was supplemented with a 2010 national park shape file from Esri (Redlands, CA), with use supported by a recent study (11). Each participant's home address was geocoded using 2010 TIGER/ Line shape files in ArcGIS 10 and checked with electronic maps as needed. The Euclidean distance from home to the nearest park edge was calculated using the ArcGIS "near" function.

Statistical Analysis

All statistical analyses were conducted in SAS version 9.3 (Cary, NC) and ArcGIS. Significance testing was set at $p < 0.10$. The GPS data files were downloaded and cleaned, removing data headers, converting coordinate data into decimal degrees, and transforming the data into wide-character ASCII format to enable further processing with SAS and ArcGIS. The accelerometer files were also downloaded and cleaned in order to match the minute-by-minute data with the GPS data. Each state had local study staff for data collection, ensuring that accelerometer and GPS data were matched within time zone. Since participants exchanged their units between weeks one to two and weeks two to three, the GPS and accelerometer data from the unit being returned by the participant overlapped some with the data from the unit being picked up. These overlapping points were removed and the three weeks of data were merged into one file.

Geoprocessing procedures were used to extract points that fell within the study park and to remove points within 50 meters of the participant's residence, accounting for any inaccuracies in point locations. The removal of points near a participant's residence affected only 5 participants. Points that corresponded to a speed of ≥ 30 kilometers/hour were further removed to exclude driving within parks. These cleaned data were then processed using SAS. To be defined as a park visit, consecutive points within the park boundaries were required to span ≥ 3 minutes. A time gap of at least 45 minutes between consecutive park points was deemed two separate park visits. Otherwise, the points were considered as part of the same park visit. Certain special cases were further investigated to determine if they were a park visit including: visits with an average speed ≥ 15 km/hour, visits mostly on streets or roads but were inside a park, multiple visits in one day for the same participant, and visits occurring overnight. To compare characteristics of participants by recruitment method, Pearson χ^2 tests were used. Wilcoxon non-parametric tests were used to compare physical activity on days when parks were and were not visited.

Secondarily, we explored the additional contribution to overall physical activity of travel to and from the park through active travel, such as through walking or bicycling. We expanded the GPS park visit data to include one hour before and one hour after each park visit and removed points within 50 meters of the participant's residence. Contribution of overall physical activity of the trip to and from the park was calculated two ways based on time and two ways based on distance. Using time, we counted physical activity that occurred 30-minutes and 60-minutes before and after each park visit. Using distance, we counted at least light intensity physical activity that occurred within a 1-mile and 5-mile buffer around the park within one hour before or after the park visit.

Results

Description of Sample

In total, 238 participants enrolled in the study and provided both GPS and accelerometer data, with 230 participants providing 3 weeks, 2 participants providing 2 weeks, and 6 participants providing 1 week of data. Among the sample, age ranged from 18 to 85 years (median 37.0 years, mean 40.4 years), 56.3% were female, 26.2% were non-Hispanic Black, and 15.2% were Hispanic (Table 1). The sample included a range of educational levels and a relatively even distribution of weight categories. Overall, the predominant self-reported modes of travel to the park were walking (56.1%) and driving (55.9%), but not bicycling (2.7%). The percent that walked or bicycled to the park varied by site: 27.3% CA, 47.8% NM, 12.5% NC, 46.8% OH, and 78.4% PA.

Overall, 80.1% were recruited within the park and 19.9% were recruited from households within 1-mile of the study park. Participants recruited from households compared to those recruited from parks were similar on most characteristics (gender, age, education, BMI), except that those recruited from households were more likely to walk or bicycle to the park ($p=0.01$) and were more likely to be non-Hispanic White ($p=0.07$; data not shown).

Description of Park Visits

Participants lived on average 0.4 Euclidean miles from the closest park and 2.6 Euclidean miles from the parks they visited (Table 2). Participants visited parks a median of 2.3 times/week and 6.0 visits over the 3-week period, using the GPS-based measures. During the 3-week period, participants visited a median of 2.0 different parks. The median duration/day spent in parks was 42.0 minutes. In the sample there were 20 participants (8.4%) that had no park visits during the 3-week period (7 recruited from households and 13 recruited from the park).

Physical Activity and Park Visits

Participants wore the accelerometer on average 11.5 hours/day (median 11.8, interquartile range (IQR) 9.0–13.6). Overall participants engaged in an average of 26.8 minutes of MVPA per day (Table 3). Overall, a mean of 4.0% of the monitored day was spent in MVPA, 9.3% in low moderate, 24.4% in light activity, and 62.4% in sedentary behavior.

Participants visited parks on average 6 days during the 3-week period (median 5 days, IQR 2–9 days). Overall, 8.2% of all moderate activity and 9.4% of all vigorous activity occurred in parks. For time spent in the park, a mean of 12.0% was spent in MVPA, 15.7% in low moderate, 23.1% in light activity, and 49.3% in sedentary behavior.

Among those with at least one park visit ($n=218$), counts per minute, lower moderate, moderate, MVPA, number and time in MVPA bouts/day, and sedentary behavior were all higher on days when a park was visited compared to days when a park was not visited

(Table 4). Light activity was higher on days when a park was not visited compared to days when a park was visited.

Active Travel To and From the Park

When considering the four definitions of active travel, either the 1- or 5-mile buffer, or the 30- and 60- minute period before and after the park visit, an additional average 3.7 to 6.6 minutes/park visit of MVPA were added (primarily through moderate activity) and 5.5 to 10.2 minutes/park visit of light moderate activity (Table 5).

Discussion

Patterns of Park Use and Association with Physical Activity

The results show that while our sample of adults visited parks relatively frequently (average of 8.8 times over the 3-week period), only 8.2% of all moderate and 9.4% of all vigorous activity occurred within parks. Even though park users stayed at parks for an average of 53.3 minutes, parks were functioning more as a destination for light and sedentary behavior and less as a venue for MVPA. We postulate that one reason for this may be insufficient programming. When collecting observational data at six parks in each study area, we documented that supervised and organized activities provided by parks and recreation departments or outside organizations, when present, were more often geared towards youth rather than adults (3). A Brazilian study found that public parks offering free supervised physical activity classes had higher usage and a higher prevalence of vigorous activity compared to parks not offering programming across age groups (28). Several studies also indicate that renovating parks can increase usage for both youth and adults (30, 35). However, another study found that park use declined, despite park improvements, and cited a decline in programming as a possible reason (5, 6). Offering free physical activity programming geared towards MVPA at the parks may be a particularly effective strategy to reach nearby residents and could include both youth and adults. In addition to programming, the types of facilities and the quality of those facilities may also be associated with use.

While distance to the closest park was short for most participants (median 0.3 Euclidean miles), the parks that were visited were usually further away (2.4 Euclidean miles). Moreover, participants visited a median of 2 different parks over the 3-week period. An understanding of why participants chose to attend certain parks would be useful to understand. This could be accomplished through qualitative query, such as showing participants the parks they attended through a GIS platform and asking questions about each visit. It could also be accomplished through quantitative study, combining use of parks with detailed information on the parks, such as facility offerings and quality of parks.

Additional Contribution of Travel to and From the Park

Active travel to and from parks provides another opportunity for physical activity. A cohort study of US adults age 38–50 years that report the presence and use of neighborhood amenities found that destinations most commonly accessed when walking were public transit stations (72%) and parks (46%), and when bicycling were parks (19%) and recreation facilities (10%) (1). These types of active trips were associated with more favorable BMI, waist circumference, and cardiorespiratory fitness. Moreover, those that bicycled had a lower risk of cardiovascular disease. Factors associated with walking to a park include higher perceived safety and aesthetics, living close to a variety of destinations, non-grid street pattern, children living at home, owning a dog, and walkable routes (8, 17, 31). In our study, when accounting for active travel to and from the park, estimated four different ways, the additional contribution to MVPA ranged from an average of 3.7–6.6 minutes/park visit. This contribution adds meaningfully to the average MVPA spent in the park, and

underscores the proximity to which many participants lived to the parks they visited (average 2.6 miles to the park visited). It also highlights the potential of parks to contribute even more to MVPA as a destination for adults.

We chose to use Euclidean (straight line) distances to calculate the active travel estimates, but recognize that network distances (shortest street trip linking the origin and destination) better represent vehicular paths. Euclidean distances better account for alternative routes that might be taken if walking or bicycling to the park, but they are theoretically always shorter than network distances. Euclidean and network distances are strongly correlated; however, the correlation declines from more urban to suburban and rural areas (40).

Limitations and Strengths

There are several limitations worth noting with regard to the objective GPS and accelerometry measures used in this study. GPS units have difficulty recording locations in dense urban environments, especially with large and closely connected buildings, or indoors. This could affect the classification of park visits that were inside recreation centers or other indoor park buildings, or in parks in urban areas surrounded by buildings. Also, the GPS battery could not last an entire week, so participants were asked to charge the unit each night. There is a small chance of missed park visits due to the need to charge the battery. Also, to minimize equipment failure, we met with participants weekly and exchanged both the GPS and accelerometer units. This overlap in exchange time provided analytic challenges. In the future, the equipment exchange time and date should be recorded to ensure a simpler approach to merging the three weeks of data. As monitor battery life improves, these concerns will be diminished.

The accelerometers we used in this study have evidence for both validity and reliability (9, 13), but only provided information in the vertical plane, so some types of physical activities may have been misrepresented (i.e., bicycling, strength training). Also, participants were told not to wear the monitor during water activities, such as swimming. Thus, all of these activities are under represented with the accelerometer data. Newer accelerometers can overcome these limitations. There is likely not one cutpoint to define MVPA from a single waist-mounted accelerometer (24), particularly for older adults (10), which is why we also explored a lower moderate activity cutpoint (24).

Although we selected participants with diversity related to geographic location, gender, race/ethnicity, and age, a limitation is that they were volunteers. Moreover, we made an effort to recruit participants both within and around the parks; however, by design our sample lived on average 0.4 miles from a park and so had higher access to parks than the general population, which in 2008 had national estimate of 7 miles (40). Our sample did have similar MVPA compared to a national sample recorded with accelerometry (32). It would be useful to next apply this technology to a representative sample of adults and to explore potential differences by urbanicity. It also would be useful to contrast parks that were visited to other parks in the area, to identify characteristics of parks that are used more often overall and specifically for MVPA.

The strengths of this study include the diverse sample from different geographic regions, and the use of objective measurement. While most studies monitor behavior for one week or less, this sample wore the monitors for 3 weeks, minimizing the potential for reactivity. This paper also contributes to the development of algorithms to use objective measures to determine park use that provided duration, frequency, and intensity of physical activity in parks. These methods could be replicated by other studies and provide an additional measurement methodology to the existing choices of self-reported park use, park user

counts, and park observation. This methodology is also useful as a criterion measure to compare against self-reported park use questionnaires or diaries (12).

Conclusions

The use of objective technologies allowed us to explore park use over an extended period of time. This study indicated that participants were more active on days they went to a park, yet a small percentage of total daily MVPA occurred within a park. Parks were a destination that offered additional support for MVPA through active travel. New GIS-based tools and methods to identify active travel patterns should be developed in the future. Another step in this line of inquiry is to understand characteristics of parks as places that can contribute more often as a place and destination for physical activity.

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Table 1

Descriptive characteristics of participants

	Overall		
	N=238	%	Missing
<u>Gender</u>			0
Female	134	56.3	
Male	104	43.7	
<u>Age</u>			0
18–35	114	47.9	
36–59	83	34.9	
60–85	41	17.2	
<u>Race/ethnicity</u>			1
non-Hispanic White	117	49.4	
non-Hispanic Black	62	26.2	
Hispanic	36	15.2	
Other	22	9.3	
<u>Education</u>			0
Less than high school, high school, or GED	55	23.1	
Some college or vocational	53	22.3	
College	82	34.5	
Post college	48	20.2	
<u>Body mass index</u>			0
Under/normal weight	86	36.1	
Overweight	75	31.5	
Obese	77	32.4	
<u>On the last visit to the park, how did you get there?***</u>			16
Walked or bicycled	91	41.0	
Drove, bus, other	131	59.1	
<u>Recruitment into study</u>			2
Household recruitment *	47	19.9	
Park recruitment	189	80.1	

* Recruited outside the park, but living within 1 mile of the study park

*** Self-reported from baseline questionnaire

Table 2

Descriptive characteristics of participants using GPS and GIS derived measures, overall and by site (n=238)

	Overall		
	Mean	Median	Inter-quartile Range
<u>Distance to Parks</u>			
Average Euclidean distance from home to the nearest park (miles)	0.4	0.3	0.1, 0.5
Average Euclidean distance from home to parks visited (miles)	2.6	2.4	1.5, 3.4
<u>Park Visits Determined with the GPS</u>			
Average number of park visits/week to parks	3.1	2.3	1.0, 4.7
Average number of parks visits over the 3-week period	8.8	6.0	2.0, 14.0
Number of different parks visited by participants over the 3-week period	2.5	2.0	1.0, 3.0
<u>Time Spent in Parks Determined with the GPS</u>			
Average duration (number of minutes/day) in parks	23.2	13.4	3.9, 30.3
Average duration (number of minutes/park visit) *	53.3	42.0	23.6, 67.8

GPS=global positioning system

* Park visits that contained overnight stays in a park or lasted over 6 hours per visit are excluded from the analysis. All measures in the table were calculated by participant, except this noted measure which was calculated for each park visit over the 3-week period.

Table 3
Distribution of physical activity overall and during parks visits among all participants (n=238)

	Overall			During a Park Visit			% Time Spent in Parks*
	Mean	Median	Inter-quartile Range	Mean	Median	Inter-quartile Range	
Counts per minute	346.1	314.8	240.1, 418.5	729.3	529.6	288.4, 883.6	N/A
<u>By intensity:</u>							
Vigorous activity (minutes/day)	2.3	0.1	0.0, 1.6	0.1	0.0	0.0, 0.0	9.4
Moderate activity (minutes/day)	24.5	21.7	12.0, 34.4	2.2	0.5	0.0, 2.6	8.2
MVPA (minutes/day)	26.8	23.1	12.5, 36.7	2.3	0.5	0.0, 2.7	8.2
Lower moderate activity (minutes/day)	63.6	57.4	43.2, 77.4	3.6	1.0	0.2, 3.4	5.2
Light activity (minutes/day)	169.0	166.3	123.4, 212.2	5.1	1.9	0.3, 5.5	3.1
Sedentary (minutes/day)	429.7	436.9	343.9, 514.9	9.9	3.8	0.6, 11.0	2.4

MVPA=moderate to vigorous physical activity; N/A=not applicable

* Calculated by dividing the time during a park visit by time overall at each intensity level

The cutpoints for intensity levels were defined in counts/minute: vigorous ≥ 5999 , moderate 2020–50998, MVPA ≥ 2020 , lower moderate 760–2019, light 101–759, and sedentary ≤ 100 .

Table 4

Accelerometer results overall and stratified by days with or without a park visit (n=218 *)

	Overall		Days When in a Park		Days When Not in a Park		p value ***
	Median	Inter-quartile Range	Median	Inter-quartile Range	Median	Inter-quartile Range	
Counts per minute	314.8	240.1, 416.0	343.0	256.2, 455.0	287.3	222.7, 381.2	<.0001
<u>By intensity:</u>							
Vigorous activity (minutes/day)	0.1	0.0, 1.6	0.0	0.0, 1.0	0.1	0.0, 1.3	0.13
Moderate activity (minutes/day)	22.1	12.2, 34.6	26.4	11.5, 45.0	16.7	8.7, 28.1	<.0001
MVPA (minutes/day)	23.6	12.7, 36.8	28.0	11.8, 46.4	18.0	8.8, 29.9	<.0001
Lower moderate activity (minutes/day)	58.5	42.4, 77.4	61.0	46.0, 83.1	52.4	37.7, 72.8	<.0001
Light activity (minutes/day)	168.1	127.6, 211.5	167.9	129.6, 217.8	169.8	119.1, 209.6	0.03
Sedentary (minutes/day)	442.0	345.5, 515.2	447.5	361.0, 526.0	430.6	329.0, 522.9	0.04
<u>Bouts:</u>							
Number of MVPA bouts/day	0.5	0.2, 0.8	0.4	0.0, 1.0	0.4	0.1, 0.7	0.0001
Time in MVPA bouts (minutes/day)	8.2	2.5, 17.6	8.9	0.0, 27.0	5.4	0.7, 12.1	<.0001
Number of MVPA bouts/day including lower moderate intensity	1.5	1.0, 2.4	2.0	1.0, 3.0	1.3	0.7, 2.1	<.0002
Time in MVPA bouts including lower moderate intensity (minutes/day)	31.3	16.4, 51.7	39.6	18.9, 68.6	23.9	10.6, 42.1	<.0003

MVPA=moderate to vigorous physical activity

* On participants who had at least one park visit during the 3-week study period

** p-values are from the Wilcoxon non-parametric signed rank test comparing days when they visited versus days when they did not visit a park

The cutpoints for intensity levels were defined in counts/minute: vigorous >=5999, moderate 2020-50998, MVPA >=2020, lower moderate 760-2019, light 101-759, and sedentary <=100. MVPA bouts were defined as consecutive sets of time >=10 minutes when the accelerometer counts were above the relevant threshold, with allowance for interruptions of one or two minutes in the moving 10-minute window below the threshold.

Table 5

Distribution of physical activity per park visit (averaged for each person) and considering time before and after the park visit (n=218^{*})

	# Minutes/park visit						# Minutes/park visit spent on trips to and from park visit					
	During park visit			1-mile buffer distance around parks			5-mile buffer distance around parks			30-min before & after park visit		
	Mean	Median	Inter-quartile Range	Mean	Median	Inter-quartile Range	Mean	Median	Inter-quartile Range	Mean	Median	Inter-quartile Range
Vigorous	0.2	0.0	0.0, 0.0	0.3	0.0	0.0, 0.0	0.3	0.0	0.0, 0.0	0.2	0.0	0.0, 0.0
Moderate	5.9	2.0	0.3, 6.4	3.7	1.7	0.3, 5.0	4.6	2.5	1.0, 6.0	3.5	2.0	0.5, 4.6
MVPA	6.1	2.2	0.4, 6.6	3.9	1.7	0.3, 5.5	5.0	2.6	1.0, 6.3	3.7	2.0	0.5, 5.1
Lower moderate	8.3	4.0	1.6, 9.8	6.0	4.4	1.8, 9.0	7.6	6.3	3.7, 10.8	5.5	4.9	3.1, 7.1
Light	12.8	7.2	2.5, 15.6	13.3	10.0	5.5, 19.1	17.8	16.6	9.1, 25.3	12.6	12.2	7.7, 16.5
										23.1	21.8	15.0, 31.5

The cutpoints for intensity levels were defined in counts/minute: vigorous ≥ 5999 , moderate 2020–50998, MVPA ≥ 2020 , lower moderate 760–2019, and light 101–759.

MVPA=moderate to vigorous physical activity

* On participants who had at least one park visit during the 3-week study period.