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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

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