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Association of neighborhood parks with child health in the United States

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Abstract

While there is evidence that parks support pediatric health, there have been no national studies. We assessed whether the presence of a neighborhood park is associated with pediatric physical or mental health across the U.S. using a nationally representative cross-sectional random sample of American children ages 0–17. Caregivers reported on the presence of parks in their child's neighborhood and the child's physical activity, screen-time, sleep, weight, and diagnosis of anxiety, depression, or attention deficit hyperactivity disorder (ADHD). Covariates included child and family sociodemographics and, for 29 states, neighborhood urbanicity. Caregivers reported on 49,146 children (mean age 9.4 years; 49% female). There were 11,791 (24%) children living in neighborhoods lacking a park; children in non-urban locations (aOR 2.19, 95% CI 1.40–1.67) or below the federal poverty level (aOR=1.48, 95%CI 1.38–1.58) had higher odds of lacking a park. Irrespective of sociodemographics, children lacking parks were more likely to have no physical activity each week (aOR1.36, 95% CI 1.24, 1.48), spend ≥ 4 hours per weekday in front of a screen (aOR=1.19, 95% CI 1.14, 1.25), or obtain inadequate sleep (aOR=1.23, 95% CI 1.18, 1.29). Children without parks were more likely obese (aOR=1.32, 95% CI 1.21, 1.43), overweight (aOR 1.25, 95%CI 1.17, 1.33), or diagnosed with ADHD (aOR 1.20, 95% CI 1.12, 1.29), but not more likely diagnosed with anxiety or depression (aOR=1.04, 95%CI 0.97, 1.11). Associations between parks and pediatric physical and mental health suggests that the provision of neighborhood parks could represent a low-cost childhood health intervention.

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Keywords

parks; greenspace; pediatric health; physical activity; sleep; screen-time; obesity; depression; anxiety; attention deficit hyperactivity disorder

Introduction

Recent evidence suggests that access to parks is important for pediatric health. Residential proximity to parks and greenspaces has been associated with more childhood physical activity (1), lower likelihood of being overweight (2) / obese (3–5), as well as greater emotional and behavioral health (6–8) and resilience (9). Park access has also been associated with fewer attention-deficit/hyperactivity disorder (ADHD) symptoms in children (10) and anxiety and depression diagnoses in adults (11,12).

The existing evidence for the association of parks and pediatric health has limitations. With exceptions (4,13,14), work to-date has tended to examine the relationship between parks and child health and health behaviors in small cohorts in particular communities (e.g., highly urban, localized to particular regions). Park associations with child health has not been examined broadly in a representative sample of the entire U.S. population, nor have country-wide socioeconomic correlates of neighborhood park presence been fully evaluated. For mental health outcomes, most research has examined greenspace as an exposure without specifying whether that greenspace is located in a park, and has largely focused on adults (12); there is limited evidence on the influence of parks on mental health outcomes in children and teens. Further, to the best of our knowledge no national studies have examined neighborhood park presence in relation to health behaviors--other than physical activity--that are important for child health.

We sought to determine whether the presence of a park or playground in the neighborhood (“park presence”) is associated with child health behaviors and outcomes using data from the National Survey of Children’s Health (NSCH) 2016, a nationally representative sample of children and adolescents aged 0–17. We hypothesized that poor, minority ethnicity, or urban populations are less likely to report having neighborhood parks and that neighborhood park presence is associated with pediatric health behaviors and health status.

Methods

Sample and exposure of interest

We drew our sample from the U.S. Census Bureau’s 2016 NSCH (21) (total N=50,212). U.S. households were selected randomly to receive mail-based surveys, with one child per household randomly selected to be the survey subject. Surveys were completed by a caregiver in the household familiar with the child who provided information on children’s physical and mental health, access to quality health care, and the child’s family, neighborhood, school, and social context.

We restricted our study sample to children and adolescents whose caregivers answered a survey question on park presence: “In your neighborhood, is there a park or playground?”

This study examined differences in outcomes for youth based on the exposure of interest: park presence.

Outcomes

It has been proposed that the health benefits of nature operate through three potential causal pathways, including the reduction of biophysical stressors (e.g., heat, noise, and air pollution), the provision of unique spaces for physical activity and social engagement, or the reduction of physiological and emotional arousal and restoration of cognitive resources (15–20). Based on this literature, we hypothesized that lacking a neighborhood park would be associated with lower levels of child physical activity, more screen-time, and less adequate sleep. We hypothesized that lacking a park would be associated with relatively common pediatric health status outcomes: overweight/obesity, anxiety, depression, and ADHD.

Table 1 present the primary study outcome measures, including three measures of child health behaviors (physical activity, screen-time, and sleep) and three measures of child health status (weight status, anxiety or depression diagnosis, and ADHD diagnosis). Secondary outcome measures included severity of mental disorder symptoms (mild/moderate vs. severe).

Covariates

Family socioeconomic status was measured via reported household income and parental education, which were examined separately in regression models. Household average annual income was publicly available for this sample as a percent of the federal poverty level (FPL) based on the US-Department of Health and Human Services guidelines (22). Families were categorized into groups of FPL: “0–99%,” “100–199%,” “200–399%,” “≥400%.” Caregivers reported on the highest level of education of any adult in the household considered a primary caregiver, categorized as “less than high school,” “high school or general-educational-diploma (GED),” “some college or technical school,” and “college degree or higher.”

Urbanicity was based on US-Census determination of a survey respondent’s home address being in a metropolitan principal city (MPC) or not. MPCs are counties with at least one urbanized area or urban cluster (core) with a population of ≥50,000. Youth were deemed “urban” if living within the largest incorporated or census-designated place within an MPC and “non-urban” if not living within the largest place or an MPC. Data are presented only for the 29 states which reported this variable (23). As a sensitivity analysis, we repeated analyses using the less conservative metric of living anywhere within an MPC rather than just the core; this did not change the results.

Statistical Approach

We summarized demographic characteristics of the sample and compared mean differences between youth with versus without parks using chi-squared tests and t-tests.

Using park presence as the dependent variable, we analyzed its association with urbanicity, poverty, and race/ethnicity as characteristics potentially associated with park presence using logistic regression. As not all states reported urbanicity, we adjusted for race and income only; as a sensitivity analysis among those residing in states with urbanicity data, we modeled the association between park presence and race and income in those with urbanicity=0 and urbanicity=1.

We then sought to determine whether park presence was associated with our primary outcomes: childhood health behaviors and physical and mental health status. We regressed each outcome individually onto park presence in univariate logistic regression models. We then created multivariable models for each outcome, independently regressed onto park presence while adjusting for family income, child age, sex, and race/ethnicity. These covariates were selected based on their association with child health and parks as reported in the literature (13), in addition to our findings from the models conducted with park presence as an outcome. Although both parent education and family income were associated with child health and park presence, these two characteristics were highly correlated; therefore, we only included income (which remained independently associated with our outcomes after adjustment, unlike education) in our final model. eTable 1 (Supplement) presents unadjusted associations of the outcome measures with the covariates. Finally, post hoc sensitivity tests repeated the adjusted logistic regressions: (1) stratifying by child age (3 groups: preschool, age 0–5; school-age, 6–12; and teenage, 13–17); (2) including a park-by-urbanicity interaction term to test for differences in associations by urban vs. rural; and (3) adding the health behaviors to the significant health-outcome models in order to determine whether park-health-outcome associations were occurring among the same individuals as park-health-behavior associations.

Survey weights were applied to all regression analyses following NSCH protocols using the “svyset” command in STATA with a single strata variable that indexed state of residence and household identifiers and centered strata for those with only one sampling unit. When survey weights are used the resulting estimates are representative of all non-institutionalized children aged 0–17 years in the U.S. (23). Analyses were conducted in Stata v15.1 (Stata Corporation, College Station, Texas).

Results

Park presence

Data were available on park presence for 49,146 children and adolescents (97.9% of sample, mean age 9.4 years, 49% female) (Table 2). There were no sex or age differences between youth missing parks data (n=1066) and youth with parks data, although youth missing data were from slightly lower socioeconomic status families (0.53 difference on a 4 point scale, $t=-17.246$, $p<.001$) and were more likely to be non-White ($t=5.283$, $p<.001$).

Of the youth with parks data, 11,791 (24%) lived in neighborhoods lacking parks (Table 2). Lack of a neighborhood park was associated with family income <100% of the FPL in bivariate analysis and remained so after adjusting for race/ethnicity (aOR 1.48, 95%CI: 1.38–1.58) (Table 3), Race/ethnicity was independently associated with likelihood of having a park, with non-White families being less likely to lack parks when compared to White families in both bivariate and multivariable analysis (Table 3). Non-urban families were significantly more likely to lack parks overall (aOR 2.26, 95%CI: 2.11–2.42) (Table 3).

Because the association of poverty or race/ethnicity with park presence may vary by urbanicity, information on which was inconsistently collected across states, we repeated logistic regressions in a subgroup with urbanicity data (28,845 families; 59% of the sample). In analyses stratified by those who did and those who did not live in an MPC, family income below the FPL increased the likelihood of lacking a park in both strata, while race was stratum-dependent (Table 3a). White, non-Hispanic families living outside of an MPC were more likely to lack parks than other ethnicities; however, among those in urban areas, African Americans were more likely than white, non-Hispanic families to lack parks (Table 3a). An interaction term between race and urbanicity was not significant. Of note, urbanicity and race were highly correlated in this subgroup. Non-Hispanic Whites had three times greater odds of living in non-urban areas, while non-Hispanic Blacks were equally divided between urban and non-urban areas. Adjusting for income did not change these findings.

Park presence as a predictor of health behaviors and health status

Caregivers reported levels of physical activity in the past week for 34,350 children and adolescents ages 6–17 years (67% of the analysis sample). 2,746 (8.0%) youth were not active at all over the past week. Youth lacking parks were more likely to experience no physical activity (OR 1.38, 95%CI: 1.27–1.51), and this was attenuated but held true even after adjusting for family income and child age, sex, and race/ethnicity (aOR 1.30, 95%CI: 1.20–1.42) (Table 4).

Caregivers reported screen-time for 48,763 (99%) children and adolescents. 17,564 (36%) youth spent an average of ≥4 hours in front of screens each weekday. Youth lacking parks were more likely to receive excessive weekday screen-time (Table 4). This finding held after adjustment for family income and child age, sex, and race/ethnicity (aOR 1.15, 95%CI: 1.10–1.20).

Caregivers reported sleep-adequacy for 47,916 (97%) children and adolescents >4 months old. 13,994 youth (29%) received less than the age-recommended sleep. Youth lacking parks were more likely to receive inadequate sleep (Table 4). This finding held after adjustment for family income and child age, sex, and race/ethnicity (aOR 1.18, 95%CI: 1.13–1.24).

Caregivers reported BMI status for 24,128 (49%) children and adolescents age 10–17. Of these, 3,062 (13%) were categorized as obese only, and 6,499 (27%) were categorized as either overweight or obese. Youth lacking parks were more likely to be obese (aOR 1.25, 95%CI: 1.15–1.36), and also more likely to be either overweight or obese (aOR 1.20, 95%CI: 1.13–1.28) after adjustment for family income and child age, sex, and race/ethnicity (Table 4).

Caregivers reported on depression and anxiety diagnoses for 41,960 children and adolescents ≥3 years old. 4,032 (9.6%) youth had a current diagnosis of either depression or anxiety. Youth lacking parks were more likely to have a current diagnosis of anxiety or depression (OR 1.16, 95%CI: 1.08–1.25) but the association was non-significant after adjustment for family income and child age, sex, and race/ethnicity (aOR 1.04, 95%CI: 0.97–1.12). Considering current and past diagnoses together did not change the results. For children with a diagnosis, park presence was not significantly associated with disorder severity for depression (aOR 1.09, 95%CI: 0.88–1.35) or anxiety (aOR 1.04, 95%CI: 0.89–1.21).

Caregivers reported on ADHD diagnoses for 41,944 children and adolescents (85%) ≥3 years old. 4,151 (9.9%) youth had a current ADHD diagnosis. Youth who lacked parks were more likely to have a current diagnosis of ADHD (Table 4). This finding held after adjustment for family income and child age, sex and race/ethnicity (aOR 1.17, 95%CI: 1.09–1.26). Considering current and past diagnoses together did not change the results. For children with diagnosed ADHD, park presence was not significantly associated with disorder severity (aOR 1.13, 95%CI: 0.98, 1.30).

Post hoc sensitivity tests

We conducted three sensitivity tests repeating the adjusted logistic regressions. First, we stratified analyses by child age-group: preschool, school-age, and teenage youth (Supplement eTable 2). We found that while effect sizes differed between groups, the overall pattern of results remained the same with two notable exceptions: (1) the association of parks with sleep-adequacy was non-significant in the teenage group (aOR 1.06, 95%CI: 0.98–1.14), and (2) the associations of parks with screen-time and parks with ADHD diagnosis were non-significant in the preschool-age group (screen-time aOR 1.10, 95%CI: 0.97–1.24; ADHD aOR 1.45, 95%CI: 0.97, 2.15).

Second, we included a park-by-urbanicity interaction term to test for differences in associations by urban vs. rural. Interaction terms were non-significant in all models (p-values from .066–.522) except for the model predicting screen-time (p=.001); park-screen-time associations were significantly greater among urban-dwelling youth (aOR=1.41, 95%CI: 1.23–1.62, N=8,541) than rural-dwelling youth (aOR=1.11, 95%CI: 1.04–1.19, N=20,083). Additional follow-up tests probing the borderline non-significant interaction term (p=.066) for the model predicting overweight status revealed that while park presence was significantly associated with overweight status among urban-dwelling youth (aOR=1.25, 95%CI: 1.13–1.37, N=3,790), there was no significant association between park presence and overweight status among rural-dwelling youth (aOR=1.01, 95%CI: 0.83–1.23, N=10,344).

Third, we tested whether the park-health-status associations were occurring among the same individuals as the park-health-behavior associations by adding the significant health behaviors (physical activity, screen-time, and sleep-adequacy) to the significant health-status models (predicting weight status and ADHD diagnosis). In both models park presence remained statistically significantly associated with the health status outcomes, with modest effect size attenuation (attenuated aOR for overweight =1.18 compared to unattenuated aOR=1.20, 10% attenuation; attenuated aOR for ADHD =1.15 compared to unattenuated aOR=1.17, 17% attenuation). This indicated that there was partial but limited overlap among the individuals displaying parks-related differences in health behaviors and health status.

Discussion

This study, using a large, U.S.-representative cross-sectional survey, produced five findings. First, by caregiver report, approximately a quarter of American children lacked a neighborhood park. While there were socioeconomic, geographic, and racial/ethnic variations in park presence, no straightforward pattern was identified. As hypothesized, children living in poverty were more likely to lack parks whether they lived in urban or non-urban settings and regardless of their race. There were racial differences in park presence across the U.S., with white families reporting, on average, lower park rates. In urban settings specifically, however, Black non-Hispanic youth were more likely to lack parks, independent of family income. Our findings should be qualified by the caveat that while we report on differences in the presence of neighborhood parks (24,25), racial and income disparities remain in the safety, maintenance, desirability, and use of parks (26–28).

Few studies have examined neighborhood park presence and sociodemographic factors across the full U.S. (25,29), including the urban-rural divide. Contrary to our hypothesis, children living outside urban areas were more likely to lack parks, although this information was gathered only in 29 of 50 states. Others have reported that children living outside major cities and in rural areas face numerous barriers in accessing useable open spaces, such as living farther from parks (30), being less physically active in parks when they visit (31,32), and having access to fewer recreation facilities within parks (33,34). To the extent that these disparities influence health behaviors, park presence could be one contributor to known differences in general health, physical activity, and obesity between urban and non-urban Americans (35).

Second, youth who lacked parks were more likely to demonstrate poor health behaviors, including having: no weekly physical activity, excess recreational screen-time, and inadequate sleep. While park-physical activity associations were present across all age groups, screen-time associations were not present among preschool-age children and sleep-adequacy associations were not present among teenagers. Other factors, such as parental permissiveness or daily school-schedules, may outweigh the influence of parks at these ages. While park presence may subtly influence pediatric health overall, individual modifiable behaviors may differ across developmental stages.

Park presence has been previously associated with physical activity in preschool (36), school-aged (37), and teenage youth (38). Experimental studies have reported that when children are asked to increase physical activity, the extent of increase varies by proximity to parks (39). Other factors such as park amenities (40,41), parent perceptions of safety (42), child gender (43), and neighborhood social (26) and built (44) factors modulate whether a neighborhood park is used for physical activity. Our findings indicate that neighborhood park presence is associated with greater likelihood of physical activity across all ages of youth in the U.S.

Less is known about parks and pediatric screen-use or sleep-adequacy. While some studies have reported that neighborhood amenities can provide children alternatives to screen-use (45,46), others found no link between the built-environment and screen-time (2,47,48). A recent study in Germany and Australia, meanwhile, reported no robust association of neighborhood green-space with youth sleep-adequacy (49). Our study suggests that this domain warrants further investigation, with particular focus on differential effects at different ages and, potentially, levels of urbanicity.

Third, youth who lacked parks were more likely to be overweight or obese. This finding replicates past reports about parks and child weight (50, 51). Singh et al (2007) reported that U.S. children without parks had a 20% higher risk of obesity and a 22% higher risk of being overweight (2). The Southern California Children's Health Study, a cohort of children ages 9–10, found that having a park within 500m of a child's home was associated with lower BMI at age 18 (5). Others have not, however, replicated these findings (52). Notably, we found that weight status associations with parks were most pronounced in urban-dwelling youth. The potential for provision of parks to help address pediatric obesity deserves further investigation.

Fourth, youth who lacked parks were not more likely to have a diagnosis of anxiety or depression, nor to have more severe presentations. These findings differ from past reports of associations between neighborhood greenspace and pediatric mental health outcomes. This may represent an inability of previous findings to generalize to the wider U.S. (53), or, alternatively, may be related to our sample's reliance on clinical diagnoses, which overlook the dimensional aspect of mental illness. It may also reflect a difference in how exposure was measured. Most research on the built-environment and mental health has investigated exposure to nature or greenspace (7), whereas here NSCH families were asked specifically about parks/playgrounds. Research on greenspace may not necessarily translate to conclusions about parks and playgrounds (30). Future research should clarify the added value of greenspace in parks in addition to facilities/amenities. Finally, much of the greenspace-mental-health research focuses on adults. It is possible that psychological benefits of green-space take time to emerge: in a Danish nation-wide study (N>900,000), Engemann el al. (2019) found that children with low-levels of greenspace exposure demonstrated 55% higher risk of psychopathology than peers later in life (54).

Fifth, youth who lacked parks were more likely to have an ADHD diagnosis, though not a more severe presentation. Others have shown that access to greenspace or outdoor play can reduce ADHD symptoms (55,56), and that brief exposure to green outdoor settings improves child impulse control. A study of 59,754 Chinese kindergarten students reported that greenspace within 500m of a school was associated with lower risk of ADHD symptoms (57). Our study reinforces the concept that parks may help address this common childhood developmental concern.

This study has notable limitations. First, our park measure was based on caregiver report and did not include information on objective park-presence, quality, or frequency of use; however, caregiver perceptions of park presence are reportedly more indicative of a child's park use than objective measures (52, 54, 58). Second, the cross-sectional design and single-reporter method could have introduced inflationary bias into the estimates of associations. Relatedly, it is likely that there were more complex patterns of association among the variables than those modeled in this study, with potential mediation of health status by health behaviors. Our goal in this study was to provide an initial overall test of associations of parental reports of neighborhood park presence with pediatric health outcomes across the wider United States. Future studies could better estimate effects using longitudinal methods or analytic approaches that allow modeling complex pathways among parks and health behaviors and endpoints (59), as well as measures of objective land-use, park quality, and park use. Third, reliance on caregiver report for child health could have resulted in misclassification for some outcomes, such as those where caregiver and child reports do not always agree (e.g., physical activity frequency) (60),where caregivers may have estimation difficulty (e.g., weight) (61), or where clinical practice differs from parent recollection (e.g., mental disorder diagnoses). Fourth, measures of neighborhood socioeconomic status and quality were not included. Fifth, this observational study cannot prove causation.

Conclusion

While most American children have a park in their neighborhood, those children without a park are more likely inactive, have too much screen-time, get too little sleep, are more likely overweight, and suffer more from ADHD symptoms. Our findings suggest that low-income and non-urban residents should be included in future studies and policy decisions around the provision of parks. We suggest further research into the differences between park presence and park access when considering race and the health benefits of nearby parks. Our findings suggest that there may be broad benefits of neighborhood parks for children.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations:

ADHD	Attention Deficit Hyperactivity Disorder
BMI	Body Mass Index
FPL	Federal Poverty Level
MPC	Metropolitan principal city
NSCH	National Survey of Child Health
US	United States

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Table 1.

Study health behavior and outcome measures.

Domain	Measure	Description	Age range	N (% of analytic sample)
Health behaviors	Physical activity	Physical activity was measured via caregiver response to the question, "During the past week, on how many days did this child exercise, play a sport, or participate in physical activity for at least 60 minutes?": "0 days", "1–3 days", "4–6 days", or "every day." Responses were dichotomized to 0 days vs. ≥1 days based on evidence that consistently inactive children are less healthy than their peers (62–64).	6–17 years	34,350 (67%)
	Screen-time	Screen-time was measured via caregiver response to two questions about the child's average *weekday* use of electronics, including "time spent in front of a TV watching TV programs, videos, or playing video games," and "time spent with computers, cell phones, handheld video games, and other electronic devices, doing things other than schoolwork?": "no use", "less than 1 hour per day," "1–3 hours per day," and "4 hours or more per day." Responses were dichotomized to ≥ 4 hours vs. <4 hours following current standards in the literature (e.g., 65).	0–17 years	48,763 (99%)
	Sleep-adequacy	Adequate sleep was measured via caregiver response to the question "During the past week, how many hours of sleep did this child get on an average weeknight?" Responses were dichotomized to adequate vs. inadequate sleep based on the American Academy of Sleep Medicine's recommendations for child sleep adequacy by age (66).	4 months-17 years	47,916 (97%)
Health outcomes	Weight status	Body mass index (BMI) was calculated based on caregiver's report of child height, weight, and age. Participants were categorized as "underweight" (less than 5^{th} percentile BMI-for-age), "healthy weight" (5^{th} to 85^{th} percentile), "overweight" (85^{th} to 94^{th} percentile), and obese (95^{th} percentile and above) (67). BMI status was dichotomized as overweight/obese vs. healthy/underweight. Sensitivity tests excluding underweight participants from the analyses did not change the results.	10–17 years	24,128 (49%)
	Anxiety or depression diagnosis	Anxiety or depression diagnosis was measured via caregiver report of current or past diagnoses of anxiety or depression. Responses were dichotomized as no or past diagnosis vs. current diagnosis. Sensitivity tests including past diagnosis with current diagnosis did not change the results. Caregivers also reported on severity of symptoms: mild/moderate vs severe.	3–17 years	41,960 (86%)
	ADHD diagnosis	ADHD diagnosis was measured via caregiver report of current or past diagnoses of ADHD. Responses were dichotomized as no or past diagnosis vs. current diagnosis. Sensitivity tests including past diagnosis with current diagnosis did not change the results. Caregivers also reported on severity of symptoms: mild/moderate vs severe.	3–17 years	41,944 (85%)

Table 2.

Sociodemographic characteristics of 2016 National Survey of Children's Health respondents with information on park presence (N=49,146)

	Total (n=49,146)		Park absent (n=11,791)		Park present (n=37,355)		
Characteristic	**n**	**(%)**	**n**	**(%)[a]**	**n**	**(%)[a]**	**p-value[c]**
Age, mean (sd)	9.4	(5.3)	10	(5.2)	9.2	(5.3)	<0.001[d]
Sex							0.50
Female	23,945	(48.7)	5,777	(24.1)	18,168	(75.9)	
Male	25,201	(51.3)	6,014	(23.9)	19,178	(76.1)	
Race/Ethnicity							<0.001
Non-Hispanic White	34,659	(70.5)	9,024	(26.0)	25,635	(74.0)	
Non-Hispanic Black	2,770	(5.6)	624	(22.5)	2,146	(77.5)	
Hispanic	5,370	(10.9)	1,030	(19.2)	4,340	(80.8)	
Other[b]	6,347	(12.9)	1,113	(17.5)	5,234	(82.5)	
Parental education							<0.001
< High school	1071	(2.2)	345	(32.2)	726	(67.8)	
High school/GED	5951	(12.1)	1926	(32.4)	4025	(67.6)	
Some college/ Technical school	10932	(22.2)	3150	(28.8)	7782	(71.2)	
College	30599	(62.3)	6194	(20.2)	24405	(79.8)	
Missing data	593	(1.2)	176	(29.7)	593	(100.0)	
Family income <100% FPL	4673	(9.5)	3306	(70.7)	1367	(29.3)	<0.001
Urbanicity							<0.001
Lives in MPC	8,611	(17.5)	1,273	(14.8)	7,338	(85.2)	
Live outside MPC	20,234	(41.2)	5,700	(28.2)	14,534	(71.8)	
Missing[e]	20,391	(41.5)	4,818	(23.6)	15,483	(75.9)	

[a]Percents shown are row percents.

[b]"Other" category includes Asian, Native American, and multiracial participants.

[c]P-values calculated using Chi-square test unless otherwise indicated.

[d]P-value calculated using a t-test.

[e]These data were not reported in all states.

MPC=Metropolitan Principal City, FPL=Federal poverty level

Table 3.

Unadjusted and adjusted logistic regression analyses of characteristics associated with park absence in 2016 National Survey of Children's Health

	Total (n=49,146)		Park absent (n=11,791)		Park present (n=37,355)		Unadjusted Analysis[b]		Adjusted Analysis[c]	
Characteristic	n	(%)	n	(%)[a]	n	(%)[a]	OR	95% CI	OR	95% CI
Urbanicity										
Lives in MPC	8,611	17.5	1,273	14.8	7,338	85.2	Ref			
Live outside MPC	20,234	41.2	5,700	28.2	14,534	71.8	2.26	(2.11, 2.42)		
Missing[b]	20,391	41.5	4,818	23.6	15,483	75.9				
Income below FPL	4,673	9.5	1,367	29.3	3,306	70.7	1.35	(1.26, 1.44)	1.48	(1.38, 1.58)
Race										
Non-Hispanic White	34,659	70.5	9,024	26.0	25,635	74.0	Ref		Ref	
Non-Hispanic Black	2,770	5.6	624	22.5	2,146	77.5	0.83	(0.75, 0.91)	0.76	(0.70, 0.84)
Hispanic	5,370	10.9	1,030	19.2	4,340	80.8	0.67	(0.63, 0.72)	0.64	(0.59, 0.69)
Other	6,347	12.9	1,113	17.5	5,234	82.5	0.60	(0.56, 0.65)	0.59	(0.55, 0.64)

MPC=Metropolitan Principal City, FPL=Federal poverty level

[a]Percents shown are row percents.

[b]ORs calculated using logistic regression models, with park absent as the dependent variable.

[c]Analyses adjusted for race or income.

Table 3a.

Unadjusted and adjusted logistic regression analyses of characteristics associated with park absence in 2016 National Survey of Children's Health respondents living in 29 states with MPC data collected (n=28845)

	Total (n=49,146)		Park absent (n=11,791)		Park present (n=37,355)		Unadjusted Analysis[b]		Adjusted Analysis	
Characteristic	**n**	**(%)**	**n**	**(%)[a]**	**n**	**(%)[a]**	**OR**	**95% CI**	**OR**	**95% CI**
Living in MPC	8611	(29.9)	1273	(14.8)	7338	(85.2)				
Income below FPL	1050	(12.2)	205	(19.5)	845	(80.5)	1.47	(1.25, 1.74)	1.43	(1.20, 1.70)
Race										
Non-Hispanic White	4908	(57.0)	702	(14.3)	4206	(85.7)	Ref		Ref	
Non-Hispanic Black	989	(11.5)	186	(18.8)	803	(81.2)	1.39	(1.16, 1.66)	1.26	(1.04, 1.51)
Hispanic	1410	(16.4)	196	(13.9)	1214	(86.1)	0.97	(0.81, 1.15)	0.90	(0.75, 1.07)
Other	1304	(15.1)	189	(14.5)	1115	(85.5)	1.01	(0.85, 1.21)	0.99	(0.83, 1.18)
Living outside MPC	20234	(70.1)	5700	(28.2)	14534	(71.8)				
Income below FPL	1897	(9.4)	665	(35.1)	1232	(64.9)	1.43	(1.29, 1.57)	1.53	(1.38, 1.69)
Race										
Non-Hispanic White	15065	(74.5)	4547	(30.2)	10518	(69.8)	Ref		Ref	
Non-Hispanic Black	933	(4.6)	238	(25.5)	695	(74.5)	0.79	(0.68, 0.92)	0.75	(0.64, 0.87)
Hispanic	2111	(10.4)	486	(23.0)	1,625	(77.0)	0.69	(0.62, 0.77)	0.66	(0.59, 0.73)
Other	2125	(10.5)	429	(20.2)	1696	(79.8)	0.58	(0.52, 0.65)	0.57	(0.51, 0.64)

MPC=Metropolitan Principal City, FPL=Federal poverty level

[a] Percents shown are row percents.

[b] ORs calculated using logistic regression models, with park absence as the dependent variable.

Table 4.

Unadjusted and adjusted logistic regression analyses of association between park absence and behavioral, physical, and mental health outcomes among 2016 National Survey of Children's Health respondents

	Total		Park absent (n=11,791)		Park present (n=37,355)		Unadjusted Analysis[b]		Adusted Analysis[c]	
Outcome for individual models	n	(%)	n	(%)[a]	n	(%)[a]	OR	(95% CI)	OR	(95% CI)
Behavioral outcomes										
Report no physical activity	2,746.00	(8.0)	863	(31.4)	1,883.00	(68.6)	1.38	(1.27, 1.51)	1.30	(1.20, 1.42)
≥4 hours screentime/day	17,564.00	(35.9)	4739	(27.0)	12,825.00	(73.0)	1.29	(1.23, 1.34)	1.15	(1.10, 1.20)
Inadequate sleep	13,994.00	(28.5)	3738	(26.7)	10,256.00	(73.3)	1.23	(1.17, 1.28)	1.18	(1.13 1.24)
Health outcomes										
Obese	3,062.00	(12.7)	953	(31.1)	2,109.00	(68.9)	1.30	(1.19, 1.41)	1.25	(1.15, 1.36)
Overweight/Obese	6,499.00	(26.9)	1918	(29.5)	4,581.00	(70.5)	1.23	(1.16, 1.31)	1.20	(1.13, 1.28)
Anxiety and/or depression[d]	4,032.00	(9.6)	1093	(27.1)	2,939.00	(72.9)	1.16	(1.08, 1.25)	1.04	(0.97, 1.12)
ADHD[d]	4,151.00	(9.9)	1198	(28.9)	2,953.00	(71.1)	1.28	(1.19, 1.38)	1.17	(1.09, 1.26)

[a] Percents shown are row percents.

[b] ORs calculated using logistic regression models, with park absent as the independent variable.

[c] Adusted for age, sex, race/ethnicity, and family income.

[d] Current diagnosis.

Note. Tests were conducted using only individuals with complete data on the outcomes and covariates. No data were imputed.