

Article

# Association Between Park Characteristics and Park-Based Physical Activity Using Systematic Observation: Insights from Bangkok, Thailand

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**Abstract:** Parks hold an essential role in promoting physical activity in urban areas. Studies have found that park characteristics such as park size, facilities, accessibility, and aesthetics are reported to have a positive association with increasing physical activity of the urban populations. However, the evidence in the context of Southeast Asian cities is still lacking, as most studies are from North America and Europe. The study explores the associations between park characteristics and park-based physical activity in Bangkok, Thailand. Ten major public parks were examined using the System for Observing Play and Recreation in Communities (SOPARC). Descriptive analysis was used to understand the characteristics of park users and park-based physical activity. A bivariate logistic regression model was employed to determine the variables of park characteristics and of having moderate to vigorous physical activity (MVPA). We found that parks with bigger sizes and better access to public transport were associated with a higher likelihood of users having MVPA in the park. We also found that adding more facilities in the park, even if they are specifically aimed for physical activity, would not increase the likelihood of having MVPA. The findings from the study suggested that investing in better accessibility and physical quality of existing parks as well as improving equal opportunities for park use will be a more sensible option for promoting park-based physical activity in Bangkok, Thailand.

**Keywords:** public park; physical activity; leisure physical activity levels; urban landscape; public health

## 1. Introduction

Persistent trends in non-communicable diseases (NCDs), overweightness, and obesity have resulted in a rapid research effort focused on exploring the relationship between the built environment and physical activity [1,2]. Evidence regarding the influence of the built environment on physical activity behavior suggests that it can both enable and limit physical activity participation [3]. Built environment features such as the quality of sidewalks and active transportation options are linked with the physical activity in many countries [4]. At the neighborhood scale, the proximity of public parks has been found to encourage physical activity among different age, ethnocultural, and socioeconomic groups [5].

Parks hold a vital role in promoting physical activity, especially in the urban area [6]. In the United States, physicians are being encouraged to routinely counsel patients about physical activity and to recommend regular visits to nearby parks [7]. Researchers have found that public parks offer a unique setting, providing more opportunities for being active, enjoying nature, and engaging in

social interactions compared to any other public infrastructure [8,9]. Investing in parks is considered as an effective strategy to promote physical activity by local governments [5]. Studies have also been found to suggest that barriers to park use, such as lack of access, safety concerns, and poor maintenance of facilities, were associated with increased insufficient physical activity [7,8]. On the other hand, the size of the park, availability of park facilities and amenities, organized activities, accessibility, and aesthetics are considered important factors in improving physical activity [10]. Parks have various facilities and features that can encourage people to engage in physical activity. For example, sports fields and courts, exercise stations, and jogging and cycling tracks are usually designed for physical activity. It was also suggested that the availability of these facilities is a strong predictor of increasing physical activity levels in the park [9,10].

Research on active living and recreational physical activity in East Asia was mostly found in China, while very few studies were available in the context of parks in Southeast Asian cities [11]. Different climate and seasonality may reveal different patterns and characteristics of park use [12]. Not only can weather conditions affect how a park is used daily, but some activities happen only in particular seasons. For example, studies in the United States have found that the number of daily park users was similar during the morning, afternoon, and evening observation periods [13]. Studies in Thailand and Singapore have found that due to the hot weather in the afternoon, parks are mostly used in the morning and evening [14,15]. The degrees to which parks are used by different age groups and genders are also different. While most studies on the topic in the Western context found that children and teens were dominant groups, most park users in Southeast Asian cities were adults and seniors [14]. The present study is designed to establish the association of park characteristics and park-based physical activity in Bangkok, Thailand. The country has been acknowledged as one of the leaders in global physical activity promotion [16]. However, the physical activity situation in Thailand does not reflect the country's leadership. In 2015, the prevalence of insufficient physical activity among adults was 19% [17]. One of the policy recommendations for Thailand to combat this issue is to navigate the physical activity promotion through the provision and quality improvement of crucial public infrastructures, such as parks and other recreation areas [18]. If public health and planning sectors in Thailand are expected to adequately invest in promoting physical activity, an understanding of who uses parks and the characteristics of parks that encourage physical activity is essential. With rapid urbanization and urban development in Thailand, there is a need for cities to understand that parks are also beneficial not only to reduce air pollution and greenhouse gases, but also to improve public health and the well-being of urban residents.

## 2. Materials and Methods

### 2.1. Park Selection

The Bangkok Metropolitan Administration's (BMA) definition of public parks includes river embankments, spaces under the highway, vertical green walls, paddy fields, indoor spaces, botanical gardens, and other green spaces under their jurisdiction. Hence, it is difficult to obtain the actual number of parks that can be used for physical activity. Under this definition, there were more than 500 public parks in Bangkok, which could be classified into three groups: Village parks, community parks, and district parks. We obtained the list of parks from the BMA. We then conducted a pre-survey and a series of interviews with BMA officials to understand which parks were suitable to support physical activity promotion. We identified a total of ten parks based on the results of pre-surveys and interviews.

The parks selected represented different characteristics of parks and users in order to capture the parks that served the largest population in the city. Since we purposefully selected parks with facilities that can promote physical activity, botanical gardens and indoor green spaces were excluded. If two parks were in close proximity, we chose the park with the bigger size or with the better

facilities. Previous studies have used a similar approach in conducting purposive sampling for park selection [12,19–21].

## 2.2. Study Design

The standard method in assessing the characteristics of park users and park-based physical activity is by using a systematic observation called the System for Observing Play and Recreation in Communities (SOPARC). It is a widely used instrument designed specifically to measure park use and physical activity [22,23]. SOPARC excels in being able to collect contextually rich information on park accessibility and usability [24]. The use of SOPARC has been a very prominent method in understanding the characteristics of parks, park users, and park-based physical activity levels [25]. In this present study, we made minor adaptation to the physical activity coding. We added activities that reflect Thai culture, such as tai chi, traditional dance, and aerobics. Since most of the park users in Bangkok were Thais, racial/ethnic background was not recorded.

In this study, park characteristics were defined as the physical environment where the park was located, following the definition employed in the previous studies [26,27]. We selected some proxy variables that have been found significantly associated with park-based physical activity in previous research: Park facilities [28], proximity to public transportation [29], population density [30], and park size [31]. These proxy variables were then used to assess the association between park characteristics and park-based physical activity.

## 2.3. Data Collection

A total of ten research assistants were recruited as assessors for data collection. Before data collection, the surveyors received training on how to conduct the SOPARC procedure. We conducted classroom and practice observation sessions during the training to understand the operational definitions, instrument notations, and coding conventions and to differentiate various physical activities and contextual characteristics. The SOPARC form was translated into the Thai language.

Before the data collection, the selected parks in the study were mapped and measured. The parks were then divided into zones or target areas, and trained assessors scanned and coded the physical activity levels in each target area. The observations were conducted from April to July 2018. Each park was observed for two days, representing weekday and weekend. Each period of observation was divided into four rounds in the morning (06:00, 07:00, 08:00, and 09:00) and the evening (16:00, 17:00, 18:00, and 19:00). During the observation, physical activity levels were recorded as sedentary, light, and moderate to vigorous physical activity. If park users were sitting, reading, eating at a picnic, or standing, we recorded the activity as sedentary. Walking was recorded as light physical activity (LPA), while more intense activities were recorded as moderate to vigorous physical activity (MVPA). These categorizations for physical activity levels were a part of the standard procedure in conducting SOPARC observation [32,33].

The assessors also obtained information related to the physical environment of the park, such as park facilities, availability of public transportation, population density that the park should accommodate, and park size. In the literature, park facilities were considered as one of the critical features for physical activity [34]. We defined park facilities as the number of facilities available in the park for physical activity. For analysis purposes, we grouped the variables into low, medium, and high. The availability of public transportation was an essential feature in determining the number of park visitors [35]. In this study, public transportation was defined as whether the park had a public bus stop or mass rapid train station less than 100 m from the park entrance. In the analysis, we exclude the public bus stop because all parks had this facility, and created a dichotomous variable called “availability of mass rapid transit” with the possible responses of yes or no. The population density was found to be associated with a higher amount of park-based physical activity in the park in previous studies [25,31,36]. We collected the district population density and park size from the BMA district office and incorporated it into the SOPARC responses for each park.

## 2.4. Data Analysis

For the analysis, the study employed the binomial logistic regression model (odds ratio = ORs, 95% confidence interval = CI), which explored the park characteristics and physical activity. The dependent variable for this model was the level of physical activity in the parks, which we dichotomized into “having a moderate to vigorous physical activity (MVPA)” and “not having MVPA” for analysis. We accounted for sample clustering in the park selection by calculating the robust standard of error for the model in the study.

## 3. Results

Table 1 summarizes the characteristics of the parks selected for the study. Park 1, a village park near the city center, had the smallest area, fewest facilities, and had to serve a greater population, since there was a smaller number of parks in the district. On the contrary, Park 8 had the largest area and was located in a suburb of Bangkok. In general, all selected parks had similar facilities, such as a jogging track, fitness stations, children playgrounds, and multipurpose spaces for other activities. All parks in the study had public transportation access within 100 m from one of the park entrances. Parks 1, 4, 7, 8, and 10 also had access to mass rapid train stations because they were located in the city center.

**Table 1.** Characteristics of parks selected in the study.

Park	Type of Park	Park Size (m <sup>2</sup> )	Public Transportation	District Population Density (person/km <sup>2</sup> )	Facilities Available in the Park
1	Village park	32,000	train, public bus	10,328	1, 3, 4, 7
2	Village park	36,800	public bus	9736	1, 3, 4, 7, 9
3	Village park	38,400	public bus	8520	1, 3, 4, 6, 7, 9
4	Community park	46,400	train, public bus	8176	1, 3, 4, 7, 9
5	Community park	101,300	public bus	3924	1, 3, 4, 7, 9
6	Community park	123,200	public bus	5950	1, 3, 4, 7, 9
7	District park	576,000	train, public bus	6055	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
8	District park	800,000	train, public bus	3224	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
9	District park	248,200	public bus	4847	1, 3, 4, 7, 9, 12
10	District park	208,000	train, public bus	8176	1, 2, 3, 4, 7, 8, 9, 12
		Mean: 221,030	Mode: public bus	Mean: 6894	Mode: 1, 2, 3, 4, 7

Note: MRT = underground train, BTS = sky train, 1 = jogging track, 2 = bike track, 3 = fitness station, 4 = children’s playground, 5 = basketball court, 6 = futsal court, 7 = multipurpose open space, 8 = roller skating rink, 9 = multipurpose sheltered space, 10 = swimming pool, 11 = tennis court, 12 = indoor gym.

Table 2 summarizes the observed park users stratified by age, gender, and physical activity levels obtained from SOPARC observation. A total of 62,031 users were recorded during the observation period. Parks in Bangkok had a mean of 1550 users per day. More than 67% of the observed users were adults, while only 4.4% were children in all ten parks. In terms of physical activity level, 75.3% of users were already engaged in physical activity; light physical activity (LPA) had the highest percentage of 45.8%. In terms of gender, we found that 54.7% of park users were male. The most significant number of visitors was found in Park 7, probably because it was the oldest public park in Bangkok, located in the city center, with excellent accessibility and various facilities. We also found that Parks 1, 2, and 3 had a large total number of visitors even though they had smaller areas and fewer facilities compared to other parks. Park 10 had the highest percentage of users with MVPA (47.60%), while Park 5 had

the highest percentage of LPA (53.55%), and Park 4 had the highest percentage of sedentary activity (36.79%).

**Table 2.** Number of observed park users by gender, age group, and physical activity level.

Park	Age Group (%)				Gender (%)		P.A. Level (%)			Total (n)
	Children	Teenager	Adult	Elderly	Male	Female	Sedentary	LPA	MVPA	
1	4.69	6.84	72.17	16.30	46.19	53.81	25.90	38.82	35.28	3583
2	2.28	1.95	50.83	44.93	60.71	39.29	21.35	52.57	26.08	2408
3	6.34	10.63	51.74	31.29	55.91	44.09	30.21	45.61	24.19	3688
4	8.02	5.76	67.99	18.24	51.28	48.72	36.79	45.37	17.84	5610
5	4.83	4.96	62.27	27.94	55.48	44.52	22.71	53.55	23.74	3003
6	5.57	3.89	65.85	24.69	57.32	42.68	20.64	51.26	28.09	3086
7	3.02	3.36	66.41	27.21	56.59	43.41	25.45	43.01	31.53	16,474
8	1.64	5.82	76.98	15.56	53.55	46.45	34.35	42.74	22.91	7063
9	6.06	6.14	67.15	20.65	52.75	47.25	18.96	52.14	28.90	10,906
10	3.37	10.40	72.77	13.46	57.67	42.33	10.85	41.55	47.60	6210
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	62,031
Mean (SD)	4.582 (2.001)	5.975 (2.799)	65.416 (8.524)	24.027 (9.449)	54.745 (4.037)	45.255 (4.037)	24.721 (7.660)	46.662 (5.298)	28.616 (8,247)	6203.1 (4425.3)

Table 3 summarizes the association between park characteristics and park-based physical activity. The overall model was significant and correctly classified 71.6% of cases. Gender was significantly associated with MVPA, with male respondents being more likely to be engaged in MVPA than female respondents. Adults were twice as likely to be found in the parks conducting MVPA compared to children. There was no significant difference in MVPA between weekdays and weekends. The district population density was found to be insignificant. Parks with access to mass rapid transportation were found to be more likely to be associated with users having MVPA. Parks with medium and high numbers of facilities were significantly associated with MVPA in the park (OR = 1.115 and 0.692, respectively). Similarly to park facilities, medium and large parks were found to be associated with MVPA (OR = 1.867 and 1.579).

**Table 3.** Association between park facilities and moderate to vigorous physical activity (MVPA) based on System for Observing Play and Recreation in Communities (SOPARC) data.

Variable	OR	95% CI
Sex		
Female	ref	
Male	1.526 **	(1.474, 1.581)
Age Group		
Child	ref	
Teen	2.532 **	(2.310, 2.776)
Adult	2.137 **	(1.963, 2.327)
Elderly	2.656 **	(2.528, 2.790)
Period of Observation		
Weekday	ref	
Weekend	0.992	(0.958, 1.0026)
District Population Density	0.781	(0.743, 1.014)
Mass rapid transport		
No	ref	
Yes	1.075 **	(1.037, 1.114)

Table 3. Cont.

Variable	OR	95% CI
Park facilities		
Low	ref	
Medium	1.115 *	(1.037, 1.199)
High	0.692 **	(0.667, 0.717)
Park size		
Small	ref	
Medium	1.467 **	(1.425, 1.510)
Large	1.579 **	(1.579, 1.638)

Note: \*  $p < 0.05$ , \*\*  $p < 0.001$ ,  $n = 62,031$ .

#### 4. Discussion

This study examined the relative importance of park characteristics in predicting park-based physical activity in Bangkok using systematic observation. With regard to park users, the results showed that there were dissimilarities with previous studies conducted in other countries. Most of the park users were adults (65.4%), while very few children, teens, and elderly were found during the observation period. This finding is dissimilar to previous studies in other Asian cities, where most users were older adults [23]. This is probably due to the demographics of Bangkok, where 64.40% of the Bangkok population is of the working age of 15–59 years [24]. Children were found to be less active than adults, although park facilities and amenities were available for this group of users. This may be due to safety reasons. A study conducted in a park in Bangkok revealed that families with children visited the park less because of safety and security reasons [14]. Consistently with past research, more males were observed conducting MVPA in the parks, which shared similarities with previous studies in the United States and Europe [27,28,37].

The variables of park characteristics were generally found to be significantly associated with MVPA. The district population density was not found to be significant. A study in the United States found that population density was associated with limited opportunities to be physically active in the park [38]. Another study in Belgium and the United States found that parks are more prevalent, of higher quality, and more easily accessible in highly walkable neighborhoods [27]. The dissimilarity in the results was probably because Bangkok already had a low number of green space areas per person due to the high population density in each district [14]. Another possible explanation was that the park we selected served not only the population in the district but also the whole city. Further investigations are needed to be able to establish a clearer picture of the relationship between population density in Bangkok and MVPA.

The availability of a mass rapid transit station was more likely associated with users having MVPA in the park. Having better access to the park has been acknowledged in the literature to increase the opportunity to be physically active [39]. Proximity to parks had a significant positive association with park-based physical activity [40]. However, other studies found that having more access is not necessarily equal to proximity. Perceived accessibility, or the ease with which one can reach the park, is considered more important in predicting park use than having proximity to the park [41]. It implies that although the provision of new parks near homes is important, creating better access to existing parks would provide multiple benefits, especially in cities like Bangkok, where increased land value and a loss of public open spaces is one of the externalities of its planning policies.

Previous studies have established that providing facilities will improve the opportunities for users to be more active in the park. However, we found that parks with higher scores for facilities were associated with decreased odds of MVPA. The dissimilarity of our findings with previous studies is probably related to the way we assess the variable. Our study only measured the total number of facilities related to physical activity without considering how they were used. For example, during observation, we found more people on the jogging tracks than in the tennis courts, and yet we assigned

the same score for both facilities. Hence, the facilities measured in the study may not necessarily match in their use for physical activity. A study conducted in Canada found that particular park features were related more strongly to park-based physical activity than were others [40]. For example, jogging tracks and paved trails were more useful to accommodate physical activity than open spaces or pools [27,39,40]. Other studies also found that the placement of facilities, as well as the design and quality of facilities, will have an impact on the use of facilities for physical activity [28,42]. We interpret this result as an indication that providing facilities is not the only factor that can affect park use for physical activity in Bangkok. Further investigations are required to determine the types of facilities that can improve park-based physical activity.

Park size was found to be associated with MVPA. Giles-Corti et al. [43] found park size to be somewhat more important than park attractiveness in explaining park-based physical activity. The same study also found that, controlling for park size, parks with more facilities attracted more users. This was because the bigger the area, the more facilities to support physical activity, such as running tracks, bicycle lanes, and walking trails, could be provided, and the more people could be accommodated.

As Bangkok becomes more urbanized and has a higher dependency on motorized transportation and sedentary jobs, parks provide safe, cheap, and convenient places to engage in physical activity. On the other hand, due to the lack of sufficient supply of parks in the city, many village parks have to serve more population, and they cannot accommodate such a high volume of users. Although the standard solution is to increase the number of public parks in Bangkok, it is currently difficult for the local government to build new parks due to the urban densification in the city [44]. Investing in better accessibility and physical quality of existing parks as well as improving the equal opportunities for park use would be a more sensible option. Addressing physical and practical constraints for particular groups may help to promote park use. For example, parks should have equipment designed for seniors and those who have physical impairments. Providing organized activities designed specifically for females, such as aerobic dance and yoga, may also improve park visitation for women. In this study, parks may have been a less attractive venue for children, which resulted in a low number of users in Bangkok. Incorporating school-organized sports programs as well as improvements in physical quality and safety of the play areas may increase the participation of children in physical activity in the park.

This study has limitations. First, this is a cross-sectional study with purposive sampling. We only selected parks that served the largest populations in the city and can accommodate their physical activity. We also excluded other recreation venues that could offer similar opportunities for physical activity. Covering more parks as well as other recreation venues, such as fitness centers, gymnasiums, and sports complexes, will reveal a clearer picture of the influence of urban environment on physical activity in Bangkok. Second, SOPARC uses momentary scans, which can miss variations over time. Due to the limitations of this method, we could not account for some other confounding factors of park-based physical activity. For example, we could not specify the effects of different types of facilities found in the park. It is also impossible to capture the socioeconomic backgrounds of the park users and preferences of urban populations for park visits.

## 5. Conclusions

This study examines the association of park characteristics with park-based physical activity in Bangkok, Thailand. In general, the findings in this study were consistent with what had been established in the literature. We found that parks with bigger sizes and better access to public transport were associated with a higher likelihood of users having MVPA in the park. We also found that park facilities were not the strongest predictors in determining park-based physical activity. This means that adding more facilities, even if they are specifically aimed for physical activity, will not increase the likelihood of having MVPA. However, due to limitations of the method used in the study, before any firm conclusion can be made, further studies are needed. Future research should be directed to combine the SOPARC method with a survey questionnaire to obtain better insights on how parks

can contribute to physical activity. Despite the limitations, the study adds to the limited literature on public parks and physical activity in Southeast Asian cities. The results from the study can provide policymakers and others that are related a better understanding of how to promote physical activity and health, using parks as an essential aspect in drafting policy actions to reduce obesity and NCDs.

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