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A longitudinal examination of improved access on park use and physical activity in a low-income and majority African American neighborhood park

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ABSTRACT

This study sought to evaluate the impact of street crossing infrastructure modifications on park use and park-based physical activity in a low-income and African American community. A five-lane major highway created an access barrier between low-income housing units and the local neighborhood park in Columbia, Missouri. The installation of a signalized pedestrian crosswalk provided an opportunity to conduct a natural experiment to examine the effect of improved safe access upon community active living behaviors. Direct observation using SOPARC was collected prior to the crosswalk instillation in June 2012, after the crosswalk installation in June 2013 and again as a follow up in June 2014 during the same two-week period to assess changes in total park use and total energy expenditure by age, gender and race/ethnicity. Analysis of covariance models, controlling for temperature examined changes in total counts and total energy expenditure using pairwise Sidak post-hoc comparisons. Total park use increased from 2012 ($n = 2080$) to 2013 ($n = 2275$) and remained constant in 2014 ($n = 2276$). However, despite increases in safe access and overall park use, there was a significant decrease in total energy expenditure following the installation of the crosswalk that was sustained in 2014. This study shows that increasing safe access to parks primarily positively influences park use but not park-based physical activity. While improved safe access is encouraging greater park use, there is a need for future research to examine additional factors such as social support, programming and environmental changes to engage community members in park-based physical activity.

1. Introduction

Sedentary behavior and obesity are highest among communities with predominantly low-income and minority populations (Day, 2006). Studies have indicated that the built environment plays an important role in promoting physical activity (Handy et al., 2008; Kerr et al., 2010; Owen et al., 2004; Sallis & Glanz, 2006), including active transportation (Alfonzo et al., 2008; Carver et al., 2010; Frank et al., 2007; Grow et al., 2008; Havard & Willis, 2012; Kaczynski & Glover, 2012) and access to parks (Giles-Corti et al., 2005; Grow et al., 2008; Kaczynski et al., 2008). However, neighborhoods with low-income, minority residents often have low walkability as a result of busy streets; absent or poorly maintained sidewalks, crosswalks, and parks; and actual or perceived threats to personal safety (Frank et al., 2007; Gordon-Larsen et al., 2006; Moore et al., 2008; Taylor et al., 2007; Vaughn et al., 2013; Zhu & Lee, 2008).

Parks are an integral resource to promoting active living within communities (Bedimo-Rung et al., 2005; Cohen et al., 2007; Kaczynski & Henderson, 2007; Mowen et al., 2008). However, numerous factors influence use and physical activity in parks, including user demographics, park features, conditions, and access (Baran et al., 2014; Bedimo-Rung et al., 2005; Besenyi et al., 2013; Cohen et al., 2007; Kaczynski et al., 2008, 2011). In particular, park proximity and access are associated with active living in both youth and adults (Babey et al., 2008; Cohen et al., 2007; Dills et al., 2011; Frank et al., 2007; Giles-Corti et al., 2005; Grow et al., 2008; Kaczynski et al., 2008; Kaczynski et al., 2009). Neighborhood accessibility to local parks is of critical importance in low-

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income minority communities (Day, 2006; Floyd et al., 2009). Because these neighborhoods typically have fewer parks, the walkability to these scarce resources is even more essential to engaging youth and adults in physical activity (Frank et al., 2007; Gordon-Larsen et al., 2006; Taylor et al., 2007).

One important aspect of accessibility is safety. Several studies have found safe access to parks and destinations in the neighborhood, in terms of route distance, traffic, and maintenance, are associated with use of the neighborhoods and resources for physical activity (Alfonzo et al., 2008; Carver et al., 2008; Dills et al., 2011; Giles-Corti et al., 2005; Handy et al., 2008; Kaczynski & Glover, 2012). Further, parental perceptions of neighborhood safety are also a significant indicator of youth physical activity (Carver et al., 2005, 2008; Dills et al., 2011; Grow et al., 2008; Timperio et al., 2004). However, little is known about the influence of the physical road environment on park use and park-based physical activity, particularly among low-income minority youth and adults. Kaczynski et al. (2014) found that residents needing to cross high-speed roads on their way to the closest park were less likely to use those parks. Yet few studies have explored how such infrastructure improvements are associated with the physical activity of pedestrians using the infrastructure (Carver et al., 2010). Indeed, much of the road safety research is centered on prevention of injuries to pedestrians and cyclists (e.g. Cervero & Duncan, 2003; Percer, 2009). Most interventions to increase park-based physical activity focus on park facility improvements and renovations with mixed findings. Some studies show that renovations have lead to increased use or increased moderate to vigorous activity (Cohen et al., 2009b; Colabianchi et al., 2009; Tester & Baker, 2009; Veitch et al., 2012) while other studies have reported decreases in visitor use or physical activity levels (Bohn-Goldhaum et al., 2013; Cohen et al., 2009a). As such, although access to parks and safe active transportation routes promote physical activity, few studies have evaluated the influence of pedestrian infrastructure changes on park use and park-based physical activity.

In 2012–2014, the installation of a signalized crosswalk and landscaped median linking low-income housing with a public park in Columbia, Missouri provided an opportunity to conduct a natural experiment to examine the effect of environmental changes upon community active living behaviors. The removal of an outdated pedestrian bridge and construction of a signalized crosswalk showed positive impacts on safe pedestrian crossing behaviors (Schultz et al., 2015). Specifically, at the intervention site there was an increase in designated crossings at the new crosswalk and a decrease in motor vehicles traveling above the speed limit. The purpose of this analysis is to examine the impact of street crossing infrastructure modifications (i.e. median and signal) on park use and park-based physical activity in a low-income and majority African American community.

2. Methods

2.1. Study population

The low-income and majority African American neighborhood in Columbia, Missouri—home to the city's largest populations of low-income and racial/ethnic minority residents—included approximately 477 households (U.S. Census Bureau, 2010). The neighborhood population was 59% black, 36% white, with only 3% mixed-race and 2% Asian (MCDC, 2011). Residents' median household income was $8359 per year (MCDC, 2011), with 57% of households living below the federal poverty level. Additionally, only 31% of adults had a high school diploma and 48% of residents over 16 were unemployed. Directly west of the neighborhood park, a majority of the target population resided in one of the Columbia Housing Authority's (CHA) 294 family units (CHA, 2013). Within the CHA public housing units, nearly 67% of households lived below poverty and 77% of children were raised in a single-parent household (MCDC, 2011). Approximately, 82% of CHA residents over 16 were unemployed, and 50% of the CHA residents had a disability.

2.2. Intervention

The neighborhood is bisected by a five-lane major arterial highway creating a barrier between a dense residential area of low-income housing on the west side and the local neighborhood park on the east side. The neighborhood park is a popular destination for community residents during the summer months, at almost 5 acres it includes several major facilities: a swimming pool, sprayground, two basketball courts, playground, baseball field and several shelters. The five-lane road, according to data provided by the City of Columbia, carries 23,000 vehicles per day at maximal speeds of 75 mph created a formidable access barrier to the park. With no marked or signalized crosswalk, there was no universally safe way for neighborhood residents to traverse the road and access the park prior to the intervention except for: (1) a poorly lit, unsafe, and rarely used non-American with Disabilities Act (ADA) compliant pedestrian footbridge and (2) two unmarked intersections a quarter-mile from where pedestrians typically cross the street to access the park's swimming pool and basketball courts. As a result, residents of all ages often dodged motor vehicles to cross the five-lanes of traffic to access the park, creating an unsafe environment for both pedestrians and motor vehicle drivers. In the spring of 2013, the City of Columbia attempted to address these concerns through an infrastructure project. A signalized pedestrian crosswalk with a 400-ft median was completed along road adjacent to both the low-income public housing and the neighborhood park; the existing pedestrian bridge was demolished and removed.

2.3. Study design and data collection

This natural experiment was designed as having a control site. However, given unanticipated changes that occurred at the control site over the duration of the study it could not be used in this analysis. Data collection ran during three hour-long shifts (7:30 am–8:30 am, 12:30 pm–1:30 pm, and 3:30 pm–4:30 pm), for a total of 21 observation shifts over the same two-week period in June 2012 (pre-crosswalk installation), June 2013 (post-crosswalk installation) and June 2014 (follow up). Park observations were collected using a modified System for Observing Play and Recreation in Communities (SOPARC; McKenzie et al., 2006) that uses a momentary time-sampling technique in which trained data collectors conduct systematic scans of park users to assess park use within predetermined activity areas. Two observers rotated through the park every shift under the guidance of an observation manager who addressed any issues and ensured the timing of the rotations. Park users were coded according to age (child 1–12 years, teen 13–20 years, adult 21–59 years, or senior 60 + years), gender (male, female), and race/ethnicity (black, white, Hispanic, Asian, Unsure/Other) while observed physical activity was coded as sedentary (e.g., lying down, sitting or standing in place), moderate (e.g., moving at a slow, casual pace), or vigorous (e.g., engaged in an activity more vigorous than an ordinary walk). The 26 park activity areas were visually scanned left to right by trained observers and the codes representing park users and physical activity levels were recorded on a standardized form. The codes for physical activity also provided estimates of energy expenditure (EE) by assigning Metabolic Equivalents (METs) to recorded categories of physical activity following previous research (Sedentary = 1.5 METs, Moderate = 3 METs, Vigorous = 6 METs; e.g., Broyles et al., 2011).

Park data collectors were trained according to the established SOPARC protocol (McKenzie et al., 2006). To ensure reliability of park observations, each data collection period began with a simultaneous observation of one target area to establish the inter-rater reliability between the two observers before collecting data independently. Intraclass correlations (ICCs) were computed to determine the test-retest reliability of demographic characteristics. Acceptable reliability was observed, with ICC scores ranging from 0.676 (substantial agreement) to 0.997 (almost perfect agreement; Landis & Koch, 1977) across the three years of observation with one exception of an ICC score of 0.488 in 2012 for Unsure/Other; however, because of acceptable values for the two other years the data was retained. The University of Missouri Institutional Review Board approved all protocols.

2.4. Analysis

Descriptive statistics were used to describe park use and total energy expenditure within each demographic category. Analysis of covariance (ANCOVA) models, controlling for temperature, were used to examine changes in the park's total counts and total EE to determine if the crosswalk intervention had a significant sustained impact upon park use and park-based physical activity. Prior to running the ANCOVA models, the count distributions were examined for goodness-of-fit and normal distribution; due to the variance of count data, case weights were applied for subsequent total counts ANCOVA models (Maletta, 2007). Pairwise differences in the estimated marginal means were examined using Sidak post-hoc comparisons. Data was analyzed using SPSS (Cary, NC).

First, a one-way ANCOVA model was fit for each dependent variable (total counts or total EE) with the independent variable of year (2012, 2013, 2014), controlling for temperature. Sidak post-hoc comparisons examined pairwise differences in total counts and total EE between years. Second, three two-way ANCOVA models, controlling for temperature, were run to examine differences in the park's total counts by year for each independent variable including: age, gender, and race/ethnicity. Due to small sample sizes the race/ethnicity categories of Hispanic, Asian, and Unsure/Other were combined into one Other race/ethnicity category. The first 2-way ANCOVA model examined total counts by year (2012, 2013, 2014), age and the year × age interaction. The second two-way ANCOVA model examined total counts by year (2012, 2013, 2014), gender and the year × gender interaction. The third two-way ANCOVA model examined total counts by year (2012, 2013, 2014), race/ethnicity and the year × race/ethnicity interaction. Finally, three similar two-way ANCOVA models, controlling for temperature, were run to examine differences in the park's total EE by year for each dependent variable including: age, gender, and race/ethnicity. Pairwise Sidak post hoc tests examined total counts or total EE differences for each demographic group and statistical significance was accepted at $p < 0.05$.

3. Results

3.1. Descriptives

The total recorded park use was 2080 in 2012, 2275 in 2013, and 2276 in 2014 (Table 1). Males were slightly more prevalent across all three years 54% (2012), 55% (2013) and 54% (2014). Likewise, adults comprised the largest majority of park use all three years (53%, 2012; 51%, 2013; 52%, 2014) followed by children (28%, 2012; 24%, 2013; 30%, 2014), and teens (17%, 2012; 19%, 2013; 13%, 2014) while seniors comprised 3% in 2012 and 5% in both 2013 and 2014. All three years, approximately 71% of the observed population was black, between 25% and 28% of the population was white, while <4% of the population was categorized as Other. Between 53% and 60% of the observed park-based physical activity (PA) was sedentary while moderate PA ranged between 43% and 35% with vigorous PA <5%.

3.2. Changes in total park counts

A one-way ANCOVA indicated a significant effect of year upon total counts (F = 114.981; $p < 0.001$) showing that overall park counts significantly increased from 2012 to 2013 ($p < 0.001$) and significantly decreased from 2013 to 2014 ($p < 0.001$); however, the overall park counts in 2014 were still significantly higher than those in 2012 (Table 2).

Table 1
Descriptive statistics of park use.

	Pre-intervention (2012)		Post-intervention (2013)		Follow-up (2014)	
	n	%	n	%	n	%
Total	2080	100	2275	100	2276	100
Age[a]						
Child	574	28	555	24	685	30
Teen	362	17	441	19	292	13
Adult	1093	53	1159	51	1177	52
Senior	51	3	120	5	121	5
Gender						
Male	1129	54	1248	55	1239	54
Female	951	46	1027	45	1037	46
Race/ethnicity[b]						
White	550	26	571	25	642	28
Black	1483	71	1615	71	1588	70
Other	47	3	89	4	46	2
Physical activity[c]						
Sedentary	1110	53	1314	58	1364	60
Moderate	889	43	921	41	791	35
Vigorous	81	4	40	2	121	5

Note. [a]Child = ages 1–12; Teen = ages 13–20; Adults = ages 21–59; Senior = ages 60 and older. [b]Other includes Asian, Hispanic and Unsure/Other. [c]Sedentary = lying down, sitting, standing in place; Moderate = moving at a slow casual pace; Vigorous = engaged in an activity more vigorous than an ordinary walk.

3.2.1. Age

The first two-way ANCOVA indicated a significant interaction between year and age (F = 73.56; $p < 0.001$). Pairwise comparisons of park use revealed a significant increase of children from 2012 to 2013 (6.99 to 10.86), and a significant decrease from 2013 to 2014 (10.86 to 9.14); however, there was still a significant increase of child park use from 2012 to 2014 (6.99 to 9.14). Both teens and adults showed a significant use increase from 2012 to 2013 (respectively, 4.24 to 5.40; 8.33 to 9.75); however, that trend reversed from 2013 to 2014 (5.40 to 3.91; 9.75 to 8.09, respectively) such that park use in the follow-up was equivalent to those observed prior to the intervention. Seniors did not show any significant changes either in the post-intervention (2013) or in the follow-up (2014) compared to pre-intervention use (2012).

Table 2
Intervention Site Park Count ANCOVA Analyses.

	Estimated marginal means		
	Pre-intervention (2012)	Post-intervention (2013)	Follow-up (2014)
Total[a]	13.266 ± 0.262	18.856 ± 0.249*	15.705 ± 0.241*§
Age[b]			
Child	6.989 ± 0.239	10.857 ± 0.239*	9.137 ± 0.214*§
Teen	4.243 ± 0.297	5.402 ± 0.268*	3.912 ± 0.328§
Adult	8.331 ± 0.172	9.751 ± 0.170*	8.092 ± 0.163§
Senior	3.815 ± 0.787	3.809 ± 0.513	3.254 ± 0.510
Gender[c]			
Male	6.948 ± 0.187	10.491 ± 0.179*	7.817 ± 0.176*§
Female	7.453 ± 0.206	9.770 ± 0.195*	9.633 ± 0.192*
Race/ethnicity[d]			
White	6.324 ± 0.293	10.645 ± 0.285*	7.881 ± 0.268*§
Black	9.827 ± 0.181	12.956 ± 0.174*	10.967 ± 0.170*§
Other	1.430 ± 0.991	6.482 ± 0.726*	1.252 ± 1.001§

Note. All data are estimated marginal means ± SE for pairwise Sidak post-hoc data. All ANCOVA models control for temperature. [a]1-way ANCOVA (Year): F = 114.981; $p < 0.001$. [b] 2-way ANCOVA interaction (Year ∗ Age): F = 73.557; p < 0.001. [c]2-way ANCOVA interaction (Year ∗ Gender): F = 61.645; $p < 0.001$. [d]2-way ANCOVA interaction (Year ∗ Race/Ethnicity): F = 81.996; $p < 0.001$. *denotes significant difference from 2012 with $p < 0.05$. §denotes significant difference from 2013 with $p < 0.05$.

3.2.2. Gender

The second two-way ANCOVA indicated a significant interaction between year and gender (F = 61.65; $p < 0.001$). Pairwise comparisons of park use revealed a significant increase of male park use from 2012 to 2013 (6.95 to 10.49) that significantly decreased from 2013 to 2014 (10.49 to 7.82); however, there was still a significant increase from 2012 to 2014 (6.95 to 7.82). Females also showed a significant increase of park use from 2012 to 2013 (7.45 to 9.78); however, unlike males, that increased use was maintained from 2013 to 2014 (9.78 to 9.63).

3.2.3. Race/ethnicity

The third two-way ANCOVA indicated a significant interaction between year and race/ethnicity (F = 82.00; $p < 0.001$). Both white and black park use significantly increased from 2012 to 2013 (6.32 to 10.65; 9.83 to 12.96, respectively). While both white and black park use significantly decreased from 2013 to 2014 (10.65 to 7.89; 12.96 to 10.97), the use levels were still significantly increased from 2012 to 2014 (6.32 to 7.89; 9.83 to 10.97). Park use by Other increased significantly from 2012 to 2013 (1.43 to 6.48) but significantly decreased from 2013 to 2014 (6.48 to 1.23) back to pre-intervention levels.

3.3. Changes in total energy expenditure

The one-way ANCOVA indicated a significant effect of year upon total EE (F = 11.75; $p < 0.001$) showing that total EE significantly decreased from 2012 to 2013 ($p < 0.001$) and from 2012 to 2014 ($p < 0.001$; Table 3).

3.3.1. Age

The first, two-way ANCOVA model for total EE indicated a significant interaction between year and age (F = 14.20; $p < 0.001$). Pairwise comparisons of total EE revealed a significant decrease in child EE from 2012 (5.03) to 2013 (3.91). Child EE significantly increased from 2013 to 2014 (3.91 to 4.57); however, the EE levels in 2014 were not significantly different from those in 2012. Adult EE did not significantly change between 2012 and 2013; however, there was a significant decrease from 2013 to 2014 (4.42 to 4.00) that was significantly different from 2012 (4.79). Neither teen nor senior EE changed significantly between any of the years.

3.3.2. Gender

The second, two-way ANCOVA model for total EE indicated a significant interaction between year and gender (F = 32.06; $p < 0.001$). Pairwise comparisons of total EE revealed both male and female EE significantly decreased from 2012 to 2013 (5.08 to 4.56; 4.01 to 3.23, respectively). While there was no significant difference between 2013 and 2014 (4.56 to 4.58; 3.23 to 3.34), the total EE for males and females in 2014 (respectively, 4.58; 3.34) was significantly lower than in 2012.

Table 3
Intervention site park total energy expenditure ANCOVA analyses.

	Estimated marginal means		
	Pre-intervention (2012)	Post-intervention (2013)	Follow-up (2014)
Total[a]	4.613 ± 0.091	3.934 ± 0.087*	4.014 ± 0.084*
Age[b]			
Child	5.034 ± 0.169	3.911 ± 0.169*	4.566 ± 0.152§
Teen	3.683 ± 0.210	3.116 ± 0.189	3.360 ± 0.232
Adult	4.790 ± 0.122	4.416 ± 0.120	4.000 ± 0.116*§
Senior	2.234 ± 0.556	2.576 ± 0.363	2.554 ± 0.360
Gender[c]			
Male	5.078 ± 0.120	4.555 ± 0.1115*	4.584 ± 0.113*
Female	4.010 ± 0.132	3.226 ± 0.125*	3.336 ± 0.123*
Race/ethnicity[d]			
White	2.893 ± 0.169	2.830 ± 0.164	3.088 ± 0.155
Black	5.277 ± 0.105	4.415 ± 0.100*	4.427 ± 0.098*
Other	2.993 ± 0.572	2.697 ± 0.419	2.734 ± 0.578

Note. All data are estimated marginal means ± SE for pairwise Sidak post-hoc data. All ANCOVA models control for temperature. [a]1-way ANCOVA (Year): F = 11.746; $p < 0.001$. [b] 2-way ANCOVA interaction (Year ∗ Age): F = 14.200; $p < 0.001$. [c]2-way ANCOVA interaction (Year ∗ Gender): F = 32.059; $p < 0.001$. [d]2-way ANCOVA interaction (Year ∗ Race/Ethnicity): F = 36.606; $p < 0.001$. *denotes significant difference from 2012 with $p < 0.05$. §denotes significant difference from 2013 with $p < 0.05$.

3.3.3. Race/ethnicity

The third, two-way ANCOVA model for total EE indicated a significant interaction between year and race/ethnicity (F = 36.61; $p < 0.001$). Pairwise comparisons of total EE revealed that black EE significantly decreased from 2012 (5.28) to 2013 (4.42). While there was no significant change between 2013 and 2014, overall there was a significant decrease in black EE from 2012 (5.28) to 2014 (4.43). Neither white nor Other EE significantly changed between any of the years.

4. Discussion

This study found an overall increase in park use after the installation of the signalized crosswalk. While park use did drop from the post intervention (2013) to the follow-up (2014), the use levels were still greater than the pre-intervention (2012), indicating that an effect of the increased safe access is still being maintained. Indeed, this same trend applies to child, male, white and black populations, showing that the crosswalk has a positive lasting impact for these groups. Further, women showed a significant increase in use with the installation of the crosswalk that was maintained at the same level in the follow-up suggesting that safe access is a particular barrier or concern that was alleviated (Loukaitou-Sideris, 2006). However, for teen, adult and Other race/ethnicity, the positive effect of the intervention completely disappears in the follow-up, returning to original pre-intervention levels. As such, these populations may not be as concerned with having safe access to parks. For teens, this may come from perceptions of invincibility leading to decreased perceived risks (Wickman et al., 2008), or that low-income teens are particularly impacted by perceived in-park safety (Babey et al., 2013), which may be more salient than access barriers.

When examining total EE, this study found that despite increases in safe access and park use, there was a decrease in activity post-intervention that was maintained. This same trend of decreased activity post-intervention that was maintained exists for male, female and black populations. For adults, there was a delayed decrease in total EE with no change immediately post intervention, but a drop at the follow-up. These findings mirror those of Kaczynski et al. (2014) who found that slower traffic was related to increased park use but not greater rates of park-based physical activity. The significant decrease in total EE suggests that while more individuals are coming to the park, they may be coming for more social reasons rather than physical activity. Ainsworth et al. (2007) found that African-American women were more likely to engage in neighborhood-based activity based on social and environmental factors (i.e., sidewalks, perception of safety). This also corresponds with previous research that indicated while parks are important facilitators for physical activity, since many individuals' park use includes both active and passive activities, overall captured park use is still largely sedentary (Floyd et al., 2008; McKenzie et al., 2006). For children, there was an initial decrease in total EE that was offset by an increase back to the original levels. A reduction in Head Start programmed youth activity in the park in 2013 that was reinstated in 2014 is likely related to the children's decrease and subsequent increase in EE. This suggests that programming is an important factor in encouraging active park use, particularly for youth. Cohen et al., (2009a), also found that despite renovations at five minority neighborhood parks, a decline of programming was related to a decline in park physical activity. As such, infrastructural changes alone may be insufficient to promote physical activity. Indeed, Shores and West (2008) suggest that a combination of both infrastructure improvements and social supports are necessary to encourage physical activity among African American park visitors.

Between 2012 and 2013, the perception of crime in the downtown area and surrounding neighborhood became more prevalent, evidenced by increased media coverage and concerns voiced by residents in interviews and surveys related to this study. The increasing perception of the neighborhood park as a dangerous location (e.g., concerns of park-based violence such as shootings and physical altercations) by the community may still be creating a barrier for many community members to utilize the park for physical activity. Indeed, Bennett et al. (2007), found that perceived neighborhood safety may serve as a barrier to physical activity in low-income communities. These findings indicate that changes in the physical and social environments impact engagement in park-based physical activity among certain demographic groups. As such, improving access is not sufficient for improving physical activity and counteracting other factors such as social pressure, programming and environmental changes within the park may also be needed to increase park-based physical activity (Broyles et al., 2011; Cohen et al., 2009a; Cohen et al., 2009b; Shores & West, 2008). Further examination of where in the park these changes occur can provide greater insight into these trends.

4.1. Study limitations and future research

This study has several limitations to consider. First, this study was designed and conducted with a control site. However, unforeseen infrastructure changes in the park (i.e., renovated fitness equipment and new walking trails) during the fall of 2013 prevented us from using that site as a control longitudinally. Second, although the Social Ecological Model, which attempts to explain complex interactions between people and their social and physical environments (Sallis et al., 2008), emphasizes the importance of the behavior setting, the other intrapersonal and interpersonal levels are not addressed in this study. Future research is needed to explore the interactions across the model. Third, in 2013 several external factors were potentially influential to community use of the neighborhood park including federal suspension of funding for Head Start programming previously ran in the park, and changes in city crime levels that may affect actual and perceived safety. However, such challenges are common with natural experiment studies and it is difficult to measure all potential mediators. Additionally, although we followed established SOPARC time protocols regarding recommended data collection time frames (McKenzie et al., 2006), future research should capture additional time frames based on natural rhythms of the community. In particular, a fourth (6:30 pm) time frame was dropped early in the study due to safety concerns in the park during evening hours, and it was also evident that there was a sizeable wave of use in the parks around 10 am that was not captured in the current study protocols. Fourth, all observed categories have some challenges and assumptions despite the reliability of our observers. This is a limitation of observation-based studies; however, adherence to established protocol was followed in this study. Finally, the measure of weather influences in this study is modeled through temperature alone; the inclusion of additional variables such as humidity and air quality may be equally important measures of how weather fluctuations are impacting physical activity behaviors among vulnerable populations.

5. Conclusions

While increasing safe access is thought to positively affect vulnerable populations (e.g., young children, elderly and females) this study shows that increasing safe access to parks primarily positively influences park use but not park-based physical activity. This suggests a need for further research into additional factors such as the availability of social support and programming in conjunction with improved access to engage community residents in park-based physical activity. By demonstrating increased park use longitudinally, this study adds support to the feasibility of advocacy efforts to promote transportation practices that favor safe pedestrian accessibility. These successful outcomes could be used to support advocacy efforts seeking to modify the built environment to increase park use in low-income and majority African American neighborhoods. However, the findings also highlight the need to consider approaches that encompass other factors (e.g., social support, programming) in addition to accessibility when targeting particularly vulnerable populations and encouraging park-based physical activity.

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