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Parks and social capital: An analysis of the 100 most populous U.S. cities

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ABSTRACT

In recent years, much attention has focused on strategies to reverse the decline of social capital in the United States. Increased social capital, which includes both intergroup contact and civic engagement, has many important benefits. For low-income individuals, friendships with high-income individuals ("economic connectedness", a measure of inter-group contact) are one of the strongest predictors of their ability to escape poverty and gain increased life opportunities. Volunteering, a measure of civic engagement, is hypothesized to be key in building trust among neighbors. Urban parks are often thought to be a 'third place' that may increase social capital within a community through both increased "mixing and mingling" and increased civic engagement. This study finds that residents of cities with better quality park systems (as measured by the ParkScore® index) are more socially connected and engaged with their neighbors (as measured by the Social Capital Atlas) than are residents of cities with lower-ranking park systems. Relative to the bottom 25 ranked cities, the top 25 ParkScore cities had 26 % more social connections between different income groups, 61 % more volunteers per capita, and 45 % more civic organizations per capita. These patterns held after controlling for other factors such as education, race/ethnicity, poverty, and family structure. These other factors often had stronger associations with the social capital indicators, suggesting park systems are an important, but not primary, driver of a community's social capital. People living in cities with more parks and recreational opportunities may be more likely to realize these important benefits.

1. Introduction/background

Much attention has focused on the decline in social capital in the United States in recent years (Mijs and Roe, 2021; Putnam, 2000; Lee, 2018). Social capital refers to social networks and the trust and reciprocity that characterize them, and is often framed in terms of the benefits it delivers: mutual assistance in times of need, tips for finding a job or an apartment, collective efficacy in achieving social and political goals (Aldrich and Meyer, 2015). "Bridging social capital" connects people who are different from each other in salient ways, such as race, ethnicity, religion, or political affiliation, while "bonding" social capital connects people who share such characteristics—say, members of the same church or civic association. Social capital is positively associated with health, well-being, and happiness (Duh-Leong et al., 2021; Ehsan et al., 2019; Leung et al., 2013; Pérez et al., 2020; Xue et al., 2020). Accordingly, for community leaders interested in these outcomes, it is important to identify and promote factors that strengthen social capital.

Some of these factors reside in the physical environment. Researchers have associated features of the built environment, including mixed land use, walkability, and public spaces in which people can mix and mingle with higher levels of social capital (French et al., 2014; Kurtenbach, 2024; Latham and Layton, 2019; Leyden, 2003; Mazumdar, 2018; Mouratidis, 2018; Mouratidis and Poortinga, 2020; Qi et al., 2024). A particular type of public space that may promote social capital is parks. Urban greenspace, which includes parks as well as tree canopy and other vegetated areas, is consistently associated with increased social capital (Wan et al., 2021; Elands et al., 2018; Rugel et al., 2019). Several pathways may operate.

First, parks are settings in which people are exposed to nature – and nature contact is associated with prosocial behavior, an association that

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emerges in childhood (Zare Sakhvidi et al., 2022; Putra et al., 2020) and persists across the lifespan (Arbuthnott, 2023; Castelo et al., 2021).

Second, parks are settings for informal social encounters such as a casual conversation on a park bench. Nor are actual conversations necessary; as Barker et al. have noted [25, pp 502–503], "The act of sharing a public space such as a park or plaza, where people come together in their mutual affinity for the place itself, can also create 'a connection to others without interaction.'" Such encounters likely encourage the "weak ties" that contribute to bridging social capital (Granovetter, 1973).

Third, formal park-based activities such as gardening, classes and team sports provide an opportunity for people to interact and form relationships, ranging from casual encounters with classmates to lasting strong ties as may occur among teammates (Prins et al., 2012), leading to bonding social capital. Beyond participating in such activities, community engagement in park oversight and governance provides further opportunities for sustained civic engagement (Vest et al., 2024).

A process closely related to social capital is intergroup contact. Contemporary evidence suggests high levels of polarization and segregation in U.S. society by race/ethnicity, social class, and ideology (Finkel et al., 2020; Garzia et al., 2023; Iyengar et al., 2019; Loh et al., 2020; Mijs and Roe, 2021; Skelley and Fuong, 2022; label). In residential settings, in schools, in workplaces, and even on Facebook, people increasingly tend to congregate with members of their in-groups rather than across group boundaries. However, there is some evidence that parks may serve as venues for successful intergroup contact (Barker et al., 2019; Powers et al., 2021, 2022a, 2022b; Mullenbach et al., 2022; Peters, 2010; Peters et al., 2010).

Of note, an association between parks and social capital is likely bidirectional. Well-used, high-functioning parks likely promote social connections, just as communities with high levels of social capital likely prioritize funding, programming, and utilization of their parks. There is evidence of this virtuous cycle in the literature (McNeill et al., 2006; Cradock et al., 2009; Seaman et al., 2010; Broyles et al., 2011).

Research has investigated what features of parks—both physical features and programming—are associated with high levels of park use and with greater social connectedness. Specific contributory park features include overall quality, amenities such as vegetation and playgrounds, and park size. Aesthetic features, maintenance and cleanliness also promote social interactions (Ng and Chow, 2023; Samsudin et al., 2022; Chen, 2024). Proximity and accessibility to parks play a role, (Cardinali, 2024) as does perceived safety (Hong et al., 2018). Structured park programming, such as sports and fitness activities and culturally-specific programs, facilitates bringing people together (Anderson-Butcher and Anderson-Butcher, 2019).

These features of high-quality parks are consistently associated with increased social connections. But does this relationship operate at the park system scale, in relation to citywide social capital? This distinction has important implications. Do efforts to improve social capital via parks need to be implemented at the site-scale (e.g. addition of specific park features or programs) or can they also include more general (often policy-level) improvements to the overall park system, such as increased park funding or systematic improvement of neighborhood parks? The purpose of the present study was to test the association between park system quality and social capital, at the city scale. We hypothesize that higher park system quality is associated with higher levels of social capital.

2. Methods

In this paper, we test the association of a city's park system quality, as measured by a composite index called ParkScore®, with the social capital of its aged 25–44 population, as measured using three established indicators from the Social Capital Atlas: Economic Connectedness, Volunteering, and Civic Organization Density. The first, *economic connectedness*, is a measure of inter-group contact between individuals of different income groups, because parks may function as venues in which people of different economic strata mix and mingle. The second and third are measures of civic engagement*: volunteering* (based on membership in volunteering or activism Facebook groups) and the *density of civic organizations* (based on the density of "public good" Facebook pages for such organizations in a location), respectively, because parks may both function as incubators of civic engagement and benefit from civic engagement.

2.1. Park system quality

The independent variable of interest is a city's park system quality, as measured by the 2024 ParkScore index. The ParkScore index is an initiative of Trust for Public Land, a national nonprofit organization. It ranks park systems each year in the 100 most populous U.S. cities. Three features of the ParkScore index support its validity as a proxy for city-level park system quality: 1) it was developed by national park and recreation experts (content validity), 2) it is correlated with health outcomes (criterion-related validity; see (Anglin et al., 2016; Mullenbach et al., 2018) for examples), and 3) it has been published annually since 2012 and is widely used by practitioners and researchers (practical validity) (Rigolon et al., 2018).

Five criteria contribute to a city's 2024 ParkScore rating: acreage, investment, amenities, access, and equity. Within these five criteria, 14 specific measures are used (Fig. 1). *Acreage* is assessed based on two equally weighted measures: median park size and parkland as a percentage of city area. *Investment* is assessed based on an aggregate measure of investments in each city's publicly accessible parks from three sources: all public agencies (including capital, maintenance, and programming spending); private organizations (including all spending by parks nonprofits, conservancies, foundations, and "friends of" groups); and volunteer hours supporting publicly accessible parks from both public and private organizations. *Amenities* are assessed based on the per capita citywide supply of six specific park amenities (basketball hoops, off-leash dog parks, playgrounds, recreation and senior centers, restrooms, and splashpads). *Access* is assessed based on the percentage of each city's population living within a 10-minute (half-mile) walk of a publicly accessible park. *Equity* is assessed based on four measures: the ratios (on a per capita basis) of nearby public park space between neighborhoods of color and white neighborhoods and between low-income neighborhoods and high-income neighborhoods, and the percentages of people of color and low-income households within a 10-minute (half-mile) walk of a public park. Data for each measure are collected annually through questionnaires and GIS park inventories completed by park agencies (for park characteristics) and U.S. Census Block Group estimates provided by Esri (for demographic data), and results are published at www.tpl.org/parkscore (where more complete information about methodology can also be found).

Each city receives two values in the ParkScore index: a *rating* on a scale of 100 points (100 is high) and a *ranking*, with each city ranked on a scale of 1–100 (1 is high), regardless of the magnitude differences among rating scores.

2.2. Social capital

Numerous methods of measuring social capital are described in the literature (Vâlsan et al., 2023; Lochner et al., 1999; Harpham et al., 2002; Engbers et al., 2017). Distinct approaches reflect interest in different types of social capital (bridging, bonding) and in different dimensions of networks (trust, civic engagement, civic norms). Traditionally, measurement of social capital has relied heavily on survey data. Many of the major national surveys lack the sample sizes necessary to provide estimates at the neighborhood or city scale. Examples include the General Social Survey (n ≈ 3500 individuals, powered for national estimate), Current Population Survey (n ≈ 60,000 households, powered for metropolitan estimates) and CDC Behavioral Risk Factor

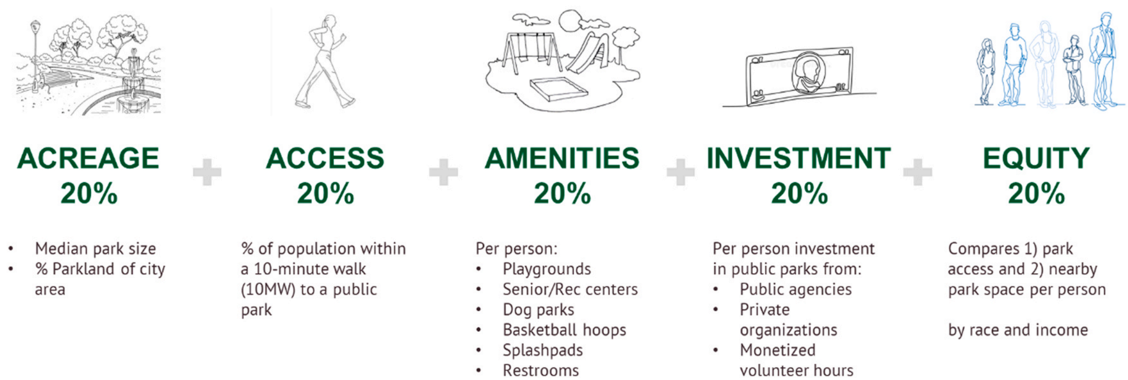

Fig. 1. 2024 ParkScore methodology.

Surveillance System (n ≈ 400,000 individuals, powered for county estimates). More recently, investigators have utilized data from social media platforms such as Facebook, LinkedIn, and Twitter (now known as X) as proxies for real-life connections, to measure and characterize social networks (Bailey et al., 2018a, 2018b).

Here we use a novel social network dataset of 72.2 million U.S. Facebook users between the ages of 25 and 44 drawn from the 2022 Social Capital Atlas as a proxy for real-life social connections. As further described by Chetty et al (Chetty et al., 2022a), this approximation is justified for four reasons. First, a Facebook social connection requires confirmation from both individuals, which distinguishes Facebook from most social networks. Second, at the time these data were collected, Facebook was widely used by U.S. adults (69 % of all adults; only YouTube was more popular), and most of those adults reported using Facebook daily (Auxier and Anderson, 2021). Third, Facebook usage rates were similar across most demographic groups (e.g. race/ethnicity, education) with the senior age group a notable exception (Auxier and Anderson, 2021). Fourth, almost all Facebook users reported being Facebook friends with “real-life” family members (93 %), current friends (91 %), and friends from the past (87 %) (Duggan et al., 2015). The Social Capital Atlas restricted the sample to active Facebook users aged 25–44 (to reduce impact of observed differential usage by age group) and to users with at least 100 U.S. based Facebook friends. This resulted in sample of 72.2 million U.S. users, which represents 84 % of all U.S. adults aged 25–44, with a demographic profile reflecting the national population based on 2014 – 2018 American Community Survey data. Results are available at the ZIP Code and county scale for the entire United States. The Social Capital Atlas data are available at https://data.humdata.org/dataset/social-capital-atlas, and the methods are more fully described elsewhere (Chetty et al., 2022a).

The Social Capital Atlas is based on three conceptual categories: *cross-type connectedness*, the extent to which different types of people (for example, low income and high income people) are friends with each other; *network cohesiveness*, the degree to which friendship networks are clustered into cliques and whether friendships tend to be supported by mutual friends; and *civic engagement*, reflecting trust and participation in civic organizations. We use three corresponding social capital measures as our dependent variables.

The first dependent variable, a measure of cross-type connectedness, is economic connectedness. Economic connectedness measures the social connections between low- and high-socioeconomic status (SES) individuals in a given geography and is calculated as the percentage of a low-SES individual’s Facebook friends who are high-SES. Each individual’s SES classification is calculated relative to the national population, with those in the bottom half classified as ‘low-SES’ and those in the top half as ‘high-SES.’ The second and third dependent variables, volunteering and civic organization density, are measures of civic engagement. Volunteering is calculated based on the portion of Facebook users with membership in a volunteering or activism Facebook group as identified based on group titles. Civic Organization density is calculated based on the density of "public good" Facebook pages for a given location, as classified based on the page title and category, excluding those pages without a listed address (Chetty et al., 2022a). Chetty et al. further validated these Facebook-derived variables through population-weighted correlations with widely-used external measures: Volunteering had a .58 correlation with The Social Capital Project’s state-level volunteering rates; Civic Organization density had a .67 correlation with the Penn State Index’s county-level civic organization densities; and estimates of high-SES percentages had a .88 correlation with American Community Survey zipcode estimates (Chetty et al., 2022a).

2.3. Study setting and spatial analysis

We use the city as the unit of analysis for two reasons. First, the city government is the primary political unit responsible for the quality and availability of parks within a city. City governments are responsible for spending 85 % of all dollars on parks within city limits (as opposed to private, county, state, or federal entities) (Klein, 2024). Second, people use a range of parks in their jurisdictions in addition to their neighborhood park. Empirical studies of travel time to parks are limited, but a study of New York City park use found a mean travel distance of three miles (Zhao et al., 2023) and a study of Chicago park use found one-sixth of park visits were over six miles from home (Saxon, 2021). And while not specific to local parks, the National Household Travel Survey reports a mean travel distance of about seventeen miles for social and recreational trips (Bricka et al., 2024). Finally, a recent study comparing neighborhood park usage across 498 U.S. cities found that *between-city* differences explained about two-thirds of differences in park usage, while *within-city* differences explained only about a third (Young et al., 2024).

To facilitate this comparison, we aggregate outcome variables and covariates to the city level. The 2024 ParkScore index included the 100 most populous U.S. cities or Census Designated Places (e.g. Arlington County, VA), with the following exceptions: two "cities" - Charlotte/Mecklenburg, NC and Honolulu, HI - represent counties and three cities - Indianapolis, IN, Fort Wayne, IN, and Enterprise, NV – have not recently been included in the Index. In this paper, all are referred to as "cities."

For each of the three social capital metrics, we calculated a population-weighted city average by aggregating data from the ZIP Code scale using Census Relationship files, which attributes the portion of each ZIP Code within city limits to each city or county unit (https://www.census.gov/geographies/reference-files/time-series/geo/relationship-files.2010.html#par_textimage_674173622). In the publicly available Social Capital Atlas data, ZIP Codes with fewer than 100 low-SES and 100 high-SES Facebook users were excluded for privacy reasons. We exclude the population of those ZIP Codes lacking social capital metric data entirely from our city scale population-weighted averages. This resulted in an average of 99 % of a city's population contributing to our city-level estimates.

2.4. Statistical analysis

We assess the association between park system quality and social capital using Ordinary Least Squares (OLS) multivariable linear regression. A city's 2024 ParkScore rating was used to measure its park system quality and the three social capital metrics described above are the dependent variables.

To assess for potential confounding, we identified 8 additional covariates from the literature (Lee, 2018; Elands et al., 2018; Chetty et al., 2022a; Dietz et al., 2023; Schlachter, 2021) that are commonly associated with community-level social capital:

- Education: proportion of population aged 25–44 with bachelor's degree or higher
- Poverty: proportion of city households under 200 % Federal Poverty Level
- Hispanic Ethnicity: proportion of city population aged 25–44 that identifies as Hispanic/Latino; log transformed to address heteroskedasticity
- Black or African American Race: proportion of population aged 25–44 that identifies as Black or African American; square root transformed to address heteroskedasticity
- Population density: city population divided by land area; log transformed to address heteroskedasticity
- Family structure: proportion of city population aged 25–44 that is married
- Transiency: proportion of city population aged 25–44 that moved within the past year

All variables were derived from the 5-year American Community Survey (2018 – 2022) with the exception of population density, which was calculated from city-provided data collected as part of the ParkScore survey. Additional potential confounders considered and not included were partisanship (which was not related to any of the outcomes in exploratory data analysis), gender and age (which varied minimally between cities), and other measures of family structure (which were highly correlated with the proportion of the population that is married).

We evaluate each of the three social capital outcome metrics (Economic Connectedness, Volunteering, and Civic Organization Density) separately, first by comparing the outcomes across four quartiles of ParkScore *ranking* (as opposed to the *rating* used in the regression analysis, described next). Because the outcomes were not normally distributed, we use Kruskal-Wallis rank sum tests to assess variation of the outcomes by ParkScore ranking quartile, and the Wilcoxon Rank Sum test to test for pairwise differences between the highest and lowest quartile groups. We calculate the median and interquartile range for each of the three social capital outcomes, for each quartile, without controlling for potential confounders. The ranking is the easiest and most common way in which the ParkScore index is communicated among city leaders and park advocates.

We also examine the associations between the ParkScore *rating* and the three outcome metrics using regression including covariates. In addition to transformations of three covariates (Black or African American race, Hispanic ethnicity, city density), the social capital outcome variables were also log transformed to address heteroskedasticity. For each outcome, we further evaluate three regression models – a bivariate model, a maximal model with the full set of theoretically-relevant control variables, and a fitted model using backwards stepwise regression optimized on adjusted R squared. The fitted models address concerns of too many predictors (nine) for the sample size of 100 cities and reduce multi-collinearity relative to the maximal model. Relative magnitudes of predictors are compared using standardized estimates calculated via sjPlot v2.8.16 in R. The result is nine models: three outcomes times three regression specifications (bivariate, fitted, maximal).

We test each of the nine models for spatial auto-correlation and for OLS assumptions. Using the sfdep v0.2.4 package in R, we evaluated all nine models for spatial autocorrelation using Moran's Global I on the model residuals, defining nearest neighbors as cities within 120 miles of each other and allowing cities to have zero neighbors (e.g. Anchorage, AK).

3. Results

Across the 100 cities, the ParkScore ratings range from a low of 24 / 100 points (Port St. Lucie, FL) to a high of 84.8 / 100 points (Washington DC) (Table 1). Economic Connectedness values, the average share of a low-income person's friends who are high-income in a given city, range from a low of 24 % (Detroit, MI) to a high of 71 % (San Francisco, CA). Low-income persons are Facebook users (aged 25–44) predicted to be in the bottom half of the U.S. by socio-economic status, with high-income those in the top half. Volunteering, the percentage of a city's aged 25–44 Facebook users who are members of a "volunteering" or "activism" page, ranges from a low of 2.2 % (Newark, NJ) to a high of 13.5 % (Boise, ID). Civic organization densities, the number of "public good organization" Facebook pages per capita in a given city, range from a low of 5 "public good" organizations per 1000 Facebook users (North Las Vegas, NV) to a high of 33 (Washington, DC).

Cities with higher ParkScore *ranking* have higher average social capital among their age 25–44 population (Table 2). We find that residents of cities with the highest ParkScore rankings are more socially connected and engaged with their neighbors than residents who live in cities with lower-ranking park systems. Relative to the bottom 25 ranked cities, the top 25 ParkScore cities had a median of 26 percent more social connections between different income groups ("economic connectedness"), 61 % more volunteers per capita, and 45 % more civic organizations per capita. Since all three outcomes (economic connectedness, volunteering, and civic organization density) varied significantly by ParkScore quartiles, the highest (1–25th percentile) was compared to the lowest (76–100th percentile) with Wilcoxon Rank Sum tests, which revealed significant differences in all three cases ($p < 0.001$).

To control for potential confounders, we ran nine multivariable regression models as described above. None of the fitted or maximal models have spatial autocorrelation (two of the bi-variates did – economic connectedness and civic organization density). Model diagnostics, analyzed using the performance v 0.11 package in R, suggest that all nine models meet the assumptions for OLS regression and that there are no hidden effects. In all six maximal and fitted models, there were modest levels of multi-collinearity as variance inflation factors for each of the variables ranged from 2.3 – 3.98 in the maximal models and 1.28 – 3.91 in the fitted models. There were modest levels of heteroskedasticity prior to the variable transformations. We evaluated both models without the ParkScore variable and did not find significant changes in any key statistics including the magnitude or direction of coefficients and minimal decreases in adjusted R-squared. Park system quality was a significant predictor in eight of the nine models (the exception being the maximal civic organization density model) and had a positive coefficient estimate in all nine.

Tables 3, 4, and 5 show results for each of the three hypothesized dependent variables: economic connectedness, volunteering, and civic organization density. Each table shows results of three regression models: 1) the bivariate association of the city's ParkScore rating with the dependent variable, 2) a maximal model including all potential covariates based on the literature, and 3) a fitted model with the predictors identified via backwards stepwise regression.

3.1. Analysis 1: economic connectedness

Cities with higher ParkScore values have higher levels of economic

Table 1
ParkScore ratings, demographic profiles, and social capital indicators in 100 U. S. cities: descriptive statistics.

Transformations for OLS regression are listed in italics		Median	Mean	Range
Independent Variables				
Park System Quality	ParkScore Rating	52.2	53.3	24–84.8
	scaled to 0–1 units for comparative purpose (ParkScore rating/100)	*0.52*	*0.53*	*.24 –.85*
Education	% pop. aged 25–44 w/ bachelor or higher	42 %	43 %	17 % - 83 %
Poverty	% pop. aged 25–44 under 200 % of Federal Poverty Level	6 %	6 %	3 % - 14 %
Hispanic Ethnicity	% pop. aged 25–44 Hispanic	18 %	26 %	4–95 %
	log (ethnicity) to normalize distribution	*−1.72*	*−1.65*	*−3.12 - −.052*
Black or African American Race	% pop. aged 25–44 Black or African American	15 %	18 %	1–75 %
	sqrt (race) to normalize distribution	*0.381*	*0.388*	*.084 –.865*
Density	City land acres per capita	6.02	7.89	.27–44.67
	log (density) to normalize distribution	*1.79*	*1.8*	*−1.33–3.84*
Family structure	% pop. aged 25–44 married	46 %	45 %	23 % - 68 %
Transiency	% pop. aged 25–44 moved within last year	21 %	21 %	11–31 %
Dependent Variables				
Economic Connectedness	of low-income individuals in a city, avg % of friends who are high-income	39.1 %	41.9 %	24 % - 71 %
	log (econ connected rate) to normalize distribution	*−0.94*	*−0.893*	*−1.44 - −.351*
Volunteering	% of users who are members of volunteering or activism group	5.8 %	6.0 %	2.2 % - 13.5 %
	log (volunteering) to normalize distribution	*−2.846*	*−2.86*	*−3.80 - −2.01*
Civic Organization Density	Number of "public good" Facebook pages per 1000 users	13	14	5–33
	log (civic density) to normalize distribution	*−4.33*	*−4.32*	*−5.32 - −3.99*

connectedness among 25–44 year-olds after controlling for confounders (Table 3). The fitted model can illustrate this difference by setting all other covariates to the sample average other than the dependent variable, economic connectedness. Low-SES residents in a city with a ParkScore rating of 30 are estimated to have 39 % of their friends be high-SES, whereas the fitted model estimates this to be 43 % in a city with a ParkScore rating of 70 (10 % increase). For a low-SES individual with 507 Facebook friends (the average as calculated via the Social Capital Atlas (Chetty et al., 2022b)), this difference translates to 20 more high-SES friends. However, with a .05 standardized estimate ($p < .05$) in both the fitted and maximal models, park system quality is not the strongest correlate of economic connectedness. Poverty rate, race, ethnicity, and education are substantially stronger correlates (absolute values of standardized estimates range from .08 to.13 in the fitted model, all with $p < .001$).

Table 2
Social capital metrics by quartile of ParkScore ranking.

ParkScore Ranking	**Economic Connectedness** of city's low-income individuals, % of friends who are high-income	**Volunteering** % of city population belonging to 'volunteering' or "activism" groups	**Civic Organization Density** # of "public good" Facebook pages in a city per 1000 population
Top Cities (#1–25)	**47.9 %**	**7.6 %**	**15.9**
*N = 25**	*41.7 % - 53.0 %*	*6.7 % - 8.5 %*	*13.1 – 20.4*
26–50	**41.0 %**	**5.8 %**	**12.5**
*N = 25**	*36.8 % - 46.2 %*	*5.1 % - 6.4 %*	*11.7 – 15.6*
51–75	**37.5 %**	**5.2 %**	**13.4**
*N = 25**	*34.0 % - 45.0 %*	*4.1 % - 6.1 %*	*11.6 – 15.1*
76–100	**37.9 %**	**4.7 %**	**11.0**
*N = 25**	*35.6 % - 39.4 %*	*3.9 % - 5.7 %*	*9.4 – 13.4*
P-Value**	*<.001*	*<.001*	*<.001*

* Median (Q1, Q3)
** Kruskal-Wallis rank sum test

3.2. *Analysis 2: volunteering*

Cities with higher ParkScore ratings have higher levels of volunteering among 25–44 year-olds after controlling for confounders (Table 4). The fitted model can illustrate this difference by setting all other covariates to the sample average other than the dependent variable, volunteering. A city with a ParkScore rating of 30 is estimated to have a 4.8 % volunteering prevalence, while a city with a ParkScore rating of 70 is estimated to have a 6.4 % prevalence. With an average population of 655,000 among cities in the sample, this 1.6 % difference translates to 10,480 more volunteers. However, with absolute values of standardized estimates ranging from .11 to .21 ($p < .01$), race, ethnicity, and marriage are more strongly associated with volunteering than is park system quality (.10 standardized estimate; $p < .01$).

3.3. *Analysis 3: civic organizations*

The evidence of an association between the ParkScore ratings and density of civic organizations is equivocal (Table 5). A city's ParkScore rating is not statistically significantly associated with civic organization density in the maximal model but is in the fitted model. The fitted model can illustrate this difference by setting all other covariates to the sample average other than the dependent variable, civic organization density. A city with a ParkScore rating of 30 is estimated to have 11.67 civic organizations per 1000 population, while a city with a ParkScore rating of 70 is estimated to have 14.51. With an average population of 655,000 among cities in the sample, this translates to 1860 more civic organizations. Similar to the prior two analyses, with absolute values of standardized estimates ranging from .13 −.16 ($p < .001$), education, city density, and family structure are more strongly associated with a city's civic organization density than is its ParkScore rating (.07 standardized estimate, $p < .05$).

4. Discussion

We find that cities with higher quality park systems have more social capital among their 25–44-year-old population than cities with lower quality park systems. The observed association between park system

Table 3
Correlates of economic connectedness in 100 U.S. cities.

Dependent Variable: log (economic connectedness rate)

Predictors		Bivariate		Maximal			Fitted		
		Estimates	*CI*	*Estimates*	*Std. Est.*	*CI*	*Estimates*	*Std. Est.*	*CI*
Park System Quality	**ParkScore Rating (0–1 scale, 1 high)**	**0.78*** **	**0.49 – 1.08**	**0.29** **	**0.05***	**0.08 – 0.51**	**0.26** **	**0.05***	**0.07 – 0.45**
Education	% 25–44 pop. w/ bachelor or higher			0.6***	0.13***	0.36 – 0.84	0.51***	0.11***	0.32 – 0.70
Poverty	% 25–44 pop. under 200 % of Federal Poverty Level			−2.79***	−0.11***	−4.21 – −1.37	−3.31***	−0.13***	−4.44 – −2.18
Hispanic Ethnicity	log (% 25–44 pop. Hispanic)			−0.07***	−0.09***	−0.11 – −0.03	−0.07***	−0.08***	−0.10 – −0.04
Black or African American Race	sqrt (% 25–44 pop. Black or African American)			−0.47***	−0.12***	−0.63 – −0.31	−0.49***	−0.13***	−0.64 – −0.34
Density	log (city land area / total pop.)			0	0	−0.04 – 0.04			
Family structure	% 25–044 pop. married			0.2	0.02	−0.18 – 0.57			
Transiency	% 25–44 pop. moved within last year			−0.45	−0.02	−1.10 – 0.21			
	Adjusted R Squared	0.214		0.825			0.824		
	AICc	−87.26		−228.78			−232.35		
	Sample	100		100			100		

Notes:
Estimates: Regression beta coefficient
Std. Est: Standardized estimates via standard deviation
CI: 95 % Confidence Interval
AICc: Akaike information criterion corrected
Statistical significance codes (p-test): '***' < 0.001; '**' < 0.01; '*' < 0.05

Table 4
Correlates of volunteering in 100 U.S. cities.

Dependent Variable: log (volunteering)

Predictors		Bivariate		Maximal			Fitted		
		Estimates	*CI*	*Estimates*	*Std. Est.*	*CI*	*Estimates*	*Std. Est.*	*CI*
Park System Quality	**ParkScore Rating (0–1 scale, 1 high)**	**1.45**	**1.00 – 1.90**	**0.61***	**.08***	**0.10 – 1.12**	**0.73*** **	**0.10** **	**0.26 – 1.20**
Education	% 25–44 pop. w/ bachelor or higher			0.27	0.04	−0.29 – 0.82			
Poverty	% 25–44 pop. under 200 % of Federal Poverty Level			−2.1	−0.05	−5.38 – 1.18	−3.2*	−.07*	−5.93 – −0.47
Hispanic Ethnicity	log (% 25–44 pop. Hispanic)			−0.24***	−0.19***	−0.33 – −0.14	−0.26***	−.21***	−0.34 – −0.18
Black or African American Race	sqrt (% 25–44 pop. Black or African American)			−0.74***	−0.13***	−1.12 – −0.37	−0.78***	−.14***	−1.15 – −0.41
Density	log (city land area / total pop.)			−0.1*	−0.08*	−0.19 – −0.01	−0.1*	−.07*	−0.17 – −0.02
Family structure	% 25–044 pop. married			−1.12*	−0.10*	−1.99 – −0.25	−1.25**	−.11**	−2.10 – −0.40
Transiency	% 25–44 pop. moved within last year			0.26	0.01	−1.25 – 1.78			
	Adjusted R Squared	0.287		0.636			0.637		
	AICc	−534.27		−592.76			−595.69		
	Sample	100		100			100		

Notes:
Estimates: Regression beta coefficient
Std. Est: Standardized estimates via standard deviation
CI: 95 % Confidence Interval
AICc: Akaike information criterion corrected
Statistical significance codes (p-test): '***' < 0.001; '**' < 0.01; '*' < 0.05

quality and social capital was strong and consistent with regard to two dimensions of social capital – economic connectedness and volunteering – and more equivocal with regard to a third dimension, civic organization density.

An association between park system quality and social capital has significant implications. It suggests that city decision-makers, business leaders, civic organizations, and community members might view strengthening their park systems as a strategy for building social capital and thereby advancing a wide range of community goals. For instance, social capital is well established as a predictor of *health* (Xue et al., 2020; Duh-Leong et al., 2021; Pérez et al., 2020; Ehsan et al., 2019). Similarly, social capital is associated with *happiness* (Leung et al., 2013; Delhey and Dragolov, 2016). One study (Tanaka and Tokimatsu, 2020) found that spending leisure time with others was a common feature of the link

Table 5
Correlates of civic organizational density in 100 U.S. cities.

Dependent Variable: log (civic organization density)		Bivariate		Maximal			Fitted		
Predictors		*Estimates*	*CI*	*Estimates*	*Std. Est.*	*CI*	*Estimates*	*Std. Est.*	*CI*
Park System Quality	**ParkScore Rating (0–1 scale, 1 high)**	**1.14*****	**0.68 – 1.60**	**0.25**	**0.03**	**−0.34 – 0.85**	**0.54***	**0.07***	**0.02 – 1.07**
Education	% 25–44 pop. w/ bachelor or higher			0.69*	.10*	0.05 – 1.34	0.84***	.13***	0.43 – 1.26
Poverty	% 25–44 pop. under 200 % of Federal Poverty Level			1.97	0.04	−1.86 – 5.81			
Hispanic Ethnicity	log (% 25–44 pop. Hispanic)			−0.07	−0.06	−0.18 – 0.03			
Black or African American Race	sqrt (% 25–44 pop. Black or African American)			−0.3	−0.05	−0.74 – 0.14			
Density	log (city land area / total pop.)			−0.12*	−0.09*	−0.23 – −0.02	−0.18***	−0.13***	−0.25 – −0.10
Family structure	% 25–044 pop. married			−1.52**	−0.13**	−2.54 – −0.50	−1.83***	−0.16***	−2.46 – −1.19
Transiency	% 25–44 pop. moved within last year			0.94	0.04	−0.83 – 2.71			
	Adjusted R Squared	0.19		0.461			0.458		
	AICc	−822.37		−854.43			−859.03		
	Sample	100		100			100		

Notes:
Estimates: Regression beta coefficient
Std. Est: Standardized estimates via standard deviation
CI: 95 % Confidence Interval
AICc: Akaike information criterion corrected
Statistical significance codes (p-test): ‘***’ < 0.001; ‘**’ < 0.01; ‘*’ < 0.05

between social capital and happiness—and parks, as a widely available, low-cost venue for leisure time socializing, are well positioned to provide this service.

High-quality park systems, and the social capital benefits they deliver, may help address other contemporary challenges in cities. One is poverty. In this study, one of the measures of social capital was social connection across economic levels. Such connections are a strong predictor of an individual’s ability to escape poverty (Chetty et al., 2022a), suggesting a role for parks in *poverty alleviation*. Strong park systems may advance this goal in two ways. First, parks—especially well-maintained parks with high-quality facilities and programming—facilitate the informal mixing of people of different economic backgrounds—as parents chat while they watch their children play or as people garden or play sports together (Powers et al., 2021, 2022a, 2022b). Second, destination parks motivate people to leave their neighborhood (de la Prada and Small, 2024); visiting a different part of one’s city brings a person into contact with people of different backgrounds.

Other measures of social capital used in this study were membership in civic organizations and civic organization density. The association with park system quality suggests that strong park systems may *promote civic engagement*, a pillar of strong communities. Additional benefits flow from this asset. First, evidence suggests that living near high-quality parks is associated with *trust in city government* (Center for Active Design, 2017). Second, the volunteerism associated with belonging to civic organizations can provide multiple benefits to a city, such as mentoring for young people, caring for elders, and environmental cleanup. Volunteering also yields multiple benefits for those who volunteer, including less depression, higher self-esteem, higher life satisfaction, and greater happiness (Borgonovi, 2008; Kim and Pai, 2010; Thoits and Hewitt, 2001; Jiang et al., 2021; Nichol et al., 2024). So whether or not the volunteering is park-based, if a strong park system is associated with civic engagement and volunteering, that represents considerable benefit for the city.

4.1. Strengths

A strength of this study is the focus on park systems at the city scale; much of the existing park literature focuses on interventions and outcomes at the level of individual parks. Another strength of this study is the use of two innovative and robust data sources: the ParkScore index to measure park system quality, and the Social Capital Atlas large network data set to measure three dimensions of social capital. Together these data sources provide national reach (the ParkScore index’s 100 cities are in 34 states across a range of geographies, demographics, and politics) and a very large population sample (72.2 million Facebook users).

4.2. Limitations

The use of Facebook data to estimate social capital is dependent upon several assumptions: a) Facebook friendships represent real-life friendships (Jones et al., 2013), b) the accuracy of modeled socio-economic classifications, c) a person’s membership in a "public good" Facebook page is correlated with the propensity to volunteer, and d) civic organizations are likely to have public Facebook pages. Additionally, the dataset only reflects U.S. adults aged 25–44 and does not reflect the 16 % of those adults not active on Facebook. The authors of this dataset address each of these concerns through correlating their Facebook estimates with established survey data, with population-weighted correlations ranging from .58 to .88 across the above assumptions (Chetty et al., 2022a).

This study does not assess causality of the relationship between social capital and park system quality. Neither the ParkScore dataset nor the Social Capital dataset is longitudinal, which may facilitate causal inference. While the ParkScore index has been published annually for over a decade, additional work is needed to validate annual changes to facilitate a longitudinal analysis. Additionally, the majority of the factors comprising the Index reflect the historical evolution of a city’s park system and have minimal annual variation. The Social Capital Atlas dataset only contains a single point in time estimate and has yet to be updated with additional years. If there were longitudinal data, further review would be needed to remove outdated friendships or page affiliations that no longer reflect "real-life" current relationships.

5. Conclusion

Parks are a classic “third space,” a venue in which people connect with each other. These relationships can be the lifeline for seniors during a pandemic, the ticket out of poverty for youth, or the beginnings of an advocacy movement for parents wanting to see something different in their community. Cities that have more parks and recreational opportunities for people to connect have more of these relationships. This paper's findings support the hypothesis that improving a park system in general ways – versus improving individual parks in specific ways – can increase community-level social capital and economic mobility, reduce loneliness and distrust, and increase health and well-being. Importantly, investing in a city's park system has other environmental and social benefits and is a strategy that can complement other investments to improve quality of life for all.

CRediT authorship contribution statement

Klein William: Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Formal analysis, Conceptualization. **Kevin Niu:** Software, Data curation. **Locke Dexter H:** Writing – review & editing, Methodology, Formal analysis. **Frumkin Howard:** Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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