

Perception vs Reality: Is Perceived or Objective Proximity to Physical Activity Opportunities in the Environment More Associated With Recent Use Among Adolescent Girls?

Daheia J. Barr-Anderson
University of Minnesota

Peter J. Hannan
University of Minnesota

Dianne Neumark-Sztainer
University of Minnesota

Katherine W. Bauer
Temple University

Mary Story
Duke University

Little is known about adolescent girls' accuracy of perception of physical activity (PA) opportunities in their neighborhood. Furthermore, few studies have explored whether proximity to PA opportunities is associated with girls' recent use. Participants included 356 high school girls enrolled in *New Moves*, a school-based physical activity intervention. Objective proximity to neighborhood PA opportunities was assessed using Geographic Information System (GIS) software. Girls self-reported their perceived proximity to resources and recent use of these opportunities. Girls' perceived proximity of distance to a park, walking/biking trail, and recreational center was associated with recent use of these resources ($P = .02$, $P < .001$, $P < .001$, respectively), whereas associations were not found with objective measures of distance. Both perceived and objective proximity were associated with recent use of a private fitness facility ($P = .006$ and $P = .002$, respectively). Perceived proximity to neighborhood PA opportunities is associated with use of those resources among adolescent girls. Increasing awareness of neighborhood opportunities could be a viable method to increasing PA.

Physical inactivity is related to the increased rates of overweight and obesity among American youth (Anderson & Butcher, 2006). This is especially so for girls who have decreasing physical activity levels throughout adolescence (Kimm et al, 2002) and increasing weight gain (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). In recent years, there has been increased attention in the association between environmental factors and levels of physical activity (Popkin, Duffey, & Gordon-Larsen, 2005). Among adolescent girls, research suggests that girls who live near more parks participate in more out-of-school vigorous intensity activity more frequently than those girls who have fewer parks near their homes (Cohen et al, 2006). In a large, urban sample of high school girls, having a place to be physically active was one of the top three correlates of physical activity (Ries, Voorhees, Gittelsohn, Roche, & Astone, 2008). While health promotion and education approaches encourage individuals to be more physically active and provide skills training, people may be limited in their ability to be regularly active due to environmental constraints, such as lack of physical space (Mikkelsen, Chehimi, & Cohen, 2007). Adolescent girls may be especially limited by the places they are able to be active because of transportation constraints (Cohen et al, 2006), which highlights the importance of physical activity opportunities close to their

homes. In addition, low income and racial/ethnic minority girls are further disadvantaged because they are less likely to have access to parks, playgrounds, and public pools than whites and higher income individuals (Strong et al, 2005). These populations are also at the highest risk for obesity and are therefore in the greatest need for safe places near their homes where they can be physically active.

While objective measures of availability and accessibility of physical activity opportunities near one's home have been associated with greater levels of physical activity among middle school girls (Scott, Evenson, Cohen, & Cox, 2007) and vigorous physical activity in high school girls (Pate et al, 2008), presumably to use these resources, girls need to be aware of their availability and locations, which could have significant intervention implications. Few studies have examined whether perceptions about the physical activity opportunities parallel objective measures of physical activity opportunities and whether perceptions and/or reality are associated with use of these opportunities.

Given the limited understanding of the relationships between adolescent girls' perceived experience of their neighborhoods and the objective physical activity environment, the aims of the current study were to: 1) examine associations between perceived (girl-reported) and objective (Geographic Information System (GIS)-generated) measures of physical activity opportunities near their home environments, such as parks, walking/biking trails, private fitness facilities, and recreational centers; and 2) compare relationships between both girls' perceived and objectively-measured neighborhood environment and the girls' reported use of these physical activity opportunities. It was hypothesized that there would be differences between girls' perception of proximity and objective distance of neighborhood physical activity opportunities and that perceived proximity, and not objective distance, would be more consistently associated with recent use of the physical activity opportunities.

Barr-Anderson is with the College of Education and Human Development, School of Kinesiology, University of Minnesota, Minneapolis, MN. Bauer is with the Department of Public Health, Temple University, Philadelphia, PA. Hannan and Neumark-Sztainer are with the School of Public Health, Division of Epidemiology & Community Health, University of Minnesota, Minneapolis, MN. Story is with Community & Family Medicine and Global Health Duke University, Durham, NC. Address author correspondence to Daheia Barr-Anderson at barra027@umn.edu.

Methods

Participants

Participants were high school girls enrolled in *New Moves*, an intervention study that included an all-girl physical education class which provided a supportive environment to promote physical activity and address weight-related issues (Neumark-Sztainer et al, 2010). Sedentary girls, at risk for obesity and other weight-related problems, were targeted in *New Moves*. A total of 356 girls enrolled in the program and completed baseline assessment (mean age = 15.8 ± 1.17 years). Data for the current analyses are from baseline data collected in Fall 2007 and Fall 2008 at the beginning of the two study phases. The study protocol for *New Moves* was approved by the University and participating school districts' Institutional Review Boards (IRB). Parents completed written consent and girls also provided assent.

Measures

Perceived and objective proximity of physical activity opportunities to each girl's home, recent use of the opportunities, physical activity behavior, body mass index (BMI), school location, and sociodemographic variables (as described below) were assessed. All data were collected via a student survey except for objective proximity data and anthropometric measures; the objective data were derived from Geographic Information System (GIS; EsRi, 2006).

Perceived Proximity and Use of Physical Activity Opportunities.

To assess perceived proximity of neighborhood physical activity opportunities, girls were asked, "Which of the following places are within walking distance of your home?" Response categories included private gyms (such as Lifetime, Bally's), a park, community recreation centers or YMCA/JCC/YWCA, walking or bike trails, and none. To assess use of these physical activity opportunities, participants were also asked, "At which of the following places have you been physically active in the past month?" Response categories included private gyms (such as Lifetime, Bally's), a park, community recreation centers or YMCA/JCC/YWCA, walking or bike trails, other, and I haven't been physically active anywhere in the past month.

Objective Proximity of Neighborhood Physical Activity Opportunities.

GIS software (EsRi, 2006) was used to geocode the addresses of physical activity opportunities (e.g., parks, walking/biking paths, private fitness facilities, and recreational/community centers) in local neighborhood environments. Straight line and road network distances (in meters) were calculated for each of the nearest physical activity opportunities from the girl's home address. Only road network distance is presented in these analyses because it is the most feasible route most girls would travel to get from her home to the closest physical activity opportunity (Sander, Ghosh, van Riper, & Manson, 2010).

Physical Activity Behavior. Physical activity was assessed using the 3-Day Physical Activity recall (3DPAR) survey (McMurray et al, 2004; Pate, Ross, Dowda, Trost, & Sirard, 2003). The 3DPAR has been shown to be a valid measure of moderate-to-vigorous physical activity (MVPA) as compared with accelerometry (Pate et al, 2003), with a 2-day test-retest reliability of $r = .71$ and $r = .77$ for moderate and vigorous activity, respectively, among adolescent girls (McMurray et al, 2004). MVPA was defined as the daily average of number of 30-minute blocks for which physical activities with a metabolic equivalent for task (MET) value greater than or equal to 3 were recorded (Dowda et al, 2007; Pate et al, 2003).

Body Mass Index (BMI). Trained research staff measured girls' height and weight using standard procedures (Webber et al, 2008). BMI was calculated [(weight in kg)/(height in m)²] and girls were categorized as nonoverweight (BMI < 85th percentile); overweight (BMI \geq 85th percentile but < 95th percentile); or obese (BMI \geq 95th percentile) based on BMI percentiles for age and gender using CDC growth charts (Krebs et al, 2007; Kuczmarski et al, 2000).

School Location. School location was a proxy for urbanicity, which is associated with access to physical activity opportunities (Nelson, Gordon-Larsen, Song, & Popkin, 2006). It was based on whether the girl's school was located in St. Paul, MN (urban) or in one of six suburbs of the Twin Cities, MN (suburban). Three urban schools and three suburban schools were included in this study.

Sociodemographic Variables. To determine race/ethnicity, girls were asked, "Do you think of yourself as...?" Response options were white, black or African American, Asian, Native Hawaiian or other Pacific Islander, American Indian or Alaskan Native, Hispanic or Latina, and mixed/other. Girls could select more than one category. If two racial/ethnic categories were selected with one being white, the girl was categorized as the nonwhite race/ethnicity. If two categories that did not include white or three or more categories were selected, the girl was included in the mixed/other category. Due to the small number, girls who selected American Indian or Alaskan Native were included in the mixed/other category. Age was calculated based on each girl's birthdate.

Data Analysis

Descriptive statistics (percentage and mean \pm standard deviation) were generated for sociodemographic, anthropometric, and behavioral variables. Additional descriptive statistics (mean \pm standard deviation, frequency, percentage) were generated to examine perceived and objective distances to physical activity opportunities and girls' use of physical activity opportunities (dichotomized as yes or no). Logistic regression models controlling for socioeconomic status, race/ethnicity, age, weight status, school location, and physical activity level were generated to examine girls' recent use of physical activity opportunities with perceived and objective proximity of physical activity opportunity to their homes. All data were analyzed in late 2010 and early 2011 using SAS 9.2.

Results

Sample Characteristics

The study population was sociodemographically diverse with 28.4% reporting they were Black or African American, followed by 24.5% White, 23.0% Asian, 14.3% Hispanic or Latina, and 9.8% American Indian, mixed, or other. Girls' mean age was 15.8 ± 1.17 years. Approximately half of this racially/ethnically diverse sample of girls was nonoverweight with almost 20% classified as overweight and the remaining 30% as obese. A slightly higher percentage of girls (54%) attended a school located in an urban area compared with 46% from a suburban school.

Perceived and Objective Proximity of Physical Activity Opportunities Near Home

The majority (90%) of girls perceived having a park within walking distance of their homes. Less frequently, girls reported having a walking/biking path (60%), a recreational center (33%), and a

private fitness facility near their homes (24%). A small percentage of girls (6%) perceived no physical activity opportunities near their homes.

Using objective measurements to examine the proximity of physical activity opportunities to girls' homes, for over 60% of girls, the closest park was further than 1600 m (~1 mile) from their homes. Forty-four percent of girls had a path less than 400 m (~1/4 mile) from their homes and another 32% had a path less than 800 m (~1/2 mile) from their homes (Table 1).

Mean Distance of Physical Activity Opportunities Near Home Based on Perception

Table 2 further displays objective, mean distance to the closest physical activity opportunity stratified by girls' perception of whether the physical activity opportunity was within walking distance of their homes. There was no difference in the measured distance to the closest park and path between girls who did and did not perceive those opportunities to be close to their homes ($P = .856$ and $P = .121$, respectively). Girls who perceived that a park or path was close to their homes did not live any closer to the park or path than those girls who perceived that they did not live close to either of those physical activity opportunities. However, girls who perceived that they lived near a private fitness facility or recreational center did actually live closer to those physical activity opportunities than girls who perceived that they did not live close to a private fitness facility ($P = .001$) or recreational center ($P < .001$).

Perceived and Objective Proximity and Use of Physical Activity Opportunities

A greater proportion of girls who perceived physical activity opportunities within walking distance of their homes used the physical activity opportunities, compared with those girls who did not perceive the opportunity to be close to their homes (Table

3). For example, of the girls who perceived having a park within walking distance of their homes, 70.7% reported using the park in the past month compared with 47.1% of girls who did not perceive having a park within walking distance of their homes. Based on adjusted logistic regression models, girls were more likely to use parks, paths, private fitness facilities, and recreational centers if they perceived the physical activity opportunity to be within walking distance of their homes (OR = 2.5, 6.4, 2.9, and 4.6, respectively; all p -values $< .020$).

Objective proximity was only associated with recent use of a private fitness facility ($P = .002$; data not shown). The association with objective distance and use of a park, a walking/biking path, and a recreational center ($P = .097$, $P = .780$, $P = .462$, respectively) were not statistically significant. In addition, regardless of proximity, girls who recently used any of the physical activity opportunities except private fitness facilities reported more physical activity than those who did not report recent use (Table 4).

Discussion

The current study builds upon current literature by comparing self-reported and objective measures of neighborhood physical activity opportunities and exploring whether perceived and/or actual distance is related to past month use of these opportunities among a sample of racially/ethnically and sociodemographically diverse female adolescents. For all of the physical activity neighborhood resources examined in the current study, girls who perceived having a physical activity opportunity within walking distance of their homes were more likely to have used that opportunity within the past month and generally, were more likely to be more physically active. Meanwhile, objectively-measured proximity to a park, walking/biking trail, and recreational center were not associated with a greater likelihood of using the respective opportunity. Both perceived and objective proximity was associated with recent use of

Table 1 % of Girls (N = 356) with Physical Activity Opportunities within a Certain Distance of Their Homes

Road Network Distance (m)	Park	Walking/biking Path	Private Fitness Facility	Recreational Center
<400	7.3	44.1	1.7	11.2
400–800	6.7	32.0	3.4	21.1
800–1200	10.4	12.6	7.3	19.1
1200–1600	14.0	7.0	11.0	11.0
>1600	61.5	4.2	76.7	37.6

Note. Data based on objective, Geographic Information System (GIS).

Table 2 Mean Road Network Distance to Closest Physical Activity Opportunity by Perception

	Perceived as within walking distance of home			Perceived as not within walking distance of home			t test p-value ^a
	N	Mean (m)	SD	N	Mean (m)	SD	
Park	297	2032	1178	34	2163	1352	.856
Walking/biking Path	200	553	479	131	631	501	.121
Private Fitness Facility	78	2150	1086	253	2675	1245	.001
Recreational Center	110	1312	1080	221	1977	1529	<.001

^aSimilar findings found from t tests on square root distances.

Table 3 Use of Physical Activity Opportunity by Perceived Closeness of Physical Activity Opportunity to Home

Physical Activity Opportunity	Perceived as within walking distance of home	N	% (n) using PA opportunity	Perceived		Objective	
				OR ^a	95% CI ^a		p-value ^a
Park	Yes	297	70.7 (210)	2.5	1.16–5.22	.020	.097
	No	34	47.1 (16)				
Walking/biking Path	Yes	200	77.5 (155)	6.4	3.75–11.19	<.001	.780
	No	131	35.1 (46)				
Private Fitness Facility	Yes	78	19.2 (15)	2.9	1.35–6.35	.006	.002
	No	253	9.1 (23)				
Recreational Center	Yes	110	32.7 (36)	4.6	2.21–9.61	<.001	.462
	No	221	8.1 (18)				

Note. Logistic regression models were adjusted for socioeconomic status, race/ethnicity, age, weight status, school location, and physical activity level.

^aOdds ratios and 95% confidence intervals are presented for perceived proximity analysis only. 'Perceived p-values' are for the perceived proximity and recent use analyses.

^b'Objective p-values' are for the objective proximity and recent use analyses.

Table 4 Reported Physical Activity in Mean 30-minute Blocks by Reported Recent Use

	Reported recent use		Didn't report recent use		t test p-value ¹
	Mean (blocks)	SD	Mean (blocks)	SD	
Park	3.4	2.99	2.2	2.49	0.034
Walking/biking Path	3.4	3.13	2.3	2.32	<0.001
Private Fitness Facility	3.0	2.84	3.0	2.90	0.919
Recreational Center	4.5	3.39	2.7	2.70	0.020

a private fitness facility. Findings suggest that perceived proximity to neighborhood physical activity resources is a stronger correlate of girls' use of resources than objective proximity.

Findings from the current study imply that girls' perceptions may not parallel reality and may vary by type of neighborhood physical activity resource. For example, almost 90% of girls perceived having a park within walking distance of their homes, but over 60% of girls did not have a park within a mile of their homes. In contrast, only 60% of girls perceived a walking/biking path within walking distance of their homes when 76% had a path within half a mile of their homes. These findings may indicate that some physical activity opportunities, such as parks that may use a larger green space or serve as a neighborhood hangout, may be more visible and salient than other opportunities, such as walking/biking trails. In addition, girls may simply not be aware of all of the physical activity opportunities available in their home neighborhoods. Another issue is that girls may view more than a mile to be "within walking distance." What one perceives as near may not be the same as what another may perceive as near, especially for those who live in urban areas compared with suburban areas where the availability of resources may vary by proximity. This further warrants the need to understand the roles perceived and objective proximity play in girls' physical activity levels.

Previous studies have examined associations between availability and accessibility of physical activity opportunities with increased levels of physical activity (Pate et al, 2008; Scott et al, 2007), but the current study focused on the reported use of these specific physical activity opportunities. Understanding how the availability of physical activity opportunities may influence overall physical activity is important. However, when thinking about how to use the local neighborhood and already established resources for obesity prevention intervention purposes, there is a need to understand how adolescent girls perceive what is in their environments and whether perception is associated with use of those resources. General physical activity can be affected by many factors (Sallis, Prochaska, & Taylor, 2000) but findings from this current study that show associations between perceived neighborhood opportunities and use of these facilities, support the strategy of promoting neighborhood resources to increase physical activity. A study of 9 to 10 year old children in England found that children used informal environmental spaces (i.e., urban streets and rural grasslands) as places to be physically active (Jones, Coombes, Griffin, & van Sluijs, 2009). It may not be about a formal place to be active, but just any place deemed appropriate to play. It is known that adolescents access "a wide variety of physical activities" (Maddison et al, 2010) and with a growing body of literature in the research area of

environmental physical activity opportunities, it is important to start dissecting these “wide variety of physical activities” to understand how specific use of physical activity opportunities in the home neighborhoods may play a role and impact adolescent girls’ overall physical activity levels. The use of these informal play spaces may also help to explain the discrepancy between the girls’ perceptions and GIS-measured proximity to parks. The GIS database may not include an open space in the neighborhood or another informal play space that the girls consider as a physical activity opportunity.

The reported use of physical activity opportunities perceived to be in close proximity is higher in our study than reported elsewhere (Grow et al, 2008). When asked to report recent use of resources less than 10 minutes away from their home, adolescents in Grow et al study (n = 124) reported that 43% and 48% of them recently used small and large parks, respectively, 39% reported use of walking/biking trails, and 43% used indoor recreational center not at school. However, both the current study and the Grow et al study found that physical activity levels are greater for youth who report recently using a physical activity opportunity, which is an important message. Making youth aware of physical activities near the places they frequently attend is a viable intervention strategy to increase overall physical activity in adolescents.

Strengths and Limitations

A significant strength of the current study is that it is one of few studies to examine perceived and objective measures of physical activity opportunities in adolescent girls. Little research has been done that examined level of agreement of perceived and objective measures among youth (Maddison et al, 2010), which is surprising since past research has supported the belief that access to physical activity facilities is important for physical activity participation (Sallis et al, 2000). In addition, the sample was racially/ethnically and socioeconomically diverse and focused on an U.S. population because in recent years, similar studies have focused on adolescents from New Zealand (Maddison et al, 2010) and England (Jones et al, 2009).

A limitation of this study is the lack of generalizability of research findings. This study was conducted in a geographical area with one of the highest ranking for availability of environmental physical activity opportunities, such as parks and walking/biking trails. In addition, distances to physical activity opportunities were calculated using the road network to the closest location. For parks and walking/biking trails, it was possible that the GIS software calculated a distance that was less than the distance to an accessible point of entry. For example, geomapping may show a trail intersecting with a road when in actuality the trail runs over/under a road/bridge and the trail is not accessible at that given point of the road. In addition, geomapping could show the road intersecting a park (especially larger parks) at a point that is not an accessible entry. This study is also cross-sectional in nature and causality cannot be determined; it is uncertain whether girls who enjoyed being physically active learned about an opportunity in their neighborhood or that being aware of the opportunity promoted use of the opportunities.

Directions for Future Research

From this research, we learned that when it comes to assessing physical activity opportunities, adolescent girls’ perceptions of certain physical activity opportunities may vary from reality, but perceiving that an opportunity is nearby was associated with use of the opportunity. A next important step for this line of research is to use this newly acquired knowledge to get a better understanding of

whether some adolescent girls (i.e., based on weight status, activity level, socioeconomic status) who less accurately perceive physical activity opportunities in their neighborhoods. Research by Ball et al suggest that this may be true—adolescents with low motivation or low self-efficacy may be more likely to misperceive their physical activity environment (Ball et al, 2008), but this theory has not been empirically tested. This information can be used to better target environmental intervention efforts among certain segments of the adolescent girl population and allow us to bring more attention to natural resources, such as parks and walking/biking paths, and local private fitness facilities and recreational centers, that could be used to increase physical activity.

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