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ORIGINAL PAPER

Environmental and Social Determinants of Youth Physical Activity Intensity Levels at Neighborhood Parks in Las Vegas, NV

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Abstract Parks can play an important role in youth activity. This study used observational data to evaluate the relationship of environmental and social determinants to youth physical activity intensity levels in Las Vegas neighborhood parks. System for observing play and leisure activity in youth was used to code activity levels as sedentary, walking, or vigorous in five low-income and five high-income parks. Environmental determinants included amenities, incivilities, size, high-speed streets, sidewalk condition, and temperature. Social determinants included percent minority and Hispanic, gender, and income. A multinomial logistic regression model was performed. We observed 1,421 youth, 59 % male, 41 % female; 21 % were sedentary, 38 % walking, and 41 % vigorous. Males were more likely to be observed walking (OR 1.42) and vigorous (OR 2.21) when compared to sedentary. High-speed streets (OR 0.76), sidewalks condition (OR 0.34), and low-income neighborhoods (OR 0.07) was associated with decreased odds of vigorous activity; incivilities (OR 1.34) and amenities (OR 1.27) were associated with greater odds of being vigorous. Environmental and social determinants are associated with physical activity intensity levels at parks. Stakeholders should ensure quality parks, as they relate to physical activity levels in youth. Understanding environmental and social determinants that influence physical activity at parks is critical to utilizing their full potential in an effort to combat childhood obesity.

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Background

The rising rates of childhood obesity are a critical public health concern. Over one-third of US children are overweight and 18 % are obese [1]. The link between physical activity and health is well established, as physical activity plays a critical role in weight control and energy balance [2]. A mere 42 % of 6–11 year olds obtain the recommended 60 min of physical activity per day, while only eight percent of adolescents obtain recommended levels [3]. Additionally, African American adolescents are the least likely to meet the recommended levels of physical activity, followed by Hispanic, then white adolescents; and males are more likely than females to attain the recommended levels [4].

Previous findings reveal an association between the neighborhood environment and physical activity levels [5–7]. Individuals who reside in a neighborhood that supports opportunities for physical activity attain more minutes of physical activity [8]. Neighborhood parks have been identified as an important factor in recreation and physical activity. Cohen et al. [9] found that people who lived within one mile of a park were four times as likely to visit the park once per week than those who lived further away. Children and adolescents who have adequate access to neighborhood parks also attain more minutes of physical activity [10, 11]. In the Las Vegas, NV metropolitan area there are about 2.6 park acres per 1,000 residents [12]. This is far lower than the National Recreation and Parks Association recommended ten park acres per 1,000 residents. Additionally, in Southern Nevada, lower income census

tracts have access to less park acreage than higher income census tracts [13]. Thus, Las Vegas residents, and especially poor ones, do not have ideal access to opportunities for physical activity.

While it is established that access to parks is associated with more physical activity in youth, few studies have examined the role that the neighborhood environmental and social determinants have on physical activity intensity. Moderate and vigorous activity is associated with greater energy expenditure and health benefits. While the cause of obesity is generally complex, the accumulation of time spent in moderate and vigorous activities has been associated with a lower BMI and decreased body fat in children [14]. Given that vulnerable populations are at greater risk for physical inactivity and the related health consequences, an understanding of determinants associated with moderate and vigorous activity related to parks can be useful in ensuring maximum physical activity benefit from existing facilities. Understanding which environmental and social determinants are associated with higher intensity physical activity can be used to guide future design of new parks and retrofitting of existing park facilities. The objective of this study was to determine if environmental and social determinants were associated with youth activity levels at neighborhood parks.

Methods

Park Selection and Evaluation

The Las Vegas metropolitan area was divided into high and low income Census tracts based on median household income from the US Census Bureau's 2010 American Community Survey (ACS) 5 year estimates. Low income tracts were defined as those with a median household income between $15,000 and $41,400. Median household incomes <$15,000 were excluded in an effort to avoid income outliers and the income level of $41,400 was chosen as it is the income threshold in Nevada for a low income family of two based on the Department of Housing and Urban Development's 2013 adjusted income limit [15]. High income tracts were defined as those with a median household income >$60,000, which is 20 % greater than the median household income of $50,046 for the Las Vegas metropolitan area.

Five geographically different parks were then chosen from each income category. Park environments were evaluated using the physical activity resource assessment (PARA). The PARA includes a list of amenities which are rated from 0 to 3 based on availability and quality, and a list of incivilities which are rated from 0 to 3 based on presence and severity [16]. If a park contained amenities which were not captured in the PARA list, they were added to the evaluation form and rated on the same scale. Park size was measured in acres using ArcGIS10.

Physical Activity Measurement

Ten neighborhood parks in the Las Vegas metropolitan area were observed in June and July 2012. The system for observing play and leisure activity in youth (SOPLAY) was used to assess physical activity levels of youth under 18 years. SOPLAY uses direct observation via a momentary time sampling technique which involves a systematic scan of the target area. In each scan youth are coded as sedentary, walking, or very active [17]. Each park was divided into small, observable segments. Trained researchers observed and categorized activity levels and apparent gender of youth who appeared to be under 18 years. Percent agreement between observers ranged from 85 to 100 %. Each park was observed on eight occasions; four times on a week day and four times on a weekend day. Observation times were 10 am, 12 pm, 4 pm, and 6 pm and lasted between 10 and 40 min, depending on the size of the park.

Neighborhood Environmental and Social Determinants

Environmental determinants in addition to park size, amenities, and incivilities collected from the PARA included temperature at observation time, number of high speed streets, and sidewalk condition. High speed streets were defined by the number of streets within a one-quarter mile radius of the park which had a posted speed of 35 miles per hour or greater. Conditions of sidewalks within a one-quarter mile radius of the park were measured via direct observation using the PARA protocol definition and scale. Social determinants included percent minority, percent Hispanic, and neighborhood income as defined by the Census 2010 ACS 5 year estimates for the Census tract that each park was located within. Neighborhood income was dichotomized into high and low income neighborhoods. Environmental and social determinants for each of the ten neighborhoods are detailed in Table 1.

Data Analysis

Independent sample *t* tests were used to determine if there was a difference in environmental and social determinants between high and low income neighborhoods in park size, sidewalk condition, and number of amenities, incivilities, and high speed streets, percent minority and percent Hispanic. A multinomial logistic regression model was used in SPSS, as the independent variable of physical activity was categorical. The sedentary category was used as the

Table 1 Environmental and social determinants for each Las Vegas Metropolitan Area Park and neighborhood included in analysis

	Size (in acres)	Amenities	Incivilities	Sidewalk quality (0–3 scale)	High speed streets	Income (in US dollars)[a]	Percent minority[a]	Percent Hispanic[a]
Low income	1.69	13	12	2	4	29,036	58.3	88.7
	72.23	20	9	2	6	29,764	52.8	68.8
	9.09	15	10	2	3	31,537	44.7	16.2
	16.57	14	11	1	3	37,013	40.2	50.2
	10.54	14	4	2	2	38,673	18.3	19.7
High income	18.03	15	1	3	2	60,559	28.9	17.0
	17.43	15	3	2	4	70,111	51.0	28.7
	31.95	16	3	3	5	73,115	35.1	25.3
	7.62	19	0	2	5	87,308	27.3	11.1
	4.40	17	0	3	5	98,571	22.8	9.3

[a] Based on US Census Bureau's 2010 American Community Survey (ACS) 5 year estimates

Table 2 Means of environmental and social determinants and effect size of independent sample *t* tests

Environmental/ social determinants	High income parks (n = 5)	Low income parks (n = 5)	Effect size (η^2)
Number of amenities	16.4	15.2	NS
Number of incivilities	**1.4****	**9.2****	**0.76**
Sidewalk quality (0–3 scale)	**2.6***	**1.8***	**0.44**
Number of high speed streets	4.2	3.6	NS
Percent minority	42.9	33.0	NS
Percent Hispanic	18.3	48.7	NS

Bold values indicate significant variables ($p \leq 0.05$)

* $p < 0.05$; ** $p < 0.001$; *NS* not significant

Table 3 Multinomial regression results of environmental and social determinants on level of physical activity intensity at neighborhood parks

	OR	*p* value	95 % CI
Walking versus sedentary			
Temperature	0.99	0.57	0.96–1.02
Amenities	1.03	0.81	0.84–1.26
Size	0.99	0.62	0.97–1.02
Incivilities	1.08	0.54	0.84–1.40
High speed street	1.24	0.13	0.94–1.65
Sidewalk condition	0.76	0.60	0.28–2.07
% minority	1.01	0.66	0.96–1.06
% Hispanic	0.99	0.50	0.97–1.02
Males (compared to females)	**1.42**	**0.02***	**1.06–1.90**
Low income (compared to high)	0.67	0.70	0.09–4.88
Vigorous versus sedentary			
Temperature	1.01	0.60	0.98–1.04
Amenities	**1.27**	**0.03***	**1.02–1.59**
Size	1.01	0.67	0.97–1.04
Incivilities	**1.34**	**0.03***	**1.02–1.75**
High speed street	**0.76**	**0.05***	**0.58–0.99**
Sidewalk cond.	**0.34**	**0.05***	**0.12–0.98**
% minority	1.02	0.50	0.97–1.07
% Hispanic	0.98	0.15	0.96–1.01
Males (compared to females)	**2.21**	**<0.01***	**1.65–2.96**
Low income (compared to high)	**0.07**	**0.01***	**0.01–0.55**

Bold values indicate significant variables ($p \leq 0.05$)

* $p \leq 0.05$; *OR* odds ratio; *CI* confidence interval; n = 1,423

reference category. The criterion for classification accuracy was satisfied and all standard errors for coefficients were <2.0, thus no multicollinearity was observed.

Human Subjects and Ethical Research Practices

The University of Nevada, Las Vegas' Office of Research Integrity reviewed this protocol and deemed it exempt from institutional review protocol.

Results

There was a total of 1,423 youth park users observed, 59 % male, 41 % female. Of the males observed 17.5 % were classified as sedentary, 36.7 % were classified as walking, and 45.8 % were classified as vigorous. Of the females observed 25.6 % were classified as sedentary, 39.9 % were classified as walking, and 34.5 % were classified as vigorous. The majority of youth were observed at 6 pm (52 %), followed by 4 pm (25 %), 12 pm (13 %), and 10 am (10 %). The greatest numbers of youth were observed using the playground (63.5 %), followed by the soccer field (16 %) and the pool (7.6 %).

Differences in environmental and social determinants between high and low income parks were assessed using *t* tests. *T* tests revealed that there was a significant

difference in number of incivilities ($p = 0.001$) and side walk condition ($p = 0.035$). Low income neighborhoods had a significantly greater number of incivilities and lower quality sidewalks. Table 2 contains the means and effect size of each characteristic.

Youth physical activity levels were assessed using a multinomial regression model. The model was statistically significant ($p < 0.001$). Results revealed that males were more likely to be observed walking (OR 1.42, CI 1.06–1.90) and doing vigorous physical activity (OR 2.21, CI 1.65–2.96) when compared to sedentary. Low income neighborhoods were associated with lower odds of youth being observed as vigorous activity (OR 0.07, CI 0.01–0.55). A greater number of high speed streets (OR 0.76, CI 0.58–0.99) and better sidewalk condition (OR 0.34, CI 0.12–0.98) were associated with decreased odds of observing vigorous physical activity. A greater number of park amenities (OR 1.27, CI 1.02–1.59) and a greater number of incivilities (OR 1.34, CI 1.02–1.75) were associated with vigorous activity. Results of all variables entered into the model are detailed in Table 3.

Discussion

Results revealed that environmental and social determinants were associated with levels of physical activity at neighborhood parks in Las Vegas, NV. It is important to understand what environmental and social determinants are associated with activity levels in youth, as greater intensity activities are more beneficial for energy balance, weight loss, and overall health benefits. The most interesting findings were that a greater number of amenities were associated with greater odds of vigorous activity, and low income parks had decreased odds of observing youth in vigorous activity. Ensuring that parks contain an adequate number of amenities may result in greater energy expenditure for youth. This finding is supported by previous research: Kaczynski et al. [18] found that the number of park features was associated with increased odds of adults using the park for physical activity. In the current study the playground equipment was the most widely used amenity at the park. An understanding of youth preferences of park amenities may result in the greatest utilization rate of such amenities.

Low income parks had decreased odds of youth being observed as vigorous. This is especially important given that low income populations are often more vulnerable to inactivity and associated health consequences. Further evaluations of low income parks are necessary to ensure that the park environment is conducive to youth activity. Our analysis revealed that low income parks had a significantly greater number of incivilities. Previous studies have found that neighborhood incivilities were associated with lower neighborhood satisfaction, fear, and worry [19]. Parental perceptions of neighborhood safety have previously been found to negatively correlate with children's physical activity levels. Qualitative research on parental perceptions of neighborhood crime and safety may provide more insight into effective methods of increasing youth physical activity levels at neighborhood parks.

A greater number of high speed streets were associated with sedentary behavior. This finding is difficult to explain, partially because the streets may be multiple blocks away from the park. It may be that children are less likely to be permitted by parents to go to the park if it requires crossing a busy street, and children are more apt to engage in vigorous physical activity than are adults.

A greater number of park incivilities were associated with increased odds of being observed as vigorous. The association of incivilities with physical activity is mixed in the literature [20]. Incivilities and disarray are often a proxy for perceived neighborhood safety. It is possible that although in this study we objectively measured incivilities, the park environment is not perceived as in disarray or dangerous. It may also be that the incivilities are more indicative of high park usage, thus a greater likelihood of observing more vigorous activity levels at these parks.

Similar to previous findings, males were more likely than females to be classified as moderately and vigorously active. It is consistently found that female physical activity levels lag that of males, especially in adolescence [3, 21]. Enjoyment of physical education has been found to be correlated with increased vigorous activity in females. Therefore, introducing physical activities to females at a young age may be an important determinant in developing healthy habits. Future research should focus on ways to engage females to be more physically active with the use of existing park amenities.

Neighborhood race and ethnicity percentages were not significantly associated with physical activity levels in youth. This differs from findings of national data which have shown that minorities are less likely to be physically active [22, 23]. This may be explained by the recent, rapid growth of Las Vegas. As it is a relatively new city, many parks are in like-new condition with appealing play structures and amenities which provide physical activity opportunities for all neighborhood residents.

There are potential limitations of the current study. Systematic observation only assesses a snapshot in time of youth physical activity, thus this may not be representative of youth physical activity levels throughout their entire stay at the park. Although observers tried to remain conspicuous, their presence may have been noticed, causing observer interference. Park observations were only conducted in the summer months and results may differ across

seasons. The observations were conducted during an academic recess, rather than during an academic calendar year and may have provided different results. Lastly, youth observed at the park may not be representative of the neighborhood sociodemographics.

Understanding the influence of environmental and social determinants on physical activity levels of youth at public parks can be useful in designing and retrofitting parks to maximize activity levels. In turn, maximized activity levels may play a role in energy balance and aid in efforts to combat childhood obesity. Future research recommendations include combining quantitative measures such as direct observational data with qualitative measures of perceived environmental characteristics resulting in a more comprehensive understanding of the neighborhood environment as it relates to childhood obesity. Additionally, public health professionals, urban planners, and policy makers should collaborate on cost effective ways to maintain environmental features of neighborhood parks, as they relate to physical activity levels.

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