

The association between recreational parks, facilities and childhood obesity: a cross-sectional study of the 2007 National Survey of Children's Health

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Abstract:

Background: Despite the rising childhood obesity rates, few studies have examined the association between access to recreational parks and facilities and obesity.

Methods: A cross-sectional study was performed among 42 278 US children who participated in the 2007 National Survey of Children's Health. Access to parks and recreational facilities was self-reported by parents, and body mass index was calculated from parents' self-report of the child's height and weight. Logistic regression was used to obtain ORs and 95% CIs. Since obesity was not a rare occurrence, an OR correction method was used to provide a more reliable estimate of the prevalence ratio (PR).

Results: Children with access to parks and facilities had decreased prevalence of obesity as compared to children without access (PR=0.79, 95% CI 0.69 to 0.91). After adjustment for covariates, the magnitude of the association remained unchanged; however, results were no longer statistically significant (PR=0.77, 95% CI 0.55 to 1.07). Race/ethnicity was an effect modifier of the access-obesity relationship ($p < 0.0001$). Among Non-Hispanic White children, there was no strong association (PR=0.89, 95% CI 0.64 to 1.23). However, among Non-Hispanic Black children, those who had access to recreational parks and facilities had 0.40 times the prevalence of obesity as compared to those without access, and this result was statistically significant (95% CI 0.17 to 0.90).

Conclusions: This research highlights potential health disparities in childhood obesity due to limited access to recreational parks and facilities. Additional studies are needed to further investigate this association. If confirmed, providing safe, accessible parks and facilities may be one way to combat childhood obesity, particularly among minority children.

Keywords: Obesity | Environmental Health | Child Health

Article:

Introduction

Childhood obesity has become the number one childhood health problem in the USA.¹ According to the 2007-2008 National Health and Nutrition Examination Survey (NHANES), rates of childhood obesity have increased among children aged 2-19 years.¹ The prevalence of obesity among children aged 2-5 years has increased from 5.0% between 1976 and 1980 to 12.4% between 2007 and 2008.¹ During that same time period, rates of obesity rose from 6.5% to 17.0% among children aged 6-11 years, whereas children aged 12-19 years have seen rates increase from 5.0% to 17.6%.¹ Obese children are more likely to experience adverse mental and physical health events compared to children who are of healthy weight.² Approximately 70% of obese children grow up to be obese adults who are more likely to be susceptible to chronic illnesses, such as diabetes, cardiovascular disease and cancer.²

Few studies have investigated the association between the built and natural environment in which children reside and obesity.³⁻⁸ Results have been inconsistent with some studies finding that access lowers obesity rates^{3 4 7} while others have found no association.^{5 6} Furthermore, the few studies that have explored this association have been limited in their generalisability due to the small sample sizes, inadequate representation of minority groups and same source bias.^{7 8} The purpose of this study was to assess the relationship between access to recreational parks and facilities and childhood obesity among a nationally representative sample of children aged 6-17 years using data from the 2007 National Survey of Children's Health (NSCH).

Methods

Study design and population

The NSCH is a survey comprised of national and state level prevalence data for an array of health indicators.⁹ Random-digit-dialing was used to identify households with one or more children under the age of 18 in the USA. The adult in the household who knew the most about the child's health was asked to answer the questions. The survey was conducted by telephone in English or Spanish using computer-assisted telephone interview equipment. A total of 91 642 children were surveyed (overall response rate: 46.7%).⁹ For the purpose of this analysis, children who were between the ages of 0 and 5 (n=27 566) were excluded as were participants who did not have information on sex (n=110), race/ethnicity (n=351), height or weight (n=18 177) or access to recreational parks and facilities (n=1160). Thus, a total of 44 278 children remained for analysis. This study was approved by the University of North Carolina at Charlotte Institutional Review Board.

Measurement of key variables

The independent variable was access to recreational parks and facilities. The following NSCH question was used: "Please tell me if the following places and things are available to your children in your neighborhood, even if [CHILD'S NAME] does not actually use them: 1) A park or playground area; and 2) A recreation center, community center, or boys' or girls' club". Parents self-reported whether a park, playground area, recreation centre, community centre, or boys'/girls' club was available in the neighbourhood. If the parents indicated that at least one of these facilities was available, the child was considered exposed.

The outcome variable was obesity. Body mass index, calculated from the child's weight and height (as reported by the parent), determined obesity.¹ Obese and overweight children (ie, ≥ 85 th percentile) were combined into one category and referred to as obese. All other children were categorised as underweight/healthy weight.

Race/ethnicity was self-reported by the parents and considered a potential effect modifier of the exposure-disease association. The categories that were considered for this analysis are: (1) Hispanic, (2) Non-Hispanic White, (3) Non-Hispanic Black and (4) Other (American Indian, Alaska Native, Asian, Native Hawaiian). Additional covariates included: child's age, child's gender, parental education, family socioeconomic status, geographic location, participation in physical activity and living status (ie, does the child reside in a one-parent or two-parent household).

Statistical analysis

Summary statistics were obtained to describe the demographics of the study sample. ORs and 95% CIs were calculated using logistic regression. If a potential confounding variable changed the magnitude of the OR by at least 10%, it was considered a confounder of the association of recreational parks and facilities and childhood obesity.¹⁰ To assess whether race/ethnicity was an effect modifier of the exposure-disease association, a stratified analysis was conducted and a test of homogeneity was used to assess heterogeneity across the strata. Since the study outcome was not a rare occurrence, the OR correction method proposed by Zhang and Yu¹¹ was used to provide a more reliable measure of the prevalence ratio (PR) for all unadjusted and adjusted associations.

A mediation analysis was also conducted to explore whether access affects physical activity levels, resulting in a reduction of obesity prevalence. The mediation analysis consisted of four steps, which followed the traditional requirements for testing mediation.¹² These requirements were: (1) the risk factor (ie, access to recreational parks and facilities) should predict the outcome (ie, childhood obesity); (2) the risk factor should predict the putative mediator (ie, physical activity); (3) the mediator should be significantly associated with the outcome; and (4) the effect of the risk factor (ie, access to recreational parks and facilities) on the outcome (childhood obesity) should be attenuated when the mediator (physical activity) is statistically controlled. SAS-callable SUDAAN was used in all analyses. All tests were conducted at the $p < 0.05$ significance level.

Results

Among this sample, most of the participants had access to recreational parks and facilities (86.8%; table 1) and approximately 32% of the children were considered obese. In the unadjusted model, Non-Hispanic Black and Hispanic children both had increased prevalence of obesity as compared to Non-Hispanic White children (PR=1.31, 95% CI 1.25 to 1.37 and PR=1.31 95% CI 1.23 to 1.39, respectively; table 1). In addition, if a child lived in a two-parent household, he/she had decreased prevalence of obesity as compared to children in a single-parent household (PR=0.76, 95% CI 0.70 to 0.83).

Table 1. Frequencies, weighted percentages, corrected unadjusted prevalence ratios (PRs) and 95% CIs of the association between various demographic and lifestyle characteristics and childhood obesity, 2007 National Survey of Children’s Health

Variables	Sample size	Weighted per cent	Unadjusted PR	95% CI
Recreational parks and facilities				
Yes	36548	86.8	0.79	(0.69 to 0.91)
No	5730	13.2	1.00	Referent group
Childhood obesity				
Yes	12237	31.5	N/A	N/A
No	30041	68.5	N/A	N/A
Physical activity				
Yes	37902	88.9	1.00	Referent group
No	4376	11.1	0.96	(0.94 to 0.99)
Age in years				
6-11	8625	23.00	1.00	Referent group
12-14	15298	39.2	0.76	(0.68 to 0.85)
15-17	18355	37.8	0.62	(0.55 to 0.70)
Race/ethnicity				
Non-Hispanic White	30415	60.3	1.00	Referent group
Non-Hispanic Black	4310	15.4	1.31	(1.25 to 1.37)
Hispanic	4134	16.6	1.31	(1.23 to 1.39)
Other	3419	7.8	1.15	(1.03 to 1.26)
Sex				
Male	22107	50.6	1.00	Referent group
Female	20171	49.4	0.87	(0.83 to 0.92)
Maternal education				
Less than HS graduate	2696	10.2	1.00	Referent group
HS graduate	8559	27.3	0.69	(0.56 to 0.83)
More than HS graduate	27980	62.5	0.48	(0.39 to 0.5)
Paternal education				
Less than HS graduate	2308	10.2	1.00	Referent group
HS graduate	7914	27.6	0.61	(0.504 to 0.77)
More than HS graduate	22879	62.2	0.39	(0.31 to 0.49)
Socioeconomic status				
Low	4018	21.00	1.00	Referent group
Middle	6629	29.6	0.77	(0.66 to 0.89)
High	14542	49.4	0.59	(0.52 to 0.68)
Geographic location				
Rural	6643	15.9	1.18	(1.07 to 1.29)
Urban	22114	84.0	1.00	Referent group
Living status				
One-parent household	10510	27.7	1.00	Referent group
Two-parent household	31768	72.3	0.76	(0.70 to 0.83)

HS, high school.

Children with access to recreational parks and facilities had 0.79 times the prevalence of obesity as compared to those children without access (95% CI 0.69 to 0.91). The magnitude of the association remained largely unchanged after adjustment; however, the result was no longer statistically significant (PR=0.77, 95% CI 0.55 to 1.07; table 2).

Race/ethnicity was an effect modifier of the access to recreational parks and facilities-obesity association (Breslow-Day test of homogeneity $p < 0.0001$). Among Non-Hispanic White children, those who had access to recreational parks and facilities had 0.89 times the prevalence of obesity

as compared to children without access (95% CI 0.64 to 1.23). Findings were similar among both Hispanic and 'Other' children (PR=0.73, 95% CI 0.28 to 1.81 and PR=0.80, 95% CI 0.23 to 2.28, respectively). However, among Non-Hispanic Black children, those with access to recreational parks and facilities had 0.40 times the prevalence of obesity as compared to those without access, and this result was statistically significant (95% CI 0.17 to 0.90; table 3).

Table 2. Corrected adjusted prevalence ratios (PRs) and 95% CIs of the association between access to recreational parks and facilities and childhood obesity, 2007 National Survey of Children’s Health

Variables	PR	95% CI
Recreational parks and facilities		
Yes	0.77	(0.55 to 1.07)
No	1.00	Referent group

This model was adjusted for age, race/ethnicity, maternal and paternal education, socioeconomic status, geographic location and living status.

Table 3. Association between access to recreational parks and facilities and childhood obesity stratified by race/ethnicity*

Variables†	Access to recreational parks and facilities
Race/ethnicity	Prevalence ratio 95% CI
Non-Hispanic White	0.89 (0.64 to 1.23)
Non-Hispanic Black	0.40 (0.17 to 0.90)
Hispanic	0.73 (0.28 to 1.81)
Other	0.80 (0.23 to 2.28)

*Breslow-Day test of homogeneity was statistically significant (p>0.0001).

†This model was adjusted for age, maternal and paternal education, socioeconomic status, geographic location and living status.

Results for steps 1, 2, 3 and 4 of the mediation analysis are displayed in table 4 . Access to recreational parks and facilities predicted childhood obesity (PR=0.79; 95% CI 0.69 to 0.91) and the potential mediator (physical activity) was associated with a slightly decreased odds of childhood obesity (PR=0.96; 95% CI 0.94 to 0.99). However, the model controlling for physical activity failed to support the hypothesis that physical activity mediated the association between access to recreational parks and facilities and childhood obesity.

Table 4. Degree to which physical activity mediates association between access to recreational parks and facilities and childhood obesity

Logistic regression	Access to recreational parks and facilities
	Prevalence ratio 95% CI
Access predicting obesity	0.79 (0.69 to 0.91)
Access predicting physical activity	1.26 (1.06 to 1.49)
Physical activity predicting obesity	0.96 (0.94 to 0.99)
Access predicting obesity, controlling physical activity	0.80 (0.70 to 0.91)

Discussion

Several studies have examined the relationship between environmental factors and obesity. Consistent with this study's findings, some studies have found that neighbourhoods with recreational parks and facilities are associated with lower rates of obesity among children.^{3 4 7} To

our knowledge, only a few studies have considered race/ethnicity as an effect modifier,¹³⁻¹⁵ and studies have not consistently found that race/ethnicity is an effect modifier of the association. One possible explanation is that some of the aforementioned studies had relatively small samples of minority groups.^{13 14} In addition, not all of these studies have been conducted among children.¹⁵ Furthermore, these studies have often been considered to be related, but with different outcomes (ie, physical activity and functional walking versus access), which may explain the inconsistent findings regarding whether race/ethnicity is an effect modifier.

The current study did have limitations. Misclassification may have been present in this study since obesity was assessed from the parent's self-report of their child's height and weight. Comprehending the exposure question could have been an issue for the parent responding to the survey. For example, the NSCH survey did not define neighbourhood boundaries and the question only asked parents about their child's access to recreational parks and facilities and not their actual use, thereby making the question a proxy for actual use. Also, the NSCH question combined all types of parks and facilities together, making it impossible to explore more individual effects of facilities. Furthermore, it is possible that parents may have only reported information on facilities that they deemed safe. Also, selection bias may be possible in the study because not all eligible children participated in the study (weighted overall response rate 46.7%).⁹

Despite these limitations, this study had strengths. This population-based study had a large sample size (n=44 278) and represented children of various racial/ethnic groups and rural/urban locations, which aids in generalising results to children in the USA. However, it should be noted that the low response rate and possibility of bias may limit the generalisability.

Despite the increased attention on childhood obesity, rates continue to rise in the USA. Studies are needed to assess the parks/facilities-obesity relationship since having such access may help reduce childhood obesity. Although some of the current study's results were not statistically significant after adjustment, they did reveal that access to recreational parks and facilities reduces the prevalence of obesity, particularly for some racial/ethnic subgroups. These findings may be important because previous research suggests that the prevalence of obesity is higher in minorities.^{8 13-15} Rates of childhood obesity have increased among all racial and ethnic groups since the 1970s; however, these rates are highest among minorities, thus highlighting health inequities.¹ If confirmed in other studies, it would be important for all communities to have safe access to recreational parks and facilities since such access may encourage physical activity and help to decrease rates of childhood obesity. However, since the association between access and obesity differs by race/ethnicity, it may be important for community leaders and policymakers to assist in creating tailored messages for these minority populations. Furthermore, since childhood obesity is a multifactorial problem, it is pertinent for researchers to employ a multidisciplinary approach to assess other issues that impact children, including access to healthy foods, cultural attitudes regarding body images, access to bike trails and sidewalks, community involvement and to determine whether these issues also differ by race/ethnicity.

Summary box

- Childhood obesity is a public health issue affecting millions of children. Research on the recreational parks/facilities-childhood obesity association is limited. In this large, population-based study, access was associated with decreased prevalence of obesity, and the strength of this association differed by a child's race/ethnicity.

What is already known on this subject

- Childhood obesity is a public health issue affecting millions of children.
- Multiple factors contribute to childhood obesity including: genetics, demographics, behavioral, and environmental.
- Research on the recreational parks/facilities- childhood obesity association is limited.

What this study adds

- While several studies have focused on the role of environmental factors in childhood obesity, most have considered factors such as community cohesion and access to healthy foods.
- In this large, population-based study, access was associated with decreased prevalence of obesity, and the strength of this association differed by a child's race/ethnicity.
- To assess the possible relationship between access to parks and facilities and childhood obesity, we used data from the 2007 NSCH focusing on this association among a diverse sample of over 40,000 children.
- This large sample size allowed for exploration of race/ethnicity as an effect modifier of the parks and facilities-obesity association.
- We believe that our findings will be of interest to the readers of the Journal of Epidemiology & Community Health since providing access to recreational parks and facilities is an important, and potentially modifiable, environmental factor that deserves increased attention in childhood obesity research.

Policy Implications

- Although this study is essential in the fight against childhood obesity it must also be addressed by the policy sector.
- It is imperative that legislators and policy makers address the pivotal role that recreational parks and facilities play in childhood obesity. Access to more recreational parks and facilities will encourage physical activity and alleviate health disparities.
- In addition, policymakers encouraging and funding programs that tailor messages to minority communities regarding access and obesity would be essential in bringing about a change in communities.

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to the acquisition, analysis and interpretation of data. She contributed to the conception of the study design, drafted and revised the article and gave her final approval to submit the article to the publishers. CRP contributed to the conception of the research design, revised the article for content and gave her final approval for publishing. AET contributed to the conception and design of the study, revised the article and approved the final copy for publishing.

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Data sharing statement: The 2007 National Survey of Children's Health can be found at the Child and Adolescent Data and Resource Center. Individuals can contact Julie Robertson and Nicolía Eldred-Skemp for the dataset and codebook.

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