11-10-2022

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ARTICLE INFO

ABSTRACT

Researchers have clearly identified the importance of green space to promote mental and physical health among humans. In urban areas, public parks are essential for providing access to green space for many residents. This study identified the relationships between demographics, neighborhood social capital, violent crime, and residential distance to the closest park (park proximity) with self-reported access to neighborhood parks, among a population-representative sample of adults in Philadelphia. Women, older age groups, minorities, and those with lower education levels had lower self-reported access to neighborhood parks. Those reporting high neighborhood social capital had higher self-reported access to neighborhood parks. Park proximity and number of violent crimes within 100 m from respondents' residence were inversely associated with self-reported access to neighborhood parks. Interestingly, those living proximal to parks had higher odds of self-reported access to parks, but only among residents living in lower violent crime quartiles, and not in the highest violent crime quartile. These results suggest that those who lived in areas with high violent crime might be deterred from using neighborhood parks, even if there are parks close to their residence. Results of the study show that demographic groups that have been historically marginalized in the U.S., including women, older age groups and minorities, had lower self-reported access to parks in Philadelphia. The study also highlights the potential importance of neighborhood social capital and perceptions of safety to self-reported access to neighborhood parks.

1. Introduction

The health promoting effects of urban green spaces have been well-documented in the academic literature (Gascon et al., 2015; Houlden et al., 2018; Kondo et al., 2018; Lee & Maheswaran, 2011). Studies investigating the causal mechanisms underlying green spaces and human health find that green spaces 1) increase physical activity, 2) foster social contacts, 3) reduce stress and restore attention, 4) enhance immune function, and 5) improve air quality (De Vries et al., 2003; Frumkin et al., 2017). In dense urban environments, public parks are essential for providing access to green space, as access is a main determinant of park use, especially among people of color (Byrne et al., 2009).

Park access is a major environmental justice issue. A well-cited review analyzed three main components of parks that are important for characterizing access- proximity, acreage, and quality, in order to identify patterns in park provision among population subgroups from an environmental justice perspective (Rigolon, 2016). The study found inconsistent results in park access between demographic groups on park proximity, but clear and dramatic inequities in park acreage and park quality among racial and ethnic minorities and low-income groups. Related studies in US cities show that low income or minority populations tend to live closer to urban parks, but they are smaller and of lower quality (Boone et al., 2009; Rigolon et al., 2018), and comparatively less safe (Williams et al., 2020).

Park access among populations is a complex, multi-dimensional construct that can be measured in many different ways. There are numerous methodological variations in measures of park access including both subjective and objectively measured access to parks. Objectively measured access to parks is measured via distance to the closest park (Mowen et al., 2007), buffer-based quantification of park proximity (Kaczynski et al., 2014), density (Schipperijn et al., 2017), or via mobile phone data (Xiao et al., 2019). Subjective, or perceived access is often measured by asking participants to self-report access to parks (Knobel et al., 2021), walking distance from parks (Ball et al., 2008) or other physical or socio-personal report of access to parks (Wang et al., 2015; Yasumoto et al., 2021). Interestingly, research shows that self-reported distance to parks and objective park-distance measures

often do not show strong correlation (Macintyre et al., 2008). Further, studies that compared objective and subjective measures of parks (Wang et al., 2015) and environmental neighborhood features (Orstad et al., 2017) found subjective measures to be more predictive of park use and physical activity, respectively, compared to objective measures.

An important area of research considers relationships between crime and perceived access to parks. Although some studies show no association between perceptions of crime and park use (Cohen et al., 2016), many studies show strong association. Researchers have found that fear of crime and safety concerns are a main deterrent to park use and physical activity (Babey et al., 2015; Foster & Giles-Corti, 2008; Harrison et al., 2007; Sefcik et al., 2019). An urban park study in low income neighborhoods found that one gun-related violent crime event per 10,000 people in the past 6 months was related to an average of 13.5–15.8 % reduction in observed park-based physical activity and use within a 6 month observation period (Han et al., 2018). Further, a study measuring the physical and socio-personal factors that most predicted perceived access to parks found that park proximity was the most important physical factor, and perceptions of safety was the most important socio-personal factor (Wang et al., 2015).

An important benefit of public parks is that they are neighborhood locations that encourage people to socialize, and may boost social capital. A study showed that proximity and quality of public open spaces was associated with self-reported sense of community, and did not vary by frequency of park use (Francis et al., 2012). Additionally, researchers have shown that the quality and not necessarily the quantity of accessible parks is associated with social capital, among low income parents with youth children (Mullenbach et al., 2022). Influential reviews presenting frameworks on the impact of green space and health identify social cohesion and increased social contacts as a main mechanism through which green space improves health (Frumkin et al., 2017; Hartig et al., 2014).

Philadelphia has over 300 parks and outdoor recreation facilities (City of Philadelphia, 2020) and is consistently ranked among the U.S. cities with the top 20 parks systems (Trust for Public Land, 2021). Although the Trust for Public Land reports that 95 % of Philadelphia residents live within a 10 min walk to a park, lower-income neighborhoods have 44 % less park space per capita than high income neighborhoods (Murrell, 2021; Trust for Public Land, 2021). Self-reported access to parks in Philadelphia has been shown to vary dramatically by neighborhood (Knobel et al., 2021). However, no studies have quantified differences between demographic groups, or measured how neighborhood factors, such as neighborhood social capital, violent crimes, or measured park proximity are associated with self-reported park access among adults in U.S. cities. Identifying demographic disparities and neighborhood factors related to park-access is an important step to improving park equity.

The primary objective of this study is to investigate how demographic factors, neighborhood social capital, and crime are associated with self-reported access to neighborhood parks among adults in Philadelphia. The secondary objective of this study is to identify how neighborhood violent crime might affect the relationship between measured distance to the closest park (park proximity) and self-reported access to a park. While results are particularly applicable at the local level in Philadelphia, study results could inform research and action among other U.S. cities.

2. Methods

2.1. Data

We used secondary data from the Public Health Management Corporation (PHMC)'s 2018 Household Health Survey (HHS) to identify the factors that were associated with self-reported access to neighborhood parks among adults in Philadelphia. The HHS is a telephone/cell phone-based survey used to identify public health issues and inform policy in

Southeastern Pennsylvania (SEPA) (PHMC, 2018). The HHS surveyed non-institutionalized SEPA residents on a range of health topics, including health behaviors, healthcare access, and chronic diseases. The survey was conducted by telephone and administered in English and Spanish from August 2018 to January 2019, and included Bucks, Chester, Delaware, Montgomery, and Philadelphia counties, reaching 7501 households (PHMC, 2018). The sample was partially stratified by 54 service areas, composed of zip code clusters in SEPA to ensure that geographic areas with small populations obtained a minimum sample. Half of the surveyed sample received Form A, which included questions of interest in this study, including the items on self-reported park access and neighborhood social capital. Addresses of respondents were obtained by cross-referenced files that linked phone number to residential addresses in the public record, and street names were confirmed and corrected, if necessary, during survey administration. Address information was also obtained for cell phone respondents who provided an address so researchers could mail them their gift card honorarium. Finally, respondents with unlisted phone numbers were asked to provide information on a close street intersection to their residence during survey administration. PHMC geocoded address and close intersections and provided latitude/longitude coordinates for analysis.

2.2. Sample

The study sample included adults in Philadelphia who responded to the HHS 2018 (n = 2838). Among those respondents, 1451 were provided Form A, which included the survey question related to access to parks. Among those, 1282 had either full addresses or intersection X, Y coordinates. Finally, for the violent crime analysis, we did not have crime information from areas outside of Philadelphia. Therefore, we had to remove 121 respondents who lived proximal to the Philadelphia border, as it would not have been possible to characterize crime proximal to their residences. The final unweighted sample size was 1161, however, missing values on covariates reduced the sample size when analyzed.

2.3. Items

Self-reported neighborhood park access was measured using the item "Is there a park or other outdoor space in your neighborhood that you're comfortable visiting during the day?" The original variable had three response options: "Yes, there is a park or outdoor space in your neighborhood that you are comfortable visiting;" "No, there is no park in your neighborhood"; or "No, there is a park in your neighborhood but you are not comfortable visiting it." We dichotomized this variable into "Yes" or "No" categories.

2.3.1. Demographics

We explored a number of demographic and neighborhood variables to identify their association with self-reported access to a neighborhood park. Race was a categorical variable that was recoded from the original seven-category response to a four-category response that included White (Not Latino), Black (Not Latino), Latino, and "Other." The reason for recoding was because of a low numbers for Asian, Multiracial, Native American, and "Other" in the original race variable from the survey. Gender was a binary variable with options for male or female. Age was a categorical variable with the following responses: 18–34, 35–49, 50–64, and 65+. The education variable was recoded from the following categories: less than high school; high school graduate; technical, trade, or vocational school after high school; some college; college graduate; and post-graduate or professional schooling after college. The new education variable combined technical, trade, and vocational school with "some college" due to a low numbers in the categories. The income variable was created by categorizing people into three groups: at or below 100 % poverty level; above 100 % poverty level, less than 200 % poverty; or at or above 200 % poverty level. Marriage status was a binary variable

categorized as "married or living with partner" or "not married or living with partner." Home ownership was also a binary variable categorized as "rent" or "own."

2.3.2. Neighborhood characteristics

Neighborhood Social Capital- The HHS contained five variables, based on questions that measure the concept of neighborhood social capital: 1) number of neighborhood groups or organizations the respondent currently participates in; 2) respondent's perception as to whether neighbors are willing to help each other; 3) respondent's perception as to whether neighbors ever worked together to improve the community; 4) respondent's feeling of belonging to the neighborhood; and 5) respondent's perception as to whether people in the neighborhood can be trusted. Each item was assigned a score, and then summed across the five questions to identify an overall neighborhood social capital score 1–10, with 10 being the highest. For analysis, we categorized the social capital score into low (scores 1–4), medium (5–7) or high (8–10) neighborhood social capital.

Park Proximity- Distance to the closest park was determined by measuring the Euclidian distance, in meters, from each HHS respondent's residence or close intersection to the closest neighborhood park. Euclidean distance, as opposed to street network distance, was used because the point locations of park entrances were unknown to the researchers. We geocoded HHS respondents using ArcGIS Pro v 2.6, and obtained distances using the Near function. A shape file of Philadelphia Park boundaries was obtained through Philadelphia's OpenDataPhilly web portal (OpenDataPhilly, 2021). The park proximity variable was converted by dividing distance by 100 to explore the change in odds with a 100 m increase in distance from the closest park.

Violent Crime- Reported crime incidents were collected by the Philadelphia Police Department. We downloaded crime incidents for 2018 via OpenDataPhilly, and geocoded them using ArcGIS Pro V. 2.6. We selected only violent crimes (homicide, rape, robbery with and without a firearm, aggravated assault with and without a firearm, and other assaults) for our analysis, as violent crimes has been shown to more strongly affect perceptions of safety and park use than non-violent crimes (Han et al., 2018). Using ArcGIS Pro V. 2.6, we generated a buffer with a radius of 100 m around each respondents' residence or closest intersection and summed the number of violent crime incidents within the buffer.

2.4. Analysis

2.4.1. Statistical analysis

IBM Statistical Package for the Social Sciences (SPSS) V. 26 (IBM Corp, 2019) were used for all analyses. PHMC generated weights to adjust for the complex overlapping multi-frame sample design, stratification, differential probabilities of selection (including oversampling of directory-listed cases), nonresponse, and noncoverage (Turakhia et al., 2019). The current study applied balancing weights to correct for underrepresentation of segments of the population in the survey sample. Statistical analysis began with descriptive statistics to summarize each variable using frequencies and percentages for categorical variables and means with standard deviations (SD) for continuous variables. Next, bivariate analyses were performed to test the associations between demographic and neighborhood characteristics with self-reported access to a neighborhood park using Chi-square Tests of Independence for categorical variables and two-sample t-tests for continuous variables. Any variable with a p-value of < 0.1 from the bivariate analysis was included in the multivariable logistic regression models. Three multivariable logistic regression models were built to identify predictors of self-reported neighborhood park access. The first model included just respondents' demographics. The second model included demographics and neighborhood social capital. The third model included all variables: demographics, neighborhood social capital, violent crime events within 100 m of residence, park proximity, and one interaction term between

violent crime and park proximity. Significance was assessed at the 0.05 level for all three multivariable models, and models were not further reduced. Tolerance and variance inflation factor (VIF) were used to assess collinearity between variables. Typically, tolerance values below 0.1 and VIF values higher than 10 indicate collinearity among variables in a model. The tolerance and VIF values showed that the variables in the regression models did not exhibit a high level of collinearity. Covariate-adjusted odds ratios (aOR) and 95 % confidence intervals (95 % CIs) are presented. The interaction effect in the third model was explored visually using a scatterplot of the predicted probability of self-reported access to a park and measured park proximity for quartiles of violent crimes within 100 m (quartiles: 0–2, 3–5, 6–9, 10+).

3. Results

3.1. Descriptive statistics

There were 1161 respondents in the unweighted sample and 1093

Table 1
Descriptive statistics for the sample of adults in Philadelphia, Public Health Management Corporation Household Health Survey 2018.

Variables (n = unweighted, weighted)	Unweighted (n = 1161) n (%) or Mean (SD)	Weighted (n = 1093) n (%) or Mean (SD)
Access to a Neighborhood Park (n = 1134, 1074)		
No access	333 (29.4)	272 (25.3)
Access	801 (70.6)	802 (74.7)
Gender (n = 1161, 1093)		
Male	420 (36.2)	470 (43.0)
Female	741 (63.8)	624 (57.0)
Age (n = 1161, 1093)		
18–34 years old	114 (9.8)	350 (32.0)
35–49 years old	192 (16.5)	215 (19.7)
50–64 years old	376 (32.4)	318 (29.1)
65 + years old	479 (41.3)	210 (19.2)
Race/Ethnicity (n = 1140, 1082)		
White (Not Latino/a)	512 (44.9)	444 (41.1)
Black (Not Latino/a)	475 (41.7)	411 (38.0)
Latino/a	73 (6.4)	116 (10.7)
Other	80 (7.0)	111 (10.3)
Income (n = 1161, 1093)		
Income at or below 100 % poverty level	268 (23.1)	287 (26.3)
Income > 100 % poverty, < 200 % poverty	233 (20.1)	185 (16.9)
At or above 200 % poverty level	660 (56.8)	621 (56.8)
Education (n = 1155, 1087)		
Less than high school	94 (8.1)	68 (6.3)
High school graduate	387 (33.5)	325 (29.9)
Some college/Trade School	253 (21.9)	263 (24.2)
College graduate	214 (18.5)	238 (21.9)
Graduate School	207 (17.9)	193 (17.7)
Marital Status (n = 1153, 1087)		
Married or living with partner	440 (38.2)	375 (34.5)
Not married or living with partner	713 (61.8)	711 (65.5)
Employment (n = 1147, 1061)		
Full Time	371 (32.3)	494 (46.6)
Part-Time	90 (7.8)	114 (10.8)
Unemployed/Disabled/Other	246 (21.4)	241 (22.7)
Retired	440 (38.4)	212 (19.9)
Housing Status (n = 1119, 1047)		
Owns residence	756 (67.6)	502 (47.9)
Rents residence	363 (32.4)	546 (52.1)
Neighborhood Social Capital (n = 988, 943)		
Low Social Capital	291 (29.5)	352 (37.3)
Medium Social Capital	512 (51.8)	474 (50.2)
High Social Capital	185 (18.7)	117 (12.4)
Violent Crimes within 100 m of Residence (n = 1161, 1093)	6.8 (7.3)	6.6 (6.5)
Distance to the Closest Park in Meters (n = 1161, 1093)	274.1 (185.6)	285.2 (193.9)

SD = Standard Deviation.

respondents in the weighted sample (Table 1). Almost ¾ of the weighted sample (74.7 %) reported access to a neighborhood park. The sample had a majority of female respondents (57.0 %). The distributions of age (32 % 18–34, 19.7 % 35–49, 29.1 % 50–64 %, and 19.2 % 65+) and race (41.1 % White, non-Latino/a, 38 % Black, non-Latino/a, 10.7 % Latino/a) were unequal between groups, but generally reflected the demographic distribution in Philadelphia. Variables describing participants' neighborhood showed that the majority reported medium neighborhood social capital (50.3 %), followed by low social capital (37.3 %) and high social capital (12.4 %). The mean number of violent crimes within 100 m from respondents' residences in 2018 was 6.6 (SD, 6.5), and ranged from 0 to 81. The mean park proximity to respondents' residences was 285.2 m (SD, 193.9), and ranged from 0 to 1144.1 m.

3.2. Bivariate analysis and multivariable logistic regression model

All demographic and neighborhood characteristics, except for housing status, were associated with self-reported access to a neighborhood park at the 0.1 level in the bivariate analyses. In order to see how the correlates of self-reported access to a neighborhood park change as the neighborhood variables were added, we included three multivariable logistic regression models (Table 2).

Consistently, in all models, we found that women reported lower odds of access to a neighborhood park than men (Model 3: aOR = 0.61, 95 % CI = 0.43, 0.88). Similarly, we found that older age categories had lower odds of self-reported access to a neighborhood park than the youngest age category, ages 18–34. In fact, there was a consistent incremental decrease in odds of self-reported access to a neighborhood park as age groups increased, with the lowest access reported by the oldest age group, ages 65 + (Model 3: aOR = 0.29, 95 % CI = 0.15, 0.58). Latino/a and those in the Other race category reported lower odds of access to a park compared to White, non-Latino/a respondents in all models. Black, non-Latino/a, respondents also reported lower odds of access to a neighborhood park, compared to White, non-Latino/a, respondents, but this relationship was not found to be significant after adding the violent crime and park proximity variables. College graduates and those with graduate education reported higher odds of access to a park compared to those who did not finish High School (Model 1: aOR = 2.23; aOR = 3.24, respectively), in the demographics-only model. However, these effects became smaller, and non-significant in successive models after including the variables describing the neighborhood environment. Social capital showed the strongest measure of effect of all variables in the analysis; as self-reported neighborhood social capital increased odds of access to a neighborhood park also increased (Model 3: Medium social capital, aOR = 4.66, 95 % CI = 3.17, 6.84; High social capital, aOR = 5.98, 95 % CI = 3.15, 11.35). Model 3 also showed that the two main effects of the number of violent crimes within 100 m of residence (aOR = 0.89, 95 % CI = 0.84–0.94) and park proximity (aOR = 0.82, 95 % CI = 0.72–0.93) were significantly associated with self-reported access to a neighborhood park, as well as their interaction

Table 2

Multivariable logistic regression model to identify factors associated with self-reported access to a neighborhood park among adults in Philadelphia. Public Health Management Corporation Household Health Survey, 2018.

	Model 1: Demographics (n = 1093)		Model 2:Demographics + Social Capital (n = 945)		Model 3:All Variables (n = 945)	
	aOR	95 % CI	aOR	95 % CI	aOR	95 % CI
Gender						
Male	Ref		Ref		–	–
Female	0.65**	0.48–0.89	0.61**	0.43–0.87	0.61**	0.43–0.88
Age						
18–34 years old	Ref		Ref		Ref	
35–49 years old	0.62*	0.39–0.99	0.52*	0.31–0.86	0.51*	0.3–0.86
50–64 years old	0.58*	0.37–0.92	0.55*	0.33–0.91	0.47**	0.28–0.8
65 + years old	0.36**	0.2–0.65	0.32**	0.16–0.62	0.29***	0.15–0.58
Race/Ethnicity						
White (Not Latino/a)	Ref		Ref		Ref	
Black (Not Latino/a)	0.67*	0.47–0.97	0.59*	0.39–0.9	0.83	0.54–1.28
Latino/a	0.39***	0.23–0.65	0.43**	0.24–0.78	0.51*	0.28–0.93
Other	0.33***	0.19–0.54	0.33***	0.18–0.6	0.37**	0.2–0.69
Income						
Income at or below 100 % poverty level	Ref		Ref		Ref	
Income > 100 % poverty, < 200 % poverty	1.54	0.97–2.44	1.53	0.91–2.56	1.36	0.8–2.32
At or above 200 % poverty level	1.64*	1.08–2.48	1.54	0.95–2.48	1.32	0.81–2.17
Education						
Less than high school	Ref		Ref		Ref	
High school graduate	1.14	0.63–2.05	0.95	0.48–1.86	0.76	0.38–1.52
Some college/Trade School	1.31	0.7–2.45	1.18	0.57–2.45	0.99	0.47–2.09
College graduate	2.23*	1.12–4.46	1.71	0.79–3.72	1.30	0.58–2.88
Graduate School	3.24**	1.54–6.82	2.87*	1.22–6.74	1.98	0.83–4.75
Marital Status						
Married or living with partner	Ref		Ref		Ref	
Not married or living with partner	1.07	0.76–1.51	0.92	0.62–1.35	0.93	0.63–1.38
Employment						
Full Time	1.09	0.62–1.91			Ref	
Part-Time	0.92	0.57–1.46	0.99	0.53–1.83	0.81	0.43–1.54
Unemployed/Disabled/Other	0.98	0.56–1.71	0.77	0.46–1.3	0.66	0.39–1.14
Retired	0.65	0.48–0.89	0.76	0.4–1.43	0.68	0.35–1.3
Neighborhood Social Capital						
Low Social Capital	–	–	Ref		Ref	
Medium Social Capital	–	–	4.52***	3.11–6.57	4.66***	3.17–6.84
High Social Capital	–	–	7.01***	3.74–13.13	5.98***	3.15–11.35
Violent Crimes within 100 m of Residence	–	–	–	–	0.89***	0.84–0.94
Distance to the Closest Park	–	–	–	–	0.82**	0.72–0.93
Violent Crimes*Distance to Closest Park	–	–	–	–	1.02*	1.002–1.03

*p < 0.05; **p < 0.01; ***p < 0.001.
[a]OR = Covariate-adjusted odds ratio; CI = Confidence interval; Ref = Reference group.

(aOR = 1.02, 95 % CI = 1.002–1.03). That is, the relationship between park proximity and self-reported access to a neighborhood park varied by number of violent crimes within 1000 m. Respondents who lived near a park and lived in an area with fewer reported violent crimes (quartiles 1–3) were more likely to self-report access to a park compared to respondents who lived in an area with a high number of violent crimes (quartile 4) (Fig. 1).

4. Discussion

This study utilized data from the PHMC's (2018) HHS to identify relationships between demographics, neighborhood social capital, violent crime, park proximity and self-reported access to neighborhood parks among adults in Philadelphia. Overall, we found that demographic groups including women, older age groups and minorities, had lower self-reported access to parks. Lower self-reported park access among women may be attributed to a social climate in which women feel less safe in parks compared to men. For example, Derose et al. (2019) surveyed park users in 48 low-income Los Angeles parks and identified that women were less likely to use parks than men, and that perceived crime in the neighborhood surrounding parks partially mediated this relationship. Women had the perception of higher neighborhood crime, and this partially accounted for their reduced park use. In our study, the differences in self-reported park access between men and women persisted even after controlling for violent crime, which suggests that crime levels might not entirely explain this disparity. As women are often caregivers for children or older family members, it is possible that environmental factors other than crime might influence perceptions of safety and serve as barriers to park access, such as road traffic, lack of sidewalks, or poor park maintenance (Groshong et al., 2020).

Age was also a factor associated with self-reported park access, as older age groups had lower odds of reported access than 18–34 year-olds. This relationship may be related to perceptions of safety, or due to age-related disability, mobility, or transportation issues. It is not clear the extent to which senior housing facilities have access to green spaces in Philadelphia, but the Age Friendly Philadelphia Action Plan, published by the Philadelphia Chapter of the American Association of Retired Persons (AARP), chose outdoor spaces as one of the three areas of focus to create liveable communities in Philadelphia, due to a "lack of green spaces and amenities in some neighborhoods and concerns about safety, poorly maintained and understaffed public facilities" among

people aged 50+ (AARP, 2020). Studies have shown that among older adults, perceived park access (Mowen et al., 2007) and physical features such as walking paths (Veitch et al., 2022) facilitate park-based physical activity. Further, safety issues are among the strongest environmental factors which serve as barriers to physical activity among older adults (Barnett et al., 2017).

We found that minorities had lower self-reported odds of access compared to Whites. Many studies have identified similar relationships when urban park access is defined comprehensively including issues of size and quality. While our study did not ask participants about specific park characteristics, we did ask participants if they had access to a neighborhood park that they feel comfortable visiting during the day. Considering issues of "comfort" in park access might cause participants to focus on perceived safety or other park features, which has been identified as an important barrier to park use in urban areas (Derose et al., 2019; Han et al., 2018; Marquet et al., 2020; Ou et al., 2016). A qualitative study among residents of low-income urban neighborhoods identified perceptions of safety to be a main concern and barrier to park access, in addition to physical conditions, including trash and drug paraphernalia (Sefcik et al., 2019). Issues of safety and park-conditions may explain why urban African American park users report not using their closest park, but travel to larger parks with better amenities (Vaughan et al., 2018). Further, in Philadelphia, like many cities in the U.S., redlining policies in the 20th century deterred or prohibited African Americans and other minorities from purchasing homes in the most desirable areas of the city. The neighborhood boundaries established by this discriminatory process persist today, making Philadelphia a racially segregated city (Shukla & Bond, 2021). Not only did redlining disadvantage Black people by preventing them from purchasing houses in more desirable neighborhoods, it also set the stage for infrastructure projects (such as building and maintaining parks) to focus on White neighborhoods and comparatively devalue Black neighborhoods (Boone et al., 2009).

Of all variables included in the final analysis, social capital showed the strongest association with self-reported access to a neighborhood park. Other studies have found correlations between social capital and green space among population subgroups including adults (Ueshima et al., 2010), low income parents (Mullenbach et al., 2022), and older adults (Hong et al., 2018). A potential explanation for this result relates to the fact that parks provide neighborhood spaces that can facilitate social ties (Kaźmierczak, 2013), social support (Seaman et al., 2010),
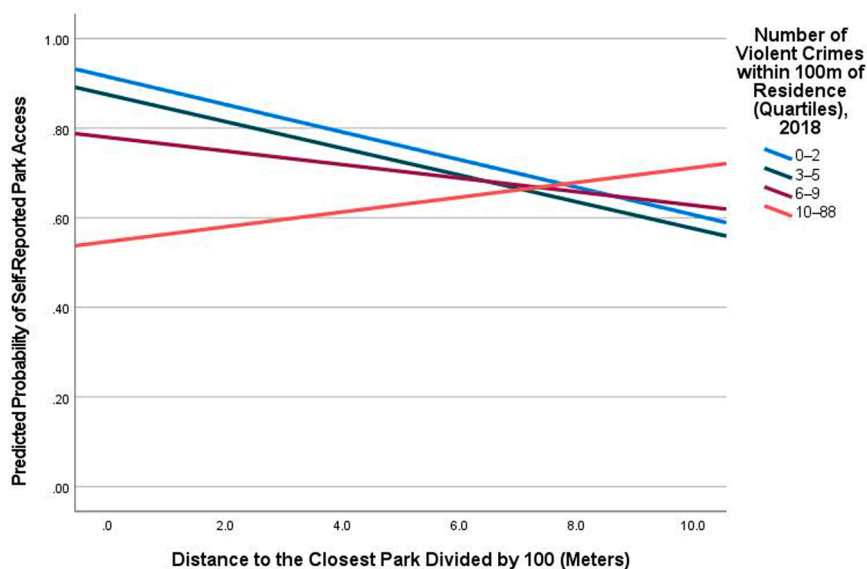

Fig. 1. The relationship between park proximity and self-reported access to a neighborhood park varied by violent crime (per-100-meter) quartiles. Public health management corporation household health survey, 2018.

and social cohesion (Peters et al., 2010). Parks provide venues for family events, community celebrations, and recreational activities, all of which create opportunities to interact with neighbors and promote the trust and sense of community that contribute to social capital. Conversely, neighborhoods with high disorder and few resources (which includes parks) are also those with low trust in neighbors, feelings of belonging, and community participation, which are the components of social capital. Neighborhoods with low social capital may be less equipped to create and sustain new parks due to a lack of resources and community participation. Future studies should use longitudinal methods to investigate the impact of installation of new parks on neighborhood social capital to further illuminate causal relationships between these factors.

The interaction term in our final model showed that the relationship between measured park proximity and self-reported park access was different for respondents in areas containing different levels of violent crime. In areas with the first, second, and third lowest quartiles of violent crime, park proximity and self-reported park access were inversely related- living closer to a park meant higher probability of reporting access to a park. However, in the 4th quartile, or the areas with the highest number of violent crimes within 100 m of respondents' residences, living closer to a park did not show higher probability of reporting access to a park. These results suggest that those who lived in areas with high violent crime might be deterred from using neighborhood parks, even if there are parks in close proximity to their homes. We found that simply living close to a park did not ensure self-reported park accessibility, especially in areas with high violent crime. Studies have shown that neighborhood violent crime deters park use (Marquet et al., 2020; Ou et al., 2016) but ours is the first to identify that measured distance to the closest park and self-reported park access varies depending on neighborhood violent crime. Our study shows that violent crime in Philadelphia neighborhoods may potentially deter people from accessing neighborhood parks that are proximally close to their residence. Violent crime and other barriers to neighborhood park-access reduce use, and therefore people will be exposed to the health promoting effects of parks such as physical activity, socializing, and contact with nature.

This study has several limitations to consider. First, the data included in the study are self-reported which may be subject to response bias. Additionally, the PHMC HHS survey is a random-digit dial phone survey, which enrolls the majority of respondents through landlines. Therefore, the sample may contain a higher proportion of landline telephone users than in the general population of Southeastern PA in 2018. Also, the cross-sectional nature of the data limits our results to those of association only and, thus, we cannot infer causal relationships between exposure and outcome variables. Second, the self-reported park access variable was measured by the item "Is there a park or other outdoor space in your neighborhood that you are comfortable visiting during the day?" As no further definition was provided for "comfortable," the interpretation of this term could have varied between respondents. Related to this, our study could not take physical disability into account when considering access, nor could we measure perceptions of other potential barriers to park-access such as public transit accessibility or road safety, as these perceptions were not measured by the survey. Finally, we needed to remove 121 participants who lived close to the Philadelphia border, as it would not have been possible to characterize crime around their residences. However, those whom we removed did not significantly differ from sample participants on important demographics such as age, gender, or race/ethnicity.

Despite these limitations, our study makes important contributions to the literature, as it shows that historically marginalized groups have lower perceived access to urban parks, which reflect disparities in built-environment features well documented in the literature (Gelormino et al., 2015; Gordon-Larsen et al., 2006). Additionally, our study showed the importance of neighborhood social capital in predicting self-reported access to parks, but further study is necessary to identify temporal relationships between these factors, and the influence of other intervening variables.

Our study quantified self-reported park inequities among adults in Philadelphia. Identifying demographic inequities and neighborhood factors related to perceived access to parks is an important step to making park access more equitable across the city. Our study can inform advocacy for more high-quality, safe parks in Philadelphia, especially for those who report not having access. Researchers suggest that local data on park use disparities can be used by local park managers and officials to identify the community needs, and potentially advocate for optimum financing of parks to meet the needs of neighborhoods (Cohen & Leuschner, 2019). Additionally, Philadelphia has high rates of premature death, poor or fair health, frequent mental and physical distress, diabetes, obesity and physical inactivity compared to counties with comparable large cities (University of Wisconsin Population Health Institute, 2022). As research has illuminated connections between green space and park use with physical and mental health, improving access to parks among Philadelphians can serve as both primary and secondary disease prevention interventions. Cities are increasingly creating pocket parks or small public urban green spaces (SPUGS) by greening abandoned lots (Liu & Wang, 2021; Peschardt et al., 2012) in-collaboration with neighborhood leaders (Thomas Jefferson University, 2022). While the creation of SPUGS may not be a solution for all park access and health issues, researchers have documented people using SPUGS for socializing, rest and restitution (Peschardt et al., 2012; Peschardt et al., 2016) and obtaining physical exercise (Wang et al., 2021). Future research should identify the impact of creation of new parks on neighborhood social capital, perceptions of safety, and health, and also consider negative outcomes of neighborhood greening such as the complications and paradoxes of gentrification (Pearsall & Eller, 2020; Rigolon & Németh, 2020), and challenges such as park maintenance.

5. Conclusion

Results from a population-representative phone survey in Philadelphia showed that women, older age groups, minorities, and those with lower education levels reported lower odds of access to a neighborhood park. Further, neighborhood social capital, residential proximity to a neighborhood park, and low violent crime were associated with higher self-reported access to a neighborhood park. Identifying demographic inequities and neighborhood characteristics related to access to parks is essential to making park access more equitable across the city. Our study can inform advocacy for parks in Philadelphia, especially for groups that report no access.

CRediT authorship contribution statement

Russell K. McIntire: Conceptualization, Methodology, Formal analysis, Writing – review & editing, Supervision, Project administration. **Tiara Halstead:** Writing – original draft, Writing – review & editing. **Devesh Dajee:** Software, Formal analysis, Data curation. **Meghan Buckley:** Methodology, Software, Formal analysis. **Kyle McGregor:** Conceptualization, Writing – review & editing. **Sharon Larson:** Conceptualization, Writing – review & editing.

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.

Acknowledgements

References

AARP, 2020. Philadelphia: An Age-Friendly, Livable City for All (2020 Livable Communities Action Plan and Assessment Report, Issue. AARP. ⟨https://www.aarp.org/content/dam/aarp/livable-communities/age-friendly-network/2020/PA-Philadelphia-Action %20Plan-Final-2020.pdf⟩.

Babey, S.H., Tan, D., Wolstein, J., Diamant, A.L., 2015. Neighborhood, family and individual characteristics related to adolescent park-based physical activity. Prev. Med. 76, 31–36.

Ball, K., Jeffery, R.W., Crawford, D.A., Roberts, R.J., Salmon, J., Timperio, A.F., 2008. Mismatch between perceived and objective measures of physical activity environments. Prev. Med. 47 (3), 294–298.

Barnett, D.W., Barnett, A., Nathan, A., Van Cauwenberg, J., Cerin, E., 2017. Built environmental correlates of older adults' total physical activity and walking: a systematic review and meta-analysis. Int. J. Behav. Nutr. Phys. Act. 14 (1), 1–24.

Boone, C.G., Buckley, G.L., Grove, J.M., Sister, C., 2009. Parks and people: an environmental justice inquiry in Baltimore, Maryland. Ann. Assoc. Am. Geogr. 99 (4), 767–787.

Byrne, J., Wolch, J., Zhang, J., 2009. Planning for environmental justice in an urban national park. J. Environ. Plan. Manag. 52 (3), 365–392.

City of Philadelphia, 2020. Philadelphia Parks and Recreation. City of Philadelphia. Retrieved November 23 from ⟨https://www.phila.gov/departments/philadelphia-parks-recreation/⟩.

Cohen, D.A., Leuschner, K.J., 2019. How can neighborhood parks be used to increase physical activity? Rand Health Q. 8 (3).

Cohen, D.A., Han, B., Derose, K.P., Williamson, S., Marsh, T., Raaen, L., McKenzie, T.L., 2016. The paradox of parks in low-income areas: park use and perceived threats. Environ. Behav. 48 (1), 230–245.

De Vries, S., Verheij, R.A., Groenewegen, P.P., Spreeuwenberg, P., 2003. Natural environments—healthy environments? An exploratory analysis of the relationship between greenspace and health. Environ. Plan. A 35 (10), 1717–1731.

Derose, K.P., Han, B., Park, S., Williamson, S., Cohen, D.A., 2019. The mediating role of perceived crime in gender and built environment associations with park use and park-based physical activity among park users in high poverty neighborhoods. Prev. Med. 129, 105846.

Foster, S., Giles-Corti, B., 2008. The built environment, neighborhood crime and constrained physical activity: an exploration of inconsistent findings. Prev. Med. 47 (3), 241–251.

Francis, J., Giles-Corti, B., Wood, L., Knuiman, M., 2012. Creating sense of community: the role of public space. J. Environ. Psychol. 32 (4), 401–409.

Frumkin, H., Bratman, G.N., Breslow, S.J., Cochran, B., Kahn Jr, P.H., Lawler, J.J., Levin, P.S., Tandon, P.S., Varanasi, U., Wolf, K.L., 2017. Nature contact and human health: a research agenda. Environ. Health Perspect. 125 (7), 075001.

Gascon, M., Triguero-Mas, M., Martínez, D., Dadvand, P., Forns, J., Plasència, A., Nieuwenhuijsen, M.J., 2015. Mental health benefits of long-term exposure to residential green and blue spaces: a systematic review. Int. J. Environ. Res. Public Health 12 (4), 4354–4379.

Gelormino, E., Melis, G., Marietta, C., Costa, G., 2015. From built environment to health inequalities: an explanatory framework based on evidence. Prev. Med. Rep. 2, 737–745.

Gordon-Larsen, P., Nelson, M.C., Page, P., Popkin, B.M., 2006. Inequality in the built environment underlies key health disparities in physical activity and obesity. Pediatrics 117 (2), 417–424.

Groshong, L., Wilhelm Stanis, S.A., Kaczynski, A.T., Hipp, J.A., 2020. Attitudes about perceived park safety among residents in low-income and high minority Kansas City, Missouri, neighborhoods. Environ. Behav. 52 (6), 639–665.

Han, B., Cohen, D.A., Derose, K.P., Li, J., Williamson, S., 2018. Violent crime and park use in low-income urban neighborhoods. Am. J. Prev. Med. 54 (3), 352–358.

Harrison, R.A., Gemmell, I., Heller, R.F., 2007. The population effect of crime and neighbourhood on physical activity: an analysis of 15 461 adults. J. Epidemiol. Community Health 61 (1), 34–39.

Hartig, T., Mitchell, R., De Vries, S., Frumkin, H., 2014. Nature and health. Annu. Rev. Public Health 35, 207–228.

Hong, A., Sallis, J.F., King, A.C., Conway, T.L., Saelens, B., Cain, K.L., Fox, E.H., Frank, L.D., 2018. Linking green space to neighborhood social capital in older adults: the role of perceived safety. Soc. Sci. Med. 207, 38–45.

Houlden, V., Weich, S., Porto de Albuquerque, J., Jarvis, S., Rees, K., 2018. The relationship between greenspace and the mental wellbeing of adults: a systematic review. PLoS One 13 (9), e0203000.

IBM Corp, 2019. IBM SPSS Statistics for Windows. In (Version 26). IBM Corp.

Kaczynski, A.T., Besenyi, G.M., Stanis, S.A.W., Koohsari, M.J., Oestman, K.B., Bergstrom, R., Potwarka, L.R., Reis, R.S., 2014. Are park proximity and park features related to park use and park-based physical activity among adults? Variations by multiple socio-demographic characteristics. Int. J. Behav. Nutr. Phys. Act. 11 (1), 1–14.

Kaźmierczak, A., 2013. The contribution of local parks to neighbourhood social ties. Landsc. Urban Plan. 109 (1), 31–44.

Knobel, P., Kondo, M., Maneja, R., Zhao, Y., Dadvand, P., Schinasi, L.H., 2021. Associations of objective and perceived greenness measures with cardiovascular risk factors in Philadelphia, PA: A spatial analysis. Environ. Res. 197, 110990.

Kondo, M.C., Fluehr, J.M., McKeon, T., Branas, C.C., 2018. Urban green space and its impact on human health. Int. J. Environ. Res. Public Health 15 (3). https://doi.org/10.3390/ijerph15030445.

Lee, A.C., Maheswaran, R., 2011. The health benefits of urban green spaces: a review of the evidence. J. Public Health 33 (2), 212–222. https://doi.org/10.1093/pubmed/fdq068.

Liu, S., Wang, X., 2021. Reexamine the value of urban pocket parks under the impact of the COVID-19. Urban For. Urban Green 64, 127294.

Macintyre, S., Macdonald, L., Ellaway, A., 2008. Lack of agreement between measured and self-reported distance from public green parks in Glasgow, Scotland. Int. J. Behav. Nutr. Phys. Act. 5 (1), 1–8.

Marquet, O., Ogletree, S.S., Hipp, J.A., Suau, L.J., Horvath, C.B., Sinykin, A., Floyd, M.F., 2020. Effects of crime type and location on park use behavior. Prev. Chronic Dis. 17.

Mowen, A., Orsega-Smith, E., Payne, L., Ainsworth, B., Godbey, G., 2007. The role of park proximity and social support in shaping park visitation, physical activity, and perceived health among older adults. J. Phys. Act. Health 4 (2), 167–179.

Mullenbach, L.E., Larson, L.R., Floyd, M.F., Marquet, O., Huang, J.-H., Alberico, C., Ogletree, S.S., Hipp, J.A., 2022. Cultivating social capital in diverse, low-income neighborhoods: The value of parks for parents with young children. Landsc. Urban Plan. 219, 104313.

Murrell, D., 2021. Poor Philadelphia Neighborhoods Have Worse Access to Public Parks. Retrieved 2021, from ⟨https://www.phillymag.com/news/2021/05/27/parks-philadelphia-equity-report/?utm_campaign = later-linkin bio-phillymag&utm_content = later-17574510&utm_medium = social&utm_source = linkin.bio)⟩.

OpenDataPhilly, 2021. *Datasets.* ⟨https://opendataphilly.org/dataset⟩.

Orstad, S.L., McDonough, M.H., Stapleton, S., Altincekic, C., Troped, P.J., 2017. A systematic review of agreement between perceived and objective neighborhood environment measures and associations with physical activity outcomes. Environ. Behav. 49 (8), 904–932.

Ou, J.Y., Levy, J.I., Peters, J.L., Bongiovanni, R., Garcia-Soto, J., Medina, R., Scammell, M.K., 2016. A walk in the park: the influence of urban parks and community violence on physical activity in Chelsea, MA. Int. J. Environ. Res. Public Health 13 (1), 97.

Pearsall, H., Eller, J.K., 2020. Locating the green space paradox: a study of gentrification and public green space accessibility in Philadelphia, Pennsylvania. Landsc. Urban Plan. 195, 103708.

Peschardt, K.K., Schipperijn, J., Stigsdotter, U.K., 2012. Use of small public urban green spaces (SPUGS). Urban For. Urban Green 11 (3), 235–244.

Peschardt, K.K., Stigsdotter, U.K., Schipperrijn, J., 2016. Identifying features of pocket parks that may be related to health promoting use. Landsc. Res. 41 (1), 79–94.

Peters, K., Elands, B., Buijs, A., 2010. Social interactions in urban parks: stimulating social cohesion? Urban For. Urban Green 9 (2), 93–100.

PHMC, 2018. Community Health Database; Southeastern Pennsylvania Household Health Survey.

Rigolon, A., 2016. A complex landscape of inequity in access to urban parks: a literature review. Landsc. Urban Plan. 153, 160–169.

Rigolon, A., Németh, J., 2020. Green gentrification or 'just green enough': do park location, size and function affect whether a place gentrifies or not? Urban Stud. 57 (2), 402–420.

Rigolon, A., Browning, M., Jennings, V., 2018. Inequities in the quality of urban park systems: an environmental justice investigation of cities in the United States. Landsc. Urban Plan. 178, 156–169.

Schipperijn, J., Cerin, E., Adams, M.A., Reis, R., Smith, G., Cain, K., Christiansen, L.B., Van Dyck, D., Gidlow, C., Frank, L.D., 2017. Access to parks and physical activity: an eight country comparison. Urban For. Urban Green 27, 253–263.

Seaman, P.J., Jones, R., Ellaway, A., 2010. It's not just about the park, it's about integration too: why people choose to use or not use urban greenspaces. Int. J. Behav. Nutr. Phys. Act. 7 (1), 1–9.

Sefcik, J.S., Kondo, M.C., Klusaritz, H., Sarantschin, E., Solomon, S., Roepke, A., South, E.C., Jacoby, S.F., 2019. Perceptions of nature and access to green space in four urban neighborhoods. Int. J. Environ. Res. Public Health 16 (13), 2313.

Shukla, A., & Bond, M., 2021, October 21, 2021. Philly Is One of the Most Segregated Cities in America. The Philadelphia Inquirer. ⟨https://www.inquirer.com/news/philadelphia/inq2/philadelphia-racial-segregation-remains-high-census-analysis-20211019.html⟩.

Thomas Jefferson University, 2022. Park in a Truck Initiative. ⟨https://www.jefferson.edu/academics/colleges-schools-institutes/architecture-and-the-built-environment/programs/landscape-architecture/park-in-a-truck.html⟩.

Trust for Public Land, 2021. See Your City's ParkScore Ranking. The Trust for Public Land. Retrieved June 9 from ⟨https://www.tpl.org/parkscore⟩.

Turakhia, C., Leiby-Clark, D., Su, J., & Best, J., 2019. 2018–2019 Southeastern Pennsylvania Household Health Survey: Methodology Report.

Ueshima, K., Fujiwara, T., Takao, S., Suzuki, E., Iwase, T., Doi, H., Subramanian, S., Kawachi, I., 2010. Does social capital promote physical activity? A population-based study in Japan. PLoS One 5 (8), e12135.

University of Wisconsin Population Health Institute, 2022. County Health Rankings & Roadmaps: Compare Counties. Retrieved 11/5/22 from ⟨https://www.countyhealthrankings.org/explore-health-rankings⟩.

Vaughan, C.A., Colabianchi, N., Hunter, G.P., Beckman, R., Dubowitz, T., 2018. Park use in low-income urban neighborhoods: who uses the parks and why? J. Urban Health 95 (2), 222–231.

Veitch, J., Ball, K., Rivera, E., Loh, V., Deforche, B., Best, K., Timperio, A., 2022. What entices older adults to parks? Identification of park features that encourage park visitation, physical activity, and social interaction. Landsc. Urban Plan. 217, 104254.

Wang, D., Brown, G., Liu, Y., Mateo-Babiano, I., 2015. A comparison of perceived and geographic access to predict urban park use. Cities 42, 85–96.

Wang, D., Brown, G., Liu, Y., 2015. The physical and non-physical factors that influence perceived access to urban parks. Landsc. Urban Plan. 133, 53–66.

Wang, P., Zhou, B., Han, L., Mei, R., 2021. The motivation and factors influencing visits to small urban parks in Shanghai. China Urban For. Urban Green 60, 127086.

Williams, T.G., Logan, T.M., Zuo, C.T., Liberman, K.D., Guikema, S.D., 2020. Parks and safety: a comparative study of green space access and inequity in five US cities. Landsc. Urban Plan. 201, 103841.

Xiao, Y., Wang, D., Fang, J., 2019. Exploring the disparities in park access through mobile phone data: evidence from Shanghai, China. Landsc. Urban Plan. 181, 80–91.

Yasumoto, S., Nakaya, T., Jones, A.P., 2021. Quantitative environmental equity analysis of perceived accessibility to urban parks in Osaka Prefecture, Japan. Appl. Spat. Anal. Policy 14 (2), 337–354.