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ORIGINAL ARTICLE

Perceptions of Neighborhood Park Quality: Associations with Physical Activity and Body Mass Index

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Abstract
Background Parks are important resources for physical activity (PA), yet few studies have examined how perceptions of park characteristics relate to PA and health.
Purpose This study investigated associations between perceptions of neighborhood park quality and overall moderate-to-vigorous PA (MVPA), park-based PA, and body mass index (BMI).
Methods Data were collected via questionnaire from 893 households in Kansas City, Missouri.
Results The newly developed neighborhood park quality scale demonstrated good test–retest and internal reliability. Residents' perceptions of neighborhood park quality were related to PA and health outcomes. Perceiving parks as a benefit was positively related to overall MVPA and park-based PA and negatively related to BMI. Perceptions of well-used parks were positively related to BMI, while perceived cleanliness was negatively related to park-based PA.
Conclusions Better measuring and understanding how perceptions of local parks are associated with PA and health can improve appreciation of how parks facilitate active living.

Keywords Recreation · Exercise · Reliability · Obesity · Environment

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Introduction

Low rates of physical activity are an important contributing factor to rising levels of obesity as well as risk of cardiovascular disease, hypertension, type 2 diabetes, stroke, colon cancer, and premature death [1–3]. Current recommendations suggest adults should engage in at least 150 min of moderate-intensity physical activity/week, 75 min of vigorous-intensity physical activity/week, or an equivalent mix of both [2]. However, only about half of the adults in the USA achieve these physical activity guidelines based on self-reports [4]. Recent efforts to promote health and physical activity have adopted ecological models which emphasize the significance of the built environment in facilitating and constraining physical activity [5, 6]. Parks are increasingly recognized as an important component of the built environment for physical activity [7, 8]. By providing low-cost and accessible opportunities for physical activity, parks are used by a vast majority of people and thus can enhance physical activity at the population level across ages, cultures, ethnicities, genders, income levels, and abilities [7, 9–12].

To investigate how parks can better facilitate physical activity and improved health, it is critical to understand factors that contribute to physical activity in parks. Bedimo-Rung et al. [7] proposed a conceptual framework on the relationship between park environmental characteristics and park-based physical activity. Stemming from this, a growing body of literature indicates that park characteristics, such as access, safety, features, condition, and attractiveness may influence physical activity [7, 13]. Most previous research has employed objective measures, such as observational audits and geographic information systems (GIS) methods to examine park characteristics related to physical activity. Such studies find that park proximity, size, neighborhood environment, park and facility condition, number of features, and certain park facilities (e.g., wooded areas, trails, playgrounds, and sidewalks) are related to park use and physical activity

[14–23]. For example, Cohen et al. [14] observed 54,660 individuals in 51 parks and found a positive association between park size and park use; with every 1-acre increase in size, an additional 95 visitors were observed. Kaczynski et al. [18] studied the number and total area of parkland within 1 km of participants' homes and found these objective proximity measures were related to self-reported physical activity within the neighborhood and in nearby parks. Particular park features are also related to park-based physical activity. For example, parks with trails, wooded areas, and water features were more likely to be used for physical activity than parks without these facilities [17].

Beyond objective measures of park characteristics, examining individuals' perceptions of these characteristics is equally important to understanding park visitation and physical activity [24]. Furthermore, some studies show differences between perceived versus objective measures of park characteristics [25–27], and perceived measures may be even more important in predicting physical activity and health [28, 29]. Specifically, although studies indicate that people may not always know accurate information about their parks [27, 30], these perceptions, even if incorrect compared with observational measures, are significant because people make their decisions based on their perceptions. Furthermore, as perceptions and meanings of parks can be formed even without having visited [31], understanding nonvisitor residents' perceptions of their neighborhood parks is also important. Most research on perceptions of park characteristics and physical activity has focused on perceptions of access and availability [24, 25, 29, 32]. For example, Hoehner et al. [25] found that recreational activity was associated with perceived access to recreational facilities (e.g., parks and walking trails). Ries et al. [32] found that the perception of more availability of parks was positively associated with weekly minutes of moderate to vigorous physical activity.

Some studies have also examined the relationship between perceptions of park quality elements (i.e., features, condition, aesthetics, and safety) and physical activity or health outcomes. Specifically, perceived safety [33], perceived availability of facilities [25, 34], perceived maintenance and condition of facilities [35, 36], perceived attractiveness [16, 37], and perceived use [32, 38] are related to park use or physical activity. For example, Ries et al. [32] found that greater perceived park quality pertaining to the amenities available, maintenance, aesthetics, and safety was associated with more than two times greater odds of using parks, but no association was found between park quality and physical activity. In another self-reported study, availability and quality of equipment and safety were found to be related to more vigorous physical activity [36]. Poor maintenance, litter, uncleanliness of bathrooms, and vandalism were found to be inversely related to park use [35], and attractiveness of parks was positively associated with park-based physical activity [16, 37].

Most studies on park characteristics and health behaviors or outcomes have examined proximity, accessibility, or availability of such resources or have focused on park use rather than physical activity. Only a few have examined perceptions of park quality such as condition or aesthetics [32], and even less research has examined them collectively. Consequently, additional research is needed to better understand perceptions of park characteristics, particularly pertaining to park quality, and how quality perceptions relate to physical activity and health.

Bedimo-Rung et al.'s conceptual model [7] suggests that park quality can influence park-based physical activity. Furthermore, the SLOTH model [39] of how people spend their time specifies that physical activity occurs in various domains and that each domain contributes to total physical activity. Therefore, perceptions of a particular domain, such as parks, can influence not only specific physical activity in that domain but also overall physical activity. Indeed, previous studies indicate that park quality may not only be related with park-based physical activity [27] but also overall physical activity [33, 37, 38]. However, the compensation hypothesis proposes that more physical activity in one setting could reduce physical activity in others [40, 41]. As such, it is important to examine relationships with not only the setting-specific physical activity that is a component of overall physical activity but also relationships with the overall physical activity and consequentially people's health.

Therefore, the purpose of this study was to investigate the relationship between residents' perceptions of park quality in their neighborhood and their overall moderate-to-vigorous physical activity, park-based physical activity, and body mass index (BMI). As park-based physical activity is an important component of overall physical activity [7, 23, 39], perceptions of parks may impact not only park-based physical activity but overall physical activity as well. Furthermore, some research has established associations between park access or features and BMI [42, 43], yet no studies to date have examined perceptions of park quality and BMI. A secondary objective was to examine the test–retest reliability of a newly developed neighborhood park quality scale.

Methods

This study used a cross-sectional, self-administered questionnaire to assess perceptions of neighborhood park quality, physical activity, and BMI.

Sample Selection and Data Collection

The Kansas City metropolitan area covers 15 counties in both the state of Missouri and the state of Kansas with a population of over two million people [44]. This study took place in Kansas City, Missouri, which has a population of 459,787 [45] and used a mail survey of residents. The study was approved by the Institutional Review Boards of the University of Missouri and Kansas State University. Initially, 60 parks were selected as part of a related study to be geographically dispersed across Kansas City, Missouri, and to represent a diverse mix of quality, size, and features; neighborhood income; and racial composition (see [46]). Next, the sampling population was determined by identifying all census blocks wholly or partially within 0.5 mile of each of the parks. From those census blocks, a random sample of approximately 66 addresses around each park was purchased from a market research company (Survey Sampling International, Shelton, CT) for a total starting sample of nearly 4,000 households (n=3,906).

Self-administered questionnaires were sent to households using a modified Dillman [47] mailing protocol including a cover letter and questionnaire, a thank you/reminder postcard, and two waves of full follow-up questionnaires and one wave of a shortened questionnaire from October through December of 2010. The initial mailing also included a small incentive (recreation center pass) and all respondents were eligible to be entered into a drawing for one of ten $50 gift cards. Of the 3,906 questionnaires mailed out, 649 were returned by the postal service as undeliverable and 893 were returned completed. This resulted in a response rate of 27.4 % (893/(3,906–649)), which is comparable to similar studies using mail questionnaires about parks within the general population ranging from 21 to 34 % [15, 48]. A nonresponse bias check comparing first and final wave respondents [49] indicated no differences in reported perceived park quality and physical activity, yet some differences did emerge in demographics. Specifically, compared with the last wave, first-wave respondents were lower income, higher BMI, older, more female, but similar race/ethnicity. As such, interpretation of these results should consider this limitation. In addition, short retest questionnaires were sent to a sample (n=150) of initial respondents 2 weeks after the first mailing to assess the test–retest reliability of select questions, including the neighborhood park quality items detailed below. This retest questionnaire mailing yielded a response rate of 48.0 % (n=72/150).

Measures

The survey instrument included questions on perceived neighborhood park quality, physical activity, past park use, and demographics, among other variables. Perceptions of neighborhood park quality were measured on a 5-point scale (1=strongly disagree and 5=strongly agree) using seven items adapted from previous qualitative and quantitative research [7, 16, 32, 35, 50–52]. Respondents indicated their agreement with statements about "parks in their neighborhood" that related to cleanliness, availability of facilities of interest, how well used the parks are, attractiveness, safety, maintenance, and the extent to which parks are a benefit to the neighborhood (see Table 3 for full items). Definitions of both neighborhood and parks were provided for respondents. Specifically, neighborhood was defined as "the area within a 10- to 15-min walk from your home" [53, 54], and parks were identified as "a public park or outdoor recreation area in the community that is designed for active or passive use" [55]. This approach was chosen because respondents may not necessarily think of the park that we used to identify the census blocks for sampling as their neighborhood park, and it often was not their closest park. In addition, many respondents live near and use multiple neighborhood parks.

Questions about physical activity captured overall physical activity participation (moderate and vigorous physical activities) as well as park-based physical activity (park-based weekly physical activity and park-based physical activity during their last visit). Overall physical activity questions were modeled after the behavioral risk factor surveillance system questions measuring both moderate and vigorous intensity activities [56]. Specifically, respondents were provided with the definition of moderate physical activity (i.e., activities that cause small increases in breathing or heart rate such as brisk walking and gardening), and the definition of vigorous physical activity (i.e., activities that cause large increases in breathing or heart rate such as jogging and heavy lifting), and were then asked to indicate how many days per week and the total time per day they participated in physical activity at each intensity level for at least 10 min at a time. Minutes of moderate and vigorous physical activity were generated by multiplying the number of days by the number of minutes per day [57]. A combined overall moderate-to-vigorous physical activity variable was calculated by summing the minutes of moderate and vigorous physical activities, using listwise deletion if either was not answered. In addition to overall physical activity, participants were asked to indicate the time their physical activity occurs in a park or outdoor recreation area in a usual week (which may include multiple parks and visits) as well as time spent being physically active during their last visit to a park [55].

To determine past park use, respondents were asked if they had visited a park within the last month. If they responded yes, they were then asked to indicate how many days they had visited a park in the last month [55]. Finally, respondent demographic characteristics that

were collected included age, gender, race, ethnicity, annual household income, and self-reported height and weight used to calculate BMI.

Data Analysis

All analyses were conducted using SPSS 19.0. Descriptive analyses provided frequencies, means, and standard deviations for the study variables. One-way model intraclass correlations (ICCs) were calculated to gauge the test-retest reliability of the seven park quality items. ICC scores ranging from 0.40 to 0.60 indicate moderate agreement while scores ranging from 0.60 to 0.80 indicate substantial agreement and over 0.80 are considered almost perfect agreement [58]. Cronbach's alpha was used to examine the internal reliability of the seven park quality items, with a value larger than 0.70 typically recommended as acceptable [59].

Due to the potential clustering of respondents within census tracts, a variance components analysis was conducted to see if there is significant variation in the dependent variables associated with the random effects variable—census tracts [60]. Census tracts were used to assess potential clustering instead of census blocks given the large number of blocks and the majority with just one individual per block. The variance components analysis revealed that there was no significant variation in the four dependent variables (at significance level $p<0.05$), indicating that a multilevel model analysis is not necessary. Furthermore, sample size recommendations for multilevel modeling commonly call for at least 30 units at each level of analysis [61, 62], yet the majority of census tracts had fewer than ten individuals. Therefore, an ordinal logistic regression was used to examine the relationship of park quality with physical activity and BMI. This analysis was chosen given that the fairly large number of individuals reporting no physical activity of each type violated the normality assumption for general linear regression, yet it still retained some variability within the continuous physical activity data [63].

The physical activity variables were divided into five ordinal levels (no physical activity and quartile split on minutes of physical activity) and four categories of BMI were employed (underweight, normal weight, overweight, and obese). We used four ordinal logistic regression models to estimate associations (odds ratios (OR) and 95 % confidence intervals (95 % CI)) between park quality and levels of overall moderate-to-vigorous physical activity, park-based physical activity (i.e., park-based weekly physical activity, park-based physical activity during last visit), and BMI.

Given that demographics and past park use have been shown to influence perceptions of parks [33, 64, 65] as well as physical activity and health [29, 66–70], gender, age, income, race/ethnicity, and past park use were controlled for in the four models. To categorize past park use, respondents who indicated that they had not visited a park within the last month were treated as nonvisitors. Then, a median split was used to categorize those who had visited into occasional visitors (1–3.99 days) and frequent visitors (4 days or more), resulting in a categorical variable of non, occasional, and frequent park visitors.

Results

Respondent Characteristics

As shown in Table 1, a majority of the respondents were female (60.7 %) and ranged in age from 18 to 98, with a mean of 50.9 years (SD=16.5). Most were non-Hispanic White (67.0 %), followed by non-Hispanic Black (24.5 %) and Hispanic/Latino of any race (4.7 %). More than half of the respondents had an annual household income of less than $50,000 (55.6 %). Within the past month, 58.4 % had not visited a park, 19.9 % visited 3 days or less, and 21.7 % had visited 4 days or more.

Table 1 Respondent characteristics

	Number	Percent
Gender (n=893)		
Female	538	60.7
Male	348	39.3
Race/ethnicity (n=881)		
White (non-Hispanic)	590	67.0
Black (non-Hispanic)	216	24.5
Hispanic/Latino of any race	41	4.7
Other (non-Hispanic)	20	2.3
Asian (non-Hispanic)	14	1.6
Annual household income (n=812)		
Less than $25,000	201	24.8
$25,000–49,999	250	30.8
$50,000–74,999	154	19.0
$75,000–99,999	93	11.5
$100,000–149,999	78	9.6
$150,000 or more	36	4.4
Age (n=865; M=50.9; SD=16.5)		
18–38 years old	230	26.6
39–50 years old	210	24.3
51–63 years old	219	25.3
64 years old or older	206	23.8
Past park use (n=856; M=6.4; SD=6.8)[a]		
Nonvisitors (0 day)	500	58.4
Occasional visitors (1–3.99 days)	170	19.9
Frequent visitors (4 and over days)	186	21.7

[a] Mean days calculated excluding nonvisitors

Self-reported Physical Activity and Health

Regarding overall physical activity, 20.1 % of respondents had engaged in no overall moderate-to-vigorous physical activity. For those who had participated, their mean participation time was 477.9 min/week (Table 2). When asked about physical activity time spent in a park or outdoor recreation area in a normal week, 55.0 % reported no park-based physical activity in a usual week. For those who did participate in park-based physical activity, their average participation time was 166.5 min. For those who visited a park during the past month, 89.9 % participated in physical activity in the park and they spent a mean of 77.1 min being physically active during their last visit. Finally, the average BMI of respondents was 27.3, indicating overweight. Although more than one third (37.4 %) of the respondents were normal weight, 36.1 % were overweight and 25.1 % were obese.

Perceptions of Park Quality

As shown in Table 3, residents reported positive perceptions of their neighborhood parks (M=3.55). Respondents most strongly agreed that parks are a benefit to people living nearby (M=3.85), followed by parks are clean (M=3.70), well used (M=3.58), and well maintained (M=3.53). The availability of facilities of interest was rated the lowest (M=3.21). ICCs for the seven items ranged from 0.49 to 0.76 (Table 3), indicating moderate to substantial agreement [58]. The set of seven items displayed high internal reliability (α=0.91).

Relationships Between Perceived Park Quality and Physical Activity and Health

As shown in Table 4, ordinal regression revealed significant relationships between park quality scores and overall moderate-to-vigorous physical activity (pseudo-R^2=0.04; p<0.05), park-based weekly physical activity (pseudo-R^2=0.06; p<0.001) and BMI (pseudo-R^2=0.03; p<0.05). Specifically, greater perceptions of neighborhood parks as a benefit to people in the neighborhood was associated with higher levels of overall moderate-to-vigorous physical activity (OR=1.46, 95 % CI=1.12–1.90), higher levels of park-based weekly physical activity (OR=1.40, 95 % CI=1.05–1.88), and lower BMI (OR=0.69, 95 % CI=0.54–0.88). Greater agreement with neighborhood park cleanliness was associated with lower levels of park-based weekly physical activity (OR=0.69, 95 % CI=0.49, 0.98). Finally, higher perceptions that parks are used by many people were associated with higher BMI levels (OR=1.29, 95 % CI=1.05–1.59). No significant relationship was found between park quality and park-based physical activity during the last visit (pseudo-R^2=0.06; p=0.10).

Discussion

Although parks have been shown to be important environments for physical activity [7, 8, 71, 72], opportunities to improve physical activity in park settings exist [73, 74]. As more than 20 % of the respondents in this study engage in no physical activity and more than 60 % were either overweight or obese, there is a need to increase physical activity participation among residents which can subsequently improve health. Previous research indicates the importance of park characteristics in promoting physical activity [14, 25], but only limited studies have examined perceptions of park quality aspects among the general population [32, 36]. The present study presented a new park quality scale adapted from previous research with demonstrated test–retest and internal reliability. Although more research is recommended

Table 2 Self-reported physical activity and health measures

Physical activity (PA) and health variables[a]	Number	Percent	Mean (SD)	Median
Overall moderate-to-vigorous PA (n=707)				
No overall PA	142	20.1	–	–
Participate in overall PA	565	79.9	477.9 (788.0)	240.0
Park-based weekly PA (n=460)[b]				
No park-based PA	253	55.0	–	–
Participate in park-based PA	207	45.0	166.5 (298.5)	120.0
Park-based PA during last visit (n=287)[c]				
No park-based PA	29	10.1	–	–
Participate in park-based PA	258	89.9	77.1 (98.6)	60.0
Body mass index (BMI; n=834)				
Underweight (BMI<18.5)	12	1.4		
Normal weight (18.5<BMI<25)	312	37.4	27.3 (5.9)	26.4
Overweight (25<BMI<30)	301	36.1		
Obese (BMI>30)	209	25.1		

[a]PA in minutes

[b]Question not included on shortened final questionnaire wave resulting in a lower n for this variable

[c]Question only answered if visited a park in the last month

Table 3 Mean ratings and intraclass correlations (ICC) for perceptions of neighborhood park quality items

Park quality items	Number	Mean[a]	SD	ICC
Parks in my neighborhood are a benefit to the people who live here	662	3.85	0.99	0.61
Parks in my neighborhood are clean	662	3.70	0.92	0.49
Parks in my neighborhood are used by many people	659	3.58	1.05	0.66
Parks in my neighborhood are well-maintained	649	3.53	1.00	0.63
Parks in my neighborhood are attractive	656	3.50	1.01	0.76
Parks in my neighborhood are safe	658	3.45	1.04	0.69
Parks in my neighborhood have facilities that I am interested in	657	3.21	1.10	0.58
Overall (α=0.905)	664	3.55	0.81	0.74

[a] 1=strongly disagree and 5=strongly agree

to validate and further improve the scale, this may be an important tool for future studies examining the impact of perceived park quality on physical activity and health.

Relationships Between Perceived Park Quality and Physical Activity and Health

Our study findings revealed that residents' perceptions of their neighborhood park quality, specifically perceived benefits, cleanliness, and how well parks are used, were related to overall moderate-to-vigorous physical activity, park-based physical activity in a usual week, and BMI. The overall moderate-to-vigorous physical activity model was related with perceived benefits, while the park-based physical activity in a usual week was associated with both cleanliness and perceived benefits. Although slight, this additional gain in associations may be due to the context-specificity of the measures. As suggested by Giles-Corti et al. [54], when environmental measures more closely match with the setting in which the behavior takes place, the predictive capacity of the model improves. Interestingly, a relationship between perceived park quality and park-based physical activity during last visit did not emerge in this study. As such, perhaps one individual visit may not be the best representation of usual overall use patterns. In addition to relationships found between perceived park quality and physical activity measures, BMI was also associated with perceived benefit and how well parks are used, consistent with previous findings that BMI is related to certain park characteristics [75, 76].

Further examining these relationships by each of the park quality items reveals that residents' perceptions of seeing parks as a neighborhood benefit was rated highest among the seven quality items and had a strong association with greater participation in overall moderate-to-vigorous physical activity and park-based physical activity in a usual week, as well as lower BMI. This finding indicates that a positive and beneficial image of parks is recognized by local residents, and greater perceptions of these benefits are related with higher physical activity and health levels. These results are consistent with previous research suggesting beneficial

Table 4 Ordinal regression models of park quality items on physical activity (PA) and body mass index (BMI)

Dependent variable models[a]	Overall MVPA (n=435)	Park-based weekly PA (n=364)	Park-based PA during last visit (n=205)	BMI (n=529)
−2 Log Likelihood	*1,381.80**	*911.18****	607.92	*1,204.72**
Pseudo-R^2 (Nagelkerke)	0.04	0.09	0.06	0.03
Independent variables (OR (95 % CI))[b]				
A benefit to the neighborhood	*1.46*** (*1.12–1.90*)	*1.40** (*1.05–1.88*)	1.17 (0.79–1.73)	*0.69*** (*0.54–0.88*)
Clean	0.78 (0.58–1.06)	*0.69** (*0.49–0.98*)	0.71 (0.44–1.15)	1.22 (0.93–1.61)
Used by many people	1.17 (0.94–1.44)	1.19 (0.92–1.54)	0.59 (0.41–0.84)	*1.29** (*1.05–1.59*)
Well maintained	0.84 (0.62–1.13)	0.97 (0.69–1.38)	1.04 (0.67–1.62)	0.90 (0.68–1.20)
Attractive	0.92 (0.70–1.22)	1.07 (0.76–1.51)	1.34 (0.79–2.29)	0.90 (0.69–1.18)
Safety	1.17 (0.92–1.47)	1.19 (0.90–1.58)	1.00 (0.70–1.43)	1.03 (0.83–1.29)
Facilities that I am interested in	1.01 (0.81–1.24)	1.16 (0.89–1.51)	1.28 (0.92–1.79)	1.00 (0.83–1.22)

MVPA moderate-to-vigorous physical activity, *OR* odds ratios

*p<0.05; **p<0.01; ***p<0.001

[a] Each model controls for age, gender, race/ethnicity, and past park use

[b] Reference groups are the lowest PA and BMI categories; all OR are interpreted as the cumulative odds of being in an equal or higher PA or BMI category

experiences, especially enjoying nature, mental health, and physical health, are important to visitors of recreation sites [77]. Anderson et al. [77] found that proximate residents rated beneficial experiences higher than distant visitors, indicating that promoting positive attitudes of local residents may be particularly helpful in encouraging physical activity and well-being. In addition, given that perceiving parks as a neighborhood benefit was positively related with both park-based physical activity and overall physical activity, this finding may indicate evidence against the compensation hypothesis which proposes that more physical activity in one setting could reduce physical activity in others [40, 41].

In contrast to benefits, cleanliness was negatively related to park-based physical activity. This finding is contrary to expectations given that previous research indicates cleaner parks and facilities encourage park use [35]. However, a similar negative relationship emerged in another study which found people who did not agree that the neighborhood was clean were more likely to attain sufficient physical activity [78]. Another observational study also found cleanliness is negatively related to park use, and suggests that higher use levels in parks may be the reason for less clean environments [20]. These findings may also suggest that more frequent active users of parks may be more cognizant of park issues, similar to a previous study that found park incivilities such as vandalism were perceived at a higher level by people who visited urban parks more often [65]. In general, few studies have examined perceptions of park cleanliness in conjunction with physical activity participation and health, and this should be a continued focus of study.

Although some studies found that surroundings with many other people exercising encourage physical activity participation [79], the present study did not find evidence of an association between agreeing that "parks in my neighborhood are used by many people" and park-based physical activity. However, interestingly, greater perceived park use levels were found to be associated with higher BMI. This finding possibly indicates that popular parks may be viewed as places for more sedentary social gatherings such as picnics. For example, in an observational study, Giles-Corti et al. [16] found that 18.4 % of the users engaged in passive activities such as picnicking, barbeques, and family use; furthermore, 82.3 % of these passive users were visiting open spaces with higher observed quality levels. Another possibility is that perceptions of crowded parks may encourage physical activity participation for some users while discouraging use for physical activity for other users. Residents living near large open spaces or attractions are more likely to perceive crowding [80, 81]. For example, a study in Central Europe found that more than 50 % of the local residents reported the park as crowded, while only 27 % of the regional visitors and 19 % of the tourists viewed it as crowded [80]. Some studies indicated that use of parks by friends and family, perceiving neighbors as being active, and having a friend to exercise with were related to more physical activity [32, 38, 79]. However, the differences in the present study's findings from previous results may relate to the measures used. Specifically, the present study assessed residents' perceptions of overall park use rather than examining use by people whose relationship was close to the respondents. As such, greater park use by acquainted people may contribute to increased physical activity participation, while greater use in general may decrease physical activity participation. Overall, further exploration of parks as social environments with opportunities for building social capital to influence physical activity and health promotion is encouraged [82].

Although previous studies found that physical activity and health were related to maintenance [23, 36, 50], attractiveness [16, 37, 72, 83], safety [20, 33, 36], and availability of facilities [17, 50], no significant relationships were found for these aspects of park quality in the present study. For example, the condition of parks and facilities was important for encouraging facility use, and quality of facilities has been associated with more physical activity [36, 50]. Furthermore, enjoyable scenery, site beauty, and attractiveness of parks were related to greater engagement in park-based physical activity [16, 37, 72, 83]. However, the insignificant relationships of some of the quality items with physical activity are similar to the results of one previous study [32] in which perceptions of overall park quality were related to park use but not to physical activity. Likewise, Cohen et al. [14] found that perceived safety did not facilitate active park use. Therefore, future research should continue to investigate these park characteristics to better understand the nuances of their relationship with physical activity. Previous research indicates that perceptions and objective measures may differ [27, 30]. As such, some variations in study findings may be due to differences in measures or respondents' levels of awareness of park opportunities or issues. For example, perceptions of characteristics such as safety may also differ based on the measures used. Some studies adopted measures of safety through crime rate, traffic accident rate, appearance of an emergency telephone, or lighting [28, 50]. Future research could use such objective measures or other park audit instruments that capture park quality [19, 46] in addition to self-reported perceptions to better understand relationships with physical activity and health, as well as the congruence between the various measurement approaches.

Limitations and Future Research

This study had several limitations which provide direction for future research. First, in the conceptual model proposed by

Bedimo-Rung et al. [7], park-based physical activity can be influenced by six factors (features, condition, aesthetics, safety, access, and policies). However, the present study focused on just the in-park characteristics related to neighborhood park quality and did not include measures of access or policies. Therefore, although the focus of the study and new scale pertains to just the in-park quality characteristics, future research should explore issues related to access and polices in conjunction with park quality. Second, self-reported measures of physical activity are widely used given the advantages of low cost, minimal influence on participants' behavior, feasibility to collect data from a large number of people, and demonstrated reliability and validity [84, 85]. However, self-reported physical activity data have limitations such as recall accuracy, over-estimation, and social desirability bias [86, 87]. As such, additional research is recommended to include objective measures of physical activity (e.g., heart rate monitoring, accelerometers, systematic observations, such as SOPLAY/SOPARC [66, 88]) which can provide more precise estimates of energy expenditure. In addition, as numerous factors contribute to BMI and health outcomes, future research should also take into account variables such as length of residence in the neighborhood. Third, similar to other scales examining neighborhood environments (e.g., streets in my neighborhood [89]), perceived park quality questions could include multiple parks in the respondents' neighborhood, rather than one specific park. However, asking respondents about one particular park may provide stronger associations with that park-specific physical activity, and would also allow for direct comparisons of perceptions and objective measures. As such, future research should also consider park specific analyses. Finally, like other cross-sectional studies, this study lacks a causal explanation for the relationships that were found. Given this, it has been called into question whether physical activity differences are a result of neighborhood design, or if individuals already wishing to engage in physical activity self-select into neighborhoods according to physical activity opportunities [89]. However, a recent study found that even those who did not place a high importance on living near parks are more likely to engage in park-based physical activity when they have greater amount of proximal parkland, indicating that self-selection is not solely the cause of the park-physical activity relationship [90]. Therefore, future research is recommended to use longitudinal designs to more definitively understand such relationships, as well as qualitative methods to provide more meaning and explanations about findings and perceptions of neighborhood and park quality.

Conclusions

Perceptions of park quality were related to more physical activity and lower BMI, suggesting park quality improvements could be an effective health promotion strategy. Given the demonstrated reliability and utility of the neighborhood park quality scale, future research and practice about parks and health behaviors and outcomes should consider residents' perceptions in addition to GIS and audit data about parks. For example, increasing efforts to demonstrate the benefits of parks and enhancing residents' awareness of those benefits could potentially help to facilitate physical activity and community health, while understanding disparities in perceptions of neighborhood park quality may be important to promote physical activity among diverse groups. In general, using better measures to understand how perceptions of local parks are associated with physical activity and health can add a valuable dimension to our appreciation of the role of parks in facilitating active living.

Conflict of Interest Statement The authors have no conflict of interest to disclose.

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