

# Where Are Youth Active? Roles of Proximity, Active Transport, and Built Environment

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## ABSTRACT

GROW, H. M., B. E. SAELENS, J. KERR, N. H. DURANT, G. J. NORMAN, and J. F. SALLIS. Where Are Youth Active? Roles of Proximity, Active Transport, and Built Environment. *Med. Sci. Sports Exerc.*, Vol. 40, No. 12, pp. 2071–2079, 2008. **Purpose:** This study examined factors related to two sources of physical activity for youth: active use of recreation sites and active transport to recreation sites. **Methods:** Parents of children ( $n = 87$ ) and matched pairs of parents and adolescents ( $n = 124$  pairs) in three US cities reported on youths' active use of, proximity to, and walking/biking to 12 recreation sites and on neighborhood walkability and safety. Multivariate regression models evaluated factors associated with youths' frequent site use and active transport to sites. **Results:** Proximity to the site was associated with frequent use of large parks and public open space. Walking/biking to the site was associated with frequent use of most sites (indoor recreation sites, small and large parks, basketball courts, walking/running tracks, school recreation sites, playgrounds, and public open space). After controlling for proximity and demographic factors, active transport to sites remained significantly associated ( $P < 0.05$ ) with frequent use of four sites for children (indoor recreation, walking/running tracks, school recreation facilities, and public open space) and all but three sites for adolescents (indoor recreation, playfields/courts, and beach/lake/rivers). Adolescents' active transport to more sites was most positively related to higher perceived traffic safety and to better pedestrian infrastructure and was negatively related to crime threat. Adolescents with driver's licenses walked/biked to recreation sites less often. **Conclusions:** Active transport was strongly associated with the use of multiple recreation sites by children and adolescents, even when accounting for proximity and demographic factors. Adolescents living in neighborhoods with better traffic safety walked/biked to more recreation sites for physical activity. Findings support the need for built environments and transportation policies that facilitate safe, active transport to recreation sites for youth physical activity. **Key Words:** CHILDREN, ADOLESCENTS, PHYSICAL ACTIVITY, RECREATION SITES, WALKING, BICYCLING

Many children and adolescents engage in low levels of physical activity. On the basis of accelerometer measurements, only 42% of youth aged 6–11 yr achieve recommended physical activity levels (60 min·d<sup>-1</sup> on at least 5 of 7 d), and less than 10% of adolescents achieve recommended levels (39). These more

objective measures are much lower than previously self-reported estimates for youth (6) and adolescents (27). The current low rates may reflect evidence of a decline in US youth physical activity for the last 20 yr (13). Given the link between low activity and obesity and associated chronic diseases (12), the need to increase physical activity among youth is clear (5,22).

Research into the places where children and adolescents are physically active is necessary to help understand factors affecting youth physical activity (16). The most studied locations for child physical activity are school (including active transport to school), neighborhood streets, and parks (4,7,21,31,36,37). At least one study has reported that adolescents use a variety of physical activity settings (19). Greater proximity to the site in which physical activity occurs, perceived traffic/road safety, and neighborhood transport infrastructure, such as sidewalks and controlled intersections, have been related to physical activity at

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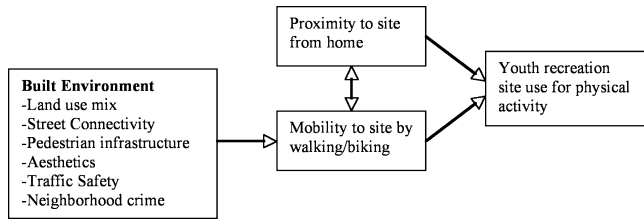


FIGURE 1—Conceptual model of possible contributory factors to recreation site use for youth physical activity.

individual sites for children (10). For adolescents, neighborhood crime incidence has also been found to negatively relate to physical activity (14,17).

More comprehensive information is needed on community settings in which youth physical activity occurs (23,32). This information can inform public health professionals, policy makers, and planners about how to design communities and recreation facilities that facilitate more physical activity (22,32). For example, although overall levels of walking among youth are related to access to recreation sites (15), studies have not yet determined whether frequency of recreation site use is related to accessibility by active transport (i.e., walking/biking) to sites (33).

The present study objectives were to investigate 1) which types of community recreation sites children and adolescents use most often for physical activity, 2) whether proximity and active transportation to recreation sites are related to site use, and 3) the neighborhood environmental factors associated with active transportation to frequently used sites (see Fig. 1 for this study's conceptual model).

## METHODS

**Participants.** Participants were recruited in Boston, Cincinnati, and San Diego metropolitan areas by mail, phone, and in-person with a sampling strategy to achieve variation in income, race-ethnicity, neighborhood walkability, and geographic location within each metropolitan area. Each respective research institution granted human subjects' approval. Participants gave written consent (parents) and assent (adolescents). Parents of 5- to 18-yr-old children were eligible, as were the 11- to 18-yr-old adolescents of these parents. Response rates varied by study site and by recruitment method. In San Diego, a "cold-calling" phone method achieved a 54% response rate from eligible participants, whereas recruitment at community centers and events resulted in a 15% response rate. In Cincinnati, 73% returned at least one survey among those who agreed by phone. In Boston, the response rate after face-to-face contact and phone prompting was 48% of those who agreed to participate.

A test-retest study design was used to evaluate the reliability of all measures except demographic information.

Average time between completing the two surveys was 27 d. Across sites, 74% of parents and 62% of adolescents who consented to participate completed both surveys 1 and 2. Participants received \$20 for completing both surveys. Only responses from the first survey were used in the present study, with the exception of test-retest reliability analyses. Complete data on questions of interest for this study were available for 87 parents of children and for 124 matched parents and adolescents (representing 90%, 65%, and 66% of the entire respective samples that returned surveys). Table 1 presents demographic data for child and adolescent participants, including child sex, child age, parent or adolescent ethnicity, parent or adolescent race, parent education, and whether the adolescent had a driver's license.

**Measures.** Twelve different recreation site types were included in the survey: "indoor recreation or exercise facility (public or private)," "other playing fields/courts (e.g., soccer, football, softball, tennis skate park, etc.)," "swimming pool," "basketball court," "walking/running track," "school recreation facilities open to the public," "small public park," "large public park," "public playground with equipment," "beach, lake, river or creek," "bike/hiking/walking trails, paths," and "public open space (grass or sand/dirt) that is not a park." These site types were based on formative research using qualitative interviews (unpublished data) and prior research (37). No further definitions of these sites were provided in the actual survey, so participants were allowed to interpret these site categories at their discretion. Frequency of use at the 12 different recreation site types was assessed by asking, "Please tell us how often your child is active in the following places," with each site listed. Response options were "never," "once a month or less," "once every other week," or "once a week or more." Given these response options, no recall time frame was specified (such as "usually or typically"). Proximity to sites was assessed by asking "About how long would it take you to walk (on your own without your children) from your home to the nearest recreation place listed below? ("1-5min," "6-10 min," "11-20 min," "21-30 min," "31+ min," or "do not know"). The survey specified walking "on your own without your children" for parents only (not for adolescents) to clarify for adults to estimate their own walking times. Active transport (walking/biking) to each site

TABLE 1. Participant demographic characteristics.

Characteristics	Parents of Children, N = 87	Adolescent Self-Report, N = 124
Child's sex, % female	49.4	47.6
Child's age (yr), mean $\pm$ SD	7.6 $\pm$ 1.7	14.4 $\pm$ 1.7
Ethnicity, % non-Hispanic	90.8	91.1
Race (%)		
White	80.5	75.0
Black	9.2	18.8
Asian/Pacific Islander	0	2.7
Other	5.7	3.6
Parent education, $\geq$ college (%)	50.6	54.8
Adolescent with driver's license (%)	—	14.5

was asked as, “If your child goes there, does he/she usually walk or bike there (alone or with someone else)?” (“yes” or “no”). Self-report adolescent questions were worded equivalently.

Frequency of site use was dichotomized to at least once every other week or not (similar to the reclassification used in the adult literature) (24) to capture the breadth of sites that youth might use for activity with some regularity. Proximity of each site to home was also dichotomized as  $\leq 10$ -min walk or  $> 10$ -min walk. This is a lower but similar value used as a cut-point among adults (24). Responses of “do not know” regarding a site’s proximity were recategorized into the  $> 10$ -min walk category. Missing responses ( $< 5\%$  of responses) on whether the youth “usually walked or biked” to each site were recoded as *not walking/biking to the site*.

Environmental variables were based on the Neighborhood Environment Walkability Scale (NEWS; available at <http://www.activelivingresearch.org/node/10649>) that has substantial evidence of reliability and validity (2,29). Perceived neighborhood environmental factors included *land use mix* (the level of integration of different land uses, including residential, office, retail/commercial, and public space), *street connectivity* (the directness of path between two points related to the characteristics of street design), and *pedestrian infrastructure* (the assessment of physical features that promote walking, such as paths, sidewalk continuity, traffic signals, and lighting), neighborhood aesthetics, traffic safety, and crime threat. Responses in each domain are based on a four-point scale: 1 = strongly disagree, 2 somewhat disagree, 3 = somewhat agree, and 4 = strongly agree. Higher scores indicate higher values for each construct. For example, higher traffic safety indicates higher perceived safety from traffic; higher crime threat indicates higher perceived threat and thus lower perceived safety from crime.

**Analysis.** Separate analyses were conducted for each respondent sample (i.e., parents of children, parents of adolescents, and adolescents). Assessment of the test–retest reliability without replacing missing or “do not know” responses was performed for each item (site use, proximity, walk/bike) and subscale (built environment constructs) using one-way random-effects single-measure intraclass correlations.

Separate chi-square tests were used to analyze relations between frequency of active use of site (once every other week or more vs less often) and proximity and active transport to *each* recreation site. Multivariate logistic regression with Poisson distribution (to obtain more conservative estimates of association than odds ratios for frequencies  $> 10\%$ ) (26,35) was used to analyze frequency of site use with factors including site proximity, active transport to the site, and the demographic variables of sex, ethnicity (Hispanic/non-Hispanic), race (white/nonwhite), parent education (completed college/less than college), city, and adolescent driver’s license.

Analyses of built environment factors and number of sites to which youth walked/biked were only conducted for adolescents (both parent and self-report) given the stronger and more consistent associations between active transport and active site use for adolescents compared with children. ANOVA was used to test differences in each perceived neighborhood environment construct between adolescents who usually walked/biked to the median number of sites or more (five sites or more) versus fewer sites. Multivariate linear regression models with Poisson distribution were then used to examine all built environment constructs in relation to the continuous number of sites to which adolescents walked or biked; analyses were conducted first unadjusted, then adjusted for demographic factors, and then also adjusted for proximity (itself statistically related to walking/biking). Proximity was defined as the sum of the number of recreation sites within a 10-min walk from home. All statistical tests were two-tailed and considered significant at the  $P < 0.05$  level, with no adjustments made to  $P$  values for conducting multiple tests.

## RESULTS

Test–retest reliability for active use of, proximity to, and active transport to/from recreation sites ranged from fair to very good for parents (ICC = 0.32 to 0.75) and adolescents (ICC = 0.25 to 0.77). “Public open space” had the lowest reliability coefficients (ICC = 0.25 to 0.60), whereas “beach/lake/river/creek” recreation place had consistently high reliability (ICC = 0.54 to 0.77). Complete test–retest reliability results are available from the authors (and at <http://www.drjamesallis.sdsu.edu>).

**Most commonly used recreation sites.** For parent report of younger children, the mean number of sites used at least every other week was 4.9 (SD = 2.6, range = 0–12). By self-report, adolescents were active at a mean of 3.6 locations (SD = 3.0, range = 0–12 locations) at least every other week; for parent report of adolescents the mean was 3.4 sites (SD = 2.7, range = 0–10 sites). Active use of a site at least once every other week among children ranged from 20% for walking/running tracks to 68% for swimming pools. Among adolescents, the frequent active use of sites ranged from 20% for playgrounds to 43% for play fields/courts. The percentage of children (by parent report) using each site for physical activity at least every other week was generally higher than for adolescents (by both parent and self-report), with the exception of basketball courts, walking/running tracks, and trails (Fig. 2). The five most commonly used sites among children were swimming pools, small public parks, playgrounds, play fields/courts, and large public parks. By adolescent report, most commonly used sites were play fields/courts, indoor recreation facilities, swimming pools, small and large parks, and walk/run tracks. Adolescents self-reported slightly more active use of most specific sites than parents reported for the same adolescents.

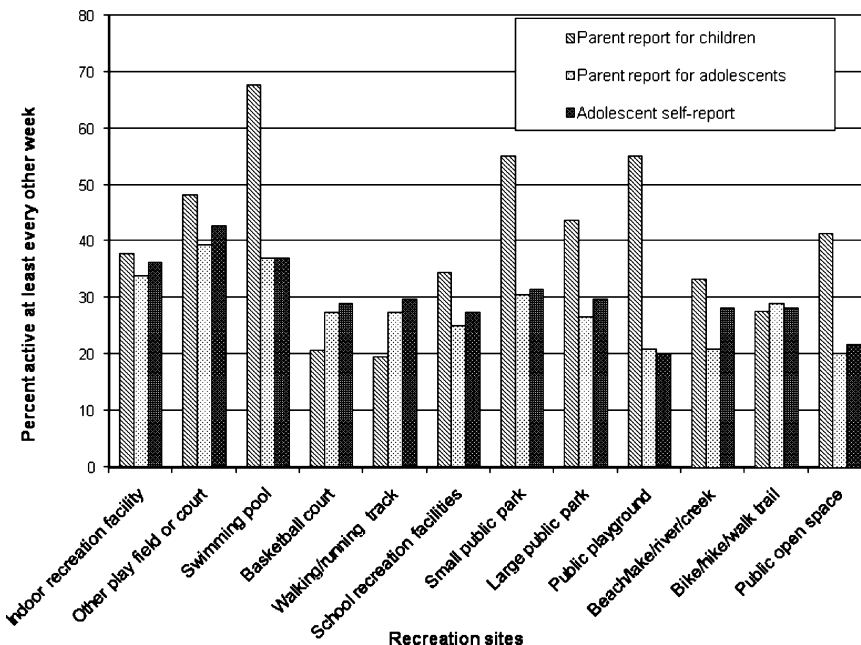


FIGURE 2—Percent of youth active at recreation site at least once every other week, by age and respondent.

### Factors Associated With Frequent Recreation Site Use

**Proximity and active site use.** Parents of children reported a mean of 3.8 recreation sites (SD = 3.1) within a 10-min walk from home. Parents of adolescents reported a mean of 4.7 sites (SD = 3.3) within a 10-min walk from home, and adolescents reported a mean of 5.1 sites (SD = 3.0). In bivariate analysis, living within a 10-min walk of a recreation site was associated with more frequent active use of some sites, with variability by child age and respondent (Table 2). Living closer to large public parks and public open space increased the likelihood of being active at these sites regardless of age. These were the only sites for which proximity was related to more use among children <11 yr

old. Among adolescents, the association between site use and proximity was significant for the majority of sites by both parent and adolescent report. However, being closer was not related to more frequent active use of indoor recreation facilities, other play fields/courts, and basketball courts for adolescents (by either parent or adolescent report).

**Walking/biking to/from the site and active site use.** Parents reported their children walked/biked to a mean of 3.2 sites (SD = 2.9) and their adolescents walked/biked to a mean of 3.8 sites (SD = 3.4). Adolescents reported walking/biking to a mean of 4.5 sites (SD = 3.4). For children and adolescents, usually walking/biking to the site was significantly associated with frequent active use of most recreation sites, including indoor recreation sites,

TABLE 2. Percent of youth frequently active at sites by proximity and by walking/biking to sites.

	Parent Report for Children, N = 87		Parent Report for Adolescents, N = 124		Adolescent Self-Report, N = 124	
	Close Proximity, Active* (%)	Walk/bike, Active† (%)	Close Proximity, Active* (%)	Walk/bike, Active† (%)	Close Proximity, Active* (%)	Walk/bike, Active† (%)
Indoor recreation facility	34.8	72.7‡	31.0	54.5‡	42.9	53.8‡
Other play field or court	44.7	61.1	41.3	58.3§	45.3	55.6
Swimming pool	66.7	81.8	50.0‡	44.4	50.0‡	58.5§
Basketball court	27.5	45.5§	26.1	57.5§	32.9	43.4§
Walking/running track	22.2	68.8§	45.9§	62.5§	38.1	56.8§
School recreation facilities	44.4	70.8§	40.6‡	56.7§	36.6	44.4§
Small public park	65.9	73.7§	38.2‡	52.4§	43.2§	50.0§
Large public park	69.2‡	68.8‡	55.9§	59.0§	47.6§	48.1§
Public playground	57.9	71.1‡	30.8§	43.1§	31.4§	37.3§
Beach/lake/river/creek	27.8	30.8	34.8	42.9§	46.2‡	48.5§
Bike/hike/walk trail	36	40	45.8§	52.0§	38.8‡	49.1§
Public open space	59.5§	63.2§	30.4‡	45.5§	36.0§	50.0§

\* Chi-square test significance reported for difference between percent active among those living ≤ 10-min walk from home compared with > 10-min walk.  
 † Chi-square test significance reported for difference between percent active among those usually walking/biking to site compared with those not usually walking/biking.  
 ‡ P < 0.05.  
 § P < 0.01.

TABLE 3. Rate ratios (95% CI) of frequent site use in multivariate model with proximity and walk/bike.\*

Recreation site	Parent Report for Child, N = 87		Parent Report for Adolescent, † N = 124		Adolescent Self-Report, † N = 124	
	Proximity	Walk/bike	Proximity	Walk/bike	Proximity	Walk/bike
Indoor recreation facility	0.6 (0.3–1.5)	3.0‡ (1.1–7.9)	0.9 (0.4–1.9)	1.9 (0.9–3.8)	1.2 (0.6–2.2)	1.8 (0.9–3.5)
Other play field or court	0.9 (0.5–1.7)	1.5 (0.7–3.1)	0.8 (0.4–1.5)	1.8 (1.0–3.6)	1.1 (0.6–2.0)	1.5 (0.8–2.7)
Swimming pool	0.9 (0.4–1.6)	1.5 (0.8–2.8)	2.1‡ (1.1–4.1)	1.1 (0.6–2.1)	1.4 (0.8–2.7)	1.9‡ (1.0–3.5)
Basketball court	1.3 (0.5–3.5)	2.6 (0.9–7.9)	0.6 (0.3–1.2)	4.5§ (2.1–9.8)	1.0 (0.5–2.3)	2.1‡ (1.0–4.6)
Walking/running track	0.6 (0.2–2.0)	11.6§ (3.4–38.8)	2.0‡ (1.0–4.1)	4.6§ (2.1–10.2)	1.2 (0.6–2.3)	3.3§ (1.6–7.1)
School recreation facilities	0.9 (0.4–2.1)	3.9§ (1.7–8.6)	1.1 (0.5–2.7)	4.4§ (1.8–11.2)	1.3 (0.6–2.8)	2.3‡ (1.1–4.9)
Small public park	1.2 (0.7–2.3)	1.7 (0.9–3.1)	1.0 (0.4–2.2)	6.0§ (2.2–16.2)	2.1 (0.7–6.6)	6.9§ (1.9–24.7)
Large public park	1.4 (0.6–3.3)	1.7 (0.7–4.1)	2.7‡ (1.1–6.3)	4.1§ (1.7–9.9)	1.4 (0.6–3.1)	2.9‡ (1.1–7.2)
Public playground	0.9 (0.5–1.7)	1.7 (0.9–3.1)	1.6 (0.6–4.5)	5.0§ (1.6–15.5)	2.7 (0.7–9.8)	5.1‡ (1.4–18.2)
Beach/lake/river/creek	1.1 (0.4–3.1)	0.8 (0.3–2.7)	1.1 (0.4–3.0)	2.4 (1.0–6.1)	1.3 (0.5–3.1)	1.7 (0.7–3.9)
Bike/hike/walk trail	1.2 (0.5–3.0)	1.4 (0.5–3.7)	1.4 (0.6–3.1)	3.7§ (1.5–9.2)	1.0 (0.5–2.1)	4.7§ (1.9–11.5)
Public open space	1.7 (0.8–3.6)	2.2‡ (1.0–4.7)	1.6 (0.6–4.2)	7.3§ (2.4–21.7)	0.9 (0.4–2.4)	9.8§ (2.9–33.4)

\* Adjusted for city, sex, ethnicity, race, and parent education.  
 † Also adjusted for whether adolescent had a driver's license.  
 ‡ P < 0.05.  
 § P < 0.01.

basketball courts, walking/running tracks, school recreation sites, small and large public parks, public playgrounds, and open space (Table 2). For adolescents, use of other sites was significantly positively correlated with walking/biking to get there, including other play fields/courts (parent report only), swimming pools (adolescent self-report only), beach/lake/river/creek, and bike/hike/walk trails.

**Multivariate analysis of active site use by proximity and walking/biking.** After controlling for demographic variables, multivariate analysis models for frequent use of each site revealed significant ( $P < 0.05$ )

positive rate ratios (RR) for children who usually walked/biked to four sites: indoor recreation (RR = 3.0), walking/running tracks (RR = 11.6), schools with recreation facilities (RR = 3.9), and public open space (RR = 2.2; Table 3). Among adolescents, walking/biking to sites was associated with frequent use for 9 of 12 recreation sites by self-report (and 8 or 12 by parent report), with rate ratios ranging from 1.9 to 9.8 for higher active use among youth usually walking/biking to those sites compared with youth not walking/biking. Walking/biking was *not* associated with adolescents' frequent use of indoor recreation facilities,

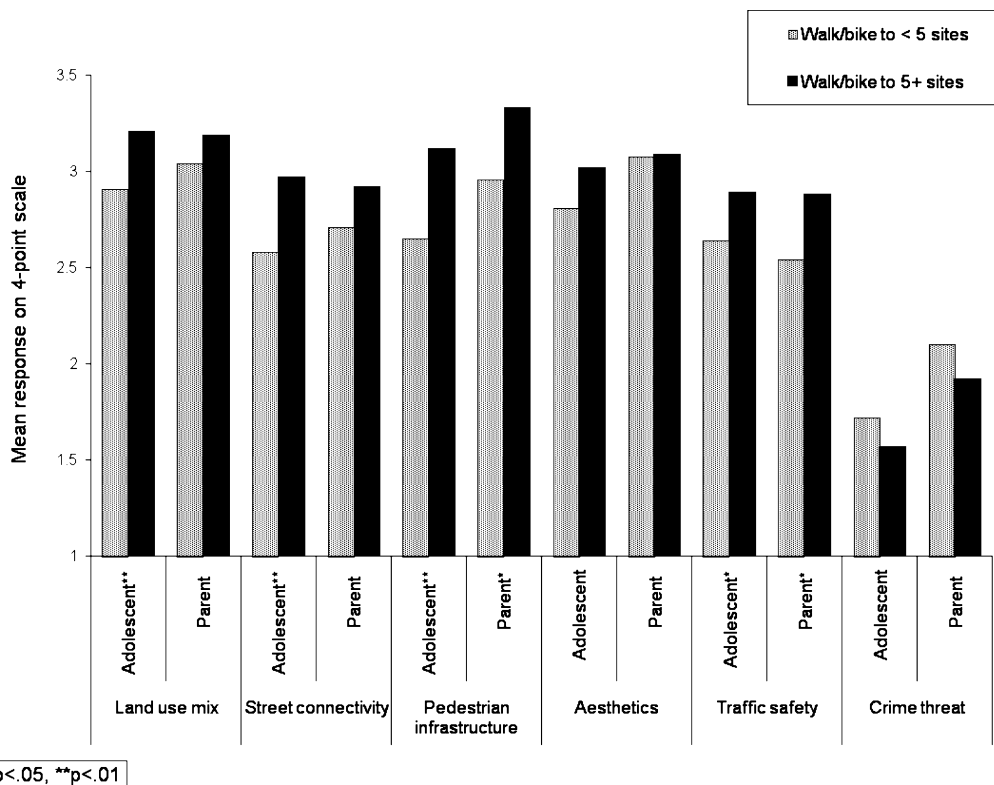


FIGURE 3—Mean response for perceived built environment factors for adolescents walking/biking to less than five versus five or more recreation sites, reported by parents and adolescents.

TABLE 4.  $\beta$  coefficients for multivariate linear modeling of number of recreation sites to which youth walk/bike at least once every other week regressed on environmental, demographic, and site proximity factors.

Variable	Parent Report for Adolescents, <i>N</i> = 124			Adolescent Self-Report, <i>N</i> = 22*		
	Unadjusted $\beta$	$\beta$ Adjusted for Demographics	$\beta$ Adjusted + Proximity†	Unadjusted $\beta$	$\beta$ Adjusted for Demographics	$\beta$ Adjusted + Proximity†
Land use mix	-0.11	-0.20	-0.20	0.23‡	0.16	0.12
Street connectivity	0.14	0.17‡	0.08	0.11	0.14‡	0.09
Pedestrian infrastructure	0.18‡	0.21§	0.14	0.16‡	0.25§	0.20§
Aesthetics	-0.13	-0.07	-0.08	0.11	0.11	0.05
Traffic safety	0.61§	0.55§	0.55§	0.19	0.2‡	0.30§
Crime threat	-0.08	-0.17‡	-0.13	-0.15‡	-0.24§	-0.21§
Female sex	—	-0.02	0.03	—	-0.24‡	-0.16
Hispanic ethnicity	—	0.13	0.31	—	-0.28	-0.17
Parent education	—	0.06	0.10	—	-0.03	-0.01
White race	—	0.04	0.15	—	-0.25‡	-0.17
City	—	-0.07	-0.07	—	-0.06	-0.06
Driver's license	—	-10.3§	-10.2§	—	-0.92§	-0.83§
Proximity*	—	—	0.10§	—	—	0.07§

\* Two adolescents had missing data for a built environment variable.

† Proximity defined as number of recreation sites within a 10-min walk from home.

‡  $P < 0.05$ .

§  $P < 0.01$ .

other play fields/courts, swimming pools (by parent report only), and natural water areas. In contrast to walking/biking and to findings from the bivariate analyses, site proximity was not significantly related to use of any site in these models for either children or adolescents, with the exception of adolescents' swimming pool use (RR = 2.1) by parent report. None of the demographic variables were significant in these models with the exception of "city" for beach/lake/river/creek (of which San Diego respondents reported higher active use).

**Neighborhood environmental factors and walking/biking to the site.** Adolescents who usually walked/biked to at least five sites (sample median) had higher scores on perceived pedestrian infrastructure and on traffic safety both by parent report and self-report and had higher land use mix and street connectivity for adolescent report only (Fig. 3). No differences in perceived neighborhood aesthetics or crime threat were observed for adolescents walking/biking to five or more sites compared with adolescents walking/biking to four or fewer sites.

Multivariate regression models were estimated with number of recreation sites used for physical activity to which adolescents' walk/bike regressed on all of the built environment factors and adjusted for demographics and proximity (Table 4). In the demographic-adjusted model, on the basis of adolescent and parent report, positive estimates were found for street connectivity, pedestrian infrastructure, and traffic safety and a negative estimate was found for crime threat in relation to the number of recreation sites to which adolescents walked/biked. After adding proximity to the model (itself positively related to the number of recreation sites to which youth walked/biked), only traffic safety remained highly significantly associated with usually walking/biking to sites for both parent and adolescent reports. In addition, for the adolescent self-report, higher pedestrian infrastructure remained significantly positively associated with usually walking/biking to sites and crime

threat remained negatively associated. The only significant sociodemographic variable in the full model was adolescent driver's license that was strongly negatively related to active transport to recreation sites on the basis of both parent and adolescent reports.

## DISCUSSION

Children and adolescents were reported to use multiple recreation sites at least once every other week for physical activity. Children and adolescents' frequent active use of several recreation sites was associated with closer proximity to home and, even more so, whether they walked/biked to sites. Among adolescents, walking/biking to sites remained significantly associated with more frequent active use of the site beyond proximity for most sites, especially sites of predominately unstructured activities, such as parks and walking/running tracks. Several neighborhood environment variables were associated with active transport to recreation sites, including traffic safety, pedestrian infrastructure, and crime. Among these variables, perceived traffic safety most strongly correlated with adolescents' walking/biking to recreation sites for both adolescent and parent reports and remained associated after controlling for demographics and site proximity.

Children were more frequently active at specific recreation sites compared with adolescents (both in mean number of sites used frequently and in frequency of individual site use). This result is consistent with patterns of decreasing physical activity from childhood to adolescence (27,39). Use of more recreation sites has been previously associated with higher levels of physical activity among young children (34). Furthermore, adolescents with less access to recreation sites have lower physical activity and higher rates of obesity (18). Additional research is needed to investigate actual levels of youth physical activity at different recreation sites and factors explaining activity levels,

such as quality of the facilities, amenities, and programs offered (28).

The present results confirm prior findings (as summarized in a review by Davison et al. [10]) that proximity to home has been associated with some children and adolescents' use of recreation sites. The strong association of active transport to recreation sites and active use of specific types of recreation sites, especially for adolescents, to our knowledge, has not been previously described. The more consistent association between site use and active transport among adolescents (9 of 12 sites) compared with children (4 of 12 sites) most likely reflects parents allowing their adolescents more opportunity to walk/bike independently. Of the three sites where use was not related to active transport or proximity to home among adolescents, two sites (indoor recreation sites and play fields/courts) offer predominately structured activities (e.g., team or club sports). Parents may be providing more car transportation for their adolescents to team sports or other structured activities at these venues (19), which may be farther from home. For other sites, walking/biking may offer increased accessibility of recreation sites when parents are unavailable or unwilling to provide transportation before adolescents have their driver's licenses. Active transport to a recreation site used for physical activity provides two opportunities for a youth to be active, thus likely increasing their total physical activity.

The finding that walking or biking to a recreation site was more consistently and strongly related to active use of that site rather than close proximity to the site is not necessarily surprising. A young person walking/biking to a recreation site is very likely using it for physical activity. In contrast, close proximity to a recreation site does not necessarily mean that a youth visits the site; reasons for not using a site may include inaccessibility (e.g., physical barriers such as highways) or lack of desired features (40). In the present study, walking or biking to any site accounted for active use much more than proximity alone; however, proximity likely made active transport to the site feasible, as demonstrated in the significant relations between proximity and walking/biking to sites. Both proximity and active transport were related to built environment characteristics, promoting walkability. Walkable neighborhoods have more destinations within walking distance and more developed infrastructure for convenient, safe walking and biking (30). Walkable built environments are consistently positively related to adults' transportation-related walking (3,30) and total physical activity (11,20), with some evidence of similar associations with youth physical activity (1,8).

After controlling for proximity to sites and demographic factors, and comparing relative strength of different built environment constructs, the most consistent (across both adolescent and parent report) and strongest environmental correlate of active transport to more recreation sites was better perceived traffic safety. Similarly, perceptions of

traffic safety were related to children's active transport to school in prior studies (1,25,37). Parental concerns about traffic and road safety have also been linked to higher risk of being overweight among adolescents (38).

Adolescents' perception of crime threat in their neighborhoods was negatively related to their walking/biking to sites in the current study, which is consistent with prior findings (14,17). In addition, adolescents with better perceived pedestrian infrastructure (e.g., sidewalks, lighting) were more likely to walk or bike to sites, similar to results reported in the adult literature (30). It is unclear why these factors were statistically significant for adolescent self-report but not parent report. One explanation might be a heightened awareness of the environment among adolescents who may be out more in their neighborhoods. No examined demographic variables were related to active transportation to more recreation sites, but as expected, adolescents with driver's licenses walked/biked to significantly fewer recreation sites.

One significant policy question is whether closer small parks or more distant large parks have a stronger association with youth physical activity. In the present study, small parks were used more often by children compared with large parks, whereas adolescents used small and large parks with similar frequency. Adolescents' active transport to the park, however, was more strongly associated with small (RR = 6.9) rather than large parks (RR = 2.9). Thus, the present findings support a policy of building more small parks that are accessible through active transport. The present study, however, cannot determine how the amenities offered at each site affect youth activity levels while visiting the site.

Limitations of the present study include the cross-sectional design, reliance on self-report, and not being designed to be a nationally representative sampling of youth. The modest response rate obtained also represents a potential threat to external validity. Test-retest reliability values for the parent and adolescent reports of active site use, proximity to sites, and active transport to/from sites were generally acceptable. However, potentially ambiguous phrases such as "open space" (which were not defined in the survey) may have resulted in some lower reliability estimates. Overall consistency in reporting between parents and their adolescents for site use, proximity, and active transport supports construct validity of the measures. Adolescents reported a higher mean number of sites to which they walk/bike, but we cannot determine whether this represents adolescent overreport or parent underreport. Although the present study obtained more specificity in evaluating active site use than most prior studies, the particular sites (e.g., which playground or park) were not specified by the respondents. This lack of specificity for the referent site could have compromised reliability. Furthermore, recreation sites may have been colocated (e.g., basketball courts located within small or large parks), so estimates of number of sites used may be inflated.

## CONCLUSION

Children and adolescents' use of recreation sites for physical activity was strongly associated with active transport to the site, even when accounting for site proximity. Public health implications of present findings are notable. Not only are youth more likely to go to a recreation site to be physically active if they walk or bike to the site but also walking/biking to sites represents additional physical activity. Conversely, youth who are unable to walk or bike to recreation facilities may be deprived of opportunities for two types of physical activity—active use of the site and active transport to the site. Neighborhood walkability features, including pedestrian infrastructure and traffic

safety, were significantly correlated with youth active transport to recreation sites. Thus, policies related to land use, transportation infrastructure, and traffic safety are relevant to young people's use of recreation facilities for physical activity. The present findings provide further empirical support for public health, community design, and transportation initiatives to facilitate youth access to recreation sites for physical activity (9,25).

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