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ORIGINAL ARTICLE

Exploring the Distribution of Park Availability, Features, and Quality Across Kansas City, Missouri by Income and Race/Ethnicity: an Environmental Justice Investigation

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Abstract
Background Parks are key community assets for physical activity, but some evidence suggests these resources are not equitably distributed.
Purpose This study examined disparities by income and race/ethnicity in the availability, features, and quality of parks across Kansas City, Missouri.
Methods All parks and census tracts (CTs) were mapped using geographical information systems, and park features and quality were determined via audits. Multivariate analyses of covariance analyzed differences in park availability, features, and quality across low-, medium-, and high-income and race/ethnicity CT tertiles.
Results Low-income CTs contained significantly more parks, but also had fewer parks with playgrounds and more quality concerns per park. High minority CTs had more parks with basketball courts, but fewer parks with trails. Medium-income CTs contained more aesthetic features per park.
Conclusions Future research should examine policies that contribute to and that might rectify disparities in park features and quality, especially in low-income and high minority areas.

Keywords Parks · Built environment · Physical activity · Income · Race/ethnicity · Environmental justice

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Recent physical activity (PA) promotion and obesity prevention efforts have adopted social ecological models that emphasize the role of the built environment in facilitating or constraining opportunities for active transportation and recreation [1, 2]. Public parks are a major environmental resource in most communities, and their proximity, accessibility, design, and quality are all important factors influencing their usage and impact on population-level PA [3–9]. Indeed, public parks generally offer diverse opportunities for PA, are present in most communities at low or no cost, and can thereby reach a large proportion of the population, especially disadvantaged groups who may not have access to other resources [10].

The idea of environmental justice (EJ) provides a conceptual foundation for investigating built environment disparities in low-income and racially/ethnically diverse communities that may be influencing poorer rates of physical activity and health [11]. Several authors [12–14] have previously provided excellent theoretical and historical overviews of the relevance of EJ to research on parks and outdoor recreation, as well as alternative conceptualizations and definitions of various ideas related to EJ (e.g., distributive and procedural justice, environmental equity, environmental racism). According to one prominent review paper citing the US Environmental Protection Agency, EJ can be defined as the fair treatment and meaningful involvement of all people in the development, implementation, and enforcement of laws,

regulations, and policies about diverse environmental issues [15]. Although proponents justifiably advocate for greater *involvement* of affected citizens in actions to promote EJ, more attention in the research literature thus far has addressed the *fair treatment* component [16]. Indeed, a growing body of research has examined whether various PA resources are equitably distributed by neighborhood socioeconomic status (SES) or ethnic/racial composition. Within this literature, it has often been concluded that areas with lower SES and/or a higher minority population contain significantly fewer parks and recreational resources than their higher SES and low minority counterparts [17–22]. However, other studies have reported that park availability is equal or greater in low-income and/or high minority neighborhoods [23–26], so further research is warranted. Moreover, another recent study in Los Angeles [14] reported that there were more, but often smaller, parks in low-income and minority neighborhoods, thus leading to more park pressure or congestion (i.e., less park space *per capita*). Additionally, little research has explored disparities in the specific facilities and amenities within parks. One exception in Australia found that within higher SES neighborhoods, public open spaces were more abundant and possessed more total amenities (e.g., picnic tables, drinking fountains, toilets) and were more likely to have shade trees, water features, walking and cycling paths, lighting, and various types of signage [27]. Finally, few studies [28, 29] have evaluated the actual quality of parks and recreation resources by neighborhood composition. However, researchers in New Zealand [30] found that public open spaces in less deprived areas had higher environmental quality scores (e.g., trees, water features, lack of graffiti and litter) than those in more deprived areas.

In summary, parks are important PA resources, especially for promoting PA and health-related EJ in low-income and minority communities. Therefore, the purpose of this study was to examine disparities in park availability, features, and overall park quality across socioeconomically and racially/ethnically diverse census tracts in Kansas City, Missouri (KCMO). We hypothesized that park availability would not differ by census tract income or race/ethnicity composition, but that there would be fewer park features and lower overall park quality in parks in tracts with lower household incomes and a greater percentage of minority residents.

Methods

Study Area and Sample

This study was set in KCMO, which intersects four counties, covers 313 square miles, and is home to almost one half million (441,545) residents. The KCMO population is ethnically and racially diverse (White=61 %, Black=31 %, Hispanic=7 %) and has a broad income distribution (median household income=$39,230; 14 % at or below the poverty line) [31]. At the time of the study, there were 219 parks and approximately 12,000 acres of total parkland in KCMO. Parks were identified for enumeration and location in the present study using geographical information systems (GIS) shape files provided by the KCMO Parks and Recreation Department. All parks in the original GIS file were visited and audited to determine if they were publicly accessible and useable for recreation. Parks that did not meet this criterion (e.g., deep ravines, grounds of public buildings) were not included in the study because the emphasis was on disparities in access to sites for PA and recreation. Ultimately, 165 parks were included in an edited GIS file, and this edited file was cross-referenced by location with census tracts to allocate parks (and their area and characteristics) to tracts (as described further below).

The units of analysis for this study were census tracts in KCMO. Census tracts are small, generally permanent subdivisions of a county that usually contain from 2,500–8,000 people and are fairly homogenous in terms of population characteristics, economic status, and living conditions [32]. In ArcGIS, shape files representing the KCMO municipal boundary and all tracts in the four counties were overlaid to determine tracts partially or fully within KCMO. In total, 186 tracts intersected KCMO, but 12 were more than 50 % outside the city boundary and were therefore excluded to maintain the focus on KCMO residents and parks. Most of the excluded tracts simply shared an edge with the KCMO boundary, and therefore, only one small City of KCMO park was found within these excluded tracts. In the end, a final sample of 174 tracts was analyzed.

Measures

Census Tract Income and Race/Ethnicity

The American Community Survey (ACS) was used to gather information on race/ethnicity and income for each census tract [33]. ACS 5-year (2005–2009) estimates are available at the census tract level and were downloaded. The median household income for each census tract was used to categorize tracts into three even tertiles (low, medium, and high income). For race/ethnicity, we identified the percentage of minority residents, defined as non-White and Hispanic White persons, and tracts were again categorized into even tertiles (low, medium, and high percent minority). For both income and percent minority, tracts were grouped into categories in order to ease interpretation between high- versus medium- versus low-income or percent minority areas and to maintain consistency with most past studies exploring similar issues [17, 19, 20, 22–27].

Park Availability

Our first dependent variable was park availability, which was measured in two ways. First, we used ArcGIS to determine the *number* of parks whose boundaries intersected the boundary of each census tract [23]. Second, a total *amount* of park space (acres) was calculated by summing the area of all parks that intersected the tract.

Park Features

The features and quality of all parks in the study were assessed using the Community Park Audit Tool (CPAT [34]). Audits of all KCMO parks were conducted by both trained community stakeholders and research assistants who underwent both classroom training on the CPAT and practice field audits in parks not included in the present study. The duration of the audits ranged from 10 to 65 min (mean= 32 min), and all data were collected in Fall 2010 and Spring 2011. Inter-rater reliability tests were conducted on data collected by two independent auditors in 66 diverse parks used in the present study. The CPAT was found to possess excellent inter-rater reliability, with all but eight items demonstrating at least moderate to perfect agreement and only three items with percent agreement less than 70 % [34].

In this study, similar to past research [9], we divided the park features rated within the CPAT into "facilities" and "amenities." Facilities were areas in the park that could be used for PA while amenities were park features that might support PA. Park facilities included 14 park activity areas—baseball fields, basketball courts, dog parks, fitness stations, green spaces, lakes, playgrounds, skate parks, splash pads, sports fields, swimming pools, tennis courts, trails, and volleyball courts. Park amenities included 25 total features that were divided into seven neighborhood amenities (transit stop, car parking, sidewalk, external trail, traffic signal, bike lane, bike rack), 11 quality amenities (restroom, drinking fountain, benches, picnic table, picnic shelter, grill, vending machine, trash can, shade, rules posted about animals, animal waste bags), and seven safety amenities (lights, park monitored, dangerous spots, threatening behaviors, neighborhood visibility, roads through the park, emergency device; note that two of these park amenities—dangerous spots and threatening behaviors—may not fit the traditional definition of a positive park attribute that contributes to park visitors' PA, but they have been included amongst the other non-facility park features while recognizing this inconsistency).

In this study, we first calculated the average number of *total* park facilities, *total* positive park amenities, and *total* park features (facilities plus positive amenities) per park for each census tract. Like other studies, we then examined disparities in each facility or amenity *individually* [26, 27]. Specifically, we calculated the proportion of parks in each tract that contained each type of facility or amenity (e.g., two of five parks=0.40)

Park Quality

Finally, to assess park quality, the presence of both overall park quality concerns—or what are sometimes referred to as incivilities [26]—as well as positive aesthetic features in the parks was also audited using the CPAT tool. Quality concerns were measured using an index of six negative attributes (e.g., vandalism, graffiti, excessive litter), and aesthetic features were measured with a list of seven items that might enhance park attractiveness or enjoyment (e.g., artistic feature, historical/educational feature, water feature, etc.). The total number of quality concerns and the total number of aesthetic features were summed for each park to determine the mean number of quality concerns and the mean number of aesthetic features per park for each tract [29].

Analyses

Multivariate analyses of covariance (MANCOVAs) were used to compare low, medium, and high census tracts (for each of income and percent minority) with respect to (a) the number of parks and the total amount of park space; (b) the average number of total park features, facilities, and amenities per park; (c) the proportion of parks with individual facilities and amenities, and (d) the average number of park quality concerns and aesthetic features per park. Significant omnibus MANCOVAs were followed by univariate ANCOVAs for each dependent variable and Sidak post hoc tests of between group differences. All analyses controlled for the land area of the tract, total tract population, percentage of the tract population under 18 years old, and the tract's income or percent minority (when not used to stratify the sample of tracts to begin with).

Results

Table 1 shows the descriptive characteristics of the 174 tracts included in the study. The average median household income of all tracts was $42,747 (SD=$23,951), and the mean percent minority for all tracts was 50.4 % (SD= 33.2 %). Across all census tracts, there was an average of 1.22 parks per tract (SD=1.14, range=0–6), 152.2 park acres per tract (SD=410.9, range=0–1,853), 3.87 out of 14 facilities per park (SD=2.07, range=0–11), 8.75 out of 23 positive amenities per park (SD=3.13, range=2–17), 12.6 out of 37 total features per park (SD=4, range=3–27), 0.57 quality concerns per park (SD=0.71, range=0–4), and 2.47 aesthetic features per park (SD=1.45, range=0–6).

Table 1 Tract characteristics

	Number	Median household income		Percent minority	
		Mean	SD	Mean (%)	SD (%)
All tracts	174	$42,747	$23,951	50.4	33.2
Income					
Low	57	$22,694	$4,393	19.6	21.9
Medium	56	$36,728	$5,250	49.8	27.5
High	57	$68,714	$23,518	81.3	14.0
Percent minority					
High	57	$24,987	$6,906	90.0	9.4
Medium	57	$39,310	$12,311	45.8	14.6
Low	58	$63,461	$27,332	13.5	6.1

Four tracts were missing income data and two tracts were missing race/ethnicity data

Park Availability

Table 2 shows the relationship between tract income and percent minority and the number of parks and total park acres per census tract. The overall MANCOVA comparing both the number of parks and total park acres across income tertiles was statistically significant (F=4.76, p<0.01). When examined individually, the number of parks was significantly different across low-, medium-, and high-income tracts (F=6.28, p<0.01). Specifically, low-income tracts (M=1.46, SD=1.25) had significantly more parks than medium (M=1.25, SD=1.00) or high (M=1.00, SD=1.10) income tracts. As well, the post hoc test comparing medium- and high-income tracts approached significance (p=0.06). These patterns are illustrated in Fig. 1 which depicts the number of parks across all low-, medium-, and high-income census tracts.

Table 2 Differences in park availability by income and percent minority

Census tract characteristic	Number	Number of parks		Total park acres	
		Mean	SD	Mean	SD
Income*					
Low	57	1.46[a]	1.25	154.30	420.75
Medium	56	1.25[b]	1.00	246.82	544.54
High	57	1.00[b]	1.10	66.93	188.41
F		6.28		3.09	
df		2,163		2,163	
p		<0.01		0.05	
Percent minority**					
High	57	1.28	1.05	194.48	506.82
Medium	55	1.27	1.13	200.72	475.10
Low	58	1.16	1.23	74.27	185.88
F		0.08		1.52	
df		2,163		2,163	
p		0.92		0.22	

* MANCOVA: F=4.76, df=4,324, p<0.01

** MANCOVA: F=0.77, df=4,324, p=0.54

[a, b] Means with different superscript letters are significantly different at p<0.05

For total park acres across income tertiles, the ANCOVA test approached significance (F=3.09, p=0.05), but post hoc tests revealed no differences between the three groups. Finally, the overall MANCOVA comparing both the number of parks and total park acres across percent minority tertiles was not significant (F=0.77, p=0.54). As shown in the bottom half of Table 2, when examining the low, medium, and high percent minority groups, no differences were found for the number of parks (F=0.08, p=0.92) or total park acres per census tract (F=1.52, p=0.22).

Park Features

The overall MANCOVA comparing the average *total* number of facilities, amenities, and total features per park across income tertiles was not significant (F=0.56, p=0.70). Likewise, there also were no significant differences among percent minority groups for the average total number of facilities, amenities, or total features (F=0.37, p=0.83). However, as discussed below, several *individual* park facilities and amenities differed across tract income and race/ethnicity tertiles.

Table 3 illustrates the proportion of parks with individual park *facilities*. Only eight of the 14 facilities were included in the analysis because some facilities were either too prevalent (e.g., green spaces) or too scarce (e.g., splash pads) within parks that variation across tertiles was non-existent (the specific inclusion criteria was a skewness value for the facility variable from −3 to +3). The overall MANCOVA comparing the proportion of parks with individual facilities per census tract by income approached statistical significance (F=1.66, p=0.06). As shown in Table 3, the proportion of parks with playgrounds differed significantly across income groups (F=4.88, p<0.01), with low- (M=0.62, SD=0.40) and medium- (M=0.52, SD=0.41) income tracts having a lower proportion of parks with playgrounds than high-income tracts (M=0.69, SD=0.38). Additionally, the overall MANCOVA comparing the proportion of parks with individual facilities across percent minority tertiles was significant (F=2.60, p<0.01). Specifically, the proportion of parks with basketball courts was greater in high minority (M=0.59, SD=0.43) tracts than in medium (M=0.30, SD=0.40) or low (M=0.13, SD=0.29) minority tracts (F=5.18, p<0.01). As well, the proportion of parks with trails was greater in low (M=0.60, SD=0.41) and medium (M=0.55, SD=0.41) minority tracts than high minority (M=0.39, SD=0.41) tracts (F=5.61, p<0.01).

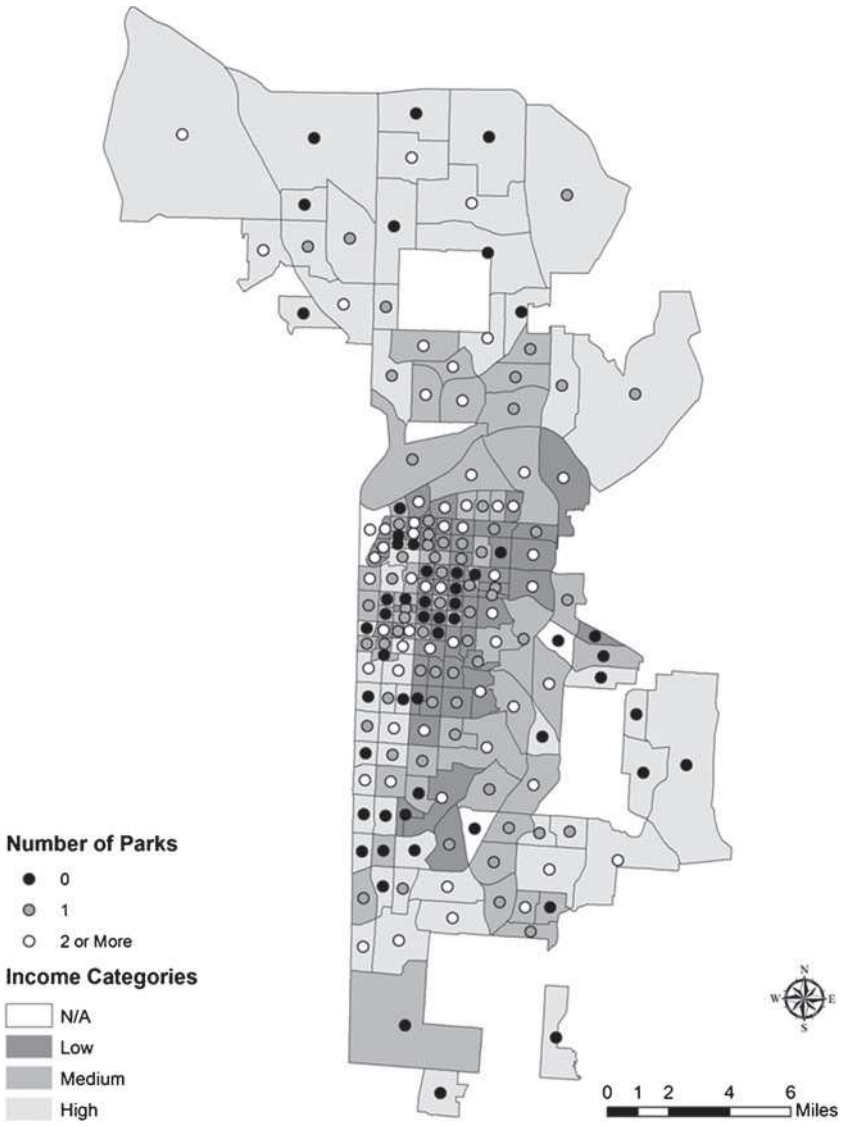

Fig. 1 Number of parks by census tract income

Tables 4, 5, and 6 show the proportion of parks in each tract with various individual *amenities* (similar to the park facilities analyses, four amenities—bike parking, bike lanes, vending machines, and emergency devices—were excluded from the analysis due to low variation). To account for conceptual differences between the types of assessed amenities, we split the remaining 21 amenities into three distinct groups for the MANCOVA analyses: neighborhood amenities (Table 4), quality amenities (Table 5), and safety amenities (Table 6).

The overall MANCOVA comparing the proportion of parks with various *neighborhood* amenities by income tertiles approached significance (F=0.85, p=0.05). When examined individually, as shown in Table 4, the proportion of parks with sidewalks was significantly higher in low- (M=0.87, SD=0.28) and high-income (M=0.74, SD=0.38) tracts than in medium-income (M=0.61, SD=0.43) tracts (F=5.13, p=0.01). The overall MANCOVA comparing the proportions of parks with neighborhood amenities by percent minority was not significant (F=1.10, p=0.36).

Table 5 shows the proportion of parks with various *quality* amenities by tract income and percent minority. The overall MANCOVA comparing the park quality amenities by tract income group was not significant (F=0.51, p=0.96). Further, the overall MANCOVA comparing the park quality amenities by tract percent minority group approached significance (F=1.59, p=0.05). The univariate ANCOVA comparing the proportion of parks with restrooms across high, medium, and low percent minority census tracts also approached statistical significance (F=2.45, p=0.09), with low (M=0.34, SD=0.40) and medium (M=0.27, SD=0.33) percent minority tracts being somewhat more likely to have parks with restrooms than high (M=0.20, SD=0.35) minority tracts (Table 5).

Finally, the overall MANCOVAs comparing the proportion of parks with *safety* amenities were not significant for

Table 3 Proportion of parks with specific facilities per census tract by income and percent minority

Tract characteristic	Playground Mean (SD)	Sports field Mean (SD)	Baseball field Mean (SD)	Swimming pool Mean (SD)	Basketball court Mean (SD)	Tennis court Mean (SD)	Trail Mean (SD)	Lake Mean (SD)
Income*								
Low	0.62[a] (0.40)	0.18 (0.34)	0.47 (0.43)	0.12 (0.27)	0.51 (0.44)	0.28 (0.39)	0.49 (0.41)	0.15 (0.29)
Medium	0.52[a] (0.41)	0.19 (0.32)	0.42 (0.42)	0.12 (0.29)	0.33 (0.42)	0.27 (0.39)	0.50 (0.43)	0.22 (0.36)
High	0.69[b] (0.38)	0.19 (0.36)	0.36 (0.40)	0.06 (0.15)	0.15 (0.32)	0.23 (0.33)	0.54 (0.41)	0.11 (0.25)
F	4.88	0.95	0.36	0.57	0.08	0.76	0.38	1.52
df	2,113	2,113	2,113	2,113	2,113	2,113	2,113	2,113
p	0.01	0.39	0.70	0.57	0.93	0.47	0.69	0.22
Percent minority**								
High	0.67 (0.39)	0.15 (0.31)	0.49 (0.42)	0.12 (0.27)	0.59[a] (0.43)	0.33 (0.41)	0.39[a] (0.41)	0.18 (0.32)
Medium	0.57 (0.39)	0.24 (0.33)	0.34 (0.38)	0.11 (0.27)	0.30[b] (0.40)	0.27 (0.38)	0.55[b] (0.41)	0.21 (0.33)
Low	0.55 (0.42)	0.18 (0.36)	0.43 (0.43)	0.08 (0.21)	0.13[b] (0.29)	0.17 (0.32)	0.60[b] (0.41)	0.10 (0.27)
F	2.98	0.77	1.36	0.04	5.18	1.59	5.61	0.56
df	2,113	2,113	2, 113	2,113	2,113	2,113	2,113	2,113
p	0.06	0.47	0.26	0.96	0.01	0.21	0.01	0.58

* MANCOVA: $F=0.56$, $df=4,224$, $p=0.70$

** MANCOVA: $F=0.37$, $df=4,226$, $p=0.83$

[a, b] Means with different superscript letters were significantly different at $p<0.05$

income ($F=0.78$, $p=0.67$) or percent minority ($F=0.97$, $p=0.48$). Table 6 shows the analyses for the six park safety amenities, none of which differed significantly across income or percent minority tertiles.

Park Quality

Table 7 shows the average number of quality concerns (i.e., incivilities) and aesthetic features per park by income and percent minority tertiles. The overall MANCOVA simultaneously comparing quality concerns and aesthetic features per park across income tertiles was significant ($F=4.84$, $p<0.01$). The number of quality concerns per park varied across income groups ($F=3.74$, $p=0.03$), with more quality concerns per park in low-income tracts ($M=0.75$, SD=0.89) than in high- ($M=0.42$, SD=0.57) or medium- ($M=0.50$, SD=0.56) income tracts. The average number of aesthetic features per park across the three income categories was also significantly different ($F=6.08$, $p<0.01$), with more aesthetic features per park in medium-income tracts

Table 4 Proportion of parks with neighborhood amenities per census tract by income and percent minority

Tract characteristic	Transit Mean (SD)	Car parking Mean (SD)	Sidewalk Mean (SD)	External trail Mean (SD)	Traffic signal Mean (SD)
Income*					
Low	0.70 (0.42)	0.90 (0.27)	0.87[a] (0.28)	0.07 (0.20)	0.86 (0.26)
Medium	0.54 (0.46)	0.91 (0.22)	0.61[b] (0.43)	0.08 (0.22)	0.74 (0.39)
High	0.29 (0.43)	0.87 (0.27)	0.74[a] (0.38)	0.12 (0.22)	0.63 (0.43)
F	0.68	0.13	5.13	0.65	2.46
df	2,113	2,113	2,113	2,113	2,113
p	0.51	0.88	0.01	0.53	0.09
Percent minority**					
High	0.69 (0.42)	0.93 (0.23)	0.82 (0.34)	0.06 (0.18)	0.84 (0.31)
Medium	0.51 (0.46)	0.83 (0.31)	0.66 (0.40)	0.10 (0.24)	0.67 (0.39)
Low	0.38 (0.45)	0.92 (0.20)	0.74 (0.40)	0.11 (0.22)	0.75 (0.38)
F	0.93	1.31	1.63	0.19	1.76
df	2,113	2,113	2,113	2,113	2,113
p	0.40	0.27	0.20	0.83	0.18

*MANCOVA: $F=0.85$, $df=10,218$, $p=0.05$

**MANCOVA: $F=1.10$, $df=10,218$, $p=0.36$

[a, b] Means with different superscript letters were significantly different at $p<0.05$

(M=3.02, SD=1.57) than in high-income tracts (M=2.29, SD=1.31). Finally, the MANCOVA comparing quality concerns and aesthetic features per park by census tract percent minority group was not significant (F=1.02, p=0.40).

Table 5 Proportion of parks with quality amenities per census tract by income and percent minority

Tract characteristic	Restrooms Mean (SD)	Drinking fountains Mean (SD)	Benches Mean (SD)	Picnic tables Mean (SD)	Picnic shelters Mean (SD)	Grills Mean (SD)	Trash cans Mean (SD)	Shade Mean (SD)	Rules about animals Mean (SD)	Animal waste bags Mean (SD)
Income*										
Low	0.22 (0.37)	0.39 (0.41)	0.76 (0.34)	0.65 (0.42)	0.30 (0.39)	0.34 (0.41)	0.78 (0.35)	0.42 (0.42)	0.10 (0.27)	0.06 (0.22)
Medium	0.27 (0.36)	0.43 (0.42)	0.71 (0.41)	0.63 (0.42)	0.24 (0.38)	0.33 (0.41)	0.77 (0.35)	0.49 (0.43)	0.11 (0.28)	0.13 (0.33)
High	0.32 (0.37)	0.51 (0.44)	0.70 (0.37)	0.66 (0.39)	0.38 (0.42)	0.44 (0.43)	0.75 (0.35)	0.55 (0.43)	0.29 (0.38)	0.26 (0.38)
F	0.11	0.03	0.24	0.04	1.25	0.59	0.52	0.24	1.55	0.68
df	2,113	2,113	2,113	2,113	2,113	2,113	2,113	2,113	2,113	2,113
p	0.89	0.97	0.79	0.96	0.29	0.55	0.60	0.79	0.22	0.51
Percent minority**										
High	0.20 (0.35)	0.33 (0.39)	0.76 (0.35)	0.66 (0.43)	0.31 (0.40)	0.36 (0.42)	0.77 (0.36)	0.42 (0.44)	0.10 (0.28)	0.03 (0.17)
Medium	0.27 (0.33)	0.44 (0.42)	0.70 (0.39)	0.57 (0.42)	0.28 (0.36)	0.34 (0.37)	0.71 (0.34)	0.52 (0.41)	0.11 (0.26)	0.10 (0.28)
Low	0.34 (0.40)	0.55 (0.42)	0.71 (0.39)	0.71 (0.38)	0.31 (0.42)	0.39 (0.45)	0.81 (0.33)	0.51 (0.43)	0.26 (0.38)	0.29 (0.41)
F	2.45	1.65	1.04	0.85	0.14	0.24	0.84	0.42	0.36	1.30
df	2,113	2,113	2,113	2,113	2,113	2,113	2,113	2,113	2,113	2,113
p	0.09	0.20	0.36	0.43	0.87	0.78	0.44	0.66	0.70	0.28

* MANCOVA: F=0.51, df=20,208, p=0.96

** MANCOVA: F=1.59, df=20,208, p=0.05

Discussion

Park Availability

In KCMO, overall park availability was greater in low-income areas. The present findings are similar to a study in California which found that there were more places to engage in PA in low SES areas [25]. Other researchers have reported no discrepancies in park availability between areas of differing SES [24, 35, 36], but there is an equally substantial body of evidence documenting fewer parks in lower-income areas [17–22]. In KCMO, our findings might be explained by the fact that low-income and diverse populations are generally found within the older, urban core of the city (Fig. 1). Many core areas of cities in the USA were developed at a time (i.e., prior to mass automobile use) when integrated planning and mixed use development were more common; these development patterns often included abundant numbers of parks and green spaces in concert with residential, commercial, and industrial land uses [37, 38]. The urban cores of many large cities have since been gentrified toward higher-income businesses and households, but in those cities where this has not occurred, park availability may yet be skewed toward more central, lower-income tracts.

Park Features

While park availability is important, park facilities and amenities may be equally significant determinants of park use and PA [9]. In the present study, the average *total* number of facilities, amenities, and features per park was not significantly different across income or percent minority tertiles. These findings are similar to another study conducted in KCMO [39]. However, these totals may mask inequities in the distribution of specific types of park features across neighborhoods throughout the city. Indeed, in our study, high-income tracts had more playgrounds per park than low- or medium-income tracts. Another study in Australia found similar results in that there were fewer playgrounds and other facilities and amenities (i.e., bike paths, picnic tables) conducive to children's PA in lower SES areas [27]. These findings are problematic because playgrounds have been shown to promote increased PA intensity and healthier weight status among children [40–42]. Areas of low SES are perhaps the neighborhoods that need playgrounds the

Table 6 Proportion of parks with safety amenities per census tract by income and percent minority

Tract characteristic	Lights Mean (SD)	Park monitored Mean (SD)	Dangerous spots Mean (SD)	Threatening behaviors Mean (SD)	Neighborhood visibility Mean (SD)	Road through park Mean (SD)
Income*						
Low	0.48 (0.45)	0.17 (0.29)	0.29 (0.39)	0.13 (0.28)	0.68 (0.42)	0.35 (0.41)
Medium	0.41 (0.42)	0.07 (0.22)	0.35 (0.44)	0.03 (0.18)	0.72 (0.40)	0.22 (0.35)
High	0.63 (0.41)	0.18 (0.32)	0.23 (0.35)	0.15 (0.32)	0.53 (0.46)	0.32 (0.39)
F	1.37	0.24	0.20	0.35	1.59	1.45
df	2,113	2,113	2,113	2,113	2,113	2,113
p	0.26	0.79	0.82	0.70	0.21	0.24
Percent minority**						
High	0.62 (0.41)	0.22 (0.36)	0.25 (0.36)	0.18 (0.35)	0.60 (0.45)	0.36 (0.42)
Medium	0.46 (0.44)	0.15 (0.24)	0.29 (0.37)	0.09 (0.25)	0.65 (0.43)	0.21 (0.32)
Low	0.47 (0.44)	0.07 (0.20)	0.31 (0.43)	0.05 (0.19)	0.66 (0.44)	0.34 (0.41)
F	1.18	1.11	0.06	0.26	0.04	2.36
df	2,113	2,113	2,113	2,113	2,113	2,113
p	0.31	0.33	0.94	0.77	0.96	0.10

* MANCOVA: $F=0.78$, $df=12,216$, $p=0.67$

** MANCOVA: $F=0.97$, $df=12,216$, $p=0.48$

most due to the increased likelihood of those areas having a higher prevalence of youth who are overweight or obese [43].

The proportion of parks with basketball court facilities was significantly greater in high minority census tracts. Conversely, the proportion of parks with trails was lower in high minority tracts. Another study reported that lower SES areas contained fewer trails [44]. Overall, these findings are disconcerting as trails are key park resources for PA [9, 45]. Likewise, several studies have reported that basketball courts are potential places to intervene due to their high levels of use and user energy expenditure [41, 46]. The greater number of basketball courts in high minority areas could be a product of greater demand for these facilities at the time certain parks were built. However, for all of the disparities observed, future research should explore why certain key park facilities are more prevalent in different areas and the impact this has on park use and PA participation. Nevertheless, none of the other park facilities in our analyses approached significance, which is promising from an EJ standpoint in that there is a relatively equal distribution for most facilities across tracts in KCMO.

Table 7 Quality concerns and aesthetic features per park by income and percent minority

Tract characteristic	Average quality concerns per park		Average aesthetic features per park	
	Mean	SD	Mean	SD
Income*				
Low	0.75[a]	0.89	2.11[a,b]	1.29
Medium	0.50[b]	0.56	3.02[a]	1.57
High	0.42[b]	0.57	2.29[b]	1.31
F	3.74		6.08	
df	2,113		2,113	
p	0.03		<0.01	
Percent minority**				
High	0.62	0.87	2.18	1.52
Medium	0.57	0.65	2.65	1.41
Low	0.57	0.71	2.68	1.39
F	0.71		1.35	
df	2,113		2,113	
p	0.49		0.26	

* MANCOVA: $F=4.84$, $df=4,222$, $p<0.01$

** MANCOVA: $F=1.02$, $df=4,224$, $p=0.40$

[a, b] Means with different superscript letters were significantly different at $p<0.05$

The one individual amenity that was significant in the analyses was sidewalks, with there being a higher proportion of parks with sidewalks in low- and high-income compared to medium-income tracts. Sidewalks are an important predictor of PA and the absence of such amenities around parks should not be ignored [47]. As well, a study conducted in St. Louis, MO found that neighborhoods that were predominantly African American were much more likely to have uneven sidewalks and sidewalks with obstructions than predominantly White neighborhoods [48]. Therefore, future research should examine not only sidewalk availability but also the condition of such access-related amenities around parks.

Park Quality

Finally, there were a greater number of overall park quality concerns (i.e., incivilities) per park in low-income tracts and more aesthetic features per park in medium-income tracts. Few previous studies have assessed park quality concerns, but these findings are consistent with researchers in Canada who found that playgrounds in high need areas were more likely to be below standard quality [32]. Related to this, Coen and Ross [49] reported that there were more quality concerns in parks in areas of poor health status. With respect to aesthetic features, researchers in Melbourne found that there were more aesthetic features (i.e., picnic tables, water features, lighting) in higher SES areas [27] and that the quality of neighborhood resources is a predictor of engaging in more outdoor activities [50]. Thus, more quality concerns and fewer aesthetic features within parks can lead to both poorer perceptions and actual problems related to park attractiveness and safety, which can deter park visitation and use. Consequently, EJ efforts must take into account not only the availability of parks and the features therein but also the quality of those resources and their attractiveness for PA.

Limitations

The present study had several limitations. We examined the number of parks and park acreage that interested the census tract, whereas future research may wish to employ other measures of park availability and accessibility. For example, Sister et al. defined service areas around parks and calculated a measure of "potential park congestion (or pressure)" based on the ratio of persons within the service area relative to the size of the park [14]. They found that Latinos, African-Americans, and low-income groups were more likely to live close to parks with higher potential park congestion. Others have used such diverse measures as acres of park space per 1,000 population (e.g., all residents, those under 18 years, those over 65 years, households without automobiles, etc.), percentage of open space relative to all available land, size of the largest park, or park and recreation funding per capita [12, 23, 51, 52].

Another limitation was that, given our detailed emphasis on public park availability, features, and quality, resources such as private parks, school grounds, and other recreation facilities were not examined. Further, not all of the park facilities and amenities audited could be included in the analyses due to a lack of variability for some (too scarce or too common). As well, the present study only accounted for quality concerns and aesthetic features of the overall park, not the quality of individual facilities and amenities (again due to low variability in facility and amenity condition ratings). Additionally, we did not have information on the age of the parks and future research (using park maps and audits over time) may wish to track whether the associations we observed are becoming stronger or being diluted.

A final limitation was that our study considered only one half of the EJ equation. Although we, like others, examined relatively thoroughly the *fair treatment* aspect of park provision, further efforts should be made to ensure *meaningful involvement* by citizens in actions that might uncover and rectify any disparities in park availability, features, or quality across communities. Parks are encouraging sites for promoting PA because their provision and management can be influenced through public policy [10, 53], but all groups do not always have equal access to policy making processes [54]. Unlike many other park audit tools, the CPAT was designed with and for non-researchers as a user-friendly yet reliable instrument that could be incorporated into community evaluation and advocacy efforts [34]. In addition to producing and testing the tool, the diverse community stakeholders involved in its development reported a range of positive *process*-related outcomes (e.g., increased resource awareness; networking and community building) from their engagement in the project [34]. Likewise, another study in two low-income urban neighborhoods reported that another park audit tool—the Physical Activity Resource Assessment [29]—was a useful needs assessment and program planning tool that facilitated familiarity with the local built and social environments [55]. Further, Ghaemi et al. [56] reported on the development of a web-based tool that would permit community organizations to analyze population demographics and green space distribution and identify areas where parks are needed. Ongoing efforts such as these should continue to engage diverse constituencies in environmental change initiatives, especially youth who may be the next wave of advocates for healthy community design [57].

Important follow-up research could also include policy analysis or historical analysis to uncover mechanisms that have led to observed disparities in KCMO and elsewhere. For example, Boone et al. [12] used official park plans, municipal master plans and ordinances, newspaper accounts, unpublished documents from neighborhood associations, and records from government mortgage and housing agencies to document historical patterns and events related to racial segregation and residential migration that have shaped park access for low-income and minority groups in Baltimore, MD. In general, concerns about the fair treatment element of EJ should be balanced with increased respect for the meaningful involvement of citizens in producing such outcomes and for an understanding of forces that influence park availability and distribution.

Conclusion

Our study uncovered few wide discrepancies in park availability, features, or quality across tracts, but there were subtle marked differences that should not be overlooked. Low-income and racially/ethnically diverse areas of KCMO are generally found within the older, urban core of the city where the inclusion of parks in neighborhood planning appears to have been more common. However, similar to past research showing less spending per capita in at-risk neighborhoods [22], greater investments in certain park facilities and amenities in these neighborhoods may also be necessary. Future research and practice should investigate law and policy changes that can ameliorate environmental disparities in the areas where quality parks are needed most. Moreover, more research is needed to examine how disparities in access to quality park environments are associated with PA and health outcomes. Addressing such disparities in low-income and high minority areas will help in leveling the playing field to combat the obesity crisis through the provision of equitable environmental supports for PA.

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