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Review

Association of proximity and density of parks and objectively measured physical activity in the United States: A systematic review

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ABSTRACT

One strategy for increasing physical activity is to create and enhance access to park space. We assessed the literature on the relationship of parks and objectively measured physical activity in population-based studies in the United States (US) and identified limitations in current built environment and physical activity measurement and reporting. Five English-language scholarly databases were queried using standardized search terms. Abstracts were screened for the following inclusion criteria: 1) published between January 1990 and June 2013; 2) US-based with a sample size greater than 100 individuals; 3) included built environment measures related to parks or trails; and 4) included objectively measured physical activity as an outcome. Following initial screening for inclusion by two independent raters, articles were abstracted into a database. Of 10,949 abstracts screened, 20 articles met the inclusion criteria. Five articles reported a significant positive association between parks and physical activity. Nine studies found no association, and six studies had mixed findings. Our review found that even among studies with objectively measured physical activity, the association between access to parks and physical activity varied between studies, possibly due to heterogeneity of exposure measurement. Self-reported (vs. independently-measured) neighborhood park environment characteristics and smaller (vs. larger) buffer sizes were more predictive of physical activity. We recommend strategies for further research, employing standardized reporting and innovative study designs to better understand the relationship of parks and physical activity.

1. Introduction

Over the past fifty years, the United States (US) has witnessed an increase in sedentary activity and a corresponding decrease in physical activity related to transportation, leisure-time and work (Brownson et al., 2005). Physical activity has been linked to improved mental and physical health (Warburton et al., 2006). While the US Centers for Disease Control and Prevention recommends at least 1 h of physical activity per day for children and adolescents, and a minimum of 225 min per week of moderate to vigorous physical activity for adults, most people in the US do not meet this recommendation (CDC, 2014; Tucker et al., 2011).

Research has shown that active transportation (primarily walking and biking) and access to exercise facilities can increase physical activity (Handy et al., 2002; Sallis et al., 1992). The built environment—defined as human-made or modified environment, including transportation, food outlets, and parks—increasingly has been recognized as a determinant of physical activity and population health (Lee and Moudon, 2004; Rao et al., 2007; Srinivasan et al., 2003). In particular, pedestrian-supportive built environment characteristics such as open space, mixed land use and walkability predict increased physical activity (Brownson et al., 2009; Durand et al., 2011; Papas et al., 2007; Sallis et al., 1998). Commercial facilities such as gyms may also promote physical activity, at least among persons with memberships (Kaufman et al., 2014). Parks are common locations for recreational physical activity and are accessible to a wider population (Giles-Corti et al., 2005; Godbey et al., 2005; Lee and Moudon, 2004). However, research on

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the association of parks and physical activity has employed a mixture of self-reported and objective measurement approaches that may contribute to inconsistency in study findings. While previous research has reported mixed findings concerning the association of parks and physical activity, we focused more specifically on research using objectively measured physical activity through devices such as accelerometers. We propose that such device-based physical activity measurement is the best single measurement approach at this time for addressing our research question: does the current research literature support investments in local parks as a strategy to increase total physical activity of local residents?

Previous systematic reviews have investigated the association of urban planning, recreational facilities, traffic, safety and parks with physical activity (Durand et al., 2011; Ferdinand et al., 2012; Kaczynski et al., 2008). One of these reviews suggested that the built environment was more likely to be associated with self-reported than objectively-measured physical activity (Ferdinand et al., 2012). In a review of the international research literature, fewer than one-quarter of studies (9 out of 41) included objective measures of physical activity, and only 3 of those papers found a positive association between activity and green space (Lachowycz and Jones, 2011). Despite the recent growth in research using accelerometers, pedometers and other portable devices, to our knowledge, no review has focused only on studies with objectively measured physical activity and measures of access to parks in the US.

This review assesses evidence relevant to whether investments in creating, maintaining or improving parks would increase total objectively measured physical activity among area residents. It aims to identify limitations in current measurement and reporting practices for built environment characteristics and physical activity and to offer recommendations ways to standardize reporting and improve measurement strategies, providing a stronger evidence base for policy.

2. Methods

2.1. Information sources and eligibility criteria

A systematic search of the published literature was conducted in PubMed, PsycInfo, TRIS, ALR Literature Database, and Web of Science, using similar methods as described previously (Lovasi et al., 2009). We searched PsycInfo and the ALR database for dissertations, in order to include gray literature. Previously published reviews and references from included studies were also screened.

Studies were eligible for this review if: 1) conducted in the United States with a sample size of 100 individuals or more; 2) results were reported in English between January 1990 and June 2013; 3) the study included physical activity measured objectively (with a pedometer or accelerometer, sometimes used in combination with GPS tracking) as an outcome; and 4) the study included park-related built environment measures such as density of parks (number of parks per unit of land area such as buffer or square kilometer) or distance to nearest park (objective or self-reported) as predictors.

2.2. Search strategy

The following search terms related to the outcome and exposure were used to identify relevant articles: accelerometer, pedometer, physical activity, green space, walkability, and recreational facilities. The full search terms for the meta-analysis project are included in Online Appendix 1. The search strategy was intended to have high sensitivity to identify a wide range of studies with built environment measures as potential predictors of physical activity, regardless of whether parks were of primary interest. While we allowed a broad definition of the exposure (parks), we restricted our attention more narrowly to objective physical activity as an outcome.

2.3. Study selection

Following automatic screening for duplicates (via Endnote), abstracts were screened by one team member for inclusion according to the eligibility criteria. A training set of fifty abstracts was used to harmonize screening across team members. If full text articles were consulted, a different team member evaluated the full article for final determination of inclusion.

2.4. Data collection process and data items

For all articles included in the review, we abstracted information on study design, sample size, demographics of the study population, independent variables, outcomes, analytic approach and associations observed. A team member completed the initial data entry, which was verified by a different team member who made any necessary corrections. Discrepancies were discussed between team members and with the senior author (GSL), as needed, to reach consensus.

2.5. Methods of analysis/synthesis of results

We first grouped the papers according to their built environment measure for parks and their objective measure of physical activity. Second, we summarized the study findings for specific park exposure categories according to the strength of the reported association between that measure and physical activity: significant in the hypothesized direction (e.g., more parks associated with more activity), significant in the opposite direction, no relationship or mixed findings (direction or statistical significance of association differed across analyses). Third, we noted potential sources of heterogeneity across the set of included studies. Finally, strengths and weakness were summarized to inform improved reporting standards and measurement practices as this research progresses toward a more credible and cohesive evidence-base to support informed action.

3. Results

3.1. Search and study selection

The database search resulted in 15,739 abstracts of which 10,949 were unique (Fig. 1). These abstracts were then screened for inclusion. In addition, 133 articles from the Active Living Research Database and 187 systematic or narrative reviews were screened for potential additional references. Ultimately, 801 full text articles were reviewed for eligibility and 320 were abstracted into a database of US-based studies linking the built environment to physical activity or adiposity. Among these, 93 articles included a built environment exposure variable related to parks or green space. Of these 93 articles, 20 had objectively measured physical activity as an outcome and thus were included in this review.

3.2. Overview of studies

Table 1 provides an overview of the 20 articles with the association of interest (parks and physical activity), study populations, location and sample size, outcomes and exposure measures and findings. The 20 publications were based on data from 16 unique