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Social and environmental determinants of physical activity in urban parks: Testing a neighborhood disorder model

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ABSTRACT

The current study examined the nexus of neighborhood disorder—in the form of physical disorder (e.g., broken glass and vandalism) and social disorder (e.g., public drinking and lewd conduct)—and physical activity (PA) in urban public parks to inform public policy addressing chronic disease in at-risk populations. Five hundred and twenty-two unique observations were conducted in 22 public parks from March to September 2016. The study utilized the System for Observing Play and Recreation in Communities (SOPARC) to document age, gender, ethnicity, and PA level of park users. The Physical Activity Resource Assessment (PARA) was used to document observed physical and social disorder incivilities in public parks included in the current study. Males, adults, and Latina/os accounted for the largest number of park users, respectively. Significant PA differences were observed across gender, age, and ethnicity. Multiple linear regression controlling for gender, age, and ethnicity found physical disorder, but not social disorder, generally predicted PA reductions. While it has been demonstrated that physical disorder predicts PA reductions in low-income communities of color, this is the first study to reveal that physical disorder may lead to decreased PA in urban public parks. Thus, remediation of public park incivilities characterized by physical disorder, paired with community outreach, may lead to increased PA in at-risk communities.

1. Introduction

Public parks are important behavior settings for physical activities (PA) associated with improved community health and reduced risk of chronic disease, such as obesity (Kaczynski et al., 2008; Wolch et al., 2005, 2014). In the urban context, public parks are model spaces for promoting health and wellness activities—e.g., structured and unstructured recreation—that contribute to health and wellbeing (Cohen et al., 2013b; De Ridder et al., 2004; Janhäll, 2015; van Dillen et al., 2012; Weiss et al., 2011), and quality of life in urban communities (Douglas, 2016; Wolch et al., 2005). Furthermore, public parks afford emotional and psychological wellbeing by promoting community cohesion, a connection with nature, and improved living standards (Fuller et al., 2007; Irvine et al., 2013; Krenichyn, 2006). Yet, concerning escalations in overweight and obesity prevalence and associated decreases in physical activity (PA) have been noted in urban communities of color (Burdette and Hill, 2008; Frederick et al., 2014; Gordon-Larsen et al., 2000; Wang et al., 2013), which may be influenced by negative social (e.g., crime, violence) and environmental (e.g., vandalism, disrepair) determinants of health (Bancroft et al., 2015; Boone et al., 2009; Cohen et al., 2007; Jones et al., 2015; Kaczynski et al., 2014; Moore et al., 2008; Weiss et al., 2011; Wen et al., 2013; Wolch et al., 2005, 2014).

Current research employing spatial methods has revealed that parks are unevenly distributed, wherein ethnic minority communities often have less park acreage than principally White communities (Wolch et al., 2005, 2014). This disparity may be problematic from a public health perspective, as some studies have shown that proximity to, and density of, public parks are positively associated with PA behaviors in urban communities (Cohen et al., 2007; Scott, 2013; Tappe et al., 2013), although results as a whole remain inconclusive (Carlson et al., 2012; Kaczynski et al., 2014; Norman et al., 2006; Saelens et al., 2012; Young et al., 2014). Furthermore, research exploring the interconnections between public parks and PA behaviors has predominantly focused on identifying how characteristics related to park access (e.g., park proximity, density) affect PA. Yet, environmental conditions within parks also appear to be important influencers of PA behaviors.

A number of studies have yielded interesting associations between

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PA and public park features and amenities, wherein higher activity levels tend to be associated with the quality and availability of park structures affording specific activities (Adams et al., 2008; Baran et al., 2014; McCormack et al., 2010). For example, PA and park use tend to be negatively associated with rundown playgrounds, overgrown grass, and an insufficient number of shaded areas (Adams et al., 2008; Holman et al., 1996; Ferré et al., 2006), whereas parks that have family-friendly features and a variety of active and passive recreational opportunities—e.g., soccer fields and picnic areas—afford increased PA levels (Evenson et al., 2016; Gearin and Kahle, 2006; Krenichyn, 2006; Kruger and Chawla, 2002). Equally, these studies have examined the distribution of features and amenities, indicating that there are fewer park features (e.g., playgrounds and exercise equipment) and amenities (e.g., water fountains and artwork) in urban communities of color (Bruton and Floyd, 2014; Vaughan et al., 2013).

Similarly, the scant body of literature assessing neighborhood and park incivilities provides additional understandings of how park conditions may affect park use and PA in urban settings. The available literature posits that ethnically diverse and socioeconomically deprived communities are exposed to higher numbers of incivilities, such as broken glass and graffiti, in public parks and surrounding environments than more affluent communities. Furthermore, it has been argued that incivilities increase proportionally to minority populations (Cohen et al., 2013b; Hughey et al., 2016; Lee et al., 2005). Additional studies report significant associations between perceived neighborhood incivilities and self-reported PA rates in low-income communities of color (Evenson et al., 2006; Hume et al., 2007; Molnar et al., 2004; Romero et al., 2001), which illustrates unequal exposure to unsafe PA spaces. However, research has yet to explore the relationship between specific incivilities observed in public parks and observed PA levels by gender, age, and ethnicity. To challenge this literature gap, this study adapted neighborhood disorder theory to explore whether incivilities in urban public parks affect PA rates for specific gender, age, and ethnic groups (Ding et al., 2011), potentially informing new and enriched pathways for improving the quality of public park spaces that promote health and wellbeing in urban communities of color (Cohen et al., 2013b; Coughenour et al., 2014; Floyd et al., 2008; Miles, 2008).

1.1. Theoretical framework

To ground our examination of the linkages between incivilities observed in public parks and corresponding PA rates in our target communities, this study employed neighborhood disorder theory, which contends that minor breaches of community standards "signal an erosion of conventionally accepted norms and values" (LaGrange et al., 1992). Such breaches often manifest in observable deterioration of the urban landscape indicated by physical incivilities and related social behavior that compromise neighborhood safety, social order, and control over deviant behavior (Goffman, 1963; Hunter, 1985; Sampson and Raudenbush, 1999). Neighborhoods associated with high levels of disorder may be identified by cues in the built environment that represent a lack of safety (Ross and Mirowsky, 2001; Skogan, 2015). These identifiable cues—e.g., noise, abandoned storefronts, litter, graffiti, and vacant lots—are recognizable signals of "dangerous situations," irrespective of the immediate presence of subversive behavior (LaGrange et al., 1992). Thus, social and environmental indicators of neighborhood disorder are fundamentally associated with quality of life (Garcia-Ramirez, 2014).

Neighborhood disorder theory identifies two types of incivilities: (1) physical disorder characterized by observable incivilities (e.g., broken glass, vandalism, and litter), and (2) social disorder illustrated by disruptive social behavior (e.g., public drinking and lewd conduct) (Baran et al., 2014; LaGrange et al., 1992), which may also be observed in the physical environment (e.g., discarded alcohol containers and sex paraphernalia). These characteristics are largely indicative of a decreased sense of public safety, which consequently results in community withdrawal from neighborhood events and activities (Vrij and Winkel, 1991). Furthermore, neighborhood disorder may discourage residents from engaging in neighborhood spaces associated with physical and social activities concomitant with community health and wellbeing (Ross, 2000). For the present paper, we extend neighborhood disorder theory to public parks, hypothesizing that physical and social disorder—e.g., broken glass and evidence of alcohol use—inhibit PA. Given this, adapting neighborhood disorder theory to examine park rather than neighborhood incivilities provides a lens for investigating the relationship between disordered park environments and PA among a range of park users (Ross and Mirowsky, 2001).

1.2. Study aims

This study draws from increasing evidence that (1) parks are important spaces for promoting community PA, particularly in the urban context (Baran et al., 2014; Kaczynski and Henderson, 2007), and (2) observable physical and social disorder is predictive of community withdrawal from neighborhood activity spaces (Vrij and Winkel, 1991), which may compromise public health outcomes (Ross, 2000). Thus, the current study seeks to assess (a) PA rates by gender, age, and ethnicity in public parks, and (b) the relationship between incivilities characterizing physical and social disorder in public parks and observed PA rates. To our knowledge, research has yet to analyze the nexus of physical and social disorder in public parks and objectively observed PA through the lens of neighborhood disorder theory. The current study addresses this limitation by developing a model locating observed PA in community parks with varying levels of physical and social disorder.

2. Methods

The current study employed a community-based participatory research (CBPR) design utilizing structured observation in public parks to assess associations between park incivilities and park users' PA levels. The impetus for this study emerged from meetings with two groups of predominantly Latina/o community members in San José Council District 3 (CD3), CA. During these initial meetings, community members expressed a variety of safety concerns, stating, "…*someone was killed*" in a local park, "*there is open drug use*," and they hear "*yelling and cursing*" in local parks. In addition, community members indicated that local parks are under attended, and they often go to parks outside of their immediate communities. Thus, CD3 was selected as a case study for its potential to inform public policy directly affecting recreational access and public health in a large, urban community of color. CBPR participants collaborated with the authors to pilot test and modify structured observation tools (i.e., dropping non-park related items such as community centers), observe local parks, identify specific variables for analysis (e.g., incivilities), and vet study results.

Following, the research team identified twenty-seven public parks in CD3. Twenty-two CD3 parks afforded a variety of public recreation and PA spaces—e.g., picnic areas and baseball fields—whereas the remaining five were not appropriate for active recreation—e.g., spaces designed for memorials and statues. Data were derived from observations of PA in all 22 CD3 parks affording a range of recreational activities, thus allowing for sample saturation. This approach afforded development of a grounded socioecological model in an ethnically diverse area—21.1% White, 20.8% Asian, 3.4% African American, and 51.6% Latina/o—that has the highest concentration of Latina/o community members out of San José's 10 Council Districts, with 23% of the population speaking Spanish at home (U.S. Census Bureau, 2010). Furthermore, the local Latina/o community suffers from high rates of overweight (44%) and obesity (24%) (Santa Clara County Public Health Department, 2017).

2.1. Structured observation

This study used the System for Observing Play and Recreation in Communities (SOPARC), which is a reliable tool ($r > 0.86$) for observing PA among a range of park users (McKenzie et al., 2006). In accordance with the SOPARC methodology, momentary time sampling was employed within CD3 park activity zones—e.g., playgrounds, picnic areas, and baseball fields. Each park was observed twice over non-holiday weekends (Saturdays and Sundays) during two randomly selected two-hour intervals, with observers conducting 20-minute momentary time scans during each interval, between 10:00 AM and 6:00 PM, from March to September 2016. These days and times were selected to provide reliable estimation of physical activity in CD3 public parks (Cohen et al., 2011). Furthermore, previous research indicated weekend days attract the highest number of users across a range of sociodemographic characteristics (Loukaitou-Sideris and Stieglitz, 2002; Scott, 1997), thus providing the ideal timeframe for observing PA behaviors among diverse park users. Observed PA was documented with the SOPARC data path coding form for individuals ($N = 522$) by gender, age group (child, teenager, adult, senior), ethnicity (White, Black, Latina/o, Asian), activity type (e.g., soccer, baseball, and volleyball), and activity level (sedentary, walking, vigorous).

The Physical Activity Resource Assessment (PARA) structured observation protocol (Lee et al., 2005) was utilized to objectively rate incivilities in all 22 CD3 public parks. The PARA protocol was developed to reliably ($r > 0.77$) assess features, amenities, and incivilities of public PA resources in a range of ethnically diverse contexts (Lee et al., 2005). In the current study, only incivilities were analyzed. Upon completion of the SOPARC protocol, observers utilized the PARA coding form to rate 12 park incivilities (e.g., broken glass, dog refuse, and evidence of alcohol use) across all park zones on a 4-point scale (0 = none; 1 = some; 2 = medium; 3 = high).

A total of eight team members participated in data collection, with two raters assigned to each park location. Prior to data collection, all team members reviewed SOPARC and PARA operational definitions, protocols, and data coding forms. Following, observers practiced coding park photographs and received feedback to correct for discrepancies. Observers then practiced in two local parks, with a minimum of 10 people observed per park. Fleiss' kappa was calculated to assess observer agreement, yielding scores of 0.84 and 0.92 for SOPARC and PARA, respectively.

2.2. Statistical analyses

IBM SPSS v. 22 was used to conduct all analyses. Independent samples *t*-tests examined PA by gender and One-Way Analysis of Variance (ANOVA) and Bonferroni post hoc comparisons assessed differences in PA levels by age and ethnicity. Pearson's correlations were used to assess relationships between gender, age, ethnicity, incivilities and PA levels to determine the appropriate multiple linear regression model for predicting PA levels from incivilities (e.g., broken glass, evidence of alcohol use, and vandalism/graffiti) in CD3 public parks. For the regression model, age was dummy coded into: (1) child, (2) teenager, (3) adult, and (4) senior citizen, with senior citizen serving as the reference category. Ethnicity was dummy coded into: (1) African American, (2) Latina/o, (3) Asian, and (4) White, with White as reference. Due to multicollinearity, a small subset of incivility variables including dogs unattended and overgrown grass were removed from analysis. In addition, graffiti and vandalism were combined into one variable to represent defacing of property. In accordance with neighborhood disorder theory, the remaining incivility predictors were categorized as (1) evidence of physical disorder (i.e., auditory annoyance, broken glass, dog refuse, litter, no grass, graffiti/vandalism); and (2) evidence of social disorder (i.e., evidence of alcohol use, sex paraphernalia). The resulting regression model with PA as the dependent variable entered the following predictors in two blocks: Block 1—age, gender, and ethnicity; Block 2—broken glass, dog refuse, litter, no grass, evidence of alcohol use, sex paraphernalia, and graffiti/vandalism. Variance inflation factors for the final model ranged between 1.6 and 7, falling within reasonable limits (Hair et al., 1995; Neter et al., 1989; Rogerson, 2001).

Table 1
Descriptive statistics for people and incivilities observed in public parks.

	N	Minimum	Maximum	Mean	95% CI
Total $N = 522$					
Gender					
Female	145	0	22	6.59	3.73–9.45
Male	376	1	62	17.09	8.66–25.53
Age group					
Child	96	0	22	4.36	1.54–7.19
Teenager	40	0	16	1.82	0.13–3.51
Adult	327	0	64	14.86	7.00–22.72
Senior	48	0	13	2.18	0.45–3.92
Ethnicity					
African American	30	0	8	1.36	0.45 -2.28
Latina/o	218	0	39	9.91	4.60–15.22
Asian	86	0	22	3.91	1.07–6.75
White	156	0	32	7.09	2.67–11.51
Total park $N = 22$					
Incivilities					
Auditory annoyance	15[a]	0	3	0.97	0.63–1.31
Broken glass	9[a]	0	3	0.59	0.25–0.95
Dog refuse	11[a]	0	3	0.53	0.23–0.85
Evidence of alcohol use	14[a]	0	3	1.13	0.68–1.57
Litter	17[a]	0	3	1.66	1.21–2.10
No grass	8[a]	0	3	0.72	0.36–1.08
Sex paraphernalia	3[a]	0	3	0.22	−0.05–0.49
Graffiti/vandalism	18[a]	0	3	0.91	0.65–0.1.16

[a] Number of parks in which incivilities were observed.

3. Results

As indicated in Table 1, which reports park user demographics (i.e., gender, age, ethnicity) and observed incivilities, 72% of all CD3 park users were male. Adults comprised the largest age group (64%) of park users. Latina/o (44%) and White (32%) individuals accounted for the highest number of park users. In Table 2, which reports PA levels by demographic characteristics, significantly higher PA levels were observed for male vs. female park users ($t = 3.26$; $p < .001$). Also, significant differences in PA rates by age ($F = 7.22$; $p < .001$) and ethnicity were observed ($F = 14.14$; $p < .001$). Bonferroni post hoc analyses of age and ethnicity PA differences indicated that children and teenagers had higher PA rates than adults ($p < .05$), and Asian park users had higher PA rates than Latina/o, African American, and White subgroups ($p < .05$). No significant differences were found for other age and ethnicity pairwise comparisons.

Table 2
Descriptive statistics for physical activity observed in public parks.

	Minimum	Maximum	Mean	95% CI
Gender				
Female	1	3	1.76	1.94–2.12
Male	1	3	1.98	1.64–1.88
Age group				
Child	1	3	2.19	1.81–1.98
Teenagers	1	3	2.26	1.85–2.01
Adults	1	3	1.82	2.06–2.27
Senior	1	3	1.70	1.88–2.03
Ethnicity				
African American	1	3	1.63	1.32–1.96
Latina/o	1	3	1.82	1.71–1.92
Asian	1	3	2.40	2.24–2.60
White	1	3	1.85	1.71–1.98

Table 3
Regression of predictor variables on physical activity.

	R^2	F	Final model β	t
Block 1	0.13***	11.42***		
Female			−0.086*	−2.09*
Child			0.128*	2.01*
Teenager			0.056	1.023
Adult			−0.123	−1.92*
Latino			−0.163**	−3.04**
Black			−0.046	−1.08*
Asian			0.127***	3.39***
Block 2	0.24***	9.92***		
Auditory annoyance			−0.09	−1.21
Broken glass			0.20***	3.42***
Dog refuse			−0.38***	−4.72***
Evidence of alcohol use			0.48***	4.38***
Litter			−0.50***	−5.91***
No grass			0.36***	5.79***
Sex paraphernalia			0.27***	3.30***
Graffiti/vandalism			−0.23***	−4.16***

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Pearson's correlations indicated that nearly all gender, age, ethnicity, and park disorganization variables were positively intercorrelated. Thus, proceeding with multiple linear regression was deemed appropriate.

Table 3 reports demographic (Block 1) and incivility (Block 2) beta weights for all predictors regressed on PA. The demographic predictor variables—gender, age, and ethnicity—significantly accounted for 13% of the total variance ($p < .001$). Adding incivility predictor variables accounted for 24% of the variance ($\Delta R^2 = 0.11, p < .001$). In the final model, after entering all predictor variables, female gender, Latina/o ethnicity, and senior age variables predicted reduced PA levels ($p < .05$), while male gender, child age, and Asian ethnicity predicted increased PA ($p < .05$). Regarding observed incivilities, dog refuse, litter, and vandalism/graffiti confirmed expectations by significantly predicting decreased PA ($p < .001$), whereas, broken glass, no grass, evidence of alcohol use, and sex paraphernalia were significantly associated with increased PA ($p < .001$). Auditory annoyance did not significantly predict PA.

4. Discussion

The current study expanded research concerning public parks and public health by exploring the effects of physical and social disorder on residents' park usage and PA in a large, urban community of color. Study data revealed that males engaged in greater PA than females and children engaged in more PA than adults, aligning with available literature (Baran et al., 2014; Cohen et al., 2007; Jago et al., 2005; Reed et al., 2008; Moore et al., 2014; Zick et al., 2007). In addition, Latina/o park users had the highest park attendance of all ethnic groups, yet engaged in less PA compared to Asian park users and equal PA compared to African American and White park users. Given that Latina/os accounted for the largest proportion of the study sample but had relatively modest rates of PA, it is possible that while Latina/os visit urban parks, they may engage in more sedentary activities (e.g., picnicking) vs. physical activities, thus receiving less immediate health benefits from their park usage. In contrast, Asian park users may be deriving greater health benefits than other ethnic groups in these contexts based on their increased observed PA levels. However, prior research findings concerning PA and ethnicity have been inconsistent (Evenson et al., 2016), indicating that PA intensity may be specific to conditions of public parks rather than ethnicity alone (Bruton and Floyd, 2014; Kaczynski et al., 2014).

In the current context, our research suggests that developing park spaces and PA-based, in-park interventions targeting female, adult, and Latina/o park users—who had lower levels of PA—may enhance PA opportunities and concordant park-related health benefits for these particular subgroups. In particular, Latina/o park users may especially benefit from cost-effective, in-park interventions, such as free exercise classes, that have been shown to increase PA in similar populations (e.g., Han et al., 2015) and reduce risk of obesity and chronic disease.

With regard to neighborhood disorder theory and our examination of the relationship between park incivilities and PA, when controlling for gender, age, and ethnicity, the presence of physical disorder variables generally predicted decreased PA, confirming the potentially deleterious effects of park disorder on community health. While earlier literature has demonstrated that physical disorder in neighborhoods predicts decreased PA in low-income communities of color (Evenson et al., 2006; Hume et al., 2007; Molnar et al., 2004; Romero et al., 2001), this study is the first to indicate that physical disorder in parks may similarly lead to decreased PA in parks situated in at-risk communities. Thus, public park maintenance ensuring prompt remediation of disordered spaces branded by dog refuse, litter, graffiti and vandalized equipment may provide a cost-effective mechanism for improving PA opportunities among park users regardless of gender, age, and ethnicity. In addition, implementing evidence-based practices such as park director and park advisory board community outreach training and implementation (e.g., Cohen et al., 2013a), as well as broader public park improvements (e.g., Tester and Baker, 2009; Veitch et al., 2012), may increase park attendance and in-park PA, while encumbering social activities that lead to physical disorder in public parks. Interventions such as these are particularly important as physical inactivity is among a short list of risk factors associated with chronic disease in the US, and thus may present effective mechanisms that dovetail epidemiology surveillance and health systems interventions toward chronic disease reduction in at-risk communities (Bauer et al., 2014; Brawner et al., 2016; Pate et al., 1995).

Surprisingly, social disorder—evidence of alcohol use and sex paraphernalia—was associated with increased PA among park users. While social disorder incivilities, similar to physical disorder, have been theorized to negatively impact PA in the neighborhood context (Evenson et al., 2006; Hume et al., 2007; Molnar et al., 2004; Romero et al., 2001), this relationship may be spurious in public parks. That is, the observed relationship concerning social disorder and PA may not be causative. Rather, social disorder variables likely correlate with unobserved park and surrounding community characteristics. Given the exploratory nature of this study, additional research is needed to confirm or refute our findings.

There are several limitations to the current study. First, our application of neighborhood disorder theory may have benefitted from inclusion of contextual factors affecting PA—e.g., neighborhood walkability, crime, poverty—which often influence community sense of safety and associated PA. Thus, multilevel analyses embedding PA and park-level factors within neighborhood-level contextual conditions may provide additional understandings of social and environmental determinants of PA (Austin et al., 2002; Coughenour et al., 2014; de Vries et al., 2007; Dulin-Keita et al., 2013; Kurka et al., 2015). Second, all data were collected during Spring and Summer seasons, limiting generalizability of research findings beyond the study period. Third, data were only collected during clement weather, wherein observations were rescheduled if rain was forecast. In addition, this study did not control for non-rain weather conditions and time of day. Finally, this study relied on cross-sectional rather than longitudinal data, limiting the possibility for making causal inferences.

5. Conclusions

Our study suggests that applying some elements of neighborhood disorder theory may be useful for assessing park PA in urban communities of color. However, additional studies are needed to validate these

findings. Taken as a whole, study findings are among the first to directly suggest that PA for a range of park users in communities of color may be improved by implementing physical disorder remediation programs within park settings. In addition, targeted community outreach initiatives and PA-based park interventions may promote park usage and increase PA among female and Latina/o residents. While programs designed to improve physical activity opportunities within public parks may require significant financial and temporal investments, these interventions may provide enriched pathways for promoting PA and positive public health outcomes in at-risk communities.

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Conflicts of interest

None.

References

Adams, A.K., Harvey, H., Brown, D., 2008. Constructs of Health and Environment Inform Child Obesity Prevention in American Indian Communities. Obesity 16 (2), 311–317. http://dx.doi.org/10.1038/oby.2007.71.

Austin, D.M., Furr, L.A., Spine, M., 2002. The effects of neighborhood conditions on perceptions of safety. J. Crim. Just. 30, 417–427. http://dx.doi.org/10.1016/S0047-2352(02)00148-4.

Bancroft, C., Joshi, S., Rundle, A., Hutson, M., Chong, C., Weiss, C.C., ... Lovasi, G., 2015. Association of proximity and density of parks and objectively measured physical activity in the United States: a systematic review. Soc. Sci. Med. 138, 22–30. http://dx.doi.org/10.1016/j.socscimed.2015.05.034.

Baran, P.K., Smith, W.R., Moore, R.C., Floyd, M.F., Bocarro, J.N., Cosco, N.G., Danninger, T.M., 2014. Park use among youth and adults: examination of individual, social, and urban form factors. Environ. Behav. 46 (6), 768–800. http://dx.doi.org/10.1177/0013916512470134.

Bauer, U.E., Briss, P.A., Goodman, R.A., Bowman, B.A., 2014. Prevention of chronic disease in the 21st century: elimination of the leading preventable causes of premature death and disability in the USA. Lancet 384 (9937), 45–52. http://dx.doi.org/10.1016/S0140-6736(14)60648-6.

Boone, C.G., Buckley, G.L., Grove, J.M., Sister, C., 2009. Parks and people: an environmental justice inquiry in Baltimore, Maryland. Ann. Assoc. Am. Geogr. 99 (4), 767–787. http://dx.doi.org/10.1080/00045600903102949.

Brawner, C.A., Churilla, J.R., Keteyian, S.J., 2016. Prevalence of physical activity is lower among individuals with chronic disease. Med. Sci. Sports Exerc. 48, 1062–1067. http://dx.doi.org/10.1249/MSS.0000000000000861.

Bruton, C.M., Floyd, M.F., 2014. Disparities in built and natural features of urban parks: comparisons by neighborhood level race/ethnicity and income. J. Urban Health 91 (5), 894–907. http://dx.doi.org/10.1007/s11524-014-9893-4.

Burdette, A.M., Hill, T.D., 2008. An examination of processes linking perceived neighborhood disorder and obesity. Soc. Sci. Med. 67 (1), 38–46. http://dx.doi.org/10.1016/j.socscimed.2008.03.029.

Carlson, J.A., Sallis, J.F., Conway, T.L., Saelens, B.E., Frank, L.D., Kerr, J., ... King, A.C., 2012. Interactions between psychosocial and built environment factors in explaining older adults' physical activity. Prev. Med. 54 (1), 68–73. http://dx.doi.org/10.1016/j.ypmed.2011.10.004.

Cohen, D.A., McKenzie, T.L., Sehgal, A., Williamson, S., Golinelli, D., Lurie, N., 2007. Contribution of public parks to physical activity. Am. J. Public Health 97 (3), 509–514. http://dx.doi.org/10.2105/AJPH.2005.072447.

Cohen, D.A., Setodji, C., Evenson, K.R., Ward, P., Lapham, S., Hillier, A., McKenzie, T.L., 2011. How much observation is enough? Refining the administration of SOPARC. J. Phys. Act. Health 8 (8), 1117–1123.

Cohen, D.A., Han, B., Derose, K.P., Williamson, S., Marsh, T., McKenzie, T.L., 2013a. Physical activity in parks. Am. J. Prev. Med. 45 (5), 590–597. http://dx.doi.org/10.1016/j.amepre.2013.06.015.

Cohen, D.A., Lapham, S., Evenson, K.R., Williamson, S., Golinelli, D., Ward, P., Hillier, A., McKenzie, T.L., 2013b. Use of neighbourhood parks: does socio-economic status matter? A four-city study. Public Health 127 (4), 325–332. http://dx.doi.org/10.1016/j.puhe.2013.01.003.

Coughenour, C., Coker, L., Bungum, T.J., 2014. Environmental and social determinants of youth physical activity intensity levels at neighborhood parks in Las Vegas, NV. J. Community Health 39 (6), 1092–1096. http://dx.doi.org/10.1007/s10900-014-9856-4.

De Ridder, K., Adamec, V., Bañuelos, A., Bruse, M., Bürger, M., Damsgaard, O., ... Weber, C., 2004. An integrated methodology to assess the benefits of urban green space. Sci. Total Environ. 334–335, 489–497. http://dx.doi.org/10.1016/j.scitotenv.2004.04.054.

van Dillen, S.M.E., de Vries, S., Groenewegen, P.P., Spreeuwenberg, P., 2012. Greenspace in urban neighbourhoods and residents' health: adding quality to quantity. J. Epidemiol. Community Health 66 (6), e8. http://dx.doi.org/10.1136/jech.2009.104695.

Ding, D., Sallis, J.F., Kerr, J., Lee, S., Rosenberg, D.E., 2011. Neighborhood environment and physical activity among youth. Am. J. Prev. Med. 41 (4), 442–455. http://dx.doi.org/10.1016/j.amepre.2011.06.036.

Douglas, J.A., 2016. What's good in the 'hood': the production of youth, nature, and knowledge. In: Shillington, L., Murnaghan, A.M. (Eds.), Children, Nature, and Cities. Ashgate Publishing Company, Burlinton, VT.

Dulin-Keita, A., Kaur Thind, H., Affuso, O., Baskin, M.L., 2013. The associations of perceived neighborhood disorder and physical activity with obesity among African American adolescents. BMC Public Health 13, 440. http://dx.doi.org/10.1186/1471-2458-13-440.

Evenson, K.R., Birnbaum, A.S., Bedimo-Rung, A.L., Sallis, J.F., Voorhees, C.C., Ring, K., Elder, J.P., 2006. Girls' perception of physical environmental factors and transportation: reliability and association with physical activity and active transport to school. Int. J. Behav. Nutr. Phys. Act. 3, 28. http://dx.doi.org/10.1186/1479-5868-3-28.

Evenson, K.R., Jones, S.A., Holliday, K.M., Cohen, D.A., McKenzie, T.L., 2016. Park characteristics, use, and physical activity: a review of studies using SOPARC (System for Observing Play and Recreation in Communities). Prev. Med. 86, 153–166. http://dx.doi.org/10.1016/j.ypmed.2016.02.029.

Ferré, M.B., Guitart, A.O., Ferret, M.P., 2006. Children and playgrounds in Mediterranean cities. Child. Geogr. 4 (2), 173–183. http://dx.doi.org/10.1080/14733280600806999.

Floyd, M.F., Spengler, J.O., Maddock, J.E., Gobster, P.H., Suau, L.J., 2008. Park-based physical activity in diverse communities of two U.S. cities. Am. J. Prev. Med. 34 (4), 299–305. http://dx.doi.org/10.1016/j.amepre.2008.01.009.

Frederick, C.B., Snellman, K., Putnam, R.D., 2014. Increasing socioeconomic disparities in adolescent obesity. Proc. Natl. Acad. Sci. 111 (4), 1338–1342. http://dx.doi.org/10.1073/pnas.1321355110.

Fuller, R.A., Irvine, K.N., Devine-Wright, P., Warren, P.H., Gaston, K.J., 2007. Psychological benefits of greenspace increase with biodiversity. Biol. Lett. 3 (4), 390–394. http://dx.doi.org/10.1098/rsbl.2007.0149.

Garcia-Ramirez, 2014. Community Psychology Contributions to the Study of Social Inequalities, Well-being and Social Justice.

Gearin, E., Kahle, C., 2006. Teen and adult perceptions of urban green space Los Angeles. Child. Youth Environ. 16 (1), 25–48.

Goffman, E., 1963. Behavior in public places: Notes on the social organization of gatherings. Free Press of Glencoe, New York.

Gordon-Larsen, P., McMurray, R.G., Popkin, B.M., 2000. Determinants of adolescent physical activity and inactivity patterns. Pediatrics 105 (6), e83. http://dx.doi.org/10.1542/peds.105.6.e83.

Hair Jr., J.F., Anderson, R.E., Tatham, R.L., Black, W.C., 1995. Multivariate Data Analysis, 3rd ed. Macmillan, New York.

Han, B., Cohen, D.A., Derose, K.P., Marsh, T., Williamson, S., Loy, S., 2015. Effectiveness of a free exercise program in a neighborhood park. Prev. Med. Rep. 2, 255–258. http://dx.doi.org/10.1016/j.pmedr.2015.03.010.

Holman, C.D., Donovan, R.J., Corti, B., 1996. Factors influencing the use of physical activity facilities: results from qualitative research. Health Promot. J. Austr. 6 (1), 16.

Hughey, S.M., Walsemann, K.M., Child, S., Powers, A., Reed, J.A., Kaczynski, A.T., 2016. Using an environmental justice approach to examine the relationships between park availability and quality indicators, neighborhood disadvantage, and racial/ethnic composition. Landsc. Urban Plan. 148, 159–169. http://dx.doi.org/10.1016/j.landurbplan.2015.12.016.

Hume, C., Salmon, J., Ball, K., 2007. Associations of children's perceived neighborhood environments with walking and physical activity. Am. J. Health Promot. 21 (3), 201–207.

Hunter, A., 1985. Private, parochial and public social orders: the problem of crime and incivility in urban communities. In: The Challenge of Social Control: Citizenship and Institution Building in Modern Society, pp. 230–242.

Irvine, K., Warber, S., Devine-Wright, P., Gaston, K., 2013. Understanding urban green space as a health resource: a qualitative comparison of visit motivation and derived effects among park users in Sheffield, UK. Int. J. Environ. Res. Public Health 10 (1), 417–442. http://dx.doi.org/10.3390/ijerph10010417.

Jago, R., Anderson, C., Baranowski, T., Watson, K., 2005. Adolescent patterns of physical activity differences by gender, day, and time of day. Am. J. Prev. Med. 28 (5), 447–452. http://dx.doi.org/10.1016/j.amepre.2005.02.007.

Janhäll, S., 2015. Review on urban vegetation and particle air pollution – deposition and dispersion. Atmos. Environ. 105, 130–137. http://dx.doi.org/10.1016/j.atmosenv.2015.01.052.

Jones, S.A., Moore, L.V., Moore, K., Zagorski, M., Brines, S.J., Diez Roux, A.V., Evenson, K.R., 2015. Disparities in physical activity resource availability in six US regions. Prev. Med. 78, 17–22. http://dx.doi.org/10.1016/j.ypmed.2015.05.028.

Kaczynski, A.T., Henderson, K.A., 2007. Environmental correlates of physical activity: a review of evidence about parks and recreation. Leis. Sci. 29 (4), 315–354. http://dx.doi.org/10.1080/01490400701394865.

Kaczynski, A.T., Potwarka, L.R., Saelens, B.E., 2008. Association of park size, distance,

and features with physical activity in neighborhood parks. Am. J. Public Health 98 (8), 1451–1456. http://dx.doi.org/10.2105/AJPH.2007.129064.
Kaczynski, A.T., Besenyi, G.M., Stanis, S.A.W., Koohsari, M.J., Oestman, K.B., Bergstrom, R., ... Reis, R.S., 2014. Are park proximity and park features related to park use and park-based physical activity among adults? Variations by multiple socio-demographic characteristics. Int. J. Behav. Nutr. Phys. Act. 11 (1), 146.
Krenichyn, K., 2006. 'The only place to go and be in the city': women talk about exercise, being outdoors, and the meanings of a large urban park. Health Place 12 (4), 631–643. http://dx.doi.org/10.1016/j.healthplace.2005.08.015.
Kruger, J.S., Chawla, L., 2002. "We know something someone doesn't know": children speak out on local conditions in Johannesburg. Environ. Urban. 14 (2), 85–96. http://dx.doi.org/10.1177/095624780201400207.
Kurka, J.M., Adams, M.A., Todd, M., Colburn, T., Sallis, J.F., Cain, K.L., ... Saelens, B.E., 2015. Patterns of neighborhood environment attributes in relation to children's physical activity. Health Place 34, 164–170. http://dx.doi.org/10.1016/j.healthplace.2015.05.006.
LaGrange, R.L., Ferraro, K.F., Supancic, M., 1992. Perceived risk and fear of crime: role of social and physical incivilities. J. Res. Crime Delinq. 29 (3), 311–334. http://dx.doi.org/10.1177/0022427892029003004.
Lee, R.E., Booth, K.M., Reese-Smith, J.Y., Regan, G., Howard, H.H., 2005. The Physical Activity Resource Assessment (PARA) instrument: evaluating features, amenities and incivilities of physical activity resources in urban neighborhoods. Int. J. Behav. Nutr. Phys. Act. 2, 13. http://dx.doi.org/10.1186/1479-5868-2-13.
Loukaitou-Sideris, A., Stieglitz, O., 2002. Children in Los Angeles parks: a study of equity, quality and children's satisfaction with neighbourhood parks. Town Plan. Rev. 73 (4), 467–488.
McCormack, G.R., Rock, M., Toohey, A.M., Hignell, D., 2010. Characteristics of urban parks associated with park use and physical activity: a review of qualitative research. Health Place 16 (4), 712–726. http://dx.doi.org/10.1016/j.healthplace.2010.03.003.
McKenzie, T.L., Cohen, D.A., Sehgal, A., Williamson, S., Golinelli, D., 2006. System for Observing Play and Recreation in Communities (SOPARC): reliability and feasibility measures. J. Phys. Act. Health 3 (Suppl. 1), S208–S222.
Miles, R., 2008. Neighborhood disorder, perceived safety, and readiness to encourage use of local playgrounds. Am. J. Prev. Med. 34 (4), 275–281. http://dx.doi.org/10.1016/j.amepre.2008.01.007.
Molnar, B.E., Gortmaker, S.L., Bull, F.C., Buka, S.L., 2004. Unsafe to play? Neighborhood disorder and lack of safety predict reduced physical activity among urban children and adolescents. Am. J. Health Promot. 18 (5), 378–386. http://dx.doi.org/10.4278/0890-1171-18.5.378.
Moore, L.V., Diez Roux, A.V., Evenson, K.R., McGinn, A.P., Brines, S.J., 2008. Availability of recreational resources in minority and low socioeconomic status areas. Am. J. Prev. Med. 34 (1), 16–22. http://dx.doi.org/10.1016/j.amepre.2007.09.021.
Moore, H.J., Nixon, C.A., Lake, A.A., Douthwaite, W., O'Malley, C.L., Pedley, C.L., ... Routen, A.C., 2014. The environment can explain differences in adolescents' daily physical activity levels living in a deprived urban area: cross-sectional study using accelerometry, GPS, and focus groups. J. Phys. Act. Health 11 (8), 1517–1524. http://dx.doi.org/10.1123/jpah.2012-0420.
Neter, J., Wasserman, W., Kutner, M.H., 1989. Applied Linear Regression Models. Irwin, Homewood, IL.
Norman, G.J., Nutter, S.K., Ryan, S., Sallis, J.F., Calfas, K.J., Patrick, K., 2006. Community design and access to recreational facilities as correlates of adolescent physical activity and body-mass index. J. Phys. Act. Health 3 (s1), S118–S128. http://dx.doi.org/10.1123/jpah.3.s1.s118.
Pate, R.R., Pratt, M., Blair, S.N., Haskell, W.L., Macera, C.A., Bouchard, C., ... Wilmore, J.H., 1995. Physical activity and public health: a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. JAMA 273 (5), 402–407. http://dx.doi.org/10.1001/jama.1995.03520290054029.
Reed, J.A., Arant, C.-A., Wells, P., Stevens, K., Hagen, S., Harring, H., 2008. A descriptive examination of the most frequently used activity settings in 25 community parks using direct observation. J. Phys. Act. Health 5 (s1), S183–S195.
Rogerson, P.A., 2001. Statistical Methods for Geography. Sage, London.
Romero, A.J., Robinson, T.N., Kraemer, H.C., Erickson, S.J., Haydel, K.F., Mendoza, F., Killen, J.D., 2001. Are perceived neighborhood hazards a barrier to physical activity in children? Arch. Pediatr. Adolesc. Med. 155 (10), 1143–1148.
Ross, C.E., 2000. Walking, exercising, and smoking: does neighborhood matter? Soc. Sci. Med. 51 (2), 265–274. http://dx.doi.org/10.1016/S0277-9536(99)00451-7.
Ross, C.E., Mirowsky, J., 2001. Neighborhood disadvantage, disorder, and health. J. Health Soc. Behav. 42 (3), 258–276. http://dx.doi.org/10.2307/3090214.
Saelens, B.E., Sallis, J.F., Frank, L.D., Cain, K.L., Conway, T.L., Chapman, J.E., ... Kerr, J., 2012. Neighborhood environment and psychosocial correlates of adults' physical activity. Med. Sci. Sports Exerc. 44 (4), 637–646. http://dx.doi.org/10.1249/MSS.0b013e318237fe18.
Sampson, R.J., Raudenbush, S.W., 1999. Systematic social observation of public spaces: a new look at disorder in urban neighborhoods. Am. J. Sociol. 105 (3), 603–651. http://dx.doi.org/10.1086/210356.
Santa Clara County Public Health Department, 2017. Obesity, Physical Activity & Nutrition in Santa Clara County. Retrieved from. https://www.sccgov.org/sites/phd/hi/hd/Documents/obesity-reports/obesity.pdf.
Scott, D., 1997. Exploring time patterns in people's use of a metropolitan park district. Leis. Sci. 19 (3), 159–174. http://dx.doi.org/10.1080/01490409709512247.
Scott, D., 2013. Economic inequality, poverty, and park and recreation delivery. J. Park. Recreat. Adm. 31 (4) Retrieved from. http://search.proquest.com/openview/46d551b36366993f4f24dad7b41c62c3/1?pq-origsite=gscholar&cbl=2037373.
Skogan, W., 2015. Disorder and decline: the state of research. J. Res. Crime Delinq. 52 (4), 464–485. http://dx.doi.org/10.1177/0022427815577836.
Tappe, K.A., Glanz, K., Sallis, J.F., Zhou, C., Saelens, B.E., 2013. Children's physical activity and parents' perception of the neighborhood environment: neighborhood impact on kids study. Int. J. Behav. Nutr. Phys. Act. 10, 39. http://dx.doi.org/10.1186/1479-5868-10-39.
Tester, J., Baker, R., 2009. Making the playfields even: evaluating the impact of an environmental intervention on park use and physical activity. Prev. Med. 48 (4), 316–320. http://dx.doi.org/10.1016/j.ypmed.2009.01.010.
U.S. Census Bureau, 2010. American FactFinder. (Retrieved May 15, 2017 from http://factfinder.census.gov).
Vaughan, K.B., Kaczynski, A.T., Stanis, S.A.W., Besenyi, G.M., Bergstrom, R., Heinrich, K.M., 2013. Exploring the distribution of park availability, features, and quality across Kansas City, Missouri by income and race/ethnicity: an environmental justice investigation. Ann. Behav. Med. 45 (1), 28–38. http://dx.doi.org/10.1007/s12160-012-9425-y.
Veitch, J., Ball, K., Crawford, D., Abbott, G.R., Salmon, J., 2012. Park improvements and park activity: a natural experiment. Am. J. Prev. Med. 42 (6), 616–619. http://dx.doi.org/10.1016/j.amepre.2012.02.015.
de Vries, S.I., Bakker, I., van Mechelen, W., Hopman-Rock, M., 2007. Determinants of activity-friendly neighborhoods for children: results from the SPACE study. Am. J. Health Promot. 21 (4 Suppl), 312–316.
Vrij, A., Winkel, F.W., 1991. Characteristics of the built environment and fear of crime: a research note on interventions in unsafe locations. Deviant Behav. 12 (2), 203–215. http://dx.doi.org/10.1080/01639625.1991.9967873.
Wang, Y., Wu, Y., Wilson, R.F., Bleich, S., Cheskin, L., Weston, C., ... Segal, J., 2013. Childhood Obesity Prevention Programs: Comparative Effectiveness Review and Meta-analysis. Agency for Healthcare Research and Quality (US), Rockville (MD) Retrieved from. http://www.ncbi.nlm.nih.gov/books/NBK148737/.
Weiss, C.C., Purciel, M., Bader, M., Quinn, J.W., Lovasi, G., Neckerman, K.M., Rundle, A.G., 2011. Reconsidering access: park facilities and neighborhood disamenities in New York City. J. Urban Health 88 (2), 297–310. http://dx.doi.org/10.1007/s11524-011-9551-z.
Wen, M., Zhang, X., Harris, C.D., Holt, J.B., Croft, J.B., 2013. Spatial disparities in the distribution of parks and green spaces in the USA. Ann. Behav. Med. 45 (1), 18–27. http://dx.doi.org/10.1007/s12160-012-9426-x.
Wolch, J., Wilson, J.P., Fehrenbach, J., 2005. Parks and park funding in Los Angeles: an equity-mapping analysis. Urban Geogr. 26 (1), 4–35. http://dx.doi.org/10.2747/0272-3638.26.1.4.
Wolch, J.R., Byrne, J., Newell, J.P., 2014. Urban green space, public health, and environmental justice: the challenge of making cities 'just green enough. Landsc. Urban Plan. 125, 234–244. http://dx.doi.org/10.1016/j.landurbplan.2014.01.017.
Young, D., Saksvig, B.I., Wu, T.T., Zook, K., Li, X., Champaloux, S., ... Treuth, M.S., 2014. Multilevel correlates of physical activity for early, mid, and late adolescent girls. J. Phys. Act. Health 11 (5), 950–960. http://dx.doi.org/10.1123/jpah.2012-0192.
Zick, C.D., Smith, K.R., Brown, B.B., Fan, J.X., Kowaleski-Jones, L., 2007. Physical activity during the transition from adolescence to adulthood. J. Phys. Act. Health 4 (2), 125–137.