Short communication

Physical activity and park use of youth in Nanchang, China

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ABSTRACT

Physical inactivity is a growing issue in Chinese youth, but parks can facilitate traditional and non-traditional forms of physical activity for little to no cost. Despite this opportunity, very little is known regarding park use among Chinese youth. The purpose of this study was to conduct a cross-sectional observational study of park usage and physical activity of youth in municipal parks in Nanchang, China. Data were collected in June of 2014 in eight parks across Nanchang, Jiangxi a large city in southeast China. Physical activity was measured by a modified version of System for Observing Play and Recreation in Communities. Ordered hierarchic generalized linear models were estimated using a logit link function. The influence of the park was estimated using random effects, with fixed effects and park, environmental, and park user characteristics. Youth were most often seen active in the afternoon, on weekends, and during cooler times ($\leq 29\,°C$). Paradoxically, more children were active when air quality was poorer. Older boys were more active than younger boys, but no differences were observed in girls. More children were seen active in unstructured play compared to structured activities. The results suggest parks are an important setting for physical activity among Chinese youth, and that unstructured activities can play an important role in promoting greater youth physical activity.

1. Introduction

Regular physical activity protects against chronic diseases such as heart disease, hypertension, obesity, diabetes, depression, and other conditions (Janssen and Leblanc, 2010). It is recommended that children engage in 60 min of physical activity every day (US Department of Health and Human Services, 2008), but data from international studies suggest that children in most developed or developing nations are falling short of this goal, especially girls (Katzmarzyk et al., 2015). This is true for Chinese youth, who often engage in insufficient physical activity, with very little occurring outside of schools (Tudor-Locke et al., 2003). These low levels of physical activity may contribute to the development of obesity (Gralla et al., 2016). In fact, the increasing prevalence of childhood obesity is a worldwide epidemic, and China has seen recent, dramatic increases in obesity (Jiang et al., 2006). A study with the largest representative sample of school-aged children and adolescents in China found that the prevalence of obesity increased from 0.2% to 8.1% between 1985 and 2010 (Song et al., 2013). Many factors are associated with physical activity in Chinese youth, including

psychological, social, environmental, and systemic (Tudor-Locke et al., 2003; Abdullah et al., 2005; Yan et al., 2017; Zhang et al., 2016). For example, Shi and colleagues (Shi et al., 2006) reported that Chinese girls with low socioeconomic status (SES) had the highest levels of physical activity, while boys with high SES reported the lowest rates of walking to school. Unfortunately, little research is available examining the relationships between features of the environment such as parks and physical activity in Chinese adults (Tu et al., 2015; Chow et al., 2016; Sallis et al., 2016) or youth (Chow et al., 2016).

The presence of parks is associated with physical activity and obesity in Western youth (Cohen et al., 2006), but little is known about their association with physical activity and/or obesity in Chinese youth. Cultural preferences might affect park utilization, which has been reported in the limited existing literature (Tu et al., 2015; Chow et al., 2016). Public parks and recreation facilities provide diverse recreation activities for children, adults, and families, but physical activity within parks depends on characteristics such as users' activity preferences, age, and gender (Cohen et al., 2007; Kaczynski et al., 2011). Therefore, the purpose of this study is to describe usage of the public parks by youth in

Nanchang, China and to identify characteristics of parks and their users associated with categories of physical activity in Chinese youth.

2. Methods

2.1. Setting and design

This study employed a cross-sectional design to describe park usage in Nanchang, China using systematic observation protocols. Parks were selected to capture those that served the largest portion of the population. A total of 15 parks were identified in Nanchang through a search of municipal websites, city maps, and local public health officials. Of these 15 parks, the following criteria were used to select parks: 1) publicly accessible without entry fees, 2) located within the city limits, and 3) intact (i.e. if construction exists, it cannot take > 50% of the target areas). Based upon these criteria, eight parks were chosen for observations.

2.2. Measures

The System for Observing Play and Recreation in Communities (SOPARC) was used to record the number of participants, modes of physical activity, intensity of physical activity, and opportunities in the parks for physical activity or leisure (McKenzie et al., 2006). Previous studies have reported evidence for the reliability of SOPARC in studies of youth (McKenzie et al., 2006; Cohen et al., 2011). SOPARC has recently been utilized in parks in China (Tu et al., 2015; Chow et al., 2016). The coding form was adapted to ensure cultural relevance with adaptations including the following: 1) adding and subtracting activity codes to better reflect activities in Chinese parks (e.g., tai chi, dance, and mahjong), and 2) including the daily average Air Quality Index (AQI) scores to examine the relationship between physical activity and air pollution (Tudor-Locke et al., 2003). Ethnic background of park users was not recorded due to the lack of readily discernable ethnic varieties in the community.

2.3. Procedure

Twelve research assistants from Nanchang University collected the data. Prior to data collection, the research assistants underwent comprehensive SOPARC training from investigators with extensive experience with systematic observation tools. The workshop introduced trainees to SOPARC definitions and notations, coding conventions, and the ability to discriminate between age groupings and types of physical activities onsite (McKenzie et al., 2006). Trainees practiced two-hour live park observations of target areas, followed with assessment of interrater reliability. All eight parks were visited before beginning the study, to observe areas and identify potential target areas consistent with the recommendations of McKenzie and colleagues (McKenzie et al., 2006). Large areas and those that accommodate a large number of people or activities were further divided into sub-target areas to facilitate more accurate recording. Once target areas were chosen, detailed maps were made depicting their locations within each park. Target areas included open spaces, grassy fields, areas of exercise equipment, running tracks, covered areas (e.g., pavilions and covered walkways), and playgrounds.

Data collection took place on four non-consecutive days over a 3-week period in June 2014. Parks were observed four days per week (two weekdays and two weekends), four times per observation day (12 days and 48 total observations per park). A total of 16 three-hour observations were recorded for each target area in each park. Previous studies have recommended this level of observation to obtain a robust estimate of park users and physical activity (Cohen et al., 2011). Observations took place over 4 time blocks: 0600–0900, 1000–1300,

1400–1700, and 1800–2100, as some parks were still utilized after dark. A one-hour break was allowed between blocks to allow for notetaking and eating. Observation days that were missed due to inclement weather or holidays were rescheduled for the same day the following week. During each observation period, one or more observers went to designated target areas and completed the coding form. Recordings began with date, time, and temperature, followed by the setting (e.g. if the area is accessible, usable, supervised, equipped, and provided with an organized activity). Organized activities were those led by an individual in a group setting. AQI was reported daily and added to each observation record later. Observers then scanned the area from left to right while tallying counts on the coding form.

Park users were categorized by age as children $(0-12)$, teens (13–20), adults (21–59) and older adults (60 +). Once primary physical activity data were recorded, observers then repeated the sequence for secondary activity (if any) and spectators in the area (if any). After completing the observation, recorders identified the most common physical activity taking place in the target area. Activity intensity was recorded as sedentary, walking, or vigorous. Sedentary activities included lying down, sitting, or standing still (US Environmental Protection Agency, 2014). Walking was recorded for park users who were ambulating at a light to moderate pace. Tai chi and similar exercises were also coded as walking. Moderate-to-vigorous physical activities (e.g. badminton, dance, use of exercise equipment, jogging, etc.) were recorded as vigorous.

2.4. Analyses

Only data from those coded as children and teens were used for the present analyses. The proportion of individuals who were engaged in sedentary, walking, and vigorous activities were compared across categories of environmental (e.g. air quality) or characteristic of observed park users (e.g. gender). Due to the hierarchical nature of the data (i.e., observations nested within parks) and the nature of the dependent variable (i.e. ordinal variable with three levels) activity intensity, ordered hierarchic generalized linear models were estimated with meglm using a logit link function, consistent with best practices in the field (Weaver et al., 2016; Beets et al., 2015). Park was estimated using random effects, with fixed effects and odds ratios calculated for park, environmental, and park user characteristics. The unit of data analyses was the park level. All analyses were conducted in Stata 14.1 (StataCorp LP, College Station, TX).

3. Results

3.1. Park features

The observed parks ranged in size from 35,000 m^2 to 326,000 m^2. Supplemental Table 1 list the features present in the parks. Basketball courts and baseball fields were not found in any of the observed areas, while only one park had a playground designated for children. Lakes and water features were common, but noted to be unusable for swimming; one park had an inaccessible and unmaintained swimming pool. Three out of the eight parks had designated badminton courts.

3.2. Observations of physical activity in parks

In the eight Nanchang parks, a total of 8996 children and teens were observed (Table 1). Sedentary activities were recorded for 44.9% of youth park users, while walking-like activity accounted for 38.3% of activities. Vigorous physical activity represented the least common category of activity at 16.8%. Significantly more males were observed than females (57.7% vs 42.3%). A greater proportion of those observed were children (76.0%) than teens (24.0%). In target areas where

Table 1

Physical activity intensity levels compared by user, environmental, and setting characteristics.

Variable	N %	Physical activity level			X^2	P
		Sedentary	Walking	Vigorous		
		n %	n %	n %		
Overall	8996	4042	3445	1509		
	100.0	44.9	38.3	16.8		
Gender					20.32	< 0.01
Male	5196	2303	1943	950		
	57.76	44.32	37.39	18.28		
Female	3800	1739	1502	559		
	42.24	45.76	39.53	14.71		
Age					161.40	< 0.01
Child	6839	3197	2379	1263		
	76.02	46.75	34.79	18.47		
Teen	2157	845	1066	246		
	23.98	39.17	49.42	11.40		
Temperature					2.36	0.31
≤ 29	4024	1820	1556	648		
	44.73	45.23	38.67	16.1		
> 29	4972	2222	1889	861		
	55.27	44.69	37.99	17.32		
Air Quality Index					16.12	< 0.01
< 100	5240	2400	2023	817		
	58.25	59.38	58.72	54.14		
101–150	1689	765	617	307		
	18.78	18.93	17.91	20.34		
151–200	2067	877	805	385		
	22.98	21.7	23.37	25.51		
Time of obs.					56.94	< 0.01
0600–900	1035	449	403	183		
	11.51	43.38	38.94	17.68		
1000–1300	2831	1371	1028	432		
	31.47	48.43	36.31	15.26		
1400–1700	2823	1317	1076	430		
	31.38	46.65	38.12	15.23		
1800–2100	2307	905	938	464		
	25.64	39.23	40.66	20.11		
Organized					144.71	< 0.01
Yes	1356	714	327	315		
	15.07	52.65	24.12	23.23		
No	7640	3328	3118	1194		
	84.93	43.56	40.81	15.63		

Data were collected in June of 2014 in Nanchang, China.

organized events were occurring, 52.7% of park users were coded as sedentary, while 43.6% of park users were sedentary in areas without organized events. The number of observed youth different significantly by time of day, with the mid-day period (1000–1700) representing the greatest proportion of youth observed (62.9%).

3.3. Observations of primary physical activities

Primary physical activities observed for sedentary, walking, and vigorous were recorded in Supplemental Table 2. Boys and girls were both most often observed walking (28.7% of boys, 27.4% of girls) or sitting (19.2 of boys, 20.0% of girls). More boys were observed engaging in vigorous activity than girls, while sedentary behaviors were observed evenly between the two.

3.4. Regression

Youth physical activity [sedentary vs. walking and vigorous physical activity (MVPA)] was examined using ordered hierarchic generalized linear models (Table 2). Girls were less likely to engage in higher intensity activity during organized activities and when the temperature was above 29 °C. Youth were more likely to engage in higher intensity activity when the AQI level was high (> 150). Youth were more likely to engage in more intense physical activity in the morning (before 1000) and in the evening (after 1800), as well as on weekend days relative to weekdays. Older boys were more likely to be observed in higher intensity activities than younger boys, but the age category of girls was not associated with likelihood of move vigorous activity.

4. Discussion

As in Western youth (Kaczynski et al., 2011), characteristics of Chinese park users (e.g. gender, age) were non-modifiable correlates of physical activity. Also consistent with prior work (Floyd et al., 2011), organized activity, a potential target of intervention, was negatively associated with physical activity intensity, suggesting that increasing the number of organized activities might have an undesirable effect on the number of youth engaged in MVPA. Paradoxically, poor air quality was associated with less sedentary behavior, in contrast to previous findings in U.S. adults (Roberts et al., 2014). However, air quality may be confounded by temperature, and more vigorous activity was seen on warmer days. Very few published studies have examined youth park usage in China. Therefore, this cross-sectional study provides a unique insight into youth park usage in a large Chinese city.

Future research should document how environmental features of parks in China are associated with physical activity in youth, as the design of the present study didn't allow for us to determine which features were associated with higher intensities of MVPA. Determining these features would allow for better understanding how certain attributes and park quality affect youths' decisions to engage in physical activities. Researchers can also evaluate these parks to assess how configurations of facilities within parks promote MVPA, and also survey parents and children to determine personal preferences in a park.

Limitations of this study included determining the age of individuals and classifying ambiguous activities. While interrater reliability was established prior to data collection, we were unable to assess reliability in the field, which could potentially invalidate the present findings. Furthermore, we did not have a formal park audit or similar tool that would give a more systematic assessment of park features and incivilities, which have been previously demonstrated to affect physical activity in parks (Lee et al., 2005).

Overall, the findings have a number of implications for policies and practice. Specifically, activity should be scheduled at cooler times when girls are more likely to engage in more physical activity, and supervised free play should be prioritized over organized activities. Future studies should observe which individual facilities within a park are used more by children and teens, which could ultimately help improve the health of China's youth by suggesting features that are most likely to promote physical activity.

Conflicts of interest

None.

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Transparency document

The Transparency document associated with this article can be found, in the online version.

Table 2
Ordered hierarchic generalized linear models regressing physical activity [sedentary vs. walking and vigorous physical activity (MVPA)] onto characteristics of parks and youth.

Parameter	All							Boys							Girls						
	Estimate	SE	Z-value	P-value	OR	(95	CI)	Estimate	SE	Z-value	P-value	OR	(95	CI)	Estimate	SE	Z-value	P-value	OR	(95	CI)
Main effects																					
Intercept 1 (vigorous)	−0.14	0.11	−1.26	0.21	−0.14	−0.37	0.08	−0.08	0.13	−0.60	0.55	−0.08	−0.34	0.18	−0.22	0.13	−1.71	0.09	−0.22	−0.47	0.03
Intercept 2 (walking)	1.69	0.12	14.56	< 0.001	1.69	1.46	1.92	1.68	0.13	12.49	< 0.001	1.68	1.41	1.94	1.75	0.13	13.16	< 0.001	1.75	1.49	2.01
Age																					
Child																					
Teen	0.07	0.05	1.60	0.11	1.08	0.98	1.18	0.20	0.06	3.14	< 0.01	1.22	1.08	1.39	−0.06	0.07	−0.85	0.39	0.94	0.82	1.08
Organized activity																					
No																					
Yes	−0.12	0.06	−1.94	0.05	0.89	0.79	1.00	−0.03	0.08	−0.38	0.71	0.97	0.83	1.14	−0.21	0.09	−2.36	0.02	0.81	0.68	0.96
Temperature																					
≤ 29c																					
> 29c	−0.17	0.06	−3.02	< 0.01	0.85	0.76	0.94	−0.12	0.07	−1.57	0.12	0.89	0.77	1.03	−0.27	0.09	−3.16	< 0.01	0.76	0.65	0.90
Air Quality Index																					
Good/moderately polluted (< 100)																					
Unhealthy for sensitive groups (101–150)	0.08	0.06	1.36	0.17	1.08	0.97	1.21	−0.03	0.07	−0.43	0.66	0.97	0.84	1.12	0.22	0.09	2.56	0.01	1.25	1.05	1.48
Unhealthy (151–200)	0.15	0.05	2.90	< 0.01	1.16	1.05	1.29	0.15	0.07	2.12	0.03	1.16	1.01	1.32	0.17	0.08	2.06	0.04	1.18	1.01	1.39
Day of the week																					
Weekday																					
Weekend	0.24	0.05	4.98	< 0.001	1.28	1.16	1.40	0.27	0.06	4.20	< 0.001	1.31	1.16	1.49	0.22	0.08	2.95	< 0.01	1.25	1.08	1.45
Observation period																					
0700–0900																					
1000–1100	−0.17	0.07	−2.48	0.01	0.84	0.73	0.96	−0.11	0.09	−1.23	0.22	0.90	0.75	1.07	−0.26	0.11	−2.30	0.02	0.77	0.62	0.96
1400–1700	−0.07	0.07	−0.94	0.35	0.93	0.81	1.08	0.01	0.10	0.13	0.90	1.01	0.84	1.23	−0.15	0.12	−1.31	0.19	0.86	0.68	1.08
1800–2100	0.19	0.08	2.54	0.01	1.21	1.04	1.40	0.13	0.10	1.37	0.17	1.14	0.94	1.39	0.30	0.12	2.53	0.01	1.35	1.07	1.71
Variance components																					
Level-2 variance (T00)	0.07	0.04				0.02	0.20	0.08	0.05				0.03	0.25	0.04	0.03				0.01	0.15
Goodness of fit																					
− 2 log likelihood	−9143.18							−5347.68							−3777.33						
Wald Chi²	82.890		< 0.001					44.84		< 0.001					70.79		< 0.001				

Note: Level 1: n = 8996; Level 2: n = 8.
Note: sedentary was used as the reference category for the three-level ordinal dependent variable (sedentary, walking, vigorous).
Data were collected in June of 2014 in Nanchang, China.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2017.11.003.

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