

RESEARCH SYNTHESIS | *February 2010*

A detailed summary of the existing evidence base on a given topic that identifies gaps in the knowledge and steps for advancing the science.

Parks, Playgrounds and Active Living

Introduction

Regular physical activity increases longevity, well-being, helps children and adults maintain a healthy weight, and can reduce the risk for obesity and its related health consequences. Parks and playgrounds provide a wide variety of opportunities for physical activity and have the potential to help many Americans lead a more active lifestyle.

Across all major U.S. cities, there are approximately 20,000 individual parks and more than 10,000 playgrounds. The total area covered by urban parks in the United States exceeds 1 million acres.¹ And these figures only represent major cities. They are much higher when suburban and rural parks and playgrounds are taken into account. For example, Cleveland Metroparks, a park district in the suburbs of Cleveland, Ohio, operates 21,250 acres and attracts more than 16 million recreational visits and 3.5 million program visits annually.

The collective body of evidence suggests that parks and playgrounds encourage physical activity, although the data are not entirely consistent. Research also indicates that the capacity of America's parks could be further leveraged to promote opportunities for helping diverse populations achieve recommended physical activity levels. **This synthesis summarizes the growing body of evidence concerning the role of parks in shaping active lifestyles across a variety of study populations, including children, seniors, lower-income families, specific racial and ethnic groups and other populations at high risk of being inactive.** The need to further substantiate these findings and to extend park, playground and active living research into other topical areas using more sophisticated research designs also is discussed.



Key Research Results

- **The majority of Americans visit their local parks, and nine out of 10 have participated in at least one outdoor recreation activity annually.**^{2, 3}
- **Park proximity is associated with higher levels of park use and physical activity among a variety of populations, particularly youth.**^{4, 5}
- **Having more parks and more park area (e.g., acreage) within a community is associated with higher physical activity levels.**^{6, 7}
- **Lower-income populations and some racial and ethnic populations have limited access to parks and recreational facilities. These disparities partially explain lower physical activity levels among these populations.**⁸
- **Within parks, people tend to be more physically active on trails, at playgrounds and at sports facilities.**^{9, 10}
- **Perceived park aesthetics, condition and safety may be associated with park visitation and physical activity levels within parks.**^{11, 12}
- **Organized park programs and supervision may increase use of parks and playgrounds and may increase physical activity, particularly among youth.**¹³
- **Park renovations can increase use of certain types of facilities (e.g., playgrounds and skate parks) and increase vigorous physical activity among children.**^{14, 15}

Details on Key Research Results

- **The majority of Americans visit their local parks, and nine out of 10 have participated in at least one outdoor recreation activity annually.**^{16, 17}

Public parks and playgrounds are common settings for outdoor recreation pursuits. According to the National Survey on Recreation and the Environment, at least nine out of 10 Americans participate at least once in some form of outdoor recreation annually, but the majority of these outdoor recreationists participate 10 days or fewer each year.¹⁸ An older, nationwide study conducted in 1992 found that nearly three out of four adults reported visiting a local park or playground. However, 68 percent of these park users reported only occasional park use.¹⁹ A more recent 2008 survey suggests that park visitation is more frequent and reported that 107 million Americans made an average of 4.8 visits to local public parks in the month of January 2008.²⁰

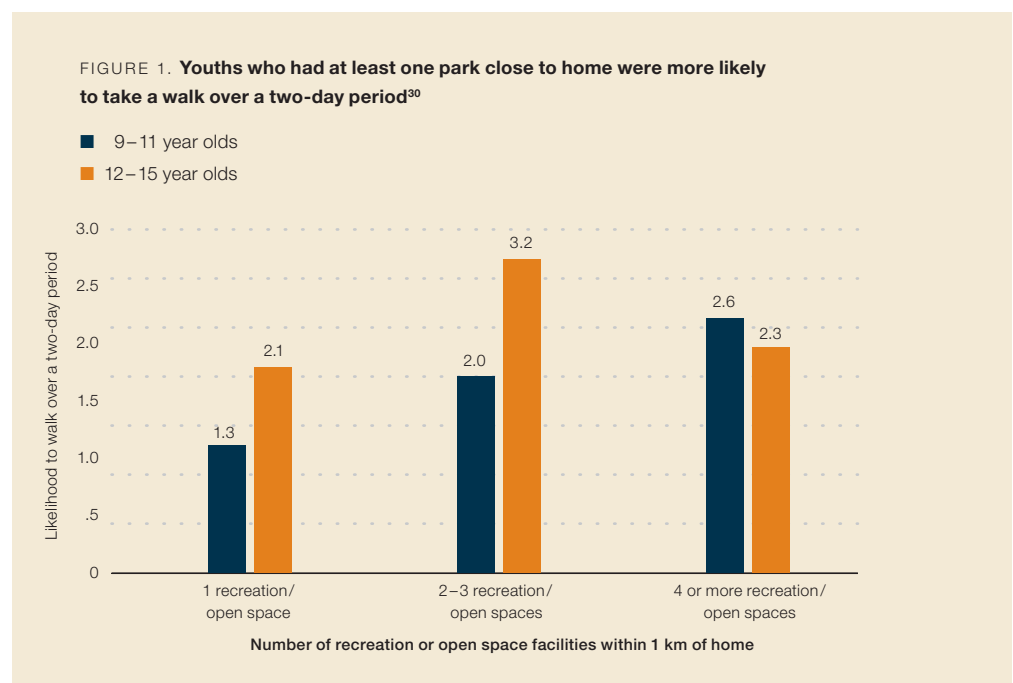
While there are limited data that specifically examine physical activity within parks, studies using observational physical activity assessments have found that most park visits involve sedentary behavior. For example, one research team observed park-based physical activity patterns in two city park systems. Across both cities, they found that more than half of the observed visitors

were sedentary and that children were more likely than adults to engage in walking or vigorous activity within parks.²¹ However, surveys of self-reported physical activity levels suggest that park visits may be more active. For example, one study of older adult park users found that a majority of visitors (69%) reported moderate-to-vigorous physical activity levels.²² Collectively, these findings suggest that outdoor recreation participation and park visitation is common, but there is a potential to increase the frequency of park use and physical activity levels within parks.

■ **Park proximity is associated with higher levels of park use and physical activity among a variety of populations, particularly youth.^{23, 24}**

A systematic literature review summarized the evidence concerning the influence park proximity can have on physical activity levels. Eight of the 13 articles that specifically examined parks and physical activity concluded that there are at least some positive associations between park proximity and physical activity.²⁵ Moreover, a national survey of U.S. adults examined both environmental and policy determinants of physical activity and found that perceived access to parks and recreational facilities were significantly related to self-reported physical activity.²⁶ Those who felt that parks and recreation facilities were accessible were almost twice as likely to meet recommended physical activity levels as those who did not perceive parks as being accessible.

A recent study of 3,000 youth ages 5 to 20 in Atlanta, Ga., compared travel diary data and recreation facility proximity.²⁷ As shown in Figure 1, youth who had recreation or open space facilities close to home were two to three times more likely to take a walk over a two-day period than were youth who had no parks nearby. Still another study found that both increased park proximity and higher rates of active transport (e.g., walking, bicycling) were strongly associated with more frequent use of multiple recreation settings among children and adolescents.²⁹



■ **Having more parks and more park area (e.g., acreage) within a community is associated with higher physical activity levels.^{31, 32}**

The number of parks and playgrounds in a community and the area devoted to these spaces correspond with physical activity levels. For example, a study of more than 500 older adults from 56 neighborhoods in Portland, Ore., found that adults with more recreational facilities and open green space area were significantly more likely to report higher levels of walking.³³ Another study in West Virginia found that the total county acres managed by public agencies and the total county acres devoted to water-based recreation were positively related to countywide physical activity levels. Counties with more public land and recreational water acreage also had a lower proportion of the population reporting insufficient physical activity.³⁴ Finally, a study of adolescent females across six cities found that subjects who had more parks within one mile of home achieved higher levels of physical activity than those who had fewer parks near home.³⁵ Each additional park within a half mile of each subject's home was associated with 17 more minutes of non-school, moderate-to-vigorous physical activity over a 6-day period.³⁶

One study that examined total park area within a community found the percentage of total park area within neighborhoods was a significant predictor of increased physical activity levels among children.³⁷ For each 1 percent increase in park area, there was a 1.4 percent increase in physical activity levels.

While the total supply (or capacity) of park area in a community can have a positive influence on physical activity, there is mixed evidence concerning the role of individual park size in shaping physical activity. For example, one study found that large parks were no more likely than small parks to be used for physical activity.³⁸ However, another study found that adults were more likely to walk in parks when park settings were perceived as large.³⁹

■ **Lower-income populations and some racial and ethnic populations have limited access to parks and recreational facilities. These disparities partially explain lower physical activity levels among these populations.⁴⁰**

Although parks and playgrounds exist in rural, suburban and urban communities across the United States, there are disparities in access to parks and recreational facilities across populations. In particular, lower-income populations and some racial and ethnic populations have reported poor access as a barrier that limits their use of parks.⁴¹ A nationally representative study of more than 20,000 U.S. youth found that all major types of physical activity resources including public parks and recreational facilities, as well as private facilities, were distributed inequitably. According to this study, non-White and lower-income neighborhoods were half as likely as White, higher-income neighborhoods to have at least one physical activity facility in their community.⁴² These inequities also corresponded with lower self-reported physical activity levels for youth who had limited access to such facilities. However, the odds of achieving recommended bouts of moderate-to-vigorous physical activity increased with each physical activity facility per Census block group. Youth who lived in neighborhoods with seven recreation activity facilities were 26 percent more likely to report being highly active than youth who lived in neighborhoods without facilities.⁴³

Another study examined the relationship between community physical activity settings, such as parks and green space, and race, ethnicity and socio-economic status.⁴⁴ Communities with higher poverty rates and communities with higher percentages of African Americans were significantly less likely to have parks and green spaces in their area.⁴⁵ A study of more than 4,000 youth in California found that one in four reported having no access to a safe park.⁴⁶ Among youth from lower-income families, those without access to a safe park were more likely to be physically inactive, but there was no association between park access and physical activity for youth from higher-income families and for those who lived in rural communities. These findings suggest that the availability of parks is particularly important in promoting physical activity among racial and ethnic minority youths, as well as youths who live in urban communities.

■ **Within parks, people tend to be more physically active on trails, at playgrounds and at sports facilities.^{47, 48}**

Park settings can encompass a wide variety of features, such as trails and paths, sport fields, open space for free play, playgrounds and pools that provide opportunities for park users to be physically active. For example, one study used observational methods to assess park-based physical activity and examine variations in energy expenditures in 28 parks in Tampa, Fla., and Chicago, Ill.⁴⁹ Across both cities, results showed that park spaces with soccer fields, tennis and racquetball, basketball and volleyball courts, and playgrounds were associated with moderate-to-vigorous levels of physical activity and overall higher levels of park-based energy expenditures.

Another research team conducted an audit of 28 features across 33 parks in Ontario, Canada, and found that parks with more features were more likely to be used for physical activity than parks with fewer features. In terms of which features corresponded with physical activity, parks with paved trails were 26 times more likely to be used for physical activity than were parks without paved trails.⁵⁰ Another study of four different park types found that observed levels of moderate and vigorous activity were highest in park areas containing courts, playgrounds, sport fields and paths.⁵¹

Proximity to specific types of park features also has been linked to physical activity levels among adolescent girls. For example, girls within a half mile of parks containing a playground, basketball court, multi-purpose room, walking, swimming and track facilities had higher non-school physical activity levels. Living close to parks with support features such as streetlights and floodlights was associated with approximately 20 minutes more per six day period of non-school, moderate-to-vigorous physical activity.⁵²

■ **Perceived park aesthetics, condition and safety may be associated with park visitation and physical activity levels within parks.^{53, 54}**

Data from one study indicated that parks were more likely to promote physical activity if they were aesthetically pleasing to users, with tree-lined paths rather than empty open space.⁵⁵ A qualitative assessment of 28 neighborhood parks in Montreal found that parks with lower ratings for maintenance or park condition and higher concentrations of physical incivilities, such as vandalism, were more likely to be located in neighborhoods with poor health status (as defined by life expectancy, cancer incidence and heart disease mortality rates). Parks in the healthiest neighborhoods also generally provided more facilities for physical activity than parks in less healthy neighborhoods.⁵⁶

A population study of park use found that fear of crime was perceived as a key barrier that limited use of local parks.⁵⁷ Furthermore, the study found that making parks safer was a highly preferred strategy by study participants to increase their park use. Another study found that adults who perceived signs of neighborhood disorder, such as graffiti, litter and overgrown vegetation, and perceived their neighborhood to be unsafe at night were less likely to encourage children to use local playgrounds.⁵⁸ Adults who felt somewhat safe were 60 percent more likely to encourage children to use local playgrounds than were adults who felt unsafe.⁵⁹

One research team examined perceptions of park safety and park visitation levels before and after major park renovations in Los Angeles and found visitors perceived parks to be safer after the renovations but that such perceptions did not correspond with increased levels of park visitation and self-reported park use frequency. Despite early evidence linking park aesthetics, conditions and safety with neighborhood health status and park use, few studies have examined whether park characteristics, particularly aesthetics and conditions, are related to observed levels of park-based physical activity. This is an important issue for future research.

■ **Organized park programs and supervision may increase use of parks and playgrounds and may increase physical activity, particularly among youth.⁶¹**

Parks provide settings for both organized recreation programs and for unstructured forms of activity. Programmed activities within parks may stimulate park visitation, provide a social venue for visitors to interact and facilitate various types of active recreation. For example, one study found that Los Angeles city parks with a greater number of supervised activities and programs had higher observed park visitation levels.⁶² However, research has yielded mixed results concerning the association between organized park programs and physical activity. A study of parks in Tampa, Fla., and Chicago, Ill., found that visitors observed in unstructured recreation were more likely to engage in walking or vigorous activity than were those in structured recreation.⁶³ Additional research will be needed to understand the role of park programs, supervision and structured activity in promoting not only park use, but also park-based physical activity. Moreover, the interplay between park physical and social spaces in relationship to physical activity is an important topic for future study.

■ **Park renovations can increase use of certain types of facilities (e.g., playgrounds and skate parks) and increase vigorous physical activity among children.**^{64, 65}

Much of the research regarding parks and physical activity relies on cross-sectional designs, and more definitive findings from field experiments are necessary to estimate the impact of park renovations on park visitation and physical activity in parks. Fortunately, recently completed and on-going studies are beginning to address this gap. One study examined use of and physical activity at renovated school playgrounds compared with un-renovated playgrounds in Cleveland, Ohio.⁶⁶ The study found that school playground renovations resulted in increased playground use among both adults and children. Children were more likely to be vigorously active at the renovated playgrounds and this was especially true among boys.⁶⁷ A quasi-experimental study of school playgrounds also found that redesigning the playground resulted in small, but statistically significant increases in children's recess physical activity when school- and student-level variables were considered in the analyses.⁶⁸ Renovations to the playground environment produced a stronger intervention effect for younger children.⁶⁹

Another study examined the role of skate park, community center and park renovations on facility use and physical activity.⁷⁰ These researchers found that, with the exception of the new skate park, renovated facilities were actually associated with a decrease in facility visitation levels and the frequency of visits reported. However, the renovated skate park attracted a six-fold increase in use. The researchers noted that decreased visitation could result from reduced hours of operation and fewer programs, and concluded that improvements to physical structures alone may be insufficient to encourage park use and physical activity.

Conclusions and Implications

Parks and playgrounds are important assets in promoting active living and overall health across broad segments of the population, yet the capacity of parks to increase physical activity levels is not fully realized. The current evidence base confirms that park proximity and availability generally corresponds with higher physical activity levels across several different population groups. Having a large number of nearby parks increases the likelihood of being physically active and parks that include certain active recreation features such as trails, playgrounds and sport facilities may stimulate higher levels of park-based physical activity. However, lower-income populations and some ethnic and racial populations tend to have more limited access to parks and recreational facilities.

Emerging research suggests that park conditions, maintenance, policies and programs may also influence park use and physical activity levels. However, few studies examine the efficacy of park improvements on park visitation and physical activity. Hence, the role of park policies, supervision and programs in shaping park-based physical activity is unclear. Future research should address these knowledge gaps so that park planners and staff, policy groups, governing bodies and advocacy organizations can better leverage the impact of America's parks in shaping a more physically active nation.

Areas Where Additional Research is Needed

The evidence concerning the role of parks in promoting physical activity has rapidly evolved. Nevertheless, a number of park-related issues merit further investigation. There is a continued need to further substantiate the evidence and to extend park, playground and active living research into other topical areas using more sophisticated research designs. For example, park characteristics such as aesthetics, conditions, programming, safety, features and disparities have not been explicitly linked to physical activity levels. Furthermore, understanding the role of park policies and programs in shaping active communities is a fertile area for additional inquiry. Finally, fewer studies focus on the role of parks and playgrounds in shaping youth activity and activity among rural populations. Research that addresses these gaps should be a high priority for park research sponsors, inter-disciplinary research teams, park advocates and policy-makers.

Addressing these issues should involve a variety of methodological approaches, particularly prospective and intervention studies as well as macro-level analyses. Based on the body of evidence reviewed in this brief, additional research is needed in the following areas:

- Existing park and physical activity research strongly relies on cross-sectional and self-report data. Evidence concerning the linkages between parks and physical activity would be strengthened with the addition of prospective and quasi-experimental studies using more objective measures of the environment and physical activity. Ecological studies that incorporate a variety of methods and measures should, therefore, be considered in order to evaluate the effects of park policy, program and environmental interventions on park use and physical activity for various populations.
- More effort should be placed on creating an inventory of existing park and recreation facilities, programs and policies nationwide and studying how Americans use their parks. A new surveillance system or a module incorporated into existing surveillance efforts could provide the structure to gather and disseminate these data to community planners, policy-makers, park advocates and researchers.
- More studies should examine the role of specific park features, such as park trails, sports fields, splashpads, open space areas and support facilities, as well as the condition and design of these features, with regard to park visitation and park-based physical activity levels, particularly across lower-income, racial and ethnic, youth and rural populations.
- Investigations are needed to examine the role of park management and administrative policies and practices, such as program supervision, staffing levels, programming and promotional efforts on park use and physical activity levels.
- Long-term studies are needed to document the impact of funding decisions on availability of parks and recreation facilities, the renovation and improvements made to these park facilities, and on physical activity levels in nearby communities.
- More studies should examine perceived and objective measures of park safety and how these contribute to park use and physical activity across targeted populations such as lower-income populations, racial and ethnic groups, females, youth and older adults.
- Studies are needed that integrate both objective and perceived measures of park characteristics, policies, programs and physical activity. From these studies, existing assessment tools could be modified into a more user-friendly format so that park professionals can assess the physical activity impact of their park design and program initiatives.

Additional Resources and References

Resources for the Future. www.rff.org/News/Features/Pages/OutdoorResourcesReviewGroup-Pubs.aspx

United States—National Physical Activity Plan. www.physicalactivityplan.org/getinvolved.htm

Trust for Public Land: Center for City Park Excellence. www.tpl.org/cityparkfacts/

Trust for Public Land: Park Equity and Public Health Toolkit. www.tpl.org/tier2_kad.cfm?folder_id=3548

Trust for Public Land: The Health Benefits of Parks. www.tpl.org/tier3_cd.cfm?content_item_id=21053&folder_id=188

National Recreation and Park Association; Step up to Health. www.nrpa.org/Content.aspx?id=587

Partnership for Play Everyday. www.playeveryday.org/

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For updates and a Web-based version of this synthesis, visit www.activelivingresearch.org.

Active Living Research, a national program of the Robert Wood Johnson Foundation, stimulates and supports research to identify environmental factors and policies that influence physical activity for children and families to inform effective childhood obesity prevention strategies, particularly in low-income and racial/ethnic communities at highest risk. Active Living Research wants solid research to be part of the public debate about active living.

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Table of Studies

The following table provides a brief summary of the studies cited in this synthesis, including sample characteristics, methods, and strengths and weaknesses.

TABLE 1. Studies Cited in this Synthesis: Samples, Methods, and Strengths/Weaknesses

Study	Sample Characteristics	Methods (park type, study approach)	+ Strengths/ – Weaknesses
Babey et al. (2008)	4,010 adolescents (12–17 yrs) from California	Randomized statewide household telephone survey; cross-sectional, self reports.	<p>+ Population assessment of statewide sample of California adolescents. Measured self-reported access to a safe park (vs. parks in general) and recreation activity. Conducted comparisons across both urban and rural areas.</p> <p>– Used only perceived walking distance as the measure of park access. Did not assess adolescent use of park and recreation facilities.</p>
Brownson et al. (2001)	Non-institutionalized adults living in the United States	Randomized household telephone survey; cross-sectional, self reports.	<p>+ Nationwide survey that examined the role of a wide range of environmental and policy characteristics in relation to a comprehensive measure of physical activity (meets/does not meet recommended levels).</p> <p>– Relied solely on self-reported data.</p>
Coen and Ross (2006)	28 parks across 6 urban neighborhoods in Montreal, Canada	Neighborhood and park-level; qualitative assessments of park condition, secondary health status data from study territories using GIS and observational methods.	<p>+ Compared quality and condition of parks with neighborhood health status.</p> <p>– Observed park features may be an artifact of other park characteristics (e.g., size). No inter-rater reliability check of park rating checklist.</p>
Cohen et al. (2006)	1,556 adolescent girls from 6 U.S. cities	Cross-sectional analysis using accelerometer and GIS data. Accelerometer data was collected from each study participant. GIS analysis was used to document the presence of parks within 1 mile of each study participant.	<p>+ Emphasized objective measures of proximity to specific kinds of park features and non-school physical activity levels.</p> <p>– Did not assess use of nearby parks or park features. Was not able to differentiate park-based physical activity from other non-school physical activity levels.</p>
Cohen et al. (2007)	8 public parks in Los Angeles; 713 park visitors and 605 neighborhood residents	Cross-sectional park level observational assessments of park activity and on-site surveys of park visitors combined with household surveys of residents living within 2 miles of parks.	<p>+ In addition to linking park proximity with use, this study also associated park programs with park use.</p> <p>– Limited sampling time frame and considered only an urban population.</p>

TABLE 1. continued

Study	Sample Characteristics	Methods (park type, study approach)	+ Strengths/ – Weaknesses
Cohen et al. (2009)	Neighborhood parks, skate parks, and senior community centers in Los Angeles	Longitudinal design with control parks; used observational assessments at each park and recreation facility. Surveyed park and facility users and neighborhood residents living within 2 miles of these facilities.	<p>+ One of the first longitudinal assessments examining the role of park improvements upon park use and physical activity. Used both observational and self-reported data; assessed different types of park and recreation facilities.</p> <p>– Limited observational days to assess long term park use, differences in post-assessment time frames across the various study parks.</p>
Colabianchi et al. (2009)	School-based playgrounds in Cleveland, Ohio	Longitudinal study design with control playgrounds; used observational methods to count playground use and physical activity levels.	<p>+ Among the first studies to examine the impact of playground renovations on playground use and physical activity levels. Used observational methods to document physical activity in playgrounds.</p> <p>– Study was delimited to school playgrounds, rather than community playgrounds.</p>
Cordell et al. (2004)	Non-institutionalized adults living in the United States	Cross-sectional nationwide household telephone survey conducted annually.	<p>+ Population sample of U.S. adults assessed participation rates in specific outdoor recreation activities.</p> <p>– Did not assess physical activity levels or use of specific park and recreation environments.</p>
Corti et al. (1996)	Focus groups of sedentary and low-to-moderate adult exercisers in Australia	Non-probability sample using qualitative methods	+ Provided qualitative data on perceptions of factors influencing the use of parks including personal and facility factors.
Crosby and Rose (2008)	Nationwide telephone survey of U.S. adults	Assessed respondent awareness, perceptions and support of public park and recreation services.	<p>+ A nationwide sample of U.S. adult perceptions about park and recreation service availability, access and use.</p> <p>– Assessed perceived use of parks only during the month of January.</p>
Floyd et al. (2008a)	Direct observation of 28 parks in Tampa, FL and Chicago, IL	Cross-sectional assessment of on-site park activity and park features using observational protocols (SOPLAY).	<p>+ Compared varying degrees of objective park-based physical activity levels across different city parks and park characteristics in lower-income neighborhoods.</p> <p>– Physical activity observations did not represent early morning, weekday or seasonal park use.</p>
Floyd et al. (2008b)	Direct observation of 28 parks in Tampa, FL and Chicago, IL	Same as Floyd et al. (2008a).	+ Same as Floyd et al. (2008a).

TABLE 1. continued

Study	Sample Characteristics	Methods (park type, study approach)	+ Strengths/ – Weaknesses
Frank et al. (2007)	Sample of 3,161 youth (5–20 yrs) in Atlanta, GA	Cross-sectional study which included an analysis of youth self-reported 2-day travel diaries and various indicators of urban form within 1km of study participants.	<p>+ Compared objective urban form measures (including number of recreation facilities) with walking activity of youth.</p> <p>– Only assessed self-reported walking for a 2-day period.</p>
Giles-Corti et al. (2005)	Sample of 1,803 adults and 516 public open space settings over 2 acres in Perth, Australia	Environmental audit of public open space at a neighborhood level and survey interviews with residents in the Perth, Australia area.	<p>+ Assessed the association between open space attractiveness, size, distance and use of public open space for physical activity.</p> <p>– Study limited to one region (Perth) and excluded those who might have reasons not to engage in recreational physical activity.</p>
Godbey et al. (1992)	Sample of 1,505 U.S. residents (15+ yrs)	Randomized telephone survey with a follow-up mail survey; cross-sectional, self report data.	<p>+ Nationwide sample of adult use of local park and recreation services.</p> <p>– Relied on self-reports of adult behaviors, did not explore use of specific park and recreation services and environments. Data is now dated.</p>
Gordon-Larson et al. (2006)	National Longitudinal Study of Adolescent Health (N = 20,745)	Randomized telephone survey, analysis was cross-sectional and linked GIS recreation facility data.	<p>+ Nationwide adolescent population analyses of relationship between socioeconomic status, distribution of recreational facilities and recommended physical activity.</p> <p>– Cross-sectional study, did not assess quality or facility type.</p>
Grow et al. (2008)	Parents (N = 87) and matched pairs of parents/children (N = 124) in three U.S. cities	Cross-sectional survey of parent and youth perception of proximity, use and transportation to 12 recreation sites and perceptions of neighborhood safety.	<p>+ Included multiple study settings and examined the role of transportation in recreation facilities.</p> <p>– Cross-sectional study, relied on self-reported measures of travel mode and park visitation.</p>
Kaczynski et al. (2007)	Literature review of peer-reviewed articles using 4 major search engines (PsycInfo, PubMed, Leisure Tourism Abstracts and Web of Science)	Descriptive comparison of key literature based upon study results showing positive, negative and mixed relationships between park and recreation settings and physical activity.	<p>+ Comprehensive assessment of literature linking park/recreation settings to physical activity.</p> <p>– Reviewed studies were typically empirical, cross-sectional designs.</p>

TABLE 1. continued

Study	Sample Characteristics	Methods (park type, study approach)	+ Strengths/– Weaknesses
Kaczynski et al. (2008)	Four neighborhoods in Ontario, Canada. Sample involved physical activity logs of 250 residential households and observational assessments of 28 features in 33 nearby parks.	Observational assessments of park environmental characteristics and self-reported physical activity diary data.	<p>+ Compared objective park proximity and park features to use of parks for physical activity.</p> <p>– Due to homogenous sample, study was not able to examine role of park quality/conditions on park use and physical activity.</p>
Li et al. (2005)	577 older adult residents (65+ yrs) from 56 neighborhoods in Portland, OR	<p>Cross-sectional, multilevel design with neighborhoods as the primary sampling unit and older adult residents as the secondary unit.</p> <p>Neighborhood characteristics were inventoried with GIS, including public parks, open space for recreation. Older adults were surveyed through direct mail and telephone to report neighborhood perceptions and behaviors.</p>	<p>+ Included both self-reported and GIS measures of park environments across 56 neighborhoods. Found relationships between walking safety perceptions and number of recreation facilities with high levels of walking activity.</p> <p>– Cross-section design confined to a single geographic area with managed urban growth. Used self-reports of walking behaviors rather than a broader range of recreational activity behaviors.</p>
Miles (2008)	2,123 adult household members from 7 European cities	Cross-sectional study that included personal household interviews concerning perceived safety and encouragement of playground use. Also included interviewer rating of neighborhood conditions.	<p>+ Examined the role of self-reported and observed safety indicators in relationship to encouragement of playground use and self-reported physical activity levels.</p> <p>– Assessed exercise in general rather than at the neighborhood level and assessed safety when returning home at dark, rather than all hours.</p>
Mowen et al. (2005)	Adult residents from seven counties in Northeast Ohio across two time periods (1991 N = 1,054 and 2001 N = 1,200)	Cross-sectional comparison on two time periods, telephone survey of residents' self-reported perceptions of park barriers, agency affordance strategies and park use behaviors.	<p>+ Assessed perceived barriers to community park use and preferred agency affordance strategies to minimize such barriers across two time periods (1991 and 2001).</p> <p>– Did not link park barriers with objective park activity levels, relied on self-reports of park use.</p>
Payne et al. (2005)	Older adults (50+ yrs) in the Greater Cleveland, Ohio region	Cross-sectional on-site survey distributed in neighborhood parks, community centers and shopping areas.	<p>+ Examined park activity levels of older adults and compared this activity with health outcome indicators.</p> <p>– Relied solely on self-reported measures of park use and park-based physical activity.</p>

TABLE 1. continued

Study	Sample Characteristics	Methods (park type, study approach)	+ Strengths/ – Weaknesses
Powell, Slater and Chalupka (2004)	Multi-year observational assessments of more than 200 communities	Cross-sectional assessments of community level physical activity space and neighborhood socio-economic status, race and density characteristics.	<p>+ National sample of communities using observational assessments of the environment. Assessed the presence of multiple park and recreation facility types.</p> <p>– Did not assess use of recreation facilities and only focused on one type of barrier that limits use of these park and recreation facilities.</p>
Ridgers et al. (2007)	470 children recruited from 26 elementary schools from a large city in North West England	Children's on-site physical activity levels during school recess were quantified using heart rate (HR) telemetry and accelerometry and were compared pre-intervention and post-intervention across treatment and control groups.	<p>+ Intervention study of school year playground modifications (colors and facilities) on objective measures of physical activity.</p> <p>– A number of missing data at both follow-up measurement points due to technical problems and student absences.</p>
Roemmich et al. (2006)	59 children (4–7 yrs) living in Erie County, NY	Cross-sectional analysis using accelerometers to assess objective physical activity levels and compare with presence of televisions, housing density and park area near children's homes.	<p>+ Combined objective measures of physical activity and environmental features (e.g., park area/neighborhood area).</p> <p>– Did not assess whether increased physical activity levels occurred within park settings or while walking to park.</p>
Rosenberger et al. (2005)	55 counties in West Virginia	Analysis of secondary health outcome, expenditure and recreation supply data. Used existing inventories, records and self-reported physical activity, BMI data.	<p>+ Used objective recreation supply indicators of across an entire state and compared with population levels of physical activity and obesity.</p> <p>– Cross-sectional study and could not assess temporal associations. Did not assess use of recreation facilities or spatial distribution of facilities.</p>
Scott and Munson (1994)	Adult residents from seven counties in northeast Ohio in 1991 (N = 1,054)	Cross-sectional telephone survey of self-reported perceptions of park barriers, agency affordance strategies and behaviors.	<p>+ Assessed barriers to use of local parks across lower-income and racial/ethnic residents across the entire northeast Ohio region.</p> <p>– Only assessed perceived barriers from those who reported infrequent/no park use; did not assess physical activity levels, specifically.</p>
Shores and West (2008)	Scans of 2,113 visitors across 4 suburban parks in a mid-sized southern U.S. town	Observational protocols to assess existing on-site park features, characteristics, users and physical activity levels.	<p>+ Compared observed park activity features with observed levels (momentary park scans) of park activity levels across different park types.</p> <p>– Limited park scans treated each observation as a case or separate visitor.</p>