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How much neighborhood parks contribute to local residents' physical activity in the City of Los Angeles: A meta-analysis

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ABSTRACT

Objective. To quantify the contribution of neighborhood parks to population-level, moderate-to-vigorous physical activity (MVPA).

Method. We studied park use in 83 neighborhood parks in Los Angeles between 2003 and 2014 using systematic observation and surveys of park users and local residents. We observed park use at least 3–4 times per day over 4–7 clement days. We conducted a meta-analysis to estimate total, age group and gender-specific park use and total MVPA time in parks.

Results. An average park measuring 10 acres and with 40,000 local residents in a one-mile radius accrued 5301 h of use (SE = 1083) during one week, with 35% (1850 h) spent in MVPA and 12% (635 h) spent in vigorous physical activity (VPA). As much as a 10.7-fold difference in weekly MVPA hours was estimated across study parks. Parks' main contribution to population-level MVPA is for males, teenagers, and residents living within a half mile.

Conclusion. Neighborhood parks contribute substantially to population MVPA. The contribution may depend less on size and facilities than on “demand goods” – programming and activities–that draw users to a park.

Introduction

Modern urban park was established as a place where people could connect with nature, socialize with others in a shared community space, and engage in active sports and passive recreation (Olmsted, 1870). While parks today are largely open access and free to the general public, parks have increasingly been adopting cost-recovery strategies as the economic base of cities have declined (NRPA, 2010). In particular, parks in large cities usually charge fees for participation in exercise classes, sports leagues and other organized activities. This could represent a barrier to those urban residents with limited incomes. An even more significant barrier to park use may be the diminished urban crowding. As society has become more affluent and technology has advanced, most Americans have access to electronic entertainment in comfortable and climate-controlled dwellings, partly obviating the pull to spend leisure time outdoors (BLS, 2013; Gortmaker et al., 1996).

Yet because physically active individuals have lower health care costs, fewer chronic diseases, and greater longevity (Colditz, 1999; Wang et al., 2005; Warburton et al., 2006), the promotion of physical activity is an important societal imperative. Given the predominance of sedentary work and the use of motor vehicles for transportation, leisure time is when most people have the opportunity to engage in moderate-to-vigorous physical activity (MVPA). Increasing the use of neighborhood parks for leisure time MVPA could yield societal dividends that go beyond individual pleasure and well-being.

Parks often have multiple facilities and a substantial amount of land available to support MVPA. Parks' size is associated with park use (Cohen et al., 2010), and often varies within cities, with smaller parks in the dense urban cores and larger ones in the periphery, based on land cost and availability at the time the areas were developed (Dahmann et al., 2010). Prior studies have also indicated that the use of parks is highly dependent on programming within the park, e.g., group exercises, classes, and organized sports events (Cohen et al., 2012a, 2013). Moreover, the use of parks may be reduced where the community considers the spaces unsafe, poorly maintained, or poorly equipped (Babey et al., 2005, 2007).

Given the socio-demographic diversity of park users in most large urban cities, it is an enormous challenge to provide park facilities and services to meet the needs of a growing population base (Gobster, 2002). This study examines the contribution of the neighborhood park system to MVPA in the City of Los Angeles and explores how park systems could support population level MVPA. To our knowledge, the degree to which the neighborhood park system of a major city contributes to leisure time MVPA has not been previously quantified.

The City of Los Angeles Department of Recreation and Parks manages 487 sites totaling approximately 16,000 acres of lands (LARAP, 2013). These parks can be divided into three categories: 1) pocket parks (usually smaller than 1.9 acres, 201 sites totaling 121 acres); 2) neighborhood parks (including recreation centers) primarily serving

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the local population (most between 2 and 25 acres, 222 sites totaling 2162 acres); and 3) regional attractions with large lot sizes (64 sites, 13,721 acres). Eight sites that are over 25 acres are also classified as neighborhood parks, because their functionalities are similar to neighborhood parks rather than regional attractions. Because neighborhood parks are of substantial size and mainly used by the local population, this study is focused on their contribution to their local populations' MVPA.

Methods

Data source and measurements

We pooled data collected from five primary studies conducted by us (Cohen et al., 2007, 2010, 2012a,b, 2013) between 2003 and 2014 (one study is still ongoing). The five previous studies included 37% (n = 83) of the neighborhood park and recreation center system in the City of Los Angeles, covering a wide variety of neighborhoods with mild oversampling in low-income areas. Fig. 1 visualizes the variations in locations, acreages, and neighborhood poverty level of the 83 study parks.

In all five previous studies, we measured park use by the System of Observing Play and Recreation in Communities (SOPARC) (McKenzie et al., 2006). Based on systematic momentary time sampling, SOPARC provides multiple snapshots of MVPA occurring within parks. Selection of parks has been changing among the previous studies due to different goals and sampling designs. Among the 83 study parks, 18 were observed in one year, 37 were observed in two years, 11 were observed in three years, 13 were observed in 4 years, and 4 were observed in five or more years. In each year of observation, a park was measured three to four times a day (with 3–4 h between any two adjacent visits), three to four days in the same week (including both weekdays and weekends), and over two to three weeks (in the same season). Except for the 18 parks measured only in one year, the other parks all have four or more weeks of measurement. All observations were conducted under clement weather conditions. When it rained on the scheduled the observations were postponed to the next week on the same day of week and at the same hours.

We also conducted surveys among users of study parks and neighborhood residents whose households were randomly chosen within three spatial strata defined by the distance to park (0.25, 0.25–0.5, and 0.5 to 1 mile). See (Cohen et al., 2013) for an example of the survey protocol, and the other four studies used the same or very similar survey protocol.

Each study park was divided into target areas to facilitate systematic observation, yielding 2925 target areas across the 83 parks. In all previous studies we conducted roughly 10,900 whole park observations. During these observations, we documented approximately 325,000 users, among whom 110,000 users were engaged in MVPA. The pooled survey data has approximately 11,000 respondents intercepted in parks and another 10,000 local residents surveyed in their homes.

Statistical analysis

We conducted two sets of analyses to estimate the cumulative time of park use and the contribution of parks to local populations' MVPA, respectively. Our methods were based on the statistical approach in Han et al. (2013).

We estimated the average cumulative time of park use during a week, denoted by T. We chose to estimate the weekly use instead of daily use because of the cyclic pattern of park use during a week. Let $Y(t)$ be the number of users in a park at time t. Then $T = \int_1^{14} \mathrm{E}[Y(t)]\ dt$. This expression suggests a two-step estimation procedure: first estimating the mean park use at time t, $\mathrm{E}[Y(t)]$, and then integrating the estimated $\mathrm{E}[Y(\mathrm{t})]$ over time within a week. We used a mixed-effect longitudinal model to estimate the mean park over time. The specific model is $y_{i,d,t(i,d)} = \alpha_t + \beta_d + \gamma_{d,t} + a_{i,d(t)} + \varepsilon_{i,d,t}$, where the response variable is the number of park users from SOPARC whole park scans in park i ($i = 1\ldots83$) on weekday d ($d = 1\ldots7$) and at hour t, and $t = \mathrm{t}(i, d)$ denotes the varying observation schedules among parks and between days.

To allow for completely flexible trajectory shapes, the mean trajectories were modeled by a group of indicators for hours of a day, days of a week, and their interactions. Fixed effects α_t, β_d, $\gamma_{d,t}$ represented the overall mean effects of hours of a day, days of a week, and interaction effects, where the interaction effect $\gamma_{d,t}$ is important because weekdays and weekends have different hourly trajectories. The random effects $\alpha_{i,d(t)}$ represented the deviations of each park from the overall mean trajectory, where $\alpha_{i,d(t)}$ consists of a group of

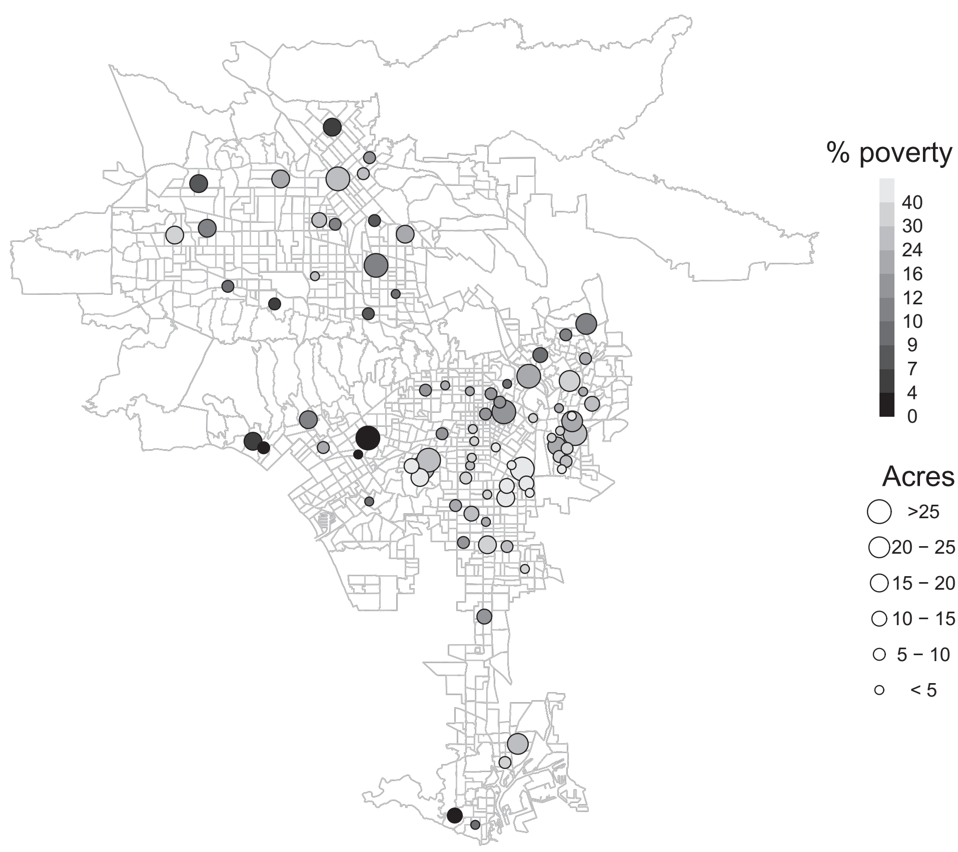

Fig. 1. Map of the 83 study parks: overlays are the census tracts overlapping with the City of Los Angeles.